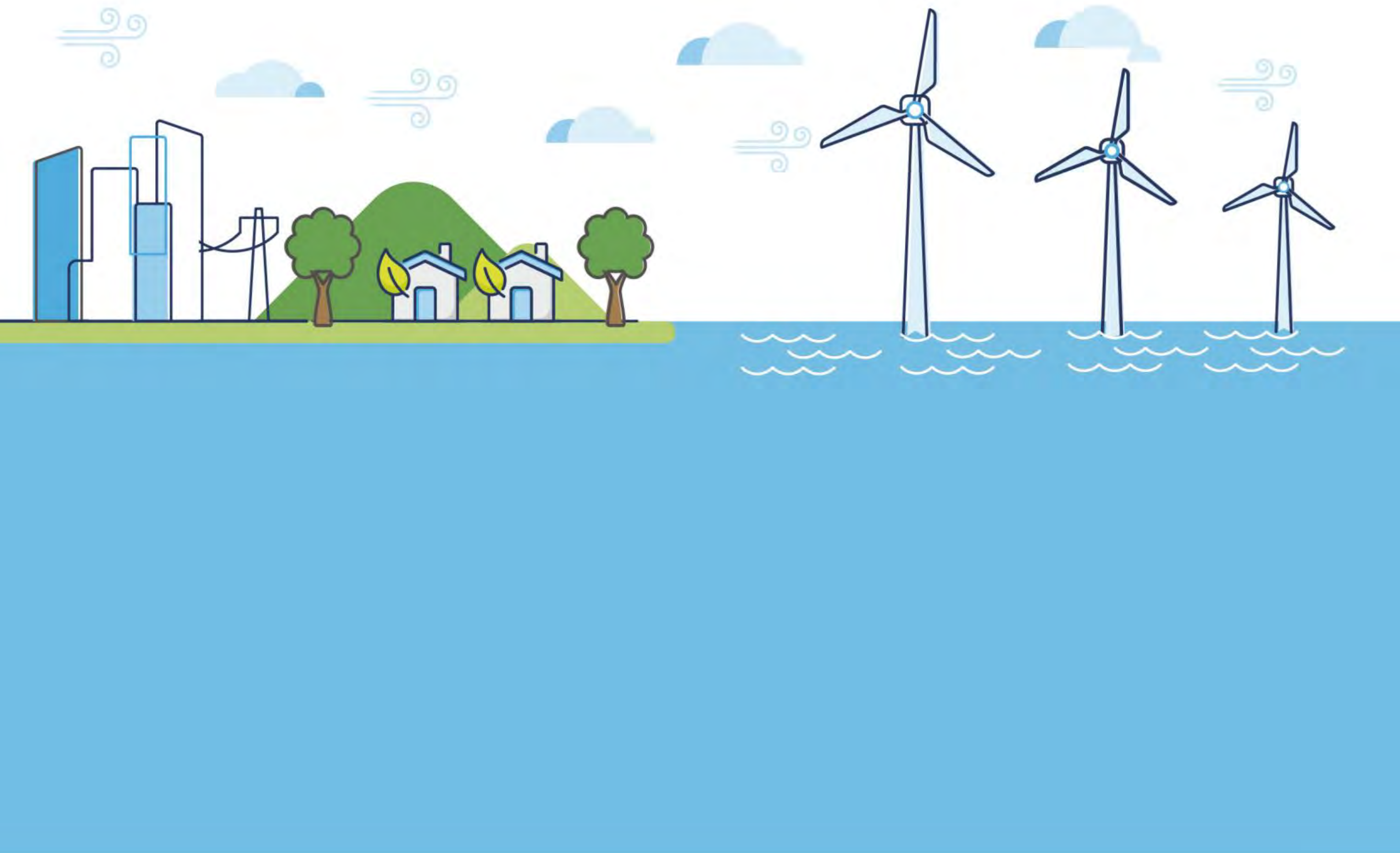
Scoping Report

Morecambe Offshore Windfarm

Generation Assets



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Document History

Version Number	
V 1.0	Draft for consultation
V 2.0	Updated following initial consultation with key stakeholders
V 3.0	Final for submission

Executive Summary

This Scoping Report supports a request for a formal Scoping Opinion from the Planning Inspectorate in relation to the Morecambe Offshore Windfarm Generation assets. This Scoping Report has been prepared in accordance with Regulation 10 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 and is submitted to the Planning Inspectorate in order to seek a formal Scoping Opinion on the information to be included in an Environmental Impact Assessment (EIA).

In 2019 the Crown Estate launched the Round 4 Offshore Wind Leasing process, opening the potential for new seabed rights for offshore wind development in the waters around England and Wales. The Morecambe Offshore Windfarm, being developed by a joint venture between Cobra Instalaciones Servicios, S.A. and Flotation Energy plc., (the Applicant) is one of six Round 4 preferred projects (announced in 2021) which together have the potential to provide clean electricity to more than seven million homes.

The Morecambe Offshore Windfarm will have an anticipated nominal capacity of 480MW and is located in the east Irish Sea. At its nearest point, the windfarm site is approximately 30km from the shore of the Lancashire coast. Wind turbine generators and offshore substation(s) will be fixed to the seabed with foundation structures. The electricity generated by the wind turbine generators would be transported via subsea inter-array cables to offshore substation platform(s) which will then connect to the shore (at the landfall location) via offshore export cables. From the landfall, onshore export cables will be routed underground to an onshore project substation which will in turn transform the power generated offshore to make it suitable to feed it into the National Electricity Transmission System (NETS) at the grid connection point (typically an existing National Grid substation).

The Morecambe Offshore Windfarm has been included under a review of offshore transmission infrastructure at a national level (the Offshore Transmission Network Review (OTNR). Under the OTNR, the National Grid Electricity System Operator (NGESO) are responsible for conducting a Holistic Network Design Review (HNDR) to assess options to improve the coordination of offshore wind generation connections and transmission networks. The output of the HNDR has concluded that the Morecambe Offshore Windfarm will share a grid connection location at Penwortham in Lancashire with the Round 4 Morgan Offshore Wind Project, also located in the east Irish Sea. Although the projects are being developed by separate companies, which means it is not feasible for all aspects of both projects to be consented under a single application, the Applicant intends to deliver a coordinated grid connection with the Morgan Offshore Wind Project, including the sharing of offshore and onshore export cable corridors and grid connection location at Penwortham.

The Applicant, as well as the applicant for the Morgan Offshore Wind Project, intend to consent their individual generation assets separately, and therefore separate scoping reports are being submitted by each applicant for the Morecambe Offshore Windfarm generation assets and Morgan Offshore Wind Project generation assets respectively. The Applicant is working together with the applicant for the Morgan Offshore Wind Project to identify the engineering options for the coordinated transmission assets and to develop a timeline for the transmission assets consent application. An additional EIA Scoping Report for such coordinated transmission assets would be submitted in due course. Note the exact design and delivery model for such transmission assets is still subject to the final HNDR outcome.

This Scoping Report includes only the Generation assets for the Morecambe Offshore Windfarm (wind turbine generators, inter-array cables, offshore substation platform(s) and possible platform link cables to connect offshore substations) (the "Project").

This Scoping Report is the first stage of the EIA process, it outlines an initial overview and description of the Project at the time of writing. It identifies the receptors that will be considered during the EIA and the potential impacts associated with the construction, operation and maintenance and eventual decommissioning of the Project on the physical, social/human and biological environments.

The EIA will be undertaken by experienced and well qualified technical specialists using industry best practice and following appropriate and relevant guidance. The planned approach to data gathering, characterising the existing environment, assessing potential impacts and developing mitigation measures are presented in this report, as well as initial details of consultation which will be ongoing with stakeholders and communities throughout the EIA process and as part of the Development Consent Order (DCO) application (under the Planning Act 2008) required to consent the Project.

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Table of Contents

Glossary of Acronyms

AC	Alternating Current
ADBA	Archaeological Desk-Based Assessment
ADD	Acoustic Deterrent Device
AEZ	Archaeological Exclusion Zone
AfL	Agreement for Lease
AIP	Aeronautical Information Publication
ALARP	As Low As Reasonably Practicable
AMSL	Above Mean Sea Level
AONB	Area of Outstanding Natural Beauty
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
BAS	Burial Assessment Study
BEIS	Department of Business, Energy and Industrial Strategy
BGS	British Geological Survey
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
CBRA	Cable Burial Risk Assessment
CCC	Climate Change Committee
Cefas	Centre for Environment, Fisheries and Aquaculture
CfD	Contracts for Difference
CIA	Cumulative Impact Assessment
CION	Connections and Infrastructure Options Note
CMS	Construction Method Statements
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
DEFRA	Department for Environment, Food & Rural Affairs
DML	Deemed Marine Licences
EEA	European Economic Area
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Ecological Management Plan
EPP	Evidence Plan Process
EPS	European Protected Species
ES	Environmental Statement

ETG	Expert Topic Groups
EUNIS	European Nature Information System
FCS	Favourable Conservation Status
FEPA	Food and Environmental Protection Act
FIR	Flight Information Region
FL	Flight Level
FLO	Fisheries Liaison Officer
GBS	Gravity Based Structures
GHG	Greenhouse gas
GT	Gross Tonnage
HAT	Highest Astronomical Tide
HER	Historic Environment Record
HPMA	Highly Protected Marine Areas
HRA	Habitat Regulations Assessment
HTZ	Helicopter Traffic Zone
HVAC	High Voltage Alternating Current
IAIA	International Association for Impact Assessment
ICES	International Council for the Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IFCA	Inshore Fisheries Conservation Authority
IFP	Instrument Flight Procedures
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
IROPI	Imperative Reasons of Overriding Public Interest
JCP	Joint Cetacean Protocol
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MCZ	Marine Conservation Zones
MGN	Marine Guidance Note
MHWS	Mean High Water Spring
MMMP	Marine Mammal Mitigation Protocol
MMO	Marine Management Organisation

MoD	Ministry of Defence
MPA	Marine Protected Areas
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
MSA	Minimum Sector Altitudes
MU	Management Units
MW	Megawatts
MWDW	Manx Whale and Dolphin Watch
NAS	Noise Abatement Systems
NATS	National Air Traffic Services
NETS	National Electricity Transmission System
NFFO	National Federation of Fisherman's Organisations
NGESO	National Grid Electricity System Operator
NGET	National Grid Electricity Transmission
NGC	National Grid Company plc
NGO	Non-Governmental Organisation
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
NtM	Notice to Mariner
NRA	Navigational Risk Assessment
OFGEM	Office of Gas and Electricity Markets
OFTO	Offshore Transmission Operator
O&M	Operation and Maintenance
ONS	Office for National Statistics
OS	Ordnance Survey
OTNR	Offshore Transmission Network Review
PAD	Protocol for Archaeological Discoveries
PDE	Project Design Envelope
PEIR	Preliminary Environmental Information Report
PEMP	Project Environment Management Plan
PEXA	Practice and Exercise Areas
PINS	Planning Inspectorate
PM	Particulate Matter
PSR	Primary Surveillance Radar

RAF	Royal Air Force
RIAA	Report to Inform Appropriate Assessment
RLoS	Radar Line of Sight
ROV	Remotely Operated Vehicles
RPG	Registered Parks and Gardens
RRH	Remote Radar Head
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAR	Safety and Rescue
SCI	Site of Community Importance
SLVIA	Seascape, Landscape and Visual Impact Assessment
SoCC	Statement of Community Consultation
SoCG	Statement of Common Ground
SOLAS	Safety of Life at Sea
SPA	Special Protection Area
SPZ	Source Protection Zone
SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
SSSI	Site of Special Scientific Interest
TCA	Trade and Cooperation Agreement
TH	Trinity House
TMZ	Transponder Mandatory Zone
TP	Travel Plan
TTS	Temporary Threshold Shift
TWT	The Wildlife Trusts
UK	United Kingdom
UXO	Unexploded Ordnance
VMS	Vessel Monitoring System
WDC	Whale and Dolphin Conservation
WFD	Water Framework Directive
WSI	Written Scheme of Investigation
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

Glossary of Unit Terms

GW	Gigawatt
km	kilometre
kV	kilovolt
m	metre
MW	Megawatts
MWh	Megawatt hour

Glossary of Terminology

Applicant	Cobra Instalaciones Servicios, S.A., and Flotation Energy plc. joint venture
Generation assets	Infrastructure in connection with electricity production, namely the fixed foundation wind turbine generators, inter-array cables, offshore substation platform(s) and possible platform link cables to connect offshore substations.
Inter-array cables	Cables which link the wind turbine generators to each other and the offshore substation platform.
Landfall	Where the offshore export cables would come ashore.
National site	Sites designated for nature conservation under the Habitats Directive and Birds Directive (as amended). This includes candidate Special Areas of Conservation, Sites of Community Importance, Special Areas of Conservation and Special Protection Areas.
Offshore export cables	The cables which would bring electricity from the offshore substation platform to the landfall.
Offshore substation platform(s)	A fixed structure located within the windfarm site, containing electrical equipment to aggregate the power from the wind turbine generators and convert it into a more suitable form for export to shore.
Onshore export cables	The cables which would bring electricity from landfall to the onshore project substation and from the onshore project substation to a National Grid substation.
Onshore project substation	Part of an electrical transmission and distribution system. Substations transform voltage from high to low, or the reverse by means of electrical transformers.
Platform link cable	An electrical cable which links one or more offshore substation platforms.
Safety zones	An area around a structure or vessel which should be avoided
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations due to the flow of water.
Study area	This is an area which is defined for each EIA topic which includes the windfarm site as well as potential spatial and temporal considerations of the impacts on relevant receptors. The study area for each EIA topic is intended to cover the area within which an effect can be reasonably expected.
Technical stakeholders	Technical consultees are considered to be organisations with detailed knowledge or experience of the area within which the Project is located and/or receptors which are considered in the EIA and HRA. Examples of technical stakeholders include Marine

	Management Organisation, local authorities, Natural England and Royal Society for the Protection of Birds.
Transmission assets	Infrastructure between the offshore point of connection with the generating windfarm assets (the offshore substation) and the National Grid Substation, namely the offshore export cables, landfall, onshore export cables and onshore project substation.
Windfarm site	The area within which the wind turbine generators, inter-array cables, offshore substation platform(s) (not including the potential for repurposing of oil and gas platforms outside of the windfarm site) and platform link cables will be present.

1. Project background

1.1 The Project

1 Morecambe Offshore Windfarm is a proposed offshore windfarm located in the east Irish Sea (Figure 1.1) with an expected nominal capacity of 480 megawatts (MW). It is being developed by a joint venture between Cobra Instalaciones Servicios, S.A., and Flotation Energy plc (the Applicant) who is requesting a Scoping Opinion.

2 The Morecambe Offshore Windfarm will make a contribution to the achievement of the UK Government's commitment to net zero by 2050 and tackle the climate emergency by producing electricity from renewable energy. The windfarm was selected in early 2021 as part of The Crown Estate's Offshore Wind Leasing Round 4. The windfarm site is situated in the vicinity of the South Morecambe Gas Fields (which are currently expected to cease production around 2027 (+/-2 years)). An important factor in the windfarm site's selection was the potential for the project to be the first windfarm to fully co-exist with oil and gas operations on previously developed seabed.

3 As the windfarm is an offshore generating station of over 100MW, it is defined under the Planning Act 2008 as a Nationally Significant Infrastructure Project (NSIP) and as such it requires a Development Consent Order (DCO). In order to support the DCO application, an Environmental Impact Assessment (EIA) is required.

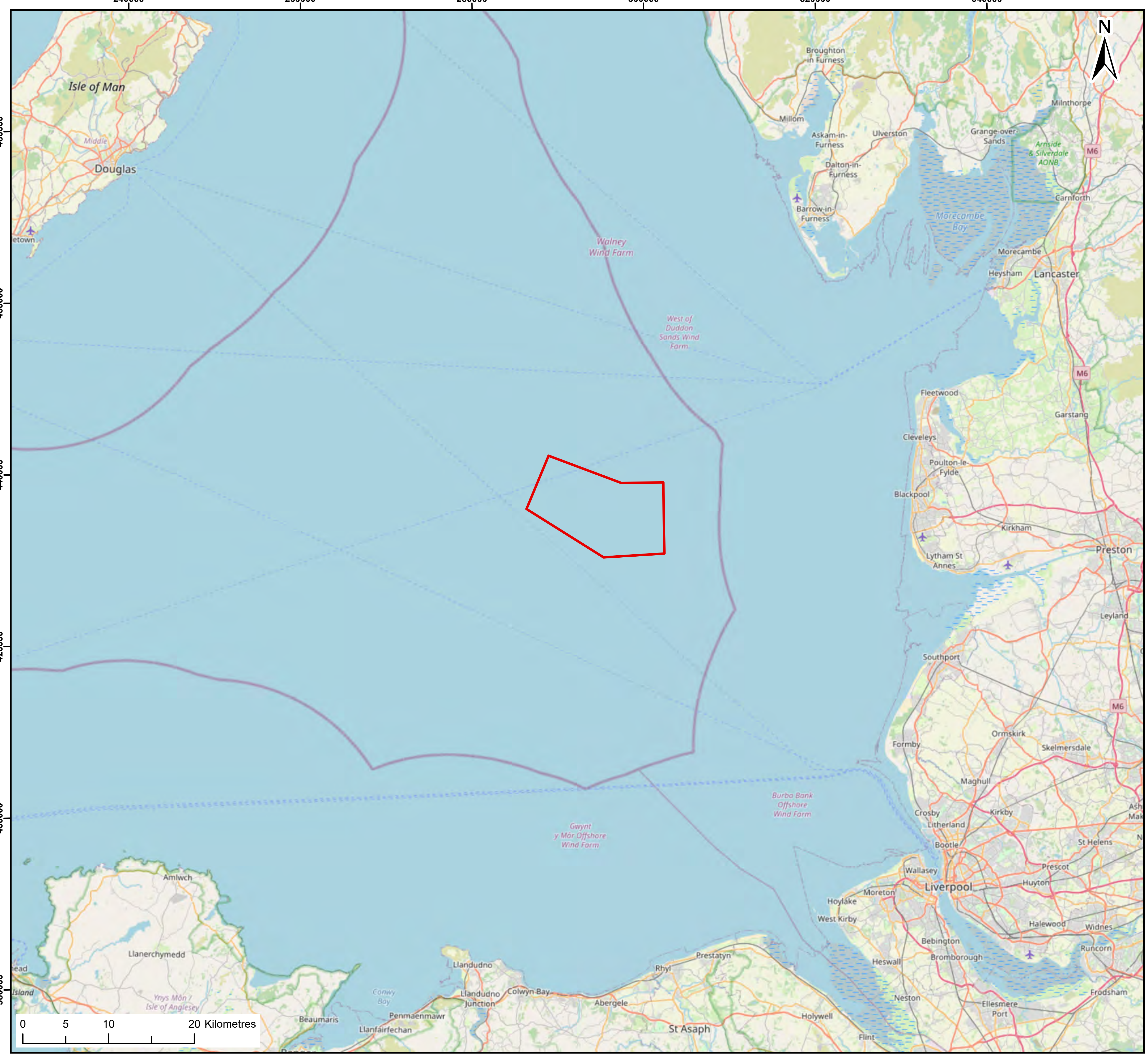
4 As explained further in Section 1.4, a Government-led review of offshore windfarm transmission connections has concluded that the Morecambe Offshore Windfarm will share a grid connection location at Penwortham in Lancashire with the Round 4 Morgan Offshore Wind Project, also located in the east Irish Sea, as shown in Figure 1.2. Given this, the Applicant intends to deliver a coordinated grid connection with the Morgan Offshore Wind Project. The transmission infrastructure to connect the Morecambe Offshore Windfarm to the national grid onshore (namely the Transmission assets) would therefore be the subject of a separate scoping report in the future. For the purposes of this Scoping Report, and request for a Scoping Opinion, the "Project" refers only to the Generation assets of the Morecambe Offshore Windfarm.

5 The Project is located approximately 30km off the Lancashire coast. As illustrated in Plate 1, the Project will include wind turbine generators

(windfarm array), offshore substation(s)[1] to convert generated power to allow transmission to shore, inter-array cables to connect wind turbine generators to the offshore substation(s), and possible platform link cables to connect offshore substations. In other words, all the infrastructure within the windfarm site. Wind turbine generators and substations will be fixed to the seabed with foundation structures.

6 Plate 1 provides an overview of the Project, as well as the anticipated Transmission assets for context.

[1] It is possible that all or part of the offshore substation platforms will be classed as Transmission assets as the Project is refined in the future, but for the purpose of this Scoping Report a precautionary approach has been taken and all infrastructure within the windfarm site included.



Legend:

Morecambe Offshore Windfarm Site

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Report:	Morecambe Offshore Windfarm Scoping Report
Title:	Morecambe Offshore Windfarm Location
Figure: 1.1	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0053

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:450,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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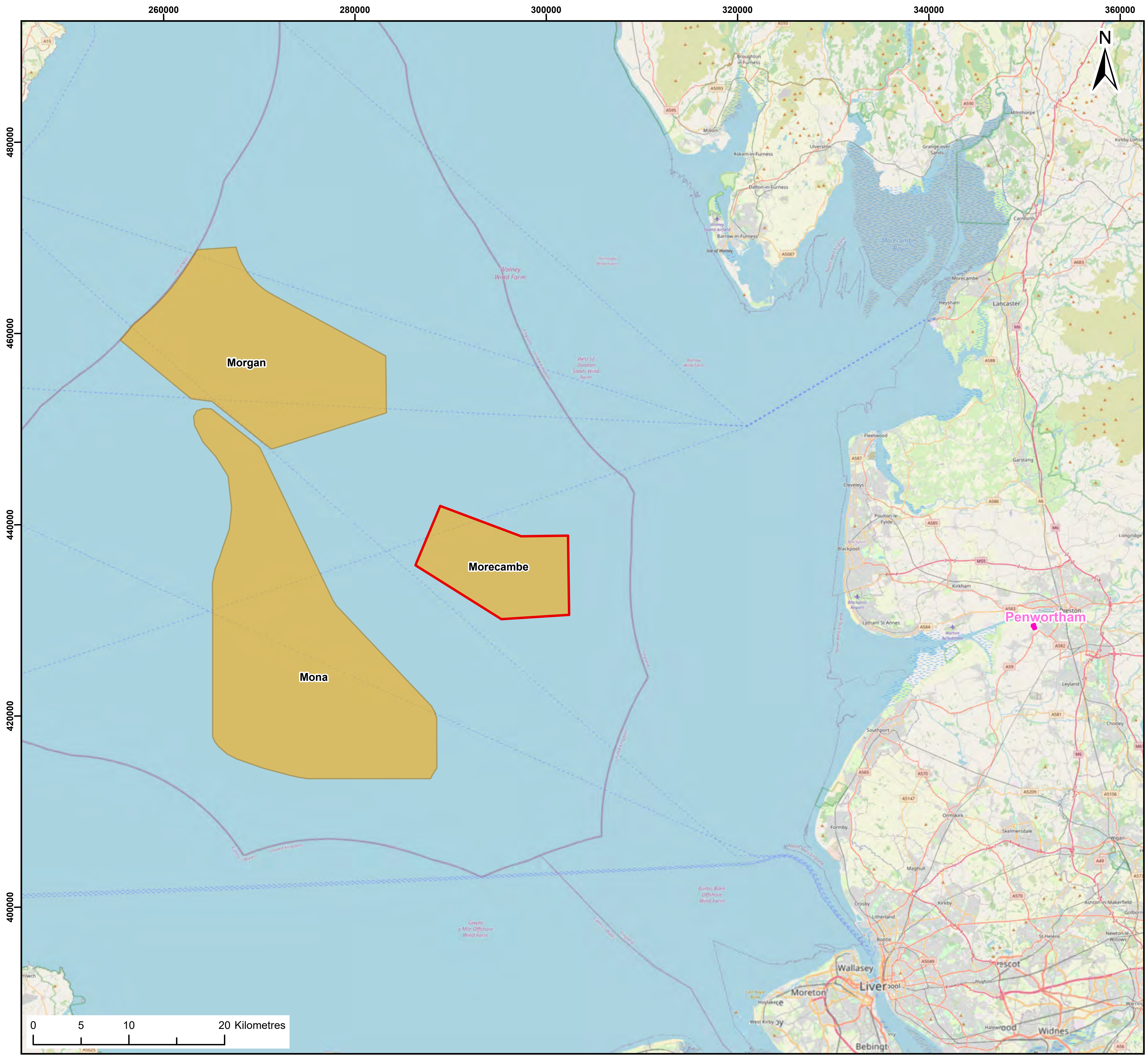

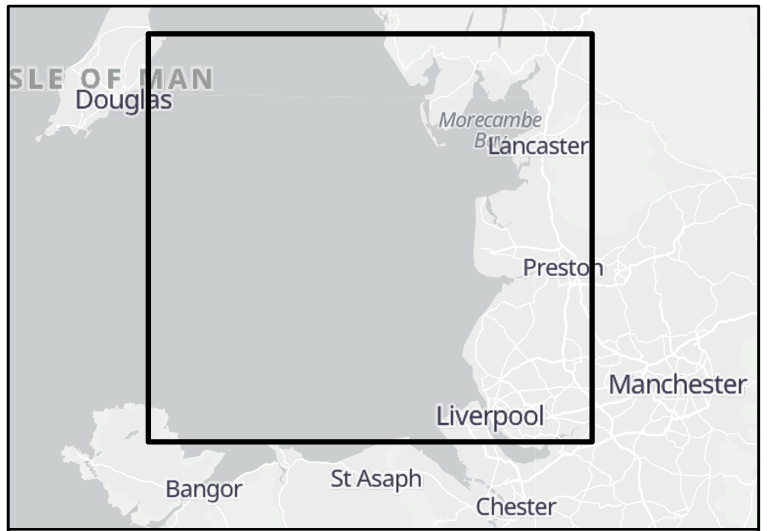

Legend:

- Morecambe Offshore Windfarm Site
- National Grid Connection Point
- Round 4 projects

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Morecambe Offshore Windfarm Location With Other Round 4 Projects

Figure: 1.2 | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0109

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	21/06/2022	JT	GC	A3	1:400,000
P01	14/06/2022	JT	GC	A3	1:400,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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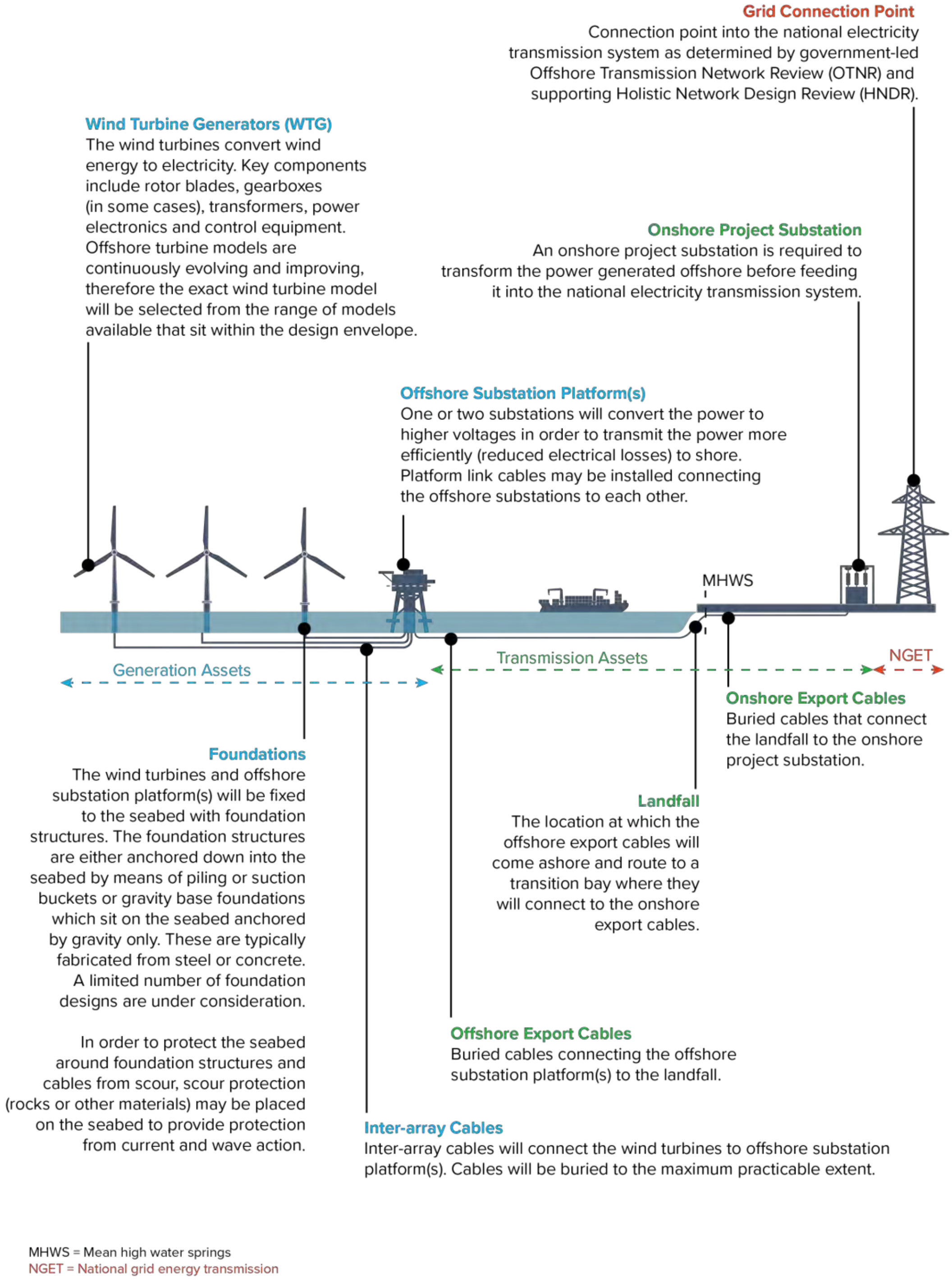

Plate 1 Components of Morecambe Offshore Windfarm

(note the components in blue are Generation assets (included in this Scoping Report) and those in green are anticipated Transmission assets (not included in this Scoping Report)

1.2 Aim of Scoping

7 This Scoping Report aims to identify the relevant potential impacts associated with the physical, human and biological environments arising from the construction, operation and maintenance (O&M), and decommissioning phases of the Project and sets out the proposed approach to addressing those potentially significant environmental issues through the EIA process. This Scoping Report provides an overview of all potential EIA issues and makes a case for focusing on those issues which have the potential to result in significant impacts, reducing the emphasis on those issues which are increasingly shown (from repeated assessment in offshore wind, available data and professional judgement) to result in non-significant impacts.

8 The EIA for the Project will take into account the lessons learnt and good practice on those offshore windfarm projects that have already been through the consenting, construction, O&M and decommissioning processes. In line with this approach, this Scoping Report makes robust recommendations, supported by evidence, regarding the issues that the Applicant proposes to exclude (scope out) of the EIA. Each EIA topic section of this report summarises potential impacts on a receptor and whether these will be considered further as part of the EIA (scoped in).

1.3 The Applicant

9 The Applicant consists of Cobra Instalaciones Servicios, S.A. (Cobra), and Flotation Energy plc. (Flotation Energy), who are Joint Venture project partners for Morecambe Offshore Windfarm.

10 Cobra is a worldwide leader with more than 75 years of experience in the development, construction and management of industrial infrastructure and energy projects. Cobra has an international presence in Europe, Asia, Africa and the Americas. In recent years the company has focused on renewable energy projects, including onshore & offshore wind and solar power including a specialised floating windfarm business. Cobra has a business culture that is focused on quality and excellence stemming from its greatest asset; it's employees.

11 Flotation Energy has a growing project pipeline of offshore wind projects with 10GW in the UK, Ireland, Taiwan, Japan and Australia and plans to expand into many more key markets. The expertise of the Flotation Energy team lies in the project and engineering management of large infrastructure projects. Flotation Energy has developed its own projects but also recognise the benefits of collaboration and working in partnership with other developers to deliver proven, cost-effective solutions.

12 The various Project work streams across engineering, consent, and legal will coordinate and interlock with each other to form a one team culture and programme that will encourage cross links between teams, encourage risk and solution sharing and promote innovation and proactivity.

13 An experienced EIA consultant has been assigned to undertake the environmental assessment work for the Project. Royal HaskoningDHV is one of the leading EIA consultancies working in the UK offshore wind sector, successfully providing environmental, development and consenting support on over 14GW of renewable energy projects across 26 UK offshore windfarm, including seven successful development consent order (DCO) applications. Royal HaskoningDHV holds the EIA quality mark from the Institute of Environmental Management and Assessment. Royal HaskoningDHV has a range of EIA technical expert teams who will provide specialist input to the EIA process. In addition, a small number of the technical assessments and associated Environmental Statement chapters will be undertaken by specialist consultancies outside Royal HaskoningDHV. Specialist input for sections of this Scoping Report has been provided by Poseidon (Section 8.7, Commercial Fisheries), Cyrrus Limited (Section 8.10 Civil and Military Aviation and Radar), Optimised Environments (Section 8.12 Offshore Seascape, Landscape and Visual Impact Assessment) and BCA Insight (Section 8.15 Human Health).

1.4 Transmission assets and consenting strategy

14 As noted at Paragraph 4, the Morecambe Offshore Windfarm has been included within a government-led national review of offshore transmission infrastructure (the Offshore Transmission Network Review (OTNR)). The OTNR aims to consider, simplify and wherever possible facilitate collaborative approach to offshore wind projects connecting to the UK National Grid. The OTNR is being led by the Department for Business, Energy and Industrial Strategy (BEIS) in conjunction with the Office of Gas and Electricity Markets (OFGEM) and the National Grid Electricity System Operator (NGESO). Under the OTNR, the NGESO are responsible for assessing options to improve the coordination of offshore wind generation connections and transmission networks.

15 As part of the OTNR, the NGESO is undertaking a Holistic Network Design Review (HNDR). The output of the HNDR has concluded that the Morecambe Offshore Windfarm will share a grid connection location at Penwortham in Lancashire with the Round 4 Morgan Offshore Wind Project, also located in the east Irish Sea. Although the projects are being developed by separate companies, which means it is not feasible for all aspects of both projects to

be consented under a single application, the Applicant intends to deliver a coordinated grid connection with the Morgan Offshore Wind Project, including the sharing of offshore and onshore export cable corridors and grid connection location at Penwortham.

16 Given the coordinated grid connection arrangements, the proposed consenting strategy for the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project is as follows:

- A stand-alone DCO application to consent the construction, operation and maintenance, and decommissioning of the generation asset of Morecambe Offshore Windfarm
- A stand-alone DCO application to consent the construction, operation and maintenance, and decommissioning of the generation asset of Morgan Offshore Wind Project
- A separate application to consent the construction, operation and maintenance and decommissioning of the transmission assets required to enable the export of electricity from both the Morecambe Offshore Windfarm and the Morgan Offshore Wind Project to the National Grid connection point at Penwortham.

17 In order to achieve this, the Applicant, together with the applicant for the Morgan Offshore Wind Project intend to seek a direction from the Secretary of State under section 35 of the Planning Act 2008 to pursue a transmission assets consent (covering both projects' offshore and onshore transmission infrastructure) through the DCO process as a Nationally Significant Infrastructure Project (NSIP). Key reasons for selecting the preferred consenting approach to the projects' transmission assets are:

- A coordinated approach would allow for better consideration of potential impacts (including cumulative impacts)
- A coordinated approach would ensure more efficient use of stakeholder resources
- A coordinated approach would also provide a formal structure for the projects to collaborate and align on transmission design, assessment and mitigation approach
- A coordinated approach will streamline the consenting process with a single permission and approval timeline
- A co-ordinated approach aligns with the National Policy Statements (NPS) for delivering major energy infrastructure (for example 4.9.2 of the current adopted NPS for Overarching Energy (EN-1), and 4.10.3 and 4.10.4 of the draft NPS EN-1).

18 As the Applicant, as well as the applicant for the Morgan Offshore Wind Project, intend to separately consent their individual generation assets, separate scoping reports are being submitted by each applicant for the Morecambe Offshore Windfarm generation assets and Morgan Offshore Wind Project generation assets respectively. The Applicant is working together with the applicant for the Morgan Offshore Wind Project to identify the engineering options for the coordinated transmission assets and to develop a timeline for the transmission assets consent application. An additional EIA Scoping Report for the coordinated transmission assets would be submitted in due course. Note the exact design and delivery model for such transmission assets is still subject to the final HNDR outcome.

19 The scoping search area for the coordinated offshore and onshore transmission assets is currently being defined by the Applicant, together with the applicant for the Morgan Offshore Wind Project. The indicative extent of the scoping search area will be in English waters connecting to a grid connection location at Penwortham in Lancashire, as shown in Figure 1.2. Further detail would be provided in the EIA Scoping Report for the transmission assets.

1.5 Next steps

20 This Scoping Report is the first stage of the EIA process. Following scoping, a Preliminary Environmental Information Report (PEIR) will be developed. The PEIR will provide the interim findings of the site characterisation and impact assessment in so far as available at that time. The PEIR will be submitted for formal consultation with relevant stakeholders. Following feedback from PEIR consultation the assessment of impacts will be completed and reported in the final Environmental Statement (ES). This forms a key part of the application for development consent. Further detail on the indicative programme associated with these stages is provided in Section 2.

1.6 The Scoping Report

1.6.1 Scoping Report structure

21 The Scoping Report structure is outlined in Table 1.1.

Table 1.1 Structure of this Scoping Report

Section	Description of content	Reference
Part 1 Introduction	Project background Section introduces the Scoping Report and the proposed Project	Section 1
	Proposed programme Overview of the DCO pre-application programme and indicative construction dates	Section 2
	Consultation Summary of the consultation undertaken to date and proposed approach to consultation going forward	Section 3
	Policy and legislative context High-level overview of where the Project sits within the policy and legislative context and how the Project aims to fulfil policy needs and meets environmental policy requirements. This section includes a discussion on the key drivers for offshore wind.	Section 4
	Site selection and assessment of alternatives Outline of the alternatives and site selection process to date, and the further assessment that will be undertaken in order to refine the project description for the EIA	Section 5
	Description of the Project High-level description of the key elements of the Project, and a description of the associated construction, operation and maintenance, and decommissioning phases	Section 6
	EIA methodology Description of how the EIA will be undertaken, the approach behind the assessment and key areas of consideration	Section 7
Part 2 – Technical sections	Environmental baseline and potential impacts Discussion of the baseline data to be used, surveys to be undertaken, approach to data analysis and impact assessments. The technical sections will also include a discussion of potential impacts, approach to the EIA for each offshore	Section 8

Section	Description of content	Reference
	topic, covering the physical, biological and human environment Summary of relevant designated sites and species designated under the national and international legislation described in Part 1 and referred to under each topic, where relevant	
Part 3 – Inter-relationships	Description of inter-relationships between receptors and how these will be addressed in the EIA.	Section 9

2. Proposed programme

22 At the time of writing, the programme is still being developed but an overview of the indicative schedule and key milestones for the Project are displayed in Plate 2.

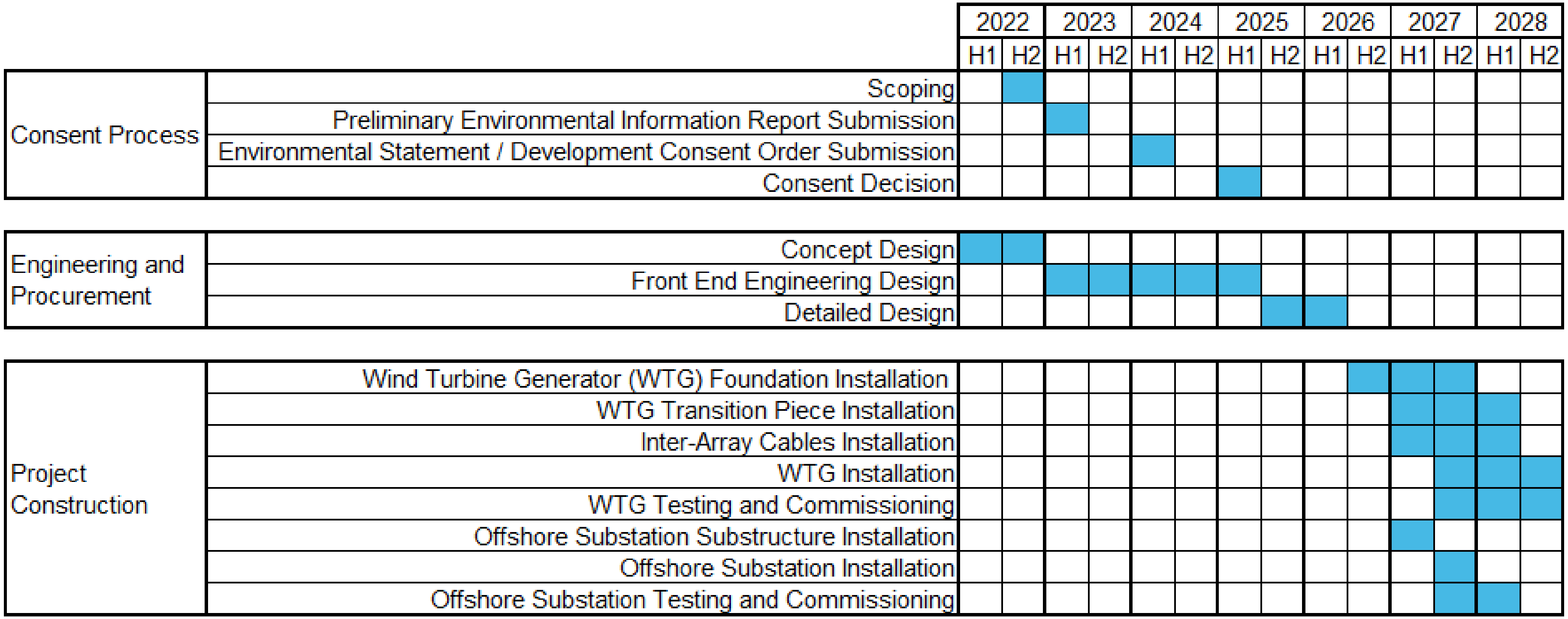

Plate 2 Indicative programme for Generation assets

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3. Consultation

3.1 Approach to consultation

23 The Applicant will undertake continuous and targeted dialogue and engagement with stakeholders, regulators, and communities which may be affected by the Project. This commitment to open, honest, transparent, and meaningful communication and engagement will make it as easy as possible for all to have a strong voice in helping shape the Project. The engagement will continue throughout the EIA process to the submission of the DCO application.

24 As part of the DCO process the Applicant will undertake consultation with prescribed bodies, and stakeholders (under Section 42 of the Planning Act (2008)), with local communities (under Section 47) and more widely with the public through the publication of a proposed application (under Section 48).

25 Consultation with technical regulators and stakeholders is being facilitated through an Evidence Plan Process (EPP) further information is provided in in Section 3.4. The EPP is an integral tool for the structure and delivery of both the Environmental Impact Assessment (EIA) and Habitat Regulations Assessment (HRA) during the pre-application phase as well as setting the basis of Statements of Common Ground (SoCG)[2] with relevant stakeholders.

26 The EPP is now common practice in almost all NSIPs which brings the regulators and key technical stakeholders to the table, thereby establishing relationships and giving opportunities to technical stakeholders to be involved in a shared technical discussion. Its aim is to establish agreement on the key aspects (data gathering, impact assessment and mitigation measures) prior to the DCO application submission to the Planning Inspectorate.

27 In summary, the EPP is an effective mechanism for technical stakeholder engagement which provides:

- A platform to debate advice on each technical topic between multiple agencies
- Greater certainty on the amount and range of evidence that should be collated to inform the EIA and HRA

[2] SoCG are joint statements made by the Applicant and other parties, such as the Marine Management Organisation (MMO) for example. The aim of SoCG are to agree factual information and to provide a commonly understood basis for the Applicant and other parties.

- Allows issues to be addressed and agreed early in the pre-application process so robust and streamlined decisions can be taken
- Opportunities to explore options to avoid, reduce and mitigate impacts before they become constrained by project design

28 A Statement of Community Consultation (SoCC) will be developed and published following Scoping[3]. The SoCC will detail the approach to community consultation, including opportunities for community to feed into the Project; and how community views will be considered and where appropriate incorporated into the development or design of the Project. Further information on the approach to community consultation and engagement is discussed in Section 3.2.

29 All pre-application consultation will be recorded within a Consultation Report (as required under Section 37 of the Planning Act). This Consultation Report will provide details of consultation undertaken in compliance with Sections 42, 47 and 48, any relevant responses received, and the account taken of any such responses. The primary purpose of the Consultation Report is therefore to provide details of both the non-statutory consultation and the statutory pre-application consultation carried out. The Consultation Report captures the views of all stakeholders, recording and identifying how their views may have been taken into account in the DCO application and the Project design.

3.2 Community and public engagement

30 Consultation with stakeholders and local communities is a key part of the planning and consenting processes. The Applicant is actively seeking input; with all comments and opinions provided carefully considered and used to help shape the development of the Project.

31 Public exhibitions (in person, virtual or hybrid) will be held to introduce and update on the progress of the Project. The events will also allow the Project team to respond to any queries and questions the public may have.

32 Pre-application consultation will be the main opportunity for communities and members of the public to; review the plans; provide comments; submit feedback; and to shape the development of the Project design prior to submission of the DCO application. All communities and members of the wider public will have the opportunity to be consulted on the Project both formally

[3] A separate SOCC will be produced for Transmission assets which are the subject of a separate DCO application.

as required under the Planning Act (see Section 3.1) and informally as described further below.

33 The Applicant will ensure that communities and wider public stakeholders who are most affected by the proposals are engaged in the development of the Project and have the opportunity to comment on the proposals at key decision making points.

34 Pre-application consultation will incorporate an initial consultation to introduce the Project followed by at least two consultation stages (one of which will be statutory). The Applicant will work with local authorities to find the best way to engage and consult communities. Engagement at different stages of the Project development ensures that consultation is thorough and timed to allow the Applicant to effectively gather and incorporate opinions and feedback into Project design and the DCO application.

35 The Project will engage with communities and their representatives, finding the best mechanisms to consult with the those affected by or interested in the development. All consultation materials will consider:

- Different formats for sharing project information
- Electronic/hard copies in person located in various locations.
- Consideration of the design and format of application documents to ensure accessibility (for example braille, requirement for translations) and where consultation materials are made available

36 The location and timings of in person events are being explored and it is expected that this will include:

- Community consultation exhibitions which will act as the focal point of consultation for both the informal consultation and formal consultation phases. Exhibitions will be held virtually and throughout the consultation area in accordance with the times published in the SoCC.
- Meetings with local representatives of communities of interest
- Information cascade through adverts and articles in the print press, project specific website, newsletters and direct mail

37 The Applicant will offer a range of ways for the public to contact the project team, and share their views based on the most appropriate mechanisms for the community.

38 This approach to consultation, using various consultation methodologies, reflects the Applicant's commitment to meaningful engagement and to capture the views of local communities from individuals, community groups and those harder to reach groups.

3.3 Pre-scoping consultation

39 The Applicant has proactively initiated engagement with several stakeholders from an early stage in the Project. Table 3.1 provides an overview of stakeholder consultation undertaken up to June 2022. The Applicant will build from this initial consultation to ensure that all stakeholders are effectively engaged as the EIA process progresses.

Table 3.1 Early initial consultation to June 2022

Dates	Topic	Organisation consulted	Number of meetings
September 2019 – June 2022	Grid Connection	National Grid (ESO, TO (NGET)), BEIS, Ofgem	21
Feb 2020 – June 2022	Co-existence with other Marine Users	Spirit Energy, Harbour Energy, Burgate, Lanis and Vodafone, EnBW/bp	56
June 2021 – June 2022	Enhanced advice service	Natural England, Marine Management Organisation	8
October 2021 – June 2022	Introductory meetings	Blackpool Airport, Cumbria LEP, Environment Agency, Isle of Man Government, Isle of Man Steam Packet Company, Historic England, Isle of Man Harbours and Coastguard, Lancaster City Council, Lancashire County Council, Marine Management Organisation , Maritime Coastguard Agency, Natural England, Ministry of Defence, The National Federation of Fishermen's Organisations, North West Inshore Fisheries and Conservation Authorities, North West Wildlife Trusts (Cumbria, Lancashire & Cheshire), Peel Ports, Associated British Ports, Port of Barrow, Royal Society for the Protection of Birds, Royal Yachting Association, Sea Truck Ferries, Stena Line Ferries, Trinity House, The Planning Inspectorate, UK Chamber of Shipping, the Welsh Government, Wyre Council, Royal Yachting Association	27
November 2021 –	Lease and Plan Level	The Crown Estate	8

Dates	Topic	Organisation consulted	Number of meetings
January 2022	Habitats Regulations Assessment (HRA) Process		
March 2022	Evidence Plan Process Steering Group	Historic England, Marine Management Organisation, Natural England, Environment Agency, Planning Inspectorate	1
May 2022	Marine Mammal Expert Topic Group (ETG)	Natural England, The Wildlife Trusts, MMO	1
May 2022	Marine Archaeology and Cultural Heritage ETG	Historic England, MMO	1
May 2022	Offshore Ornithology ETG	Natural England, MMO	1
June 2022	Marine Ecology ETG	Natural England, MMO, The Wildlife Trusts, North West Inshore Fisheries Conservation Authority, Environment Agency	1

40 The Project is wholly located within English territorial waters, however it is in proximity to Welsh waters and the Isle of Man. Consultation with the respective Government's will be undertaken as required and where applicable.

3.4 Technical consultation

41 Consultation is an important element of the EIA process and consultation with technical consultees will be crucial to the development of the assessments. This consultation will initially include discussions on the detailed methodologies for data collection and undertaking the impact assessments, as well as any key points raised in the Scoping Opinion.

42 As additional data and project information, including mitigation measures develop, further discussions will take place and it may be appropriate to scope impacts out at this stage. This would be based on, for example, site specific

survey information, and only where there is documented agreement with relevant regulators and stakeholders. Agreement logs will be developed with attendees for review and signoff; it is hoped these will ultimately be able to form the basis for the Statements of Common Ground (SoCG) and for inclusion within the Consultation Report, which will be submitted as part of the DCO application.

43 As part of the EPP, Expert Topic Groups (ETGs) have been established where it is relevant for multiple agencies to collectively engage in topic specific technical discussions. Table 3.2 provides an overview of the likely stakeholders that will be engaged throughout the EIA and the broad environmental topic areas to be discussed. From experience on other NSIPs the EPP is very beneficial, enabling early engagement and discussion over evidence needs between applicants and relevant stakeholders. The EPP helps to identify and address evidence gaps and issues faced by projects in the pre-application stage.

44 The Applicant will support and facilitate the EPP process and Table 3.2 sets out the typical structure of ETGs that the Applicant would seek to refine and develop for the Project.

Table 3.2 Consultation groups

Consultation	Purpose and topics included	Technical Stakeholders
EPP	The EPP process is a voluntary mechanism to help agree the information required as part of a DCO application to help to ensure compliance with the EIA Regulations and Habitat Regulations. It is expected that the following ETGs will be established for the Project[4]: ▪ Marine Ecology (including marine processes, benthic ecology, fish and shellfish ecology) ▪ Offshore Ornithology ▪ Marine Mammals ▪ Offshore Historic Environment ▪ Seascape, Landscape and Visual Impact Assessment (SLVIA) ▪ Human environment (Socio-Economics, Tourism and Recreation and Human Health) Where there is sufficient overlap in technical expertise, topics may be combined to provide efficiency for all parties. The EPP aims to give greater certainty to all parties on the amount and range of evidence the applicant should collect and present to support the DCO application. The EPP for the Project commenced in 2022, and some prior	Technical stakeholders and ETG meeting attendance will be refined as the Project progresses. Stakeholders invited to join the ETGs where relevant include: ▪ Marine Management Organisation (MMO) ▪ Centre for Environment, Fisheries and Aquaculture (Cefas) (where invited by the MMO) ▪ Natural England ▪ Historic England ▪ North West Inshore Fisheries Conservation Authority (IFCA) ▪ Local Planning Authorities (LPAs) ▪ Environment Agency ▪ Highways England ▪ Non-governmental organisations (NGOs) e.g. Royal Society for the Protection of Birds (RSPB), Whale and Dolphin Conservation (WDC), The Wildlife Trusts (TWT)

[4] ETGs for topics impacted by Transmission assets only will also be established in due course

Consultation	Purpose and topics included	Technical Stakeholders
	consultation have also been undertaken, e.g. regarding survey methodologies.	
Targeted Consultation with interested parties: Fisheries	This topic typically sits outside the framework of the EPP. Local fisheries organisations and individual fishermen will be contacted at an early stage in the EIA process to provide information about the Project and to seek information on fishing activity in order to inform the assessment. A fisheries liaison officer (FLO) has been appointed by the Project to undertake consultation with the fishing industry, as discussed in Section 8.7	▪ UK fisheries ▪ Foreign fisheries
Targeted Consultation with interested parties: Aviation and Radar	This topic typically sits outside the framework of the EPP. Consultation with aviation stakeholders will be undertaken at an early stage in the EIA process to provide information about the Project and to seek information on potential issues with regards to Aviation and Radar in order to inform the assessment.	▪ Civil Aviation Authority (CAA) ▪ Ministry of Defence (MoD) ▪ National Air Traffic Services (NATS) En Route ▪ Offshore Helicopter operators (Warton and Blackpool airports) ▪ Civil Airports
Targeted Consultation with interested parties: Shipping and Navigation	This topic typically sits outside the framework of the EPP. Consultation with shipping and navigation stakeholders will be undertaken at an early stage in the EIA process (through the Navigational Risk Assessment (NRA)) to provide information about the Project and to seek information on potential issues with regards to shipping and navigation in order to inform the NRA. A NRA consultant has been appointed by the Project to undertake consultation regarding shipping and navigation.	▪ Maritime and Coastguard Agency (MCA) ▪ Trinity House ▪ Royal Yachting Association (RYA) ▪ Chamber of Shipping ▪ Port Authorities ▪ Shipping and ferry companies ▪ Those with development rights

Consultation	Purpose and topics included	Technical Stakeholders
Targeted Consultation with interested parties: Oil and Gas	This topic typically sits outside the framework of the EPP. Consultation with oil and gas stakeholders will be undertaken at an early stage in the EIA process (and has begun as shown in Table 3.1) to provide information about the Project and to seek information on potential issues with regards to inform the EIA, including the NRA.	▪ Relevant oil and gas operators

4. Policy and legislative context

4.1 Need for the Project

45 The need for the Project and its key objectives will be set out fully in consultation documents and the Development Consent Order (DCO) application. In summary, the key drivers for the development of offshore wind energy are:

- The need to reduce greenhouse gas emissions
- The need for energy security
- The need to maximise economic opportunities from energy infrastructure investment for the UK
- The need to produce affordable energy

46 Background to these key drivers are discussed further in the sections below.

4.1.1 The need to reduce greenhouse gas emissions

47 The UK has made international commitments to limit global temperature increases, most recently through the 21st Conference of Parties (COP) in Paris in 2015. This commitment has been ratified and has been implemented in 2020 through the sixth UK Carbon Budget which recommends the UK commits to a 78% reduction in carbon emissions by 2035, compared to emission levels in 1990 (Climate Change Committee, 2020). The UK Government has committed to net zero (reduction in greenhouse gas emissions by 100% relative to 1990 levels) by 2050. The latest COP26 was held in Glasgow in November 2021 to accelerate climate action for this decade and strengthen efforts to keep global warming under 1.5°C.

48 The Climate Change Committee (CCC) (2020) recommends that "Offshore wind becomes the backbone of the whole UK energy system, growing from the Prime Minister's promised 40GW in 2030 to 100GW or more by 2050". In April 2022, the British Energy Security Strategy (HM Government, 2022) was published, which increases the target for offshore wind again from 40GW by 2030 to 50GW.

4.1.2 The need for energy security

49 Electricity generation in the UK fell by 2.4% between 2018 and 2019 and by 15% between 2010 and 2019, highlighting the need for new infrastructure to deliver a secure national energy supply as part of a long-term sustainable energy policy and to support the UK Government's policy to "Build Back Better" (HM Government, 2021).

50 The Overarching National Policy Statement for Energy (NPS EN-1) estimates that additional electricity generating infrastructure to ensure adequate supplies will require a new overall capacity of approximately 59GW by 2025, of which up to 33GW will need to be from renewable sources (DECC, 2011a). NPS EN-1 makes clear that the need for new electricity NSIPs is urgent: "In order to secure energy supplies that enable us to meet our obligations for 2050, there is an urgent need for new (and particularly low carbon) energy NSIPs to be brought forward as soon as possible, and certainly in the next 10 to 15 years, given the crucial role of electricity as the UK decarbonises its energy sector." (DECC, 2011a).

4.1.3 The need to maximise economic opportunities from energy infrastructure investment for the UK

51 In 2019 the Offshore Wind Sector Deal was adopted by the Government and the offshore wind sector to build on the UK's global leadership in offshore wind and maximise the advantages for UK industry from the global shift to clean growth. Subsequently, the Energy White Paper (HM Government, 2020b) commits the UK to building up to 40GW of offshore wind by 2030 which could account for over £50 billion of infrastructure spending in the next decade (HM Government, 2020b). The 50GW targets in the British Energy Security Strategy mean that the offshore wind sector could grow to support around 90,000 jobs by 2030.

52 A key commitment within the UK's Low Carbon Transition Plan (HM Government, 2009) was to assist in making the UK a green industry centre by supporting the development and use of clean energy technologies, a commitment updated by the Ten Point Plan for a Green Industrial Revolution (HM Government, 2020). The Ten Point Plan explains the Government's vision for the energy industry whereby Industry and Government work together to build a competitive and innovative UK supply chain that delivers and sustains jobs, exports and generates economic benefits for the UK, supporting offshore wind as a core and cost-effective part of the UK's long-term electricity mix. The introduction of the British Energy Security Strategy further secures this commitment to maximising economic opportunities from energy infrastructure investment for the UK.

4.1.4 The need to produce affordable energy

53 As offshore wind technology has matured and developers have innovated there has been a significant reduction in the cost of energy produced by offshore wind in recent years, with a 32% reduction between 2012 and 2016 (ORE Catapult, 2017). The latest allocation round of the UK Government's

Contracts for Difference (CfD) scheme was notable for the greatly reduced cost of offshore wind projects to below £40/MWh, compared with the first CfD round in 2015 which resulted in costs of more than £150/MWh (HM Government, 2020b). This demonstrates the progress being made, with a threefold drop in price, a reduction in levelized cost of offshore wind energy by 73% in five years.

4.2 Summary of climate change and renewable energy policy and legislation

54 Climate change policy has been established at an international and national level. Key aspects are presented in Table 4.1

Table 4.1 Summary of relevant climate change legislation and policies

Legislation/Policy	Summary
United Nations Framework Convention on Climate Change (Paris Agreement)	▪ Limit global temperature increase to below 2°C, while pursuing efforts to limit the increase to 1.5°C ▪ Commitments by all parties to prepare, communicate and maintain a Nationally Determined Contribution ▪ In 2023 and every five years thereafter, a global stocktake will assess collective progress toward meeting the purpose of the Agreement
The UK Climate Change Act 2008 Climate Change Act 2008 (2050 Target Amendment) Order 2019	▪ Introduction of the targets: ▪ A reduction of 34% in greenhouse gases by 2020 (below 1990 levels) ▪ A reduction of 80% in greenhouse gases by 2050 (below 1990 levels) ▪ Introduces a target for at least a 100% reduction of greenhouse gas emissions (compared to 1990 levels) in the UK by 2050 ▪ Supersedes the Climate Change Act 80% target
The UK Energy Act 2013	▪ Introduction of provisions to enable a statutory 2030 decarbonisation target range for the GB electricity sector ▪ Electricity Market Reform including introduction of the contract for difference (CfDs) support mechanism
Net Zero Strategy: Build Back Greener 2021	▪ Net zero emissions by 2050 ▪ 40GW of offshore wind by 2030.
British Energy Security Strategy April 2022	▪ 50GW of offshore wind by 2030.

4.3 Planning policy and legislation

55 Planning policy and legislation influences almost all aspects of the Project from an EIA perspective, the DCO and the Project design. International, national and local policies all shape the need for the Project, its location and how it can be developed.

56 As part of its application for a DCO, the Applicant may seek other relevant permissions, consents and licences such as Marine works under Deemed Marine Licences (DML(s)).

57 Secondary legislation and guidance relevant to DCO applications will also be taken into account in planning the approach to the Project's Environmental Impact Assessment (EIA).

58 The Planning Act 2008 (as amended) is the primary legislation that establishes the legal framework for applying for, examining, and determining applications for NSIPs taking into account the guidance in National Policy Statements (NPSs).

4.3.1 National Policy Statements (NPS)

59 NPSs are produced by the UK Government to set out national policy for delivering major energy infrastructure across five technology specific areas. The three NPSs of particular relevance to the Project are:

- EN-1 Overarching Energy (DECC 2011a), which sets out the Government's policy for delivery of major energy infrastructure
- EN-3 Renewable Energy Infrastructure (DECC 2011b), which covers nationally significant renewable energy infrastructure (including offshore generating stations in excess of 100MW)
- EN-5 Electricity Networks Infrastructure (DECC 2011c), which covers the electrical infrastructure associated with an NSIP

60 The Energy White Paper (December 2020) announced a review of the existing energy NPS. At the time of writing revisions to the current energy NPS are in draft. Any updates will be incorporated into the PEIR and ES.

61 Although not currently a mandatory requirement for NSIPs, it is likely that the updated NPSs will encourage projects to consider delivering biodiversity net gain, as required under the Environment Act (2021). The Project will explore opportunities for biodiversity net gain as the Project develops and where possible this will be included in the design of the Project.

62 In addition, the Marine Policy Statement (MPS) adopted by all UK administrations in March 2011 provides the policy framework for the

preparation of Marine Plans and establishes how decisions affecting the marine area should be made in order to enable sustainable development. The statutory reporting cycle for Marine Plans is a frequency of no less than three years. A draft North West Marine Plan was issued for consultation in January 2020 and the MMO is now using the formal representations received to finalise the plans for submission to the Secretary of State for Environment, Food and Rural Affairs (Defra) for consideration for adoption.

4.3.2 Marine and Coastal Access Act (2009)

63 Under the Marine and Coastal Access Act (2009) (MCAA), a Marine Licence is required for the construction and operation of all parts of a project below Mean High Water Springs (MHWS). In cases where applications are made to the Planning Inspectorate for an offshore windfarm (projects over 100MW), a deemed Marine Licence may be granted as part of the DCO. The Planning Inspectorate retains responsibility for the review of the application and the MMO acts as a statutory consultee in defining the conditions relating to the deemed Marine Licence.

64 The MCAA also enabled the designation of Marine Conservation Zones (MCZs). MCZs are a type of Marine Protected Area (MPA) which seek to protect a range of nationally important marine wildlife, habitats, geology and geomorphology. A MCZ assessment will be undertaken as part of the DCO application.

4.3.3 The EIA directive

65 Environmental Impact Assessment (EIA) is the principle environmental decision support tool, to provide information on the likely impacts of development projects to decision makers. EIA was introduced under the European Union (EU) EIA Directive 85/337/EEC (as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC). The EIA Directive was transposed into English law for NSIPs by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009. In 2011, the original EIA Directive and amendments were codified by EIA Directive 2011/92/EU.

66 Amendments were made by EIA Directive 2014/52/EU and have been transposed into English law for NSIPs by the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) 2017. These are the relevant EIA regulations for the Project.

67 The Project EIA process will take account of guidance provided by the Planning Inspectorate. The Advice Notes listed in Table 4.2 are of particular relevance to the Project.

Table 4.2 Planning Inspectorate Advice Notes

Advice Note	What is included	How this is considered for the Project
Advice Note Three: EIA consultation and notification (The Planning Inspectorate 2017a)	Explains the approach taken by the Planning Inspectorate, on behalf of the Secretary of State, when identifying consultation bodies to be notified under Regulation 11 of the EIA Regulations, and where relevant, consulted on the scope of the ES under Regulation 10 of the EIA Regulations. Also identifies non-prescribed consultation bodies that the Planning Inspectorate may consult on a discretionary basis.	See Section 3
Advice Note Seven: Environmental Impact Assessment, Preliminary Environmental Information, Screening and Scoping (The Planning Inspectorate 2020a)	Provides advice on the pre-application stages of the EIA process, namely screening and scoping and to assist in understanding the role of preliminary environmental information. The advice note also provides advice regarding the preparation of an Environmental Statement (ES).	See Sections 1.2 , 1.5, 2 and 4.3.3
Advice Note Nine: Rochdale Envelope (The Planning Inspectorate 2018)	Addresses the use of the 'Rochdale Envelope' approach, providing information on the degree of flexibility that would be considered appropriate with regards to an application for a NSIP.	See Section 6.2
Advice Note Ten: Habitat Regulations Assessment (The Planning Inspectorate 2017b)	Provides information in relation to the preparation of a HRA Report.	See Section 4.4.1
Advice Note Twelve: Transboundary impacts and process (The Planning Inspectorate 2020b)	Explains the roles and responsibilities of the Secretary of State, the Planning Inspectorate, European Economic Area Member States and applicants applicable	See Section 7.8

Advice Note	What is included	How this is considered for the Project
	under Regulation 32 of The Infrastructure Planning (EIA) Regulations 2017.	
Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects (The Planning Inspectorate 2019)	Sets out a staged approach to a cumulative impact assessment (CIA) and provides template formats for documenting the CIA within an ES.	See Section 7.7

4.4 Environmental legislation

68 Table 4.3 provides an overview of the key environmental legislation that will be of relevance to the Project.

69 The UK ceased to be a member of the EU on 31st January 2020, and as such is no longer bound by European Directives. However, such Directives have been transposed to UK domestic legislation. The Environmental Assessments and Miscellaneous Planning (Amendment) (EU Exit) Regulations 2018 (made under the European Union (Withdrawal) Act 2018) made the necessary changes to domestic legislation which governs EIA as a result of the UK leaving the EU and ensures that the EIA Regulations continue to apply in substantially the same way. The same applies to the Habitats Regulations through the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

Table 4.3 Key relevant environmental legislation

Legislation	Summary
International	
The OSPAR Convention	▪ Establishes a network of Marine Protected Areas (MPAs)
The Convention on Wetlands of International Importance especially as Waterfowl Habitat	▪ Establishes Ramsar sites to protect important areas for waterfowl

Legislation	Summary
(Ramsar Convention)	
UK Legislation	
Natural Environment and Rural Communities Act 2006 (NERC)	▪ Requires the relevant Secretary of State to compile a list of habitats and species of principal importance for the conservation of biodiversity.
Marine Coastal and Access Act 2009	▪ Enables the designation of MPAs in England, Wales and UK offshore waters, including Marine Conservation Zones (MCZs) and Highly Protected Marine Areas (HPMA) ▪ Introduced measures including a streamlined marine licensing system and the introduction of a marine planning system and decision-making to enable sustainable development in accordance with the MPS
Marine Strategy Regulations 2010	▪ Establishes measures to maintain or achieve 'good environmental status' (GES) in the marine environment
Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 and Conservation of Offshore Marine Habitats and Species (Amendment) (EU Exit) Regulations 2019 (together referred to as the 'Habitats Regulations')	▪ Provides a framework for the conservation and management of wild fauna and flora, including protection for specific habitats listed in Annex I and species listed in Annex II of the Directive ▪ Provides for the establishment of a Europe wide network of protected sites, known as Natura 2000 (the definition of which includes Special Areas of Conservation (SAC) and Special Protection Areas (SPA)). Makes it an offence to kill, injure, capture or disturb European Protected Species (EPS) ▪ Note that these two sets of regulations are currently being consolidated by the Government; however, there will be no policy changes as a result of this exercise ▪ Further detail is provided in Section 4.4.1

4.4.1 Habitat regulations assessment

70 Under the Habitats Regulations the Secretary of State must consider whether a plan or project has the potential to have an adverse effect on the integrity and features of a National Site Network site (i.e. a Special Area of Conservation (SAC), Special Protection Area (SPA), candidate SAC or Site of Community Importance (SCI)). This process is known as a Habitat Regulations Assessment (HRA). Under the Habitats Regulations, an Appropriate Assessment is required for a plan or project, which either alone or in combination with other plans or projects, is likely to have a significant effect

on a National Site and is not directly connected with or necessary for the management of the site.

71 HRA can be described as a four-stage process (Planning Inspectorate, 2017b), as outlined in Plate 3.

Plate 3 HRA process

Stage 1: Screening is the process which initially identifies the likely impacts upon the interest features of a National Site of a project or plan, either alone or in combination with other projects or plans and considers whether these impacts could be significant. It is important to note that the burden of evidence is to show, on the basis of objective information, that there will be no significant effect; if the effect may be significant, or is not known, that would trigger the need for an appropriate assessment.

Stage 2: Appropriate assessment is the detailed consideration of the impact on the integrity of the National Site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's conservation objectives and its structure and function. This is to ensure there are no adverse effects on the integrity of the site. This stage also includes the development of mitigation measures to avoid or reduce any possible impacts. If no adverse effect on site integrity is found the assessment is complete. However, if an adverse effect is determined to be likely then the project may not be permitted. In this case a developer may seek a derogation under article 6(4) of the Habitats Directive. The further stages of the assessment under the article 6(4) derogation are described below as stage 3 and 4.

Stage 3: Assessment of alternative solutions is the process which examines alternative ways of achieving the objectives of the project or plan that would avoid adverse impacts on the integrity of the National Site, should avoidance or mitigation measures be unable to prevent adverse effects.

Stage 4: Where no alternative solutions exist and where adverse impacts remain likely, an assessment is made as to whether or not the development is necessary for imperative reasons of overriding public interest (IROPI) and, if so, compensatory measures are required to maintain the overall coherence of the National Sites Network.

72 It is intended that the HRA Screening will be undertaken for the Project in 2022 and will be consulted upon with the relevant stakeholders through the Evidence Plan Process (EPP) (see Section 3). A separate Screening report will be produced for Transmission Assets.

73 Following screening, further assessment will be undertaken as required and presented with the DCO application in the Report to Inform an Appropriate Assessment (RIAA). The RIAA will contain sufficient information to enable the competent authority (the Secretary of State for BEIS) to carry out an appropriate assessment. A draft RIAA will be provided for consultation.

74 The requirement for Stage 3 and 4 will be subject to the findings of the RIAA and consultation through the EPP. The decision to undertake derogation will be undertaken following consultation and considering the evidence available.

75 At the time of writing, The Crown Estate (TCE) is currently finalising the Plan-Level HRA for the Offshore Wind Leasing Round 4 to assess the potential impacts of the six projects identified through the Round 4 tender process. The Plan-Level HRA assesses the potential strategic, high-level impacts of the Round 4 Plan on protected sites within the UK and the UK offshore marine area to determine whether the TCE can grant Agreements for Lease to prospective developers. Further to awarding an Agreement for Lease, each successful project will commence a detailed Project-Level HRA as part of the application for development consent through the statutory planning process, as described above.

5. Site selection and assessment of alternatives

5.1 Identifying the windfarm site

76 The windfarm site was identified through considering a number of key factors including:

- Physical Parameters (including water depths, wave height, ground conditions and wind resource)
- Grid connection (distance to and available capacity)
- Landscape designations
- Environmental designations
- Oil and gas interaction opportunities
- Sensitive ecological habitats and receptors
- Other sea and air users (e.g. Ministry of Defence (MoD) activity, shipping and navigation, National Air Traffic (NATs) services, fishing activity, oil and gas infrastructure and key resource areas (carbon capture and storage, marine aggregates, tidal energy))
- Cumulative impacts with other licensed activities

77 A factor in the windfarm site's selection was the potential for the Project to co-exist with oil and gas operations. The windfarm site was selected to overlap with the South Morecambe Gas Fields (which are currently expected to cease production around 2027 (+/-2 years)). This provides the potential for the Project to be the first windfarm to fully co-exist with oil and gas operations on previously developed seabed. It was felt this approach also minimised the potential for impacts on other existing sea users.

78 Further refinement of the windfarm site is now currently being undertaken considering for example:

- Ground conditions
- Co-location with oil and gas infrastructure
- Existing marine use
- Wind resource
- Environmental constraints

6. Description of the Project

6.1 Introduction

79 This section provides an overview of the main components of the Project. It also summarises the main activities that will occur during construction, operation and maintenance and decommissioning of the Project.

6.2 Design envelope approach

80 At this early stage in development of the Project, the Project description is indicative. The Project description submitted as part of the DCO application will be based on a Design Envelope, comprising parameters for key elements rather than a finalised detailed design. For example, the make and model of turbines (and hence their dimensions) will not have been selected at the point of the DCO application. The use of the Design Envelope approach has been recognised in the Overarching National Policy Statement (NPS) for Energy (NPS EN-1) (DECC, 2011a) and the NPS for Renewable Energy Infrastructure (NPS EN-3) (DECC, 2011b), as well as the draft (2021) EN-1 and EN-3 (DECC 2021a, DECC 2021b). This approach has been used in all offshore windfarm DCO applications to date.

81 In the case of offshore windfarms, NPS EN-3 (paragraph 2.6.42) recognises that: "Owing to the complex nature of offshore wind farm development, many of the details of a proposed scheme may be unknown to the applicant at the time of the application, possibly including:

- Precise location and configuration of turbines and associated development
- Foundation type
- Exact turbine tip height
- Cable type and cable route
- Exact locations of offshore and/or onshore substations".

82 NPS EN-3 (paragraph 2.6.43) continues: "The Secretary of State should accept that wind farm operators are unlikely to know precisely which turbines will be procured for the site until sometime after any consent has been granted. Where some details have not been included in the application to the Secretary of State, the applicant should explain which elements of the scheme have yet to be finalised, and the reasons. Therefore, some flexibility may be required in the consent. Where this is sought and the precise details are not known, then the applicant should assess the effects the project could have to ensure that the project as it may be constructed has been properly assessed (the Rochdale [Design] Envelope)". (DECC, 2011b).

83 NPS EN-3 also states that: "The 'Rochdale [Design] Envelope' is a series of maximum extents of a project for which the significant effects are established. The detailed design of the project can then vary within this 'envelope' without rendering the ES [Environmental Statement] inadequate".

84 Draft NPS EN-1 (DECC 2021a) states that: "Where some details are still to be finalised, the ES should set out to the best of the applicant's knowledge, what the likely worst-case environmental, social and economic effects of the proposed development may be and assess, on that basis, to ensure that the impacts of the project as it may be constructed have been properly assessed".

85 The Design Envelope approach is widely recognised and is consistent with Planning Inspectorate (PINS) Advice Note Nine: Rochdale Envelope (PINS, 2018) which states that: *"The 'Rochdale Envelope' is an acknowledged way of dealing with an application comprising EIA development where details of a project have not been resolved at the time when the application is submitted"*. Flexibility to respond to emerging economic circumstances and technological advances is essential if the Project is to proceed and be successful. A degree of flexibility will, therefore, be built into the design basis for the DCO application by applying a PDE approach that is consistent with PINS Advice Note Nine (Planning Inspectorate, 2017c).

86 Throughout this Scoping Report and subsequent EIA, the Rochdale [Design] Envelope approach is being taken, referred to as the Project Design Envelope (PDE), to allow meaningful assessments of the Project to proceed, whilst still allowing reasonable flexibility for future project design decisions, where this is required.

6.2.1 Applying the 'design envelope' approach

87 The utilisation of a PDE is intended to identify key design parameters for the Project, setting out a 'maximum design scenario' that initially informs this environmental Scoping Report, whilst retaining sufficient flexibility to accommodate further refinement during detailed design, including improvements that cannot be predicted at the time of submission of any applications. This section therefore sets out a series of options and/or parameters for which maximum values are defined. The Project design will be refined through the Preliminary Environmental Information Report (PEIR) and Environmental Statement (ES) process, with flexibility retained in the Design Envelope to enable Project delivery.

88 This approach does introduce some complexity into the Environmental Impact Assessment (EIA) process which is common to many large-scale developments. The 2017 EIA Regulations require an ES to provide a

description of the location, design and size of the scheme to enable the likely significant environmental effects to be assessed and to enable the decision-maker, statutory consultees and the public to make properly informed responses.

89 A balance has to be sought between defining the Project in enough detail to predict impacts, while leaving enough flexibility to enable the Project to be successfully delivered under conditions which may be subject to change, for example, to utilise the latest technology available at the time of construction. The PDE will provide a basis for the impact assessment process. The Applicant recognises the desire for certainty of the Project design and will ensure that flexibility in the PDE is restricted to only those areas where it is required. Further, it is the intention to see the PDE refined over the life of the EIA as key design decisions can be taken by the engineering team and EIA team working together.

90 Such an approach is recognised practice, as reflected in case law on the Design Envelope principle (for example Rochdale MBC Ex. Parte C Tew 1999). Suitably applied in EIA it can help to avoid the need for protracted re-submission procedures at a later stage, whilst giving a comprehensive assessment of the likely environmental effects.

6.3 Project infrastructure overview

91 The Project includes the Generation assets to be located within the windfarm site (wind turbine generators, inter-array cables, offshore substation platform(s) and possible platform link cables to connect offshore substations).

92 The windfarm site (as shown in Figure 6.1) reflects the boundary of the successful Offshore Wind Leasing Round 4 bid (awarded to the Applicant as a preferred project), with the Agreement for Lease (AfL) for the site expected in 2022 following conclusion of the Plan level Habitats Regulations Assessment (HRA) by The Crown Estate. The key characteristics of the windfarm site area are summarised in Table 6.1.

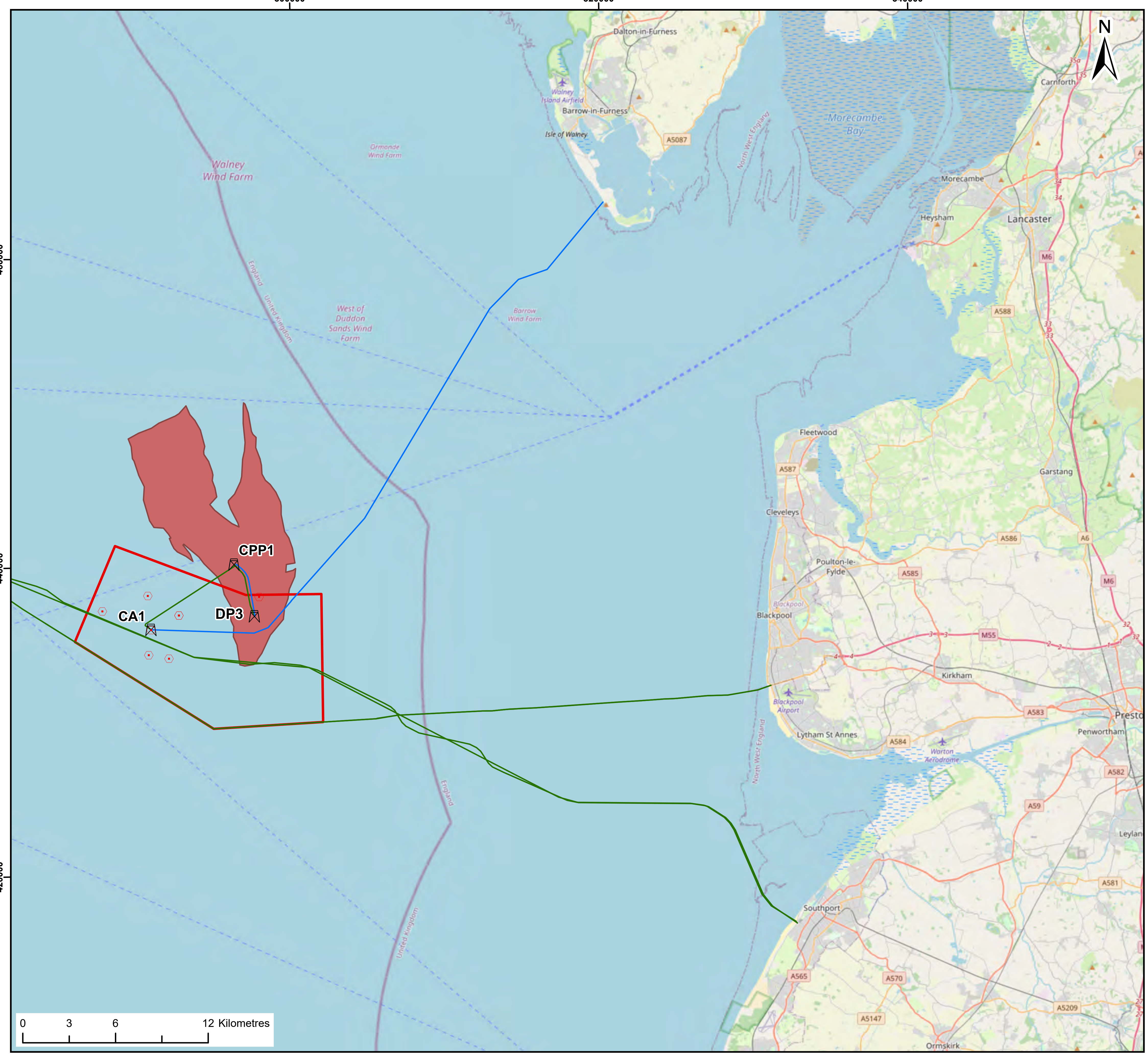
Table 6.1 Morecambe Offshore Windfarm Site Overview

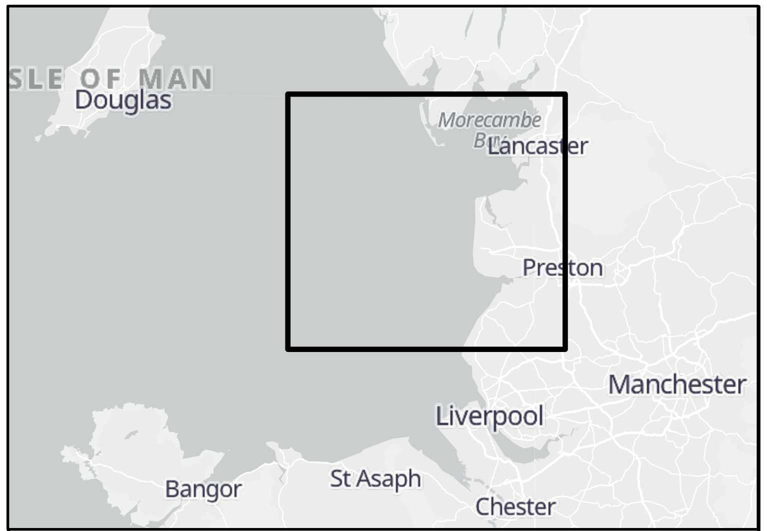
Area	Parameters	Values
Windfarm site	Area	$125km^2$
	Closest distance to shore	30km (approximate)
	Water depth	18 – 40m

93 The windfarm site overlaps with the Morecambe South Gas Fields and its infrastructure of platforms, pipelines, cables and wells, as shown in Figure

6.1. The live telecommunication cable GTT/Hibernia Atlantic also traverses the area in a west-east direction. The Lanis 1 cable owned by Vodafone runs along the edge of the site, defining the southern boundary.

94 The area required for infrastructure within the windfarm site will be refined throughout the EIA process alongside the development of the layout, capacity and density requirements. As such the final boundary of the windfarm site may reduce from 125km^2.





Legend:

- Morecambe Offshore Windfarm Site
- South Morecambe Gas Field
- Offshore platform
- Wellhead
- Subsea cable
- Pipeline

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Offshore Platforms and Existing Cables in the Vicinity of the Morecambe Offshore Windfarm Site

Figure: 6.1 | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0054

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	21/06/2022	JT	GC	A3	1:250,000
P01	18/01/2022	JT	GC	A3	1:250,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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6.3.1 Wind turbine generators

95 The current wind turbine generator design envelope for the Project is outlined in Table 6.2, illustrated in Plate 4 and subsequently described.

Table 6.2 Wind turbine generator design envelope

Wind turbine generator parameter	Indicative value
Wind turbine generator capacity	12-24MW (indicative range)
Turbine type	Three bladed horizontal axis
Rotor diameter[5]	220 – 300m (indicative range)
Maximum number of wind turbine generators	40
Maximum rotor swept area[6]	Total swept area of 40 x 12MW wind turbine generators = 1.53km^2
Maximum tip height (above Highest Astronomical Tide (HAT))	345m (equivalent to 350m above mean sea level)
Minimum air gap above HAT	22m (equivalent to 27m above mean sea level)
Indicative minimum separation distance between turbines (inter-row)	990m

[5] Rotor diameter is the cross sectional dimension of the circle swept by the rotating blades
[6] Swept area is area inside the circle of the rotating blades

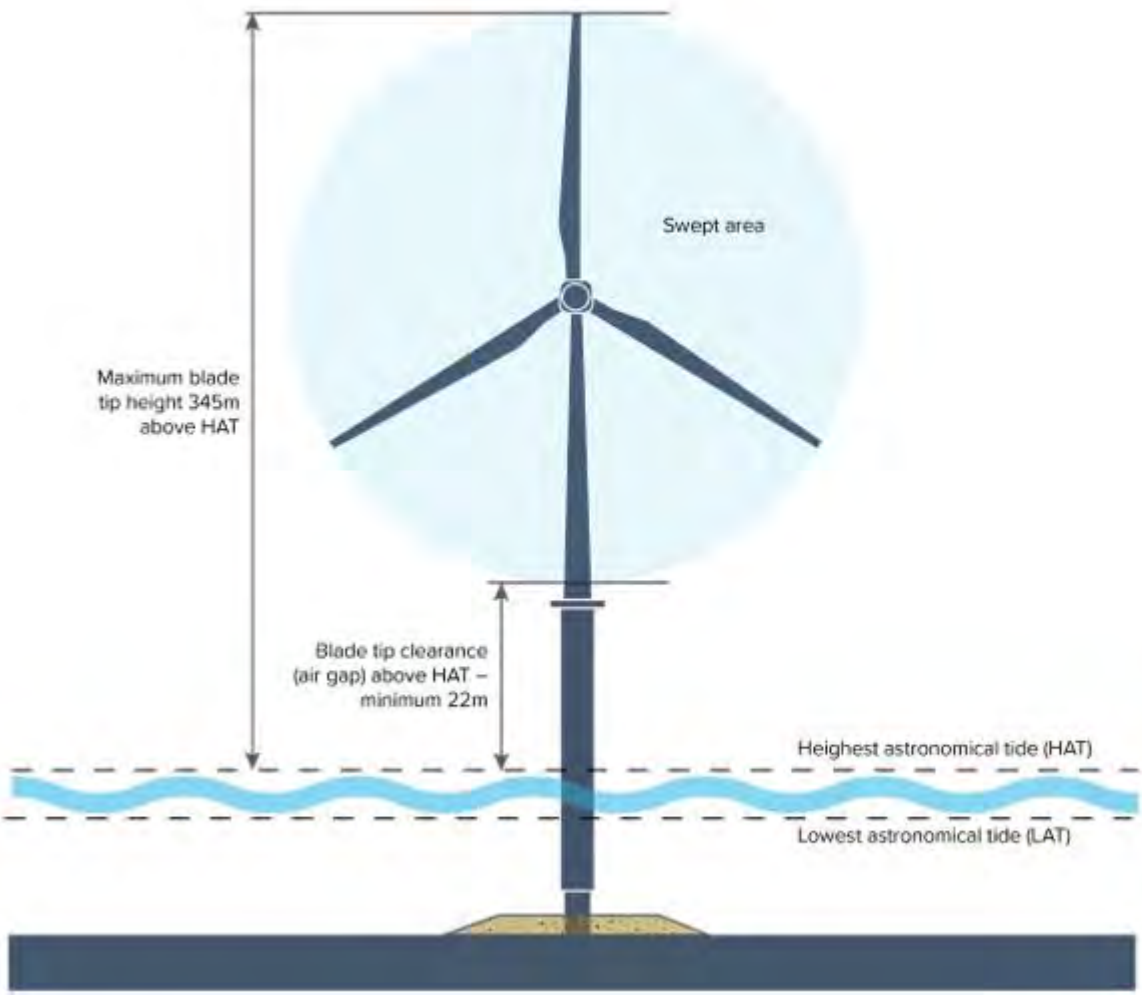


Plate 4 Turbine schematic

96 The size, number and capacity of the wind turbine generators will be decided at a later stage, prior to final investment decision, considering the following:

- Technology developments – for example the available sizes of turbines are expected to increase over the coming years
- Density requirements (capacity per area of seabed)
- Results from engineering and environmental surveys and assessments

97 The layout of turbines will be finalised post consent in consideration of design rules (as detailed in Marine Guidance Note (MGN) 654) and in consultation with relevant authorities e.g. Marine Management Organisation (MMO), Maritime and Coastguard Agency (MCA) and Trinity House (TH). The required lighting and navigational markings will also be agreed post consent.

98 Design parameters, for example air gap and tip height, will also be developed with results for the EIA to as far as possible reduce impacts on receptors.

6.3.2 Wind turbine foundations

99 Wind turbine generators will be fixed to the seabed with foundation structures. Potential wind turbine foundation types being considered are (options are illustrated in Plate 5:

- Monopile
- Jacket with pin piles
- Tripod
- Suction bucket (monopile, noting there could be multiple suction buckets)
- Suction bucket (jacket)
- Gravity based structures (GBS)

100 The wind turbine foundation parameters are listed in Table 6.3, which are subsequently described. Seabed levelling may be required for the installation of all foundations. Gravity based structures are most sensitive to seabed levelling (i.e. the worst case scenario) where the diameter of seabed levelling could reach up to 100m per foundation. Where piling is required for installation the maximum hammer size is also identified.

Table 6.3 Wind turbine foundation design envelope

Offshore Foundation Types	Parameter	Indicative maximum (unless specified)
Monopile	Diameter	14m
	Hammer size	5000kJ
Jacket with piling	Leg spacing	35m
	Hammer size	3000kJ
	Pile Diameter	1.5-5m per pile
Tripod	Leg spacing	35m
	Hammer size	3000kJ
	Pile Diameter	3-5m per pile
Jacket with suction buckets	Leg spacing	35m
	Bucket diameter	20m
Suction bucket (monopile)	Bucket diameter	40m
Gravity based structure	Diameter	65m

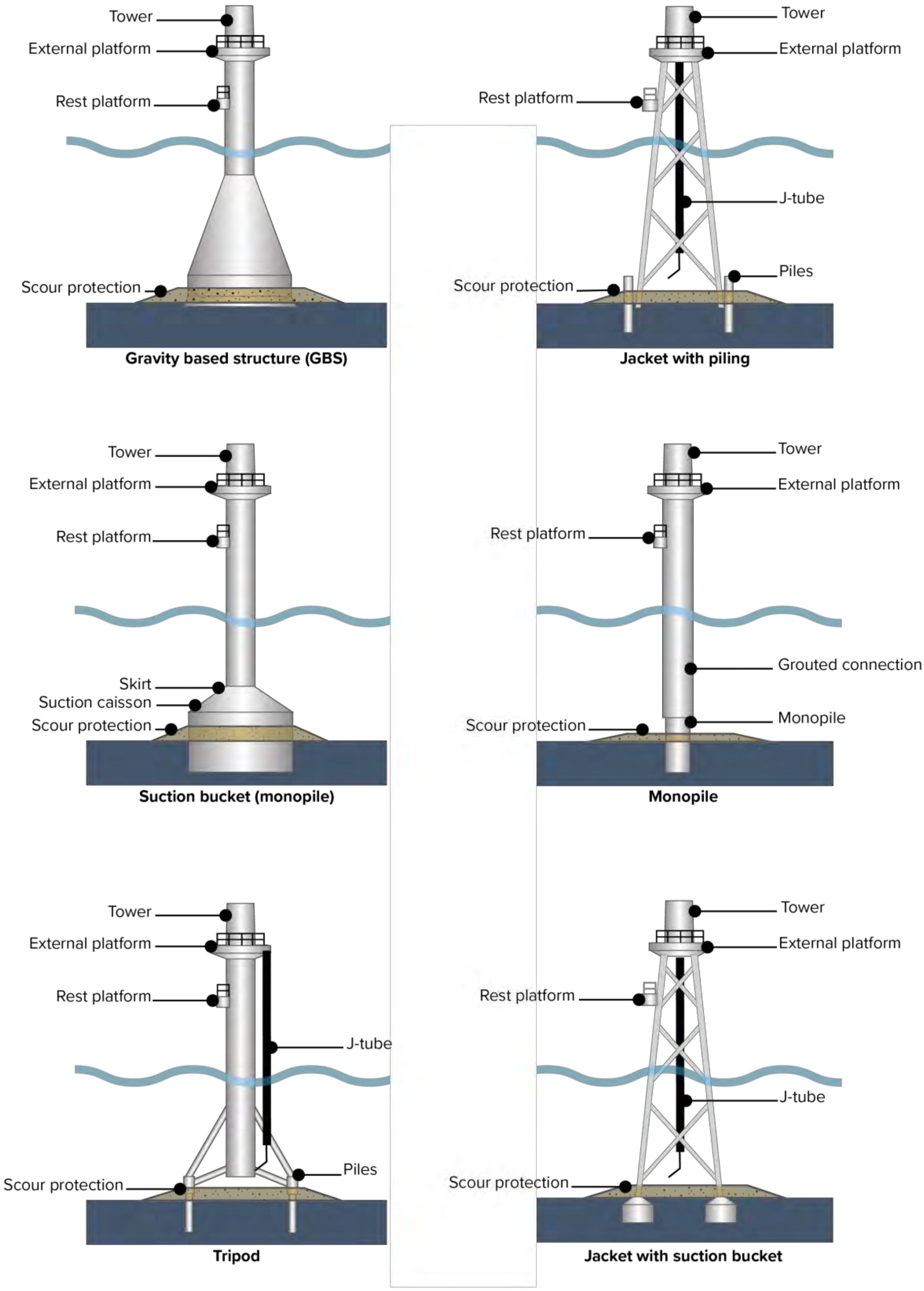


Plate 5 Wind turbine foundation options

101 A number of factors will influence the choice of foundation and the parameters of each foundation type, such as ground conditions, wave, wind and tidal conditions, wind turbine generator selection and supply chain approach and constraints as well as commercial consideration. As such, the design of foundations for the wind turbine generators will be informed by site investigation and procurement, post consent. For each foundation type a number of options will be considered to protect the foundations from scour if required, including rock dumping and mattressing. The amount required will be defined and refined during the PEIR process.

102 Monopiles are usually constructed from rolled and welded steel, with dimensions dependent on the size of the wind turbine generators, seabed/ground conditions, metocean conditions, and installation and transportation methods. The piles are installed vertically into the seabed using piling hammers and/or vibrational methods with the driving method determined by the seabed soil strata. In the most challenging soil conditions such as stiff clays or rock, piles may be installed by a mix of driving and drilling using a drive/drill/drive methodology.

103 A jacket foundation typically consists of three or four main legs which are linked by a supporting matrix of cross-braces. Jacket foundations are anchored to the seabed by using single piles or suction buckets at each leg. Driven piles provide the most flexible type of foundation, suiting most types of seabed soil encountered in the Irish Sea.

104 The tripod concept is a mixture of jacket and monopod. It consists of a transition piece incorporating fabricated steel grillage which connects the foundation of the wind turbine tower to three supporting legs. The three legs each connect down to a pile driven into the seabed. In all versions of this concept the piles are driven into the seabed, at a measured separation, using percussive hammers and a temporary piling frame or piling gate.

105 Suction caissons/buckets are typically utilised in soft clay soils areas of the Irish Sea and can be used for jackets or monopiles. These can be thought of as "upturned buckets" that are installed by providing suction to pump out water from within the bucket, thereby creating pressure to force the pile into the seabed.

106 A gravity-based foundation sits on the seabed and is typically a heavy ballasted structure made of steel and/or concrete and can be used for jackets or cylindrical section. The gravity base structure is placed on a pre-prepared area of seabed which may include removal of soft, mobile sediments and the levelling of an area by installation of a layer of rock/gravel.

107 Some form of seabed preparation may be required to enable some or all installation of the foundations (as well as the inter-array cables). Seabed preparation typically includes seabed levelling, ground reinforcement, cutting and removal of any out of service cables and removing surface and subsurface debris such as boulders, fishing nets, lost anchors etc. If debris is present below the seabed surface then excavation may be required for access and removal. Any unexploded ordnance (UXO) found with live ammunition will be avoided, removed or if required disposed of using low order deflagration, and as a last resort detonation (if deflagration is not possible), and any remaining debris removed, where practicable.

108 Consent for UXO removal will be sought in a future Marine Licence application and European protected species (EPS) licence post-consent when geophysical survey data of suitable spatial resolution is available to identify and quantify UXO risk and appropriate techniques (such as deflagration) and mitigation measures will be identified.

109 Following seabed preparation, a typical turbine construction sequence is as follows:

- Install foundation
- Install scour protection and inter-array cables
- Install transition piece
- Install turbine tower
- Install nacelle
- Install blades

110 There are a number of specialised vessels that can be used for the installation of foundations and turbines, such as a jack-up vessel (typically with four or six legs or a floating platform). It is noted that the installation methods required to accommodate emerging large diameter monopiles with weights exceeding 1,000t (which are included in potential options of the Project) may differ from current methods. For these new larger turbines, the market for installation vessels is limited, but it is expected that the availability of installation vessels will adapt to the increase in turbines sizes. Details of the anticipated jack-up operation footprints will be considered in the PEIR.

6.3.3 Wind measurements

111 There is no requirement for the installation of a met mast for the Project. If wind measurements are needed this could be collected through floating LIDARs inside the windfarm site. The installation of floating LIDARs will be subject to separate marine licences and will be dealt with under a marine license application process, not the DCO process.

6.3.4 Inter-array cables

112 Inter-array cables connect the turbines to each other and to the offshore substation(s). The inter-array cables are expected to be 66KV to 132kV alternating current (AC). The length of each inter-array cable will depend on the final windfarm layout. A realistic maximum distance of inter-array cables will be defined for the purposes of the EIA and used as the basis for the assessments.

113 The inter-array cables will be buried in the seabed, typically to a depth of 1m, but may range from 0.5-3m, noting that the burial depth will be determined by a Burial Assessment Study (BAS) and a Cable Burial Risk Assessment (CBRA). Cables can be buried via a number of techniques depending on the seabed conditions along the route. These techniques include ploughing, jetting, trenching or post-lay burial.

114 Where cable burial is not possible alternative cable protection measures could be used. This may include rock placement, grout/sand bags, concrete mattresses and polyethylene ducting. The appropriate level of protection will be determined based on an assessment of the risks posed to the Project in specific areas.

6.3.5 Offshore substation platform(s)

115 The cables from turbines will be brought to an offshore substation platform, located appropriately to optimise the inter-array cable and offshore export cable lengths. Up to two substations may be required. At the offshore substation platform(s), the generated power will be transformed to a higher AC voltage. This higher voltage will be determined by detailed studies, although it expected that the substation(s) will step up the 66kV or 132kV inter-array cable voltage to 220kV for the export cabling. There is also an option currently being investigated for the offshore export cable rating to be 275kV.

116 The offshore substation platform(s) will typically include components including but not limited to transformers, batteries, generators, switchgear, fire systems, and modular facilities for operational and maintenance activities.

117 The offshore substation will comprise a topside platform installed on a foundation which may require construction of a new foundation. The Applicant is also investigating the option of repurposing existing adjacent oil and gas structures as a substation foundation. The location of the offshore substation platform(s) will be confirmed during the detailed design process.

118 The type of foundations being considered for the offshore substation platform(s) will likely be the same type as those being considered for the wind turbine generators, as described in Section 6.3.2.

6.3.6 Platform link cables

119 Should the final design of the Project include two offshore substation platforms, up to two platform link cables may be installed to link the two substations to improve the reliability of the transmission system.

6.4 Construction

120 The main construction activities associated with the Project infrastructure are outlined in Section 6.3 and further details will be provided in the Preliminary Environmental Information Report (PEIR).

6.4.1 Construction programme

121 The indicative high-level construction milestones over an anticipated two-and-a-half-year construction programme are provided in Plate 2 in Section 2.

122 Offshore construction will typically be performed on a 24-hour basis depending on suitable construction weather windows but will be established as the Project develops.

6.4.2 Fabrication and port facilities

123 Turbines, foundations, substations and electrical infrastructure will be fabricated offsite, marshalled and assembled at a suitable port facility and transported to site as required. Fabrication contracts have not been placed and the Applicant will run competitive tendering processes to identify the most suitable contractors to deliver the required elements of the Project. Fabrication can take place in the UK, in Europe or elsewhere dependent upon the location of the chosen contractor.

124 The Project could provide significant levels of employment during the construction phase and long term opportunities for employment through the operational life. There is an opportunity for many local firms to be involved during the life of the Project and the Applicant is keen to engage with these firms to provide opportunities for collaboration. The Applicant will continuously seek out ways in which it can encourage local suppliers to engage with the Project and has already started to engage with the broader supply chain with regards to the development of the windfarm.

125 The port facilities required for construction (and operations and maintenance) are unknown at this stage and agreements with ports are typically finalised

post DCO consent. It is noted that for the PEIR, the offshore impact assessments will consider vessel movements to and from port, based on a realistic worst case scenario port location. Any onshore works required within a port are outwith the scope of the Project EIA.

6.5 Operation, maintenance and decommissioning phases

6.5.1 Operation and maintenance

126 Across the operational life of the Project, operation and maintenance (O&M) activities can be split into three main categories as follows:

- Scheduled maintenance
- Unscheduled maintenance
- Emergency/special maintenance (in the event of major equipment breakdown and repairs)

127 The O&M strategy will be finalised based on the location of a suitable port/harbour which is yet to be defined. In choosing a suitable port/harbour there will be requirements to ensure sufficient access to a fleet of vessels with the capabilities to complete any required O&M activities. The overall O&M strategy will also reflect the technical specification once known, including wind turbine generator type, electrical transmission design and final project layout.

128 At this stage, the high level O&M activities will include but not be limited to the following:

- Wide ranging inspections of foundations, transition pieces, blades, safety equipment, offshore substation platform equipment, etc.
- System performance assessments and fault-finding
- Replacement of lubricants, oils, filters, etc.
- Painting and coating of turbines, etc.
- Replacement of wind turbine generator parts including bearings, gearboxes, generators, nacelles, transformers and blades
- Minor repair and replacements including access ladders, corrosion protection system (including anodes and protective coatings), secondary steel, boat landings, cable penetrations and ducting, aids to navigation
- Removal of marine growth and guano
- Substructure monitoring and inspection
- Reburial or other remedial actions of inter-array cables
- Repair or replacement of inter-array cables
- Replenishment of rock protection as additional cable and scour protection

6.5.2 Decommissioning

129 The duration of lease, and therefore potential operational lifetime is 60 years. It is anticipated one re-powering of the Project may be required in lease duration. This will be subject to a future separate consent under the applicable regulations at that time this would be required. Potential future re-powering are not included as part of the DCO scope.

130 At the end of the operational lifetime of the Project the decommissioning sequence will nominally be undertaken in reverse of the construction sequence, involving similar types and numbers of vessels and equipment.

131 It is anticipated that all offshore structures above the seabed will be removed and that electrical cables will be left in-situ to minimise environmental impacts associated with their removal. The possibility of removing the subsea cables and leaving structures above the seabed in-situ with appropriate navigation markers will also be assessed.

132 At this stage, the full detail of the required decommissioning activities is not currently known. A decommissioning plan will be prepared during detailed design and developed and refined during the Project’s lifetime and as decommissioning approaches. To reflect future best practice and new technologies, the approach and methodologies of the decommissioning activities will be compliant with the relevant legislation, guidance and policy requirements at the time of decommissioning.

7. EIA methodology

133 The Environmental Impact Assessment (EIA) will be undertaken in accordance with the Planning Act 2008 and the EIA Regulations 2017 (the EIA Regulations). This section provides detail on the overarching methodology for the EIA.

134 The EIA methodology for the Project is outlined in this section. It is noted that as the Generation and Transmission assets are to be the subject of separate consent applications, then each application would include a full and comprehensive assessment of relevant impacts and interactions between them including cumulative, inter-relationships and transboundary impacts, insofar as the information is available in line with any relevant guidance.

7.1 Characterisation of the existing environment

135 The characterisation (description) of the existing environment will be undertaken to determine the baseline conditions in the area that have the potential to be affected by the Project. This will require the following steps:

- Study areas defined for each receptor based on the zone of influence (ZoI) and relevant characteristics of the receptor (e.g. mobility/range)
- Review available information
- Review likely or potential impacts that might be expected to arise from the Project
- Determine if sufficient data to make the Environmental Impact Assessment (EIA) judgements with sufficient confidence
- If further data required, ensure data gathered are targeted and directed at answering the key question and filling key data gaps
- Review information gathered to ensure the environment can be sufficiently characterised in sufficient detail

136 Existing data from research, government and industry, will be used alongside data collected by the Applicant specifically for the Project. The proposed data and information sources are outlined in the existing environment subsections within Section 1.

137 Consideration will also be given to the evolution of the baseline in the absence of the Project. This will take account of wider issues such as climate change and biodiversity loss (in line with the 2017 EIA Regulations).

138 Where appropriate, detailed method statements (for example in relation to data gathering and survey methodologies) will be provided to the relevant technical stakeholders in order to agree the relevant approach.

7.2 Assessment of impacts

139 The approach the EIA team will take to making balanced assessments will be guided by EIA and technical specialists using available data, new data, experience and expert judgement. In order to provide a consistent framework and system of common tools and terms, where appropriate, a matrix approach will be used to frame and present the judgements made. However, it should be noted that for each topic of the EIA the latest guidance or best practice will be used and therefore definitions of sensitivity and magnitude of impact will be tailored to each receptor. The impact assessment will consider the potential for impacts during construction, operation and maintenance, and decommissioning phases of the Project. For each topic the realistic worst case scenario for each phase of the Project will be identified and used to undertake the assessment.

140 The assessment of impacts on some receptors will be predicated on a source-pathway-receptor model (Plate 6), whereby the source is the initiator event, the pathway is the link between the source and the receptor impacted by the effect, and the receptor is the receiving entity. An example of this type of conceptual model is provided by cable installation which disturbs sediment on the seabed (source). This sediment is then transported by tidal currents until it settles back to the seabed (pathway). The deposited sediment could change the composition and elevation of the seabed (receptor).

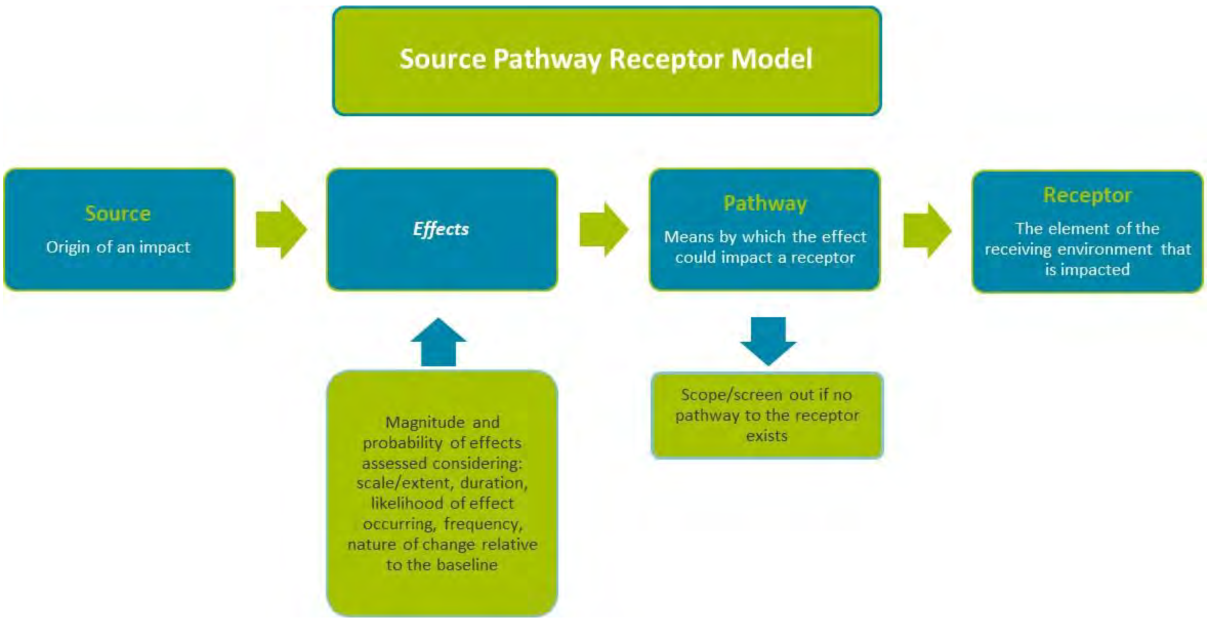


Plate 6 Source pathway receptor model

141 The approach to the EIA and the production of the Preliminary Environmental Information report (PEIR) and Environmental Statement (ES) will closely follow relevant guidance including:

- Planning Inspectorate Advice Notes (as outlined in Section 4.3.3)
- Overarching National Policy Statements for Energy EN-1, Renewable Energy Infrastructure EN-3, and Electricity Networks Infrastructure EN-5 (Department of Energy and Climate Change (DECC) 2011a, 2011b, 2011c) (as revised)
- Assessment of the environmental impact of offshore windfarms (OSPAR Commission, 2008)
- Relevant guidance issued by other UK Government and non-governmental organisations
- Receptor-specific guidance documents

7.2.1 Determining receptor sensitivity and value

142 The ability of a receptor to adapt to change, tolerate, and/or recover from potential impacts will be key in assessing its sensitivity to the impact under consideration. For ecological receptors tolerance could relate to short-term changes in the physical environment, for human environment receptors tolerance could relate to displacement effects and therefore impacts upon economics or safety. It also follows that the times required for recovery will be key considerations in determining receptor sensitivity.

143 Receptor value considers whether, for example, the receptor is rare, has protected or threatened status, importance at local, regional, national or international scale, and in the case of biological receptors whether the receptor has a key role in the ecosystem function.

144 The overall receptor sensitivity is determined therefore by considering a combination of value, adaptability, tolerance and recoverability as well as applying professional judgement and/or past experience. Expert judgement is particularly important when determining the sensitivity of receptors. For instance, an Annex II species (under the Habitats Directive) would have a high value, but if it was highly tolerant of an effect or had high recoverability it would follow that the sensitivity in this instance should reflect this.

7.2.2 Predicting the magnitude of impacts

145 In order to predict the significance of an impact it is fundamental to establish the magnitude and probability of impact occurring through a consideration of:

- Scale or spatial extent (small scale to large scale or most of the population or a few individuals)
- Duration (short term to long term)
- Frequency and or likelihood that adverse ecological effects will occur
- Nature of change relative to the baseline

7.3 Evaluation of significance

146 Subsequent to establishing the receptor sensitivity and magnitude of effect, the impact significance will be predicted by using quantitative or qualitative criteria, (as appropriate for each receptor and/or receptor group) to ensure a robust assessment. Where possible a matrix such as the one presented in Table 7.1 will be used to aid assessment of impact significance based on expert judgement, latest guidance and any specific input from consultation. A description of the approach to impact assessment and the interpretation of significance levels will be provided within each technical topic chapter of the ES. This approach will ensure that the definition of impacts is transparent and relevant to each topic under consideration

147 For the purposes of the EIA, major and moderate adverse impacts are deemed to be significant, and, as such, may require mitigation. Whilst minor impacts are not significant in their own right, these may contribute to significant impacts cumulatively or through interactions.

Table 7.1 Significance of an impact - resulting from each combination of receptor sensitivity and the magnitude of the effect upon it

		Negative Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

7.4 Embedded and additional mitigation, impact significance and residual impact

148 The 2017 EIA Regulations require a description of the measures envisaged to avoid, prevent, reduce or (where possible) offset any significant adverse effects on the environment. Where possible, embedded mitigation, i.e. mitigation identified at an early stage (often using experience from operational projects), can include:

- The design elements aimed at reducing impacts
- Commitment to specific best practice
- Commitment to pre-construction surveys
- Commitment to consultation

149 Embedded mitigation will be incorporated into the project design and listed where relevant for each topic. Impacts will then be assessed with this mitigation in place. Where impacts are significant and additional mitigation is required, impacts may be reassessed and the post-mitigation or 'residual impact' identified. If the impact does not require mitigation (or none is possible) the residual impact will remain the same.

150 In some circumstances it may be necessary to detail monitoring requirements as part of the mitigation measures identified. Monitoring may be appropriate to confirm the assumptions that the assessment is reliant upon (i.e. continue to monitor baseline conditions) and/or to confirm the efficacy of mitigation measures implemented. Monitoring should be proportionate and directly relevant to the findings of the impact assessment, i.e. it should not be monitoring for the sake of monitoring.

7.5 Confidence

151 Once an assessment of a potential impact has been made, it is necessary to assign a confidence value to the assessment to assist in the understanding of the judgment. This is undertaken on a simple scale of high-medium-low, where high confidence assessments are made on the basis of well defined evidence, with lower confidence assessments being based, for example on extrapolation and use of proxies.

7.6 Inter-relationships

152 The impact assessment will consider the inter-relationship of impacts on individual receptors. The objective will be to identify where the accumulation of different residual impacts on a single receptor, and the relationship between those impacts, gives rise to a need for additional mitigation. When considering the potential for impacts to inter-relate it is assumed that any residual effect determined as having no impact will not result in a significant inter-relationship when combined with other effects on receptors. However, where a series of negligible or greater residual impacts are identified, they will be considered further.

7.7 Cumulative impacts

153 Cumulative impact assessment (CIA) forms part of the EIA process. The Planning Inspectorate advice notes nine and 17 provide guidance on plans and projects that should be considered in the CIA including:

- Projects that are under construction
- Permitted applications not yet implemented

- Submitted applications not yet determined
- Projects on the Planning Inspectorate's Programme of Projects
- Development identified in relevant Development Plans, (and emerging Development Plans - with weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited
- Sites identified in other policy documents as development reasonably likely to come forward

154 Where it is helpful to do so 'Tiers' of these other projects' development statuses will be defined as well as the availability of information to be used within the CIA. This approach is based on the three tier system proposed in Planning Inspectorate Advice Note 17 (Planning Inspectorate, 2019).

Tier 1

- Under construction
- Permitted application(s), whether under the Planning Act (2008) or other regimes, but not yet implemented
- Submitted application(s) whether under the Planning Act (2008) or other regimes but not yet determined

Tier 2

- Projects on the Planning Inspectorate's Programme of Projects where a scoping report has been submitted.

Tier 3

- Projects on the Planning Inspectorate's Programme of Projects where a scoping report has not been submitted
- Identified in the relevant Development Plan (and emerging Development Plans – with appropriate weight being given as they move closer to adoption) recognising that there will be limited information available on the relevant proposals
- Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward

155 Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment will be included in the CIA. Projects which are sufficiently implemented during the site characterisation for the Project will be considered as part of the baseline for the EIA. Where possible the Project will seek to agree with stakeholders the use of as-built project parameter information (if available) as

opposed to consented parameters to reduce over-precaution in the cumulative assessment.

156 For some topics (where for example the receptors include highly mobile or migratory species, fishing or shipping) the CIA will have a large geographic scale and include many plans and projects, for others where receptors (or impact ranges) are more spatially fixed the CIA will be narrower. The scope of the CIA will therefore be established on a topic-by-topic basis with the relevant consultees as the EIA progresses.

157 Cumulative impacts may come from interactions with the following activities and industries:

- Other windfarms
- Transmission works, including proposed transmission works for Morecambe Offshore Windfarm and the Morgan Offshore Wind Project
- Aggregate extraction and dredging
- Licensed disposal sites
- Navigation and shipping
- Commercial fisheries
- Sub-sea cables and pipelines
- Potential port and harbour development
- Oil and gas activities
- Unexploded Ordnance (UXO) clearance
- Other energy generation infrastructure

158 It is intended that screening of plans and projects to include in the CIA will be undertaken for the Project in 2022 and will be consulted upon with the relevant stakeholders through the Evidence Plan Process (EPP) (Section 3).

159 It is also the intention to provide information as part of the DCO application for the Project, insofar as available, which summarise the impacts of the Transmission assets for the Morecambe Offshore Windfarm.

7.8 Transboundary impacts

160 Regulation 32 of the EIA Regulations sets procedures to address issues associated with a development that might have a significant impact on the environment in another European Economic Area (EEA) member state

161 The procedures involve providing information to the member state and for the Planning Inspectorate to enter consultation with that state regarding the significant impacts of the development and the associated mitigation measures. Further advice on transboundary issues, in particular regarding

consultation is given in the Planning Inspectorate advice note 12 (Planning Inspectorate, 2018b).

162 Transboundary impacts, like cumulative impacts are considered on a topic-by-topic basis.

163 It is intended that screening of plans and projects to include in the Transboundary assessment will be undertaken for the Project in 2022 and will be consulted upon with the relevant stakeholders through the EPP (Section 3).

8. Part 2: Technical sections

164 This section of the Scoping Report considers the potential impacts of the construction, operation and maintenance and decommissioning of the Project. It details the existing offshore environment, the proposed approach to data collection and an assessment of potential impacts (covered under the EIA regulations).

165 It should be noted that Study Areas per topic are defined in the subsections below based on the potential spatial and temporal considerations of the impacts on relevant receptors and are intended to cover the area within which an effect can be reasonably expected.

8.1 Marine geology, oceanography and physical processes

8.1.1 Introduction

166 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on the marine geology, oceanography and physical processes. It covers tidal currents, waves, bedload sediment transport, suspended sediments and processes at the coast.

8.1.2 Study area

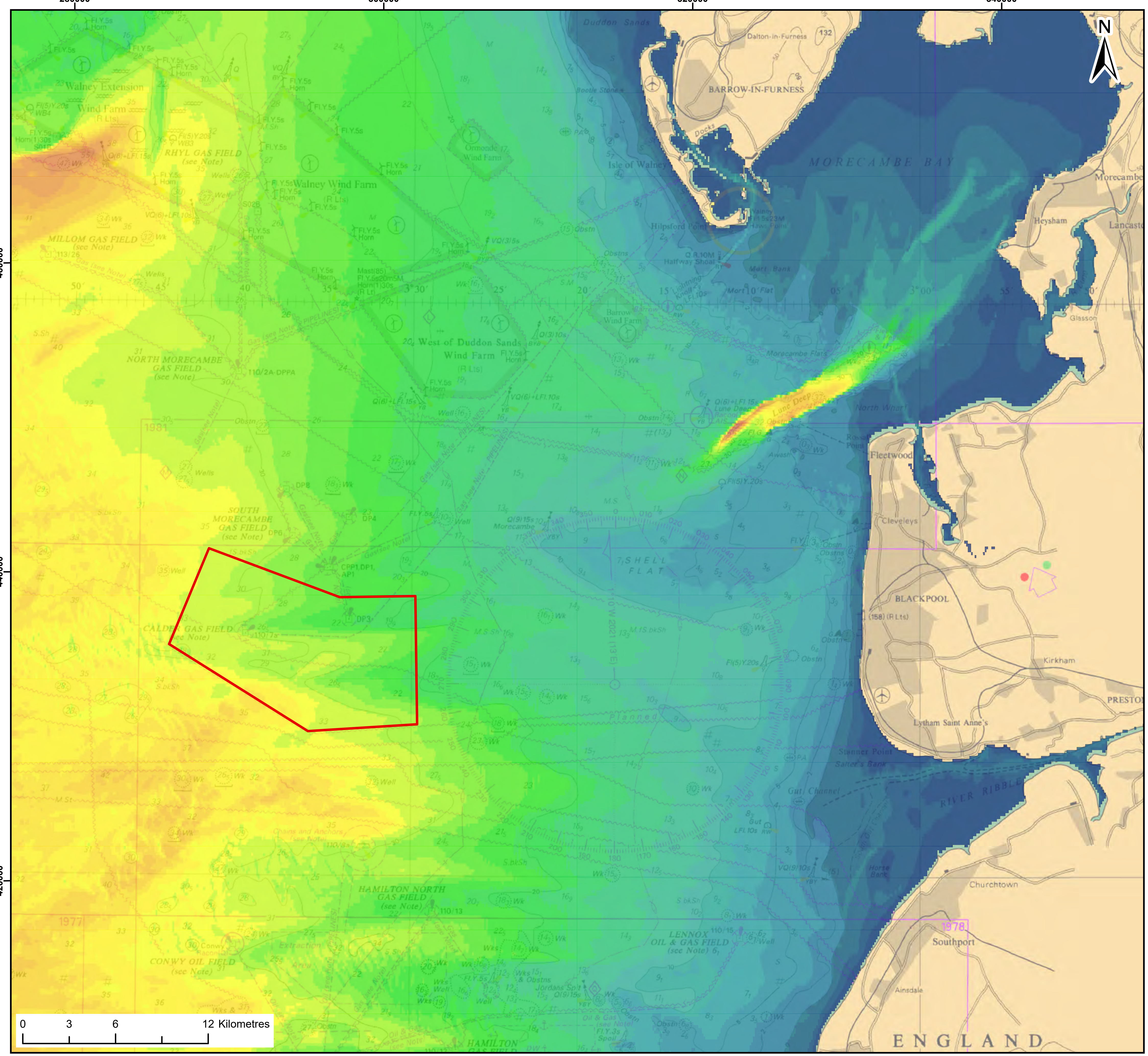
167 The existing baseline is described considering both the near-field (within the windfarm site and far-field (beyond the windfarm site and across the wider regional seabed and coastline) environment, which together comprise the marine geology, oceanography and physical processes Study Area (Figure 8.1).

8.1.3 Existing environment

168 An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

8.1.3.1 Bathymetry

169 The windfarm site is located in the eastern Irish Sea, the closest point of which is approximately 30km off the coast of Lancashire, northwest England. Water depths within the windfarm site range from 19-40m below Lowest Astronomical Tide (LAT) with depths generally increasing towards the west and south-west. Figure 8.1 shows the bathymetry across the marine geology, oceanography and physical processes Study Area.



Legend:

- Morecambe Offshore Windfarm Site

Depth (m, LAT)

6 - 12	-29 - -27
3 - 6	-31 - -29
0 - 3	-34 - -31
-3 - 0	-36 - -34
-6 - -3	-38 - -36
-9 - -6	-40 - -38
-12 - -9	-42 - -40
-14 - -12	-44 - -42
-17 - -14	-46 - -44
-19 - -17	-49 - -46
-22 - -19	-52 - -49
-24 - -22	-58 - -52
-27 - -24	-60 - -58
	-65 - -60

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Bathymetry within marine geology, oceanography and physical processes Study Area

Figure:	8.1	Drawing No:	PC1165-RHD-ZZ-OF-DR-Z-0055		
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:250,000

Co-ordinate system: WGS 1984 UTM Zone 30N

MORECAMBE

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8.1.3.2 Tidal currents

170 Tidal current flows across the windfarm site travel approximately to the east or north-east on a flood tide, and to the west or south-west on an ebb tide. Mean spring tidal current speeds of about 0.45-0.75m/s occur at the windfarm site on a flood tide, and about 0.45-0.60m/s on an ebb tide (Halcrow, 2010a). The Lune Deep is subject to strong tidal currents (Department for Business, Energy & Industrial Strategy, 2005). Tidal current speeds in the deep-water channel are approximately 0.90-1.05m/s (flood tide) and 1.05-1.35m/s (ebb tide). These speeds decrease closer to the coastline (Halcrow, 2010a).

8.1.3.3 Wave regime

171 The most frequent waves across the windfarm site approach from the west-southwest (Plate 7). Fetch lengths from this direction are relatively short due to the presence of Ireland, Isle of Man and Anglesey land masses (Halcrow, 2011b). Nearshore wave conditions are modified by the presence of sandbanks such as Cockerham Sands, Sunderland Bank, Shell Flat and the Shoulder of Lune (Halcrow, 2011b). The Lune Deep protects the northern Fleetwood coast by refracting severe waves northwards (Environmental Agency, 2003).

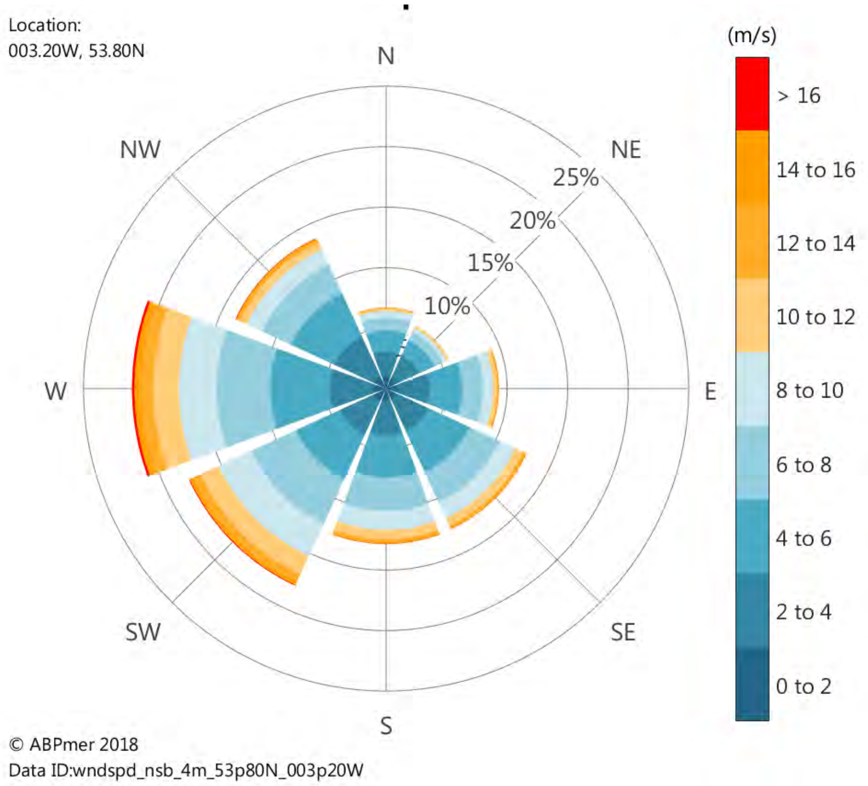


Plate 7 Dominant wave direction rose diagram at the windfarm site (ABPmer, 2018)

8.1.3.4 Bedload sediment and transport

172 British Geological Survey (BGS) data indicates that the seabed across the windfarm site is predominantly muddy sand and slightly gravelly muddy sand overlying a sequence of quaternary sediments. These are underlain by a bedrock of Permo-Triassic mudstone and sandstone (Mercia Mudstone and Sherwood Sandstone), which dominate the bedrock of the Eastern Irish Sea and show relatively uniform rock properties (BGS, 2015). This will be confirmed through a site specific survey.

173 The windfarm site falls within the Eastern Irish Sea Mud Belt, which is characterised by a smooth and relatively featureless seabed (BGS, 2005 – Plate 8). Closer to the coastline of Fylde and within outer Morecambe Bay, the seabed transitions into an undifferentiated bedform zone, with mobile bedforms such as sandwaves and sandbanks (BGS, 2005). Sandbanks within Morecambe Bay are formed almost parallel to the prevailing tidal streams and in wave-dominated areas almost parallel to longshore drift (BGS, 2005). Historical bathymetry data shows sandwaves to be present at the southwest boundary of the windfarm site, and they could also be present close to the Fylde coastline and within outer Morecambe Bay.

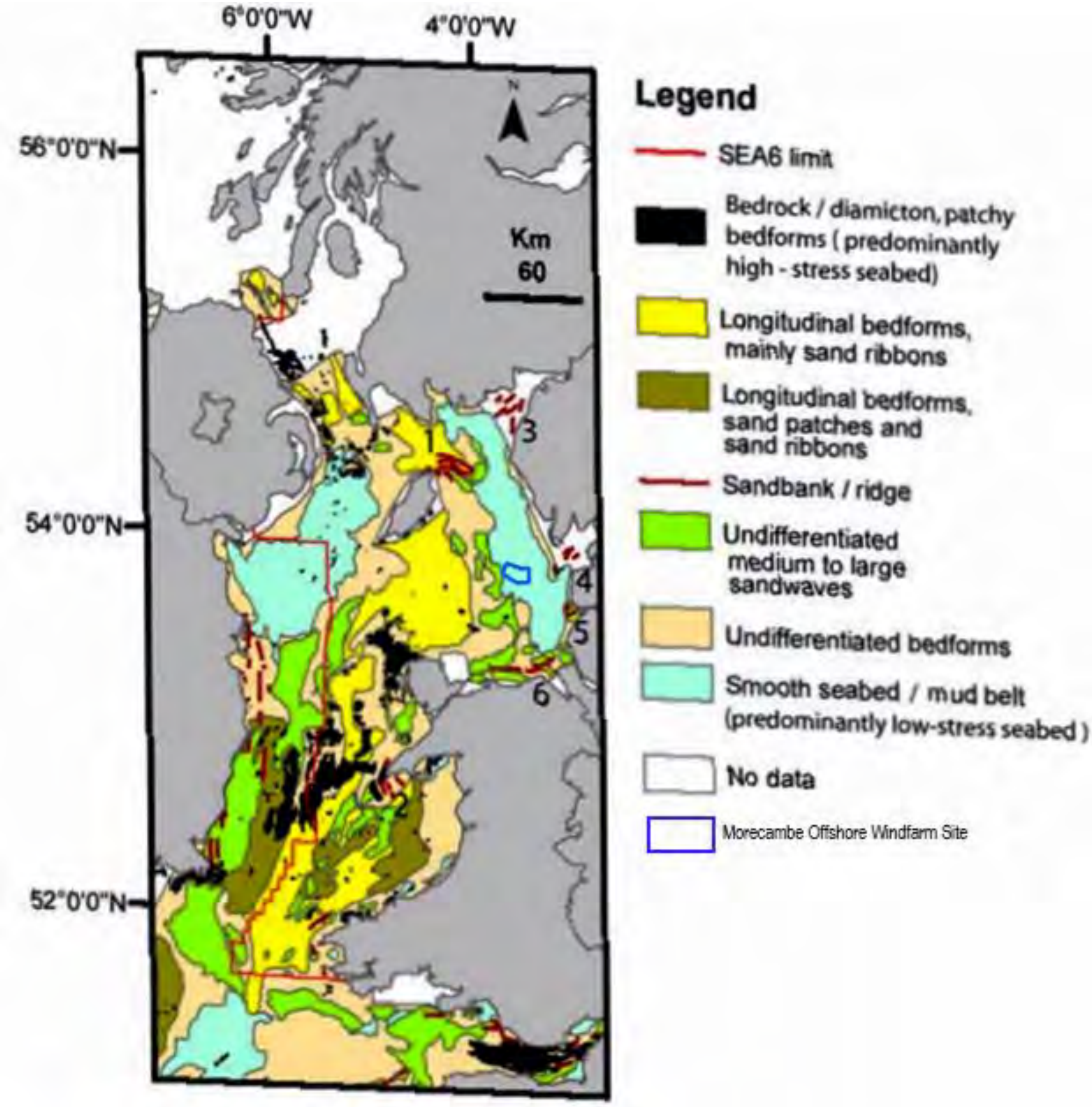


Plate 8 Generalised distribution patterns of mobile bedforms set between high seabed stress (bedrock/diamicton[7]) and low seabed stress (smooth seabed/mudbelt) static bedforms (BGS, 2005)

8.1.3.5 Suspended sediment

174 Suspended sediment concentration (SSC) information is available from analysis of satellite data by Dolphin *et al*. (2011). Background SSC levels in the surface waters of the Eastern Irish Sea during winter are approximately 2-4mg/l offshore at the windfarm site, gradually increasing toward the coastline to 13-28mg/l. During summer, SSCs are around 1-1.5mg/l offshore

[7] Sediment resulting from the erosion of terrestrial land

at the windfarm site, gradually increasing toward the coastline to approximately 5-13mg/l (Dolphin *et al*., 2011). Lower in the water column, concentrations would be expected to be higher, in the region of 42 to 62mg/l for example as measured during baseline measurements for jetting trials for the Barrow Offshore Wind Farm (RSK, 2000).

8.1.3.6 Designated sites

175 The following sites are designated for seabed features and, are within 30km of the windfarm site, and will be considered in this section:

- Shell Flat and Lune Deep SAC – designated for Annex I sandbanks and reefs
- Morecambe Bay SAC – designated for mudflats and sandflats
- West of Copeland MCZ – protected for subtidal coarse sediment, mixed sediments and sand
- West of Walney MCZ – protected for subtidal sand and mud as well as sea-pen and burrowing megafauna communities
- Flyde MCZ - protected for subtidal sand and mud

176 There is potential for physical processes to have an indirect impact on sites designated for benthic habitats and species. These sites are listed in Section 8.3.6.

8.1.4 Approach to data collection

177 It is intended that during the EIA, full analysis of the baseline sources (desk based) listed in Table 8.1 is completed.

Table 8.1 Data sources to inform the marine geology, oceanography and physical processes assessment

Data source	Date	Data contents
Barrow Offshore Windfarm Environmental Statement and associated technical supporting documents	2002	All marine geology, oceanography and physical processes information and data related to the existing offshore wind farms within the eastern Irish Sea
Ormonde Offshore Windfarm Environmental Statement and associated technical supporting documents	2005	
DTI Strategic Environmental Assessment Area 6, Irish Sea, seabed and surficial geology and processes	2005	

Data source	Date	Data contents
West of Duddon Sands Offshore Windfarm Environmental Statement and associated technical supporting documents	2006	
Walney 1 & 2 Offshore Windfarm Environmental Statements and associated technical supporting documents	2006	
Awel y Môr Offshore Wind Farm Environmental Statements and associated technical supporting documents	2022	
England's Historic Seascapes: Liverpool Bay Pilot Area. York: Archaeology Data Service	2006	
Cell Eleven Tidal and Sediment Study Phase 2	2010	
Cell Eleven Regional Monitoring Strategy (CERMS)	2010	
North West England and North Wales SMP2 - Shoreline Management Plan 22	2011	
Joint Probability Study Extreme wave heights and JOIN-SEA results September 2011	2011	
Natural Variability of Turbidity in the Regional Environmental Assessment (REA) Areas. Marine Aggregate Levy Sustainability Fund MEPF 09/114	2011	
Rhiannon Offshore Windfarm Preliminary Environmental Information Report (PEIR)	2012	
Walney Extension Offshore Wind Farm Environmental Statement and associated technical supporting documents	2013	
Burbo Bank Extension Offshore Windfarm Environmental Statement and associated technical supporting documents	2013	
Geology of the seabed and shallow subsurface: The Irish Sea. British Geological Survey	2015	

178 In addition to the data listed in Table 8.1, the following surveys/studies will be undertaken in 2021-2022 to inform the assessment (Table 8.2). Survey methodologies will be agreed in advance with stakeholders where possible.

Table 8.2 Proposed baseline surveys

Data set	Purpose	Spatial coverage	Survey timings
Geophysical (multibeam echosounder, side scan sonar & sub bottom profiling) survey	Bathymetry, seabed texture and shallow geology	Windfarm Site	2021
Geotechnical (Cone Penetration Testing (CPT), vibrocore and borehole) surveys	Geotechnical engineering properties of soils / sediment and delineating soil / sediment stratigraphy	Windfarm site	2022/2023
Grab sampling and drop-down video	Seabed sediment characterisation	Windfarm site	Completed in 2022

179 Other data and information available to inform the PEIR include

- UK Atlas of Marine Renewable Energy
- Wavenet wave buoys
- United Kingdom Hydrographic Office (UKHO) tidal diamonds and historical charts
- Class A tide gauges
- United Kingdom Climate Projections 2018 (UKCP18)
- British Geological Survey 1:250,000 sea-bed sediment, Quaternary geology and bedrock geology mapping
- Admiralty Charts and UKHO bathymetry data
- Projects including Futurecoast and Shoreline Management Plans (SMPs).

180 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.1.5 Approach to impact assessment

181 The specific assessment requirements for marine geology, oceanography and physical processes are in accordance with the overarching NPS for Energy (EN-1) and NPS for Renewable Energy infrastructure (EN-3), and with the draft versions that have been published for consultation.

182 The assessment will be undertaken in accordance with following standards and guidance:

- Guidance on Environmental Impact Assessment in Relation to Dredging Applications (Office of the Deputy Prime Minister, 2001)
- Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements: Version 2 (Cefas, 2004)
- Review of Cabling Techniques and Environmental Effects applicable to the Offshore Windfarm Industry (BERR, 2008)
- Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment (COWRIE, 2009)
- General advice on assessing potential impacts of and mitigation for human activities on Marine Conservation Zone (MCZ) features, using existing regulation and legislation (JNCC and Natural England, 2011)
- Guidelines for Data Acquisition to support Marine Environmental Assessments of Offshore Renewable Energy Projects (Cefas, 2011)

183 As part of the EIA process, the existing environment with respect to marine geology, oceanography and physical processes will be described, including, but not limited to the following:

- Bathymetry
- Geology
- Water levels
- Tidal currents
- Waves
- Climate change
- Seabed sediment distribution
- Bedload sediment transport
- Suspended sediment transport
- Morphological change
- Coastal processes at the landfall
- Anticipated trends in baseline conditions

184 The assessment of effects on marine geology, oceanography and physical processes will be predicated on a source-pathway-receptor conceptual model (as outlined in Section 7.2).

185 The assessment will follow two approaches. The first type of assessment will cover impacts directly affecting receptors which possess their own intrinsic morphological value. The impact assessment will incorporate a combination

of the sensitivity of the receptor, its value (if applicable) and the magnitude of the change to determine a significance of impact.

186 In addition to identifiable receptors, the second type of assessment would cover changes to marine geology, oceanography and physical processes which in themselves are not necessarily impacts to which significance can be ascribed (such as an increase in suspended sediment concentrations). However, such changes may indirectly impact other receptors such as benthic ecology (for example). In this case, the magnitude of effect is determined in a similar manner to the first assessment method but the significance of impacts on other receptors is made within the relevant chapters of the Environmental Statement (ES) pertaining to those receptors.

187 The assessment for marine geology, oceanography and physical processes will consider the PDE (following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario'

8.1.6 Potential impacts

188 A range of potential impacts on marine geology, oceanography and physical processes have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.1.6.1 Potential impacts during construction

189 There is potential for impacts on marine geology and oceanography during construction which may include:

- Effects on waves and tidal currents
- Effects on bedload sediment transport and seabed morphological change
- Effects on suspended sediment concentrations and transport
- Effects on seabed morphology due to deposition of suspended sediment
- Indentations on the seabed due to installation vessels

Effects on waves and tidal currents

190 Whilst there is potential for the physical presence of construction plant and offshore infrastructure to impact upon the wave and tidal current regimes, these impacts would increase incrementally as the windfarm is constructed with the greatest potential impacts resulting from the physical presence of the completed windfarm. These impacts are therefore covered under 'Potential

impacts during operation' and is scoped out of further consideration in relation to the construction phase.

Effects on bedload sediment transport and seabed morphological change

191 Construction of the windfarm will not change the geology of the site other than in the case of localised effects associated with foundation and cable installation. Due to the localised nature of these effects, it is not anticipated that such changes would give rise to significant impacts on seabed features, and neither would there be any changes in coastal morphology. However, further consideration will be given to the potential effects on the form and function of the bedload sediment transport processes due to cable and foundation installation, including the potential requirement for sand wave levelling, boulder clearance, cable removal and rock dumping for scour protection.

Effects on suspended sediment concentrations and transport

192 Potential effects during construction include temporary disturbance of the seabed due to the installation activities for cables and foundations which release sediment into the water column, resulting in increased suspended sediments and changes to seabed levels. Installation activities that could involve such seabed disturbance include seabed preparation and installation methods such as ploughing/trenching and burial, piling, hammering, suction caisson installation and jack-up vessel operations.

193 These effects will be assessed as part of the EIA and there may be a requirement for modelling (the specific assessment methodology will be determined through the EPP).

Effects on seabed morphology due to deposition of suspended sediment

194 There is potential for increases in suspended sediment concentrations during construction to deposit and slightly raise seabed elevation. The height of the resulting 'mound' will depend on the prevailing physical conditions and particle size distribution. The effect will be considered for the windfarm site and potential interactions with hydrodynamic conditions considered.

Indentations on the seabed due to installation vessels

195 There is potential for certain vessels used during installation of the foundations and cable infrastructure to directly impact the seabed. This applies for those vessels that utilise jack-up legs or several anchors to hold station and to provide stability for a working platform. Where legs or anchors (and associated chains) have been inserted into the seabed and then removed, there is

potential for an indentation to remain proportional to the dimensions of the object and depending on local conditions such as sediment transport. These effects will be assessed as part of the EIA.

8.1.6.2 Potential impacts during operation and maintenance

196 There is potential for impacts on marine geology and oceanography during operation and maintenance which may include:

- Effects on waves and tidal currents
- Effects on bedload sediment transport and seabed morphological change
- Effects on suspended sediment concentrations and transport
- Effects on seabed morphology due to deposition of suspended sediment
- Indentations on the seabed due to O&M vessels

Effects on waves and tidal currents

197 Potential effects during operation could occur due to the physical presence of infrastructure (i.e. foundations, scour protection and any cable protection above the seabed), which may result in localised changes to waves and tidal currents due to physical blockage effects. These changes could potentially affect the sediment transport regime and/or sea-bed morphology. In addition, there is potential for the temporary presence of engineering equipment (e.g. jack-up barges or anchored vessels) to have local effects on the hydrodynamic and sediment regimes during maintenance activities. These effects are anticipated to be minimal but will be assessed as part of the EIA.

Effects on bedload sediment transport and seabed morphological change

198 Previous studies have been undertaken to assess effects on bedload sediment transport and morphological change, for example the generic industry modelling undertaken for the Department of Trade and Industry (DTI) (ABPmer, 2003) and work undertaken at the Scroby Sands offshore windfarm (Cefas, 2005). They have concluded that minimal impacts can be expected on prevailing bedload sediment transport conditions, both within windfarm sites as well as further afield, provided that the foundations are adequately spaced (which will vary depending on the details of the foundations and windfarm layout). Impacts on sediment transport are likely to be localised to the areas immediately surrounding the individual foundations in the form of seabed scour where the sediment is soft enough to be mobilised. Scour at each foundation will be assessed as part of the EIA using well-established empirical methods based on existing literature (Whitehouse, 1998; Whitehouse, 2004; Den Boon *et al.*, 2004; Zaaijer, 2003; DNV, 2004), recent monitoring from the Round One offshore windfarms (Cefas, 2005; ABPmer, 2008; HR Wallingford, 2008) and engineering judgement.

Effects on suspended sediment concentrations and transport

199 There is potential for sediments to be re-suspended by scouring effects. Consideration will be given to likely changes in suspended sediment concentrations due to scour during the operational phase within the EIA. Small volumes of sediment could be re-suspended during maintenance activities such as unplanned cable repair or from disturbance caused by jack up vessel legs and work vessel anchors. The volume of sediment arisen would be lower than during construction.

Effects on seabed morphology due to deposition of suspended sediment

200 Potential re-suspension of sediments by scouring effects could deposit on the seabed and raise seabed elevation slightly. Consideration will be given to likely changes in seabed elevation due to deposition of suspended sediment during the operational phase within the EIA.

Indentations on the seabed due to O&M vessels

201 As outlined above, there is potential for certain vessels used during the operation and maintenance (O&M) phase to directly impact the seabed. This applies for those vessels that utilise jack-up legs or several anchors to hold station and to provide stability for a working platform. These effects will be assessed as part of the EIA.

8.1.6.3 Potential impacts during decommissioning

202 It is anticipated that the decommissioning impacts would be similar in nature to those of construction (Section 8.1.6.1), although the magnitude of effect is likely to be lower. The removal of the foundations and cables has the potential to affect the wave and tidal current regimes, bedload sediment transport, and suspended sediment concentrations and transport.

8.1.6.4 Potential cumulative impacts

203 There may be potential for cumulative impacts to occur on marine geology, oceanography and physical processes as a result of other activities.

204 Offshore wind projects and other activities relevant to the assessment of cumulative impacts on marine geology, oceanography and physical processes will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management

measures in place for the Project and other projects will reduce the risk of impacts occurring.

205 The cumulative assessment will be based on a zone of influence which will define the extent of which effects of the windfarm are expected based on local hydro-geological conditions. The zone of influence will be defined as part of the EIA and will consider other projects (including other offshore windfarms nearby, aggregate extraction and dredging, subsea cables and oil and gas activity) and marine users. These will be identified and assessed in accordance with the guidance and methodologies set out in Section 7.7. The assessment will be dependent on the availability and accessibility of information for other developments, but potential cumulative impacts could include impacts to the tidal, wave or sedimentary regime.

8.1.6.5 Potential transboundary impacts

206 The windfarm site is a minimum of 120km from any international territorial boundary. Given that the likely marine geology, oceanography and physical processes impacts will be restricted to near-field change, coupled with its remote location from any international territory boundary, there would be no pathway for transboundary impacts. It is therefore proposed to scope out transboundary effects on marine geology, oceanography and physical processes.

8.1.6.6 Summary of potential impacts

207 Table 8.3 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.3 Summary of impacts relating to marine geology, oceanography and physical processes

Potential Impact	Construction	Operation and maintenance	Decommissioning
Effects on waves and tidal currents	x	✓	x
Effects on bedload sediment transport and seabed morphological change	x	✓	x
Effects on suspended sediment concentrations and transport	✓	✓	✓

Potential Impact	Construction	Operation and maintenance	Decommissioning
Effects on seabed morphology due to deposition of suspended sediment	✓	✓	✓
Indentations on the seabed due to installation, O&M, decommissioning vessels	✓	✓	✓
Cumulative impacts	✓	✓	✓
Transboundary impacts	x	x	x

8.1.7 Potential mitigation measures

208 As discussed in Section 7.4 mitigation measures will be developed as further site specific information becomes available, the project design is refined and the PEIR, and ultimately the ES, are prepared. A number of mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the impact assessment process. Further mitigation measures may be proposed in response to initial impact assessment outcomes. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

209 Examples of mitigation measures which are likely to be considered include:

- Where seabed preparation is required (e.g. seabed levelling, or sandwave levelling) adoption of methods and equipment that have been designed to minimise potential for sediment suspension and dispersal
- Application of foundation installation techniques using methods and equipment to minimise sediment suspension
- Selection of cable installation methods and equipment most suitable for seabed conditions and designed to minimise sediment suspension into the water column
- Preparation of Construction Method Statements (CMS), post consent, setting out detailed turbine foundation and cable installation methods and techniques (based on final project design)
- Cables will be buried to a minimum target burial depth of 1m where possible (recognised industry good practice). A detailed Cable Burial Risk Assessment (CBRA) will also be required to confirm the extent to which cable burial can be achieved. Where it is not possible to achieve cable

burial, additional cable protection (rock placement, concrete mattressing or grout bags) may be required.

210 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process.

8.2 Marine water and sediment quality

8.2.1 Introduction

211 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on the marine water environment, including water quality and sediment quality.

8.2.2 Study area

212 The marine water and sediment quality Study Area reflects that identified in Section 8.1 Marine geology, oceanography and physical processes, i.e. the near-field (within the windfarm site and far-field (beyond the windfarm site and across the wider area potentially impacted by sediment plumes) environment.

8.2.3 Existing environment

213 An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

8.2.3.1 Sediment quality

214 Determining the physical characteristics of sediments in the windfarm site is important to understanding the risks to water quality. This assists in predicting suspended sediment concentrations associated with seabed disturbance and assessing the risk of sediments containing concentrations of contaminants given that contaminants tend to bind to finer material, especially organic-rich fine grains (Cefas, 2020).

215 Sediments of the eastern Irish Sea are largely derived from eroded boulder clays and contain high proportions of sand (Dong Energy, 2013). As outlined in Section 8.1, and in Plate 8, British Geological Survey (BGS) data indicates that the seabed across the windfarm site is predominantly muddy sand and slightly gravelly muddy sand.

216 There are two gas platforms within the windfarm site - Calder CA1 and South Morecambe DP3. Findings of sediment analysis undertaken to inform the Environmental Impact Assessments (EIAs) for Walney Extension Offshore Wind Farm (Dong Energy 2013) and West of Duddon Sands offshore windfarms (Dong Walney (UK) Ltd, 2006) do not indicate significant levels of contaminants but this would be confirmed through site specific survey which would take into account the presence of offshore gas infrastructure and associated contaminant risks.

217 Analysis of sediments and contaminant concentrations during the site-specific survey would seek to focus on areas where muddy sediments are likely to be present within the windfarm site.

8.2.3.2 Water quality

218 In general, water quality within the Irish Sea has been reported as good in EIAs supporting other offshore windfarms in the eastern Irish Sea. This is supported by the Coordinated Environmental Monitoring Programme (CEMP) assessment report for 2019-2020 (OSPAR, 2020).

219 Suspended sediment concentration (SSC) information is available from analysis of satellite data by Dolphin *et al*. (2011). Background SSC levels in the surface waters of the Eastern Irish Sea during winter are approximately 2-4mg/l offshore at the windfarm site, gradually increasing toward the coastline to 13-28mg/l. During summer, SSCs are around 1-1.5mg/l offshore at the windfarm site, gradually increasing toward the coastline to approximately 5-13mg/l (Dolphin *et al*., 2011).

220 Lower in the water column, concentrations would be expected to be higher, in the region of 42 to 62mg/l for example as measured during baseline measurements for jetting trials for the Barrow Offshore Wind Farm (RSK, 2000).

221 The Water Framework Directive (WFD) requires the monitoring of various water quality parameters in water bodies out to one nautical mile from mean high water in England and Wales. Whilst Project activities within these water bodies will require a separate assessment the water quality information gathered for compliance is also relevant to this topic. The WFD water bodies through which the offshore export cable corridor will run will be considered once the grid connection location is known in a separate Scoping Report for Transmission assets, and also protected areas such as bathing waters and shellfish waters.

8.2.4 Approach to data collection

222 It is intended that during the EIA, full analysis of the baseline sources (desk based) listed in Table 8.4 is completed. The assessment is closely linked to the Marine Geology, Oceanography and Physical Processes chapter, therefore relevant information in Section 8.1 will also be used to inform impacts on Marine Water and Sediment Quality.

Table 8.4 Existing datasets to inform the marine water and sediment quality assessment

Dataset	Applicable information	Data
Walney Extension Offshore Wind Farm Environmental Statement and associated technical supporting documents	Sediment contaminant analysis	October 2011 and January 2012
West of Duddon Sands Offshore Windfarm Environmental Statement and associated technical supporting documents	Sediment contaminant analysis	2006
Walney 1 & 2 Offshore Windfarm Environmental Statements and associated technical supporting documents	Sediment contaminant analysis	2006
Awel y Môr Offshore Wind Farm Environmental Statement and associated technical supporting documents	Sediment contaminant analysis	2022

223 In addition to the data shown in Table 8.4, grab sampling and contaminant analysis will be collected in the windfarm site in 2022 using a 0.1m2 day grab sampler. The scope and approach to the grab sampling survey and contaminant analysis (including the number of samples, areas to be sampled and the use of a lab accredited by the Marine Management Organisation (MMO)) will be agreed with relevant stakeholders through the Expert Topic Group (ETG).

224 Other data and information available to inform the EIA for the Generation assets includes:

- The Clean Seas Environmental Monitoring Programme (CSEMP, 2018)
- OSPAR Quality Status Report 2010
- Natural England Best Practice Guidance Documentation

225 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand

stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.2.5 Approach to impact assessment

226 The specific assessment requirements for marine water and sediment quality set are in accordance with the overarching National Policy Statement (NPS) for Energy EN-1 and NPS for Renewable Energy infrastructure (EN-3), and with the draft versions that have been published for consultation.

227 The assessment of sediment quality and the potential risk to water quality will be based on the source-pathway-receptor conceptual model in relation to sediment disturbance and build on the assessment undertaken for Marine geology, oceanography and physical processes as described in Section 8.1.3. The risk associated with the release sediment contamination would be based on the site specific survey data and use of recognised sediment quality guidelines such as the Cefas Action Levels (see Table 8.5).

Table 8.5 Cefas Action Levels

Contaminant	Action Level 1 (mg/kg)	Action Level 2 (mg/kg)
Arsenic	20	100
Mercury	0.3	3
Cadmium	0.4	5
Chromium	40	400
Copper	40	400
Nickel	20	200
Lead	50	500
Zinc	130	800
Organotins	0.1	1
Polychlorinated Biphenyl PCBs (sum of ICES 7)	0.01	none
PCBs (sum of 25 congeners)	0.02	0.2
Polyaromatic hydrocarbons (PAHs)	0.1	none
Total hydrocarbons	100	none

228 Where concentrations are at, or below, action level 1, no additional assessment is considered necessary as the risk to water quality is considered to be low (Environment Agency, 2017). Where concentrations fall close to, or above action level 2, then more quantitative assessment regarding water

quality effects might be required which would consider the risk of breaching water quality Environmental Quality Standards.

229 The impact significance on marine water quality is assessed based on the magnitude of effect and the receptor sensitivity.

230 Further liaison with stakeholders will be undertaken to agree the methodology and approach to data collection for EIA purposes and the specific assessment methodology through the Evidence Plan Process (EPP). Through the EPP, a detailed method statement will be presented and agreed with stakeholders at ETG meetings as detailed in Section 3.

231 The assessment for marine water and sediment quality will consider the PDE (following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario' upon which the assessment will be made. The worst case scenario will be outlined in the PEIR.

8.2.6 Potential impacts

232 A range of potential impacts on marine water and sediment quality have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.2.6.1 Potential impacts during construction

233 Potential impacts during construction will result from disturbance of the seabed due to installation activities for cables and foundations (including seabed preparation). These have potential to cause:

- Localised temporary increases in suspended sediments
- Remobilisation of existing contaminated sediments if present
- Potential for spills and leaks from vessels

Localised temporary increases in suspended sediments

234 Potential effects during construction include temporary disturbance of the seabed due to the installation activities for cables and foundations which release sediment into the water column, resulting in increased suspended sediments in the water column. Installation activities that could involve such seabed disturbance include seabed preparation and installation methods such as ploughing/trenching and burial, piling, hammering and suction caisson installation. These effects will be assessed as part of the EIA.

Remobilisation of existing contaminated sediments if present

235 Due to the location of existing infrastructure within the marine water and sediment quality Study Area there is the potential for resuspension of contaminants which could result in changes to water and sediment quality during activities that give rise to increases in suspended sediment.

Potential for spills and leaks

236 Due to the presence and movements of construction vessels/equipment there is the potential for spills and leaks which could result in changes to water and sediment quality. All vessels involved will be required to comply with the International Convention for the Prevention of pollution from Ships (MARPOL) 73/78. A Project Environment Management Plan (PEMP) will also be produced post- consent and implemented to cover the construction and operation and maintenance phases of the Project. This will set out all procedures and measures (in the form of a Marine Pollution Contingency Plan (MPCP)) to be taken during construction and operation to minimise the risk of, and subsequently manage in the event of an accidental spill. The PEMP will be developed in consultation with key stakeholders for approval by the MMO.

237 It is therefore proposed that accidental spills and leaks are scoped out of the assessment.

8.2.6.2 Potential impacts during operation and maintenance

238 There is the potential for impacts to arise during routine operational maintenance activities from cable repair or reburial for example. The following potential impacts are scoped in for further assessment:

- Localised temporary increases in suspended sediments
- Remobilisation of existing contaminated sediments if present
- Potential for spills and leaks from vessels

Localised temporary increases in suspended sediments

239 There is potential for sediments to be re-suspended by scouring effects which could result in changes to suspended sediment concentrations. Small volumes of sediment could also be re-suspended during maintenance activities such as unplanned cable repair.

Remobilisation of existing contaminated sediments

240 Similar to during construction, due to the location of existing infrastructure within the marine water and sediment quality Study Area there is the potential for resuspension of sediment bound contaminants where activities release sediment into the water column.

Potential for spills and leaks from vessels

241 As outlined above, due to the presence of vessels used during the O&M phase there is the potential for spills and leaks to impact water and sediment quality. However, the control measures listed in Section 8.2.6.1 will also be implemented for the operational phase therefore this effect is scoped out of the EIA.

8.2.6.3 Potential impacts during decommissioning

242 It is anticipated that the decommissioning impacts would be similar in nature to those of construction, although the magnitude of effect is likely to be lower. For example, where construction may require drilling of foundations and/or seabed preparation, decommissioning would likely require cutting of foundations to seabed level and therefore result in less seabed disturbance. The risk of accidental spills and leaks will be managed in a specific decommissioning phase PEMP to be undertaken once decommissioning requirements are further identified, therefore it is proposed that this effect is scoped out of the EIA.

8.2.6.4 Potential cumulative impacts

243 There may be potential for cumulative impacts to occur on marine water and sediment quality as a result of other activities. The Project wide approach to assessment of potential cumulative impacts is set out in Section 7.7.

244 Offshore wind projects and other activities relevant to the assessment of cumulative impacts on marine water and sediment quality will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

8.2.6.5 Potential transboundary impacts

245 Given that the likely water quality impacts would be restricted to near-field effects only, transboundary impacts are unlikely to occur, or are unlikely to be significant, and therefore it is proposed that transboundary impacts will not be considered further during the EIA for this topic.

8.2.6.6 Summary of potential impacts

246 Table 8.6 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.6 Summary of impacts relating to marine water and sediment quality

Potential Impact	Construction	Operation and maintenance	Decommissioning
Increases in suspended sediments	✓	✓	✓
Remobilisation of contaminated sediments (if present)	✓	✓	✓
Pollution events resulting from the accidental release of pollutants from vessel	x	x	x
Cumulative impacts	✓	✓	✓
Transboundary impacts	x	x	x

8.2.7 Potential mitigation measures

247 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the PEIR, and ultimately the ES, are prepared. A number of mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

248 Examples of mitigation measures, likely to be considered include:

- Where seabed preparation is required (e.g. levelling) adoption of methods and equipment that have been designed to minimise potential for sediment suspension and dispersal
- Application of foundation installation techniques using methods and equipment to minimise sediment suspension
- Selection of cable installation methods and equipment most suitable for seabed conditions and designed to minimise sediment suspension into the water column

- Preparation of Construction Method Statements (CMS), post consent, setting out detailed turbine foundation and cable installation methods and techniques (based on final project design).An Offshore Decommissioning Plan will be developed and implemented post consent which will be designed to minimise sediment suspension into the water column.

249 Potential mitigation measures for water and sediment quality (and associated biological receptors) will be consulted upon with stakeholders throughout the EIA process.

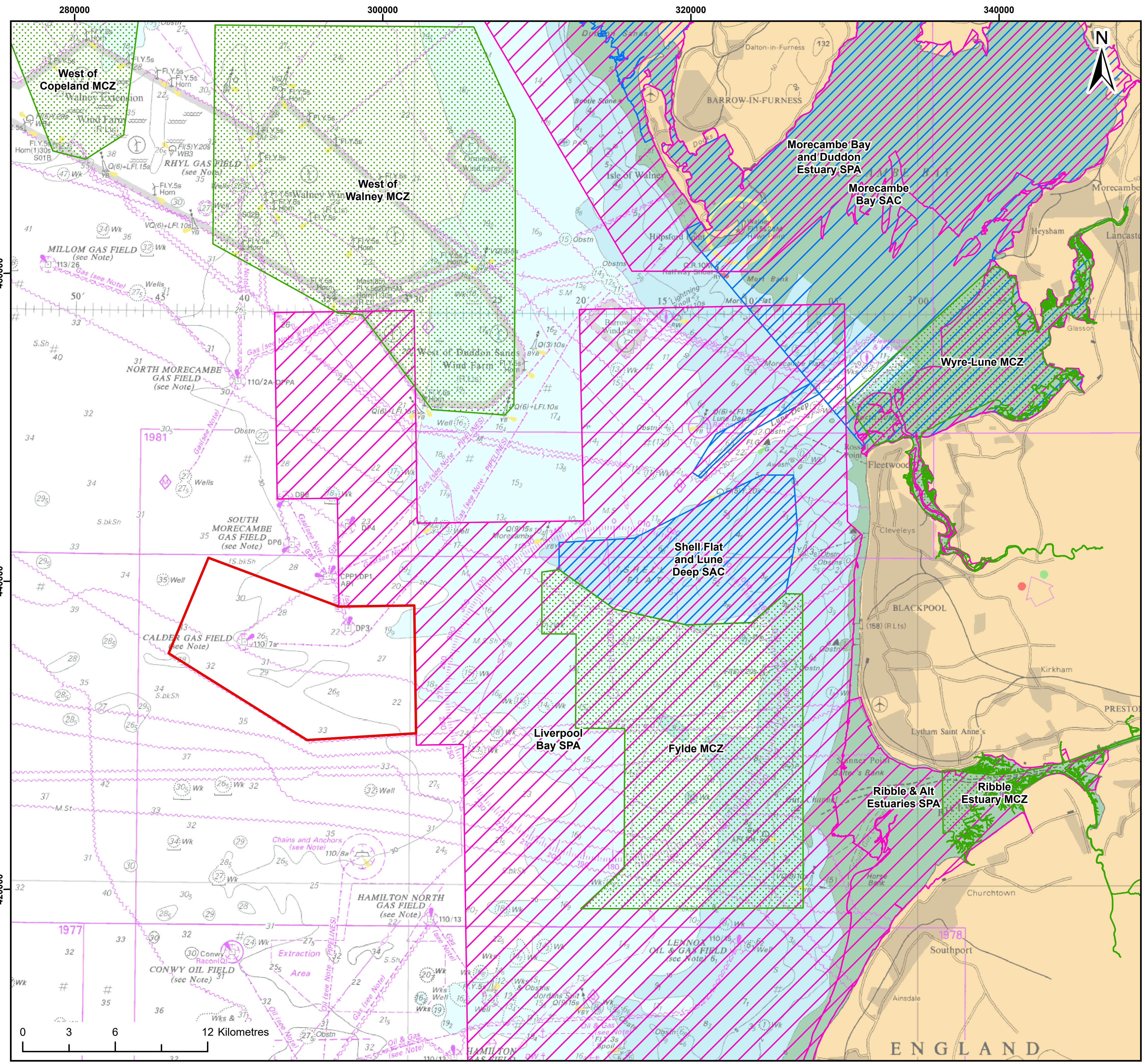
8.3 Benthic ecology

8.3.1 Introduction

250 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on benthic ecological receptors.

8.3.2 Study area

251 The benthic ecology Study Area is shown in Figure 8.2 alongside designated sites relevant to benthic features within 30km of the windfarm site. The benthic ecology Study Area will be further defined upon results from the assessment for Physical Processes.



Legend:

- Morecambe Offshore Windfarm Site
- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Marine Conservation Zone (MCZ)

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Overview of the Offshore Environment and Designations Relevant to Benthic Ecology

Figure: 8.2 | Drawing No: PC1165-RHD-ZZ-OF-DR-0056

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	08/06/2022	JT	GC	A3	1:250,000
P01	17/05/2022	JT	GC	A3	1:250,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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8.3.3 Existing environment

252 The existing environment is described for the benthic ecology Study Area which encompasses the windfarm site. An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

8.3.3.1 Windfarm site

253 The windfarm site is characterised by water depths between 19 and 40m deep and by the following main benthic habitats based on broadscale mapping:

- Offshore circalittoral sand (SS.SSa.OSa)
- Offshore circalittoral mud (SS.SMu.OMu)
- Circalittoral sandy mud (SS.SMu.CSaMu)

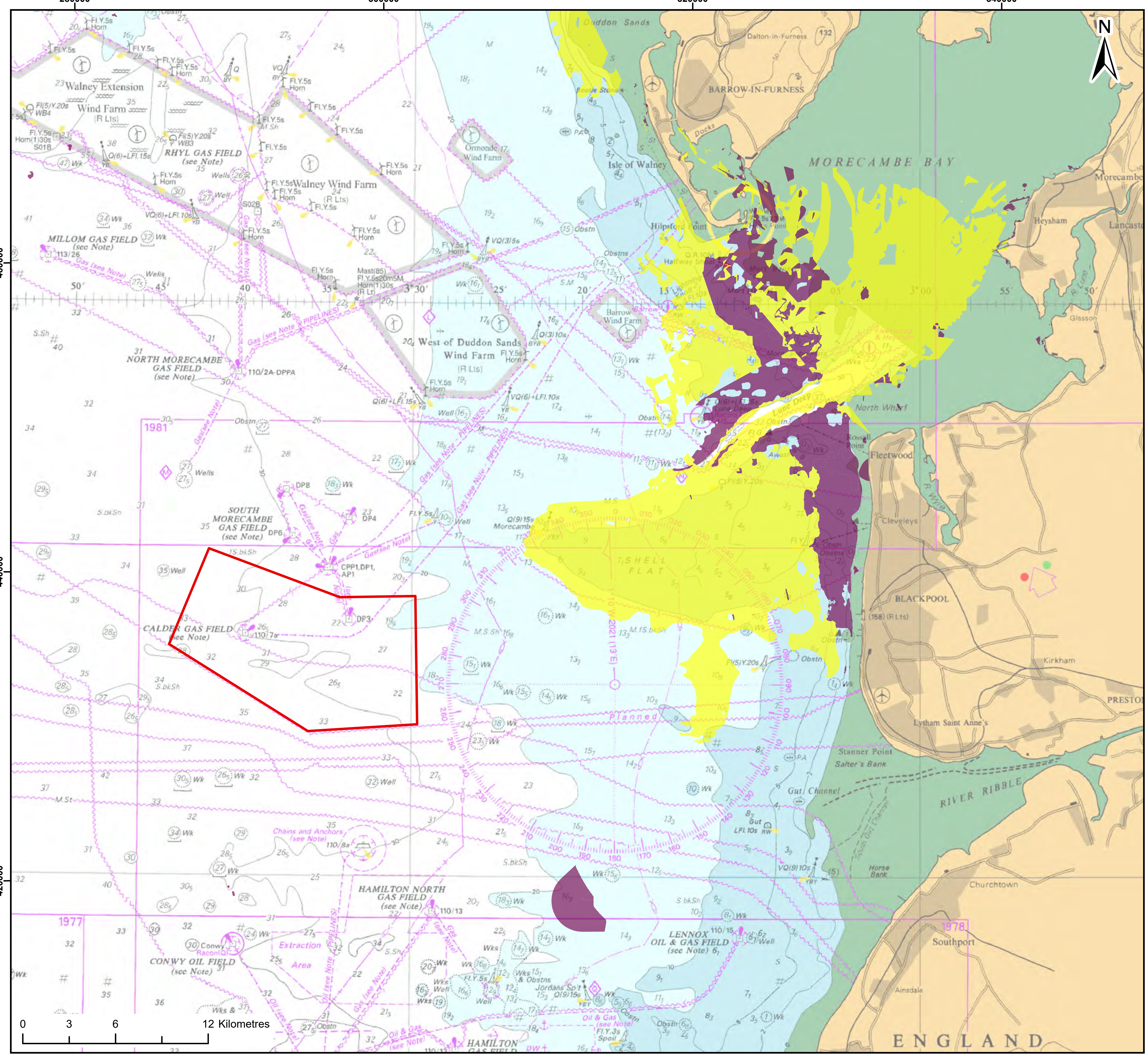
254 The windfarm site does not overlap with any designations, including those with benthic qualifying features. Table 8.7 highlights the designated sites with benthic features within 30km of the windfarm site.

Table 8.7 Designated sites with benthic features within 30km of the windfarm site

Site name	Features
Morecambe Bay SAC/ SPA	Amongst the habitats that are a primary reason for designation are mudflats and sandflats not covered by seawater at low tide. Morecambe Bay forms the largest single area of continuous intertidal mudflats and sandflats in the UK and the best example of muddy sandflats on the west coast. At low water, large areas of sandflats are exposed, and these range from the mobile fine sands of the outer Bay to more sheltered sands in the inner areas. With increasing shelter in the Bay's adjoining estuaries, finer sediments settle out and form extensive mudflats, supporting a particularly rich and diverse range of infaunal species.
Shell Flat and Lune Deep SAC	Shell Flat and Lune Deep is considered to be an excellent example of Annex I sandbank habitat and is noted as an important foraging ground for many over wintering bird species. Reefs are also part of the primary reason for selection, but the distribution is less well known.
Flyde Marine Conservation Zone (MCZ)	Extensive areas of subtidal sediment habitats located next to Shell Flat sandbank, part of the Shell Flat and Lune Deep SAC and offers protection to other rich areas of seabed outside of the SAC.
West of Walney MCZ	This site is designated for subtidal sand and subtidal mud, as well as sea-pen and burrowing megafauna communities

Site name	Features
West of Copeland MCZ	This is protected for subtidal coarse sediment, mixed sediments and sand
Liverpool Bay SPA	Provides protection for particular bird features and their supporting benthic habitats.

255 There are no known Annex I reef or sandbanks or other protected habitats and species within the windfarm site, as shown in Figure 8.3.



Legend:

- Morecambe Offshore Windfarm Site
- Annex I Sandbanks
- Annex I Reef

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Annex 1 Features

Figure: 8.3 | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0057

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Co-ordinate system: WGS 1984 UTM Zone 30N

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8.3.4 Approach to data collection

256 It is intended that during the EIA, full analysis of the baseline sources (desk based) listed in Table 8.8 is completed.

Table 8.8 Existing datasets to inform the benthic ecology assessment

Data Set	Description
EUSeaMap 2021 predictive mapping	The EMODnet broad-scale seabed habitat map for Europe
UKSeamap 2018 v1 predictive mapping	EUNIS broad-scale habitat map, building on UKSeaMap 2016 with updates to substrate.
Joint Nature Conservation Committee (JNCC) Sandbanks (marine habitat data product)	Potential areas of sandbanks. Polygons have been produced using depth and slope information in combination with sediment data to identify independent sandy elevations from the seabed.
Marine Protected Sites Supporting Evidence Records	Supporting literature/data related to characterisation of marine protected sites (MCZs and SACs/SPAs)
Marine Protected Sites Supplementary Advice on Conservation Objectives and Advice on Operations	Natural England conservation advice packages for marine protected sites
JNCC marine habitat data	Areas where Annex I reef and/or sandbank habitat is known to be or might be present.
Priority Habitat Inventory (England)	Geographic extent and location of Natural Environment and Rural Communities Act (2006) Section 41 habitats of principal importance.
North West Inshore and North West Offshore Marine Plan	Strategic approach to planning within the inshore and offshore waters between the Solway Firth border with Scotland and the River Dee border with Wales
Manx Marine Environmental Assessment	Baseline environmental information in Manx territorial waters
Barrow Offshore Windfarm Environmental Statement and associated technical supporting documents	There have been many benthic studies undertaken for existing offshore windfarms which overlap with the benthic ecology Study Area. All benthic information and data related to existing offshore windfarms will be used to inform the Project's EIA.
Ormonde Offshore Windfarm Environmental Statement and associated technical supporting documents	

Data Set	Description
West of Duddon Sands Offshore Windfarm Environmental Statement and associated technical supporting documents	
Walney 1 & 2 Offshore Windfarm Environmental Statements and associated technical supporting documents	
Rhiannon Offshore Windfarm Preliminary Environmental Information Report	
Walney Extension Offshore Wind Farm Environmental Statement and associated technical supporting documents	
Awel y Môr Offshore Wind Farm Environmental Statement and associated technical supporting documents	

257 In addition to the data in Table 8.8, the data in Table 8.9 has been collected for the assessment via direct commissioning of surveys by the Applicant. The surveys were designed to identify the extent and distribution of key benthic habitats and features, including species or habitats of conservation importance. Survey methodologies were agreed in advance with stakeholders where possible. Data from the survey will be used to inform the EIA.

Table 8.9 Site specific survey data

Data Set	Spatial Coverage	Survey timings
Geophysical survey	Windfarm site	Completed in 2021
Grab sampling and drop-down video	Windfarm site	Completed in 2022

258 Grab sampling surveys will be used to characterise infaunal communities. Drop down video transects, which targeted areas of interest identified from the geophysical survey, will be used to identify localised epibenthic sensitivities. In addition to the transects, drop down video footage has been obtained at each of the grab sample stations and will be used to identify any sensitive

epibenthos at each location. Further detail on infaunal and epifaunal communities in the wider area (including epibenthic survey data from other wind farm projects) will be taken from the data sources described in **Table 8.8**.

259 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.3.5 Approach to impact assessment

260 The specific assessment requirements for benthic ecology are set out in accordance with the overarching National Policy Statement (NPS) for Energy EN-1 and NPS for Renewable Energy infrastructure (EN-3), and with the draft versions that have been published for consultation.

261 The existing environment will be described in detail with respect to the presence of different habitats and species. The site specific characterisation surveys (Table 8.9) that are to be conducted, alongside existing data, will allow the production of habitat maps alongside the baseline description. As part of developing the benthic ecology baseline the Applicant will work closely with stakeholders to ensure that all available data relevant to the Project is considered.

262 Following the collection of geophysical data (including multi-beam bathymetry, side scan sonar) a detailed method statement for the subsequent benthic grab and video survey was developed and provided to regulators as part of the early Evidence Plan Process (EPP). The benthic surveys were designed in accordance with current standards and guidance as appropriate, including:

- Centre for Environment, Fisheries and Aquaculture (Cefas) (2012) Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Centre for Environment Fisheries and Aquaculture Science
- Wyn & Brazier (2001); Joint Nature Conservation Committee (JNCC) Marine Monitoring Handbook
- Marine Management Organisation (MMO) *et al*. (2010) Guidance on the Assessment of Effects on the Environmental and Cultural Heritage from Marine Renewable Developments

- Ware, S.J & Kenny, A.J (2011) Guidelines for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (2nd edition). Marine Aggregate Levy Sustainability Fund
- Institute of Ecology and Environmental Management (IEEM) (2010) Guidelines for Ecological Impact Assessment in Britain and Ireland
- BSI (2015). Environmental impact assessment for offshore renewable energy projects – Guide. PD 6900:2015
- MMO (2014) Review of environmental data associated with post-consent monitoring of licence conditions of offshore wind farms
- Noble-James, T., Jesus, A. & McBreen, F. (2018) Monitoring guidance for marine benthic habitats (Revised 2018). JNCC Report No. 598. JNCC, Peterborough.
- JNCC (2010) Handbook for Phase 1 Habitat Survey – a Technique for Environmental Audit. Joint Nature Conservation Committee, Peterborough
- Natural England Best Practice Guidance Documentation.

263 Assessment of impacts on benthic ecology will follow the guidelines set out in the 2018 CIEEM guidance document *"Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine"*, with consideration to any other applicable best practice guidance.

264 The sensitivity of biotopes will be reviewed based on expert judgement and informed by sensitivity information in the Marine Life Information Network (MarLIN), as well as review of online resources and published research where available. It is recognised that the MarLIN assessments have limitations; the nature of the impact as set out for the MarLIN assessments will be compared with that of the offshore windfarm to determine whether the information is applicable. Where information is unavailable for a key species present at the Morecambe windfarm site, consideration will be given to a potential proxy species that is closely related and has similar habitat preferences. Any proxy species will be discussed with the marine ecology ETG.

265 For further information on the sensitivity of features of nearby designated sites, reference will be made to Natural England's Marine Conservation Advice package for the relevant designations, including Supplementary Advice on Conservation Objectives and Advice on Operations.

266 To assess impacts on benthic receptors the assessment will consider the following:

- Magnitude/extent: the size or amount of the impact
- Duration: time for recovery (may vary with receptor sensitivity) and duration of activity causing an impact
- Reversibility of the impact

- Timing and frequency of the impact
- Sensitivity of features based upon the Marine Evidence-based Sensitivity Assessment (MarESA) framework (MarLIN, 2021) where possible

267 The assessment as far as possible will use a quantitative assessment based on the Project parameters, for example, the area of habitat permanently impacted by the installation of foundations.

268 The assessment for benthic ecology will consider the Project Design Envelope (PDE) (following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario' upon which the assessment will be made. The worst case scenario will be outlined in the PEIR.

8.3.6 Potential impacts

269 A range of potential impacts on benthic ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.3.6.1 Potential impacts during construction

270 Activities that have the potential to effect benthic habitats include:

- Seabed preparation and turbine foundation (and offshore substation platform(s)) installation
- Inter-array cable laying and any associated seabed preparation and cable protection measures

271 Associated to the activities above potential impacts include:

- Physical disturbance and habitat loss
- Increased suspended sediment concentration
- Remobilisation of contaminated sediment
- Deposition of suspended sediment
- Underwater noise and vibration
- Colonisation of introduced substrate, and introduction of non-native species (INNS)
- Risk of water quality deterioration due to spillages / leakages

Physical disturbance and habitat loss

272 As a result of construction activities, there is potential for temporary and permanent physical disturbance and habitat loss to seabed habitats and species. The principal sources of disturbance in the windfarm site will include the installation of the foundations and any associated seabed preparation and scour protection, as well as the burial of the inter-array cables that will link the wind turbine generators and offshore substation platform(s). Vessel activities such as jacking up or anchoring of installation or support vessels (if required) may also result in physical disturbance to the seabed.

273 Potential impacts from seabed preparation, cable laying, anchoring and jacking-up activities are anticipated to result in short-term, temporary impacts from which habitats and species will be able to recover once construction is complete.

274 Physical disturbance due to foundation installation (and cable protection installation if required) will result in long-term or permanent habitat loss, albeit within a relatively small footprint in the context of habitat from the surrounding region. Given the longevity of the Project, the assessment will be based on an assumption that habitat loss would effectively be permanent. While the continued presence of the foundation structures would remain throughout the operational phase of the project, habitat loss would manifest during the construction phase hence would be considered as part of the construction phase impacts.

Increased suspended sediment concentrations and subsequent deposition

275 Potential effects during construction include temporary disturbance of the seabed due to the installation activities for inter-array cables and foundations which release sediment into the water column, resulting in increased suspended sediments and subsequent deposition (and potential for smothering of benthos). Installation activities that could involve such seabed disturbance include seabed preparation and installation methods such as ploughing/trenching and burial, piling, hammering, suction caisson installation and jack-up vessel operations. These effects will be assessed as part of the EIA.

Increased suspended sediment concentrations

276 Potential effects during construction include temporary disturbance of the seabed due to the installation activities for inter-array cables and foundations which release sediment into the water column, resulting in increased suspended sediments and changes to seabed levels. Installation activities that could involve such seabed disturbance include seabed preparation and

installation methods such as ploughing/trenching and burial, piling, hammering, suction caisson installation and jack-up vessel operations. These effects will be assessed as part of the EIA.

Remobilisation of contaminated sediments

277 Existing contaminants that may be contained within the surface sediments may be re-mobilised by construction activity. This has the potential to impact on benthic communities should benthic sediment feeders and filter feeders ingest and uptake released contaminants, which could subsequently enter the food chain and may accumulate in predatory species. Potential impacts related to the resuspension of contaminants are scoped in for assessment. However, should the results of benthic sampling demonstrate low levels of contamination the Applicant would seek to scope these out of further assessment through the EPP, in common with the approach presented in Section 8.2.

Underwater noise and vibration

278 Scientific research into the effects of underwater noise in relation to benthic ecology is ongoing. However, it is likely that there is habituation to noise created by the existing shipping which occurs in the area. There may be reactions from some benthic species to episodic noise such as that from pile driving (Lovell *et al*, 2005, Heinisch and Weise, 1987). Any impact is likely to be localised and temporary. The latest research will be considered and presented within the ES.

Colonisation of introduced substrate, and introduction of non-native species

279 Due to the level of vessel activity and introduction of infrastructure into the environment there is the potential for colonisation of introduced substrata and invasive species to be introduced to the construction area. Invasive species, if present, have the potential to alter benthic communities and reduce biodiversity. Potential impacts from invasive species will be considered further in the assessment, alongside INNS prevention methods that will be adhered to.

Risk of deterioration of water quality due to spillages / leakages

280 Due to the presence and movements of construction vessels/equipment there is the potential for spills and leaks which could result in changes to water quality and pollution of the environment, as discussed in Section 8.2.6. This has the potential to impact on benthic communities. All vessels involved will be required to comply with the International Convention for the Prevention of pollution from Ships (MARPOL) 73/78. A Project Environment Management

Plan (PEMP) will also be produced post- consent and implemented to cover the construction and operation and maintenance phases of the Project. This will set out all procedures and measures (in the form of a Marine Pollution Contingency Plan (MPCP)) to be taken during construction and operation to minimise the risk of, and subsequently manage in the event of an accidental spill. The PEMP will be developed in consultation with key stakeholders for approval by the MMO.

281 It is therefore proposed that Risk of deterioration of water quality due to spillages / leakages are scoped out of the assessment.

8.3.6.2 Potential impacts during operation and maintenance

282 Impacts during operation largely arise from the physical presence of infrastructure (i.e. foundations, cables and any cable protection above the seabed) and from periodic maintenance activities. Maintenance activities during the operational phase have the potential for all the effects outlined during construction.

283 Associated to the operational phase and potential maintenance activities, potential impacts include:

- Change in habitat type due to physical presence of infrastructure
- Interaction with EMFs
- Temporary physical disturbance
- Increased suspended sediment concentrations and subsequent deposition
- Remobilisation of contaminated sediments
- Underwater noise and vibration
- Introduction and colonisation of non-native species
- Risk of deterioration of water quality due to spillages / leakages

284 While loss of existing habitat due to the presence of foundations would persist throughout the operational phase, this impact would manifest during the construction phase (Section 7.3.1).

Physical presence of infrastructure (change in habitat type)

285 The sub-sea structures (foundations, scour, and inter-array cable protection) are expected to be colonised by a range of species during the operational phase, leading to a localised increase in biodiversity. The presence of the structures would provide habitat for mobile species and potentially serve as a refuge for fish. This does, however, represent a change from the baseline ecology of the area.

286 Overall, the area available for colonisation would be low and to date there is no evidence of significant changes of the seabed beyond the vicinity of the foundation structures due to the installation of windfarms (Lindeboom *et al*, 2011).

287 This impact would also take into account the potential indirect effects to habitat that may arise from localised changes in hydrodynamic/sedimentary processes due to the physical presence of structures.

Interaction with EMFs

288 EMFs as a result of the presence of offshore cables may be detected by some benthic species. Effects are likely to be highly localised, as EMFs are strongly attenuated and decrease as an inverse square of distance from the cable (Gill and Barlett, 2010). Several studies have shown that various benthic species do not react to EMF such as brown shrimp *Crangon crangon*, common starfish *Asterias rubens* and polychaete worm *Nereis diversicolor* (Bochert & Zettler, 2006). Gibb *et al*. (2014) state there is no evidence of EMF impacting *Sabellaria spinulosa*. It is therefore proposed that interactions with EMFs is scoped out of the assessment.

Temporary physical disturbance

289 There is potential for ongoing physical disturbance of the seabed from maintenance activity, such as indentations on the seabed from jack-up vessels required for inter-array cable repairs or reburial. In general, the impacts from planned maintenance should be temporary, localised and smaller in scale than during construction.

Increased suspended sediment concentrations and subsequent deposition

290 Small volumes of sediment could be re-suspended during maintenance activities; the volumes would be lower than for construction. It is not expected that there would be significant smothering effects.

Remobilisation of contaminated sediments

291 A pathway may exist for impacts from the remobilisation of contaminants from within the windfarm site. If the sediment sample results show no contaminated sediment, or if contamination levels are below relevant thresholds such as CEFAS Action Levels then it is proposed this impact is scoped out of the EIA.

Underwater noise and vibration

292 Noise and vibration generated by the operational wind turbine generators can be conducted through the tower and foundations into the water column. Monitoring studies of underwater noise from operational turbines have shown the noise levels from North Hoyle, Scroby Sands, Kentish Flats and Barrow windfarms to be only marginally above ambient noise levels (Stober and Thomsen, 2021) There is no evidence to suggest this low level of noise and vibration has a significant impact on benthic ecology and this impact is scoped out of the assessment.

Introduction and colonisation of non-native species

293 The potential impact in relation to INNS during the operational phase is related to the artificial structures introduced by the Project which have the potential to act as 'stepping stones' for the spread of INNS. INNS could potentially be introduced during the operational phase due to the presence of vessels. INNS prevention methods will be identified during the EIA and impacts assessed accordingly.

294 The potential for climate change-related effects to facilitate the spread and exacerbate the impacts of the introduction of non-native species will also be considered.

Risk of deterioration of water quality due to spillages / leakages

295 As discussed in Section 8.2.6, due to the presence and movements of construction vessels/equipment there is the potential for spills and leaks which could result in changes to water quality and pollution of the environment. This has the potential to impact on benthic communities. All vessels involved will be required to comply with the International Convention for the Prevention of pollution from Ships (MARPOL) 73/78. A Project Environment Management Plan (PEMP) will also be produced post- consent and implemented to cover the construction and operation and maintenance phases of the Project. This will set out all procedures and measures (in the form of a Marine Pollution Contingency Plan (MPCP)) to be taken during construction and operation to minimise the risk of, and subsequently manage in the event of an accidental spill. The PEMP will be developed in consultation with key stakeholders for approval by the MMO.

296 It is therefore proposed that Risk of deterioration of water quality due to spillages / leakages are scoped out of the assessment.

8.3.6.3 Potential impacts during decommissioning

297 Given the lack of information regarding timing and methodology used for decommissioning, nor the benthic ecology baseline that would be in place at the time of decommissioning, it is not possible to undertake a detailed assessment at this time. Removal of infrastructure would represent a further change in benthic community structure and result in a habitat loss and change. A further assessment will be undertaken at the time of decommissioning, therefore at this stage it is proposed that decommissioning impacts are only covered at a high level.

8.3.6.4 Potential cumulative impacts

298 There may be potential for cumulative impacts to occur with respect to benthic ecology as a result of other activities. The Project wide approach to assessment of potential cumulative impacts is set out in Section 7.7.

299 Offshore wind projects and other activities (such as oil and gas operations) relevant to the assessment of cumulative impacts on benthic ecology will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

300 Based on the results of the physical processes assessment, the Cumulative Impact Assessment (CIA) will consider cumulative changes to seabed habitat in conjunction with other projects. These will be identified and assessed in accordance with the guidance and methodologies set out in Section 7.7. The assessment will be dependent on the availability and accessibility of information for other developments.

8.3.6.5 Potential transboundary impacts

301 Given the anticipated localised nature of impacts (expected within the near-field) transboundary impacts are unlikely to occur and it is proposed that transboundary impacts are scoped out from future consideration within the EIA. This is on the basis that the area of influence highlighted in the physical processes chapter, and the ecological receptors present (as highlighted in the baseline description) only include benthic habitats in England. I In consideration of the spread of invasive species necessary mitigation and biosecurity measures will be in place to prevent and manage the spread of invasive species.

302 Therefore, only benthic receptors in English waters have the potential to be affected by the Project.

8.3.6.6 Summary of potential impacts

303 Table 8.10 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.10 Summary of impacts relating to benthic ecology

Potential Impact	Construction	Operation and maintenance	Decommissioning
Physical disturbance and habitat loss	✓	✓	✓
Physical presence of infrastructure (change in habitat type)	x	✓	x
Increased suspended sediment concentrations and subsequent deposition	✓	✓	✓
Remobilisation of contaminated sediments	✓	✓	✓
Underwater noise and vibration	✓	x	✓
Interactions with EMF	x	x	x
Introduction and colonisation of non-native species	x	✓	x
Risk of deterioration of water quality due to spillages / leakages	x	x	x
Cumulative impacts	✓	✓	✓
Transboundary impacts	x	x	x

8.3.7 Potential mitigation measures

304 As discussed in Section 7.4 mitigation measures will be developed as site specific information becomes available, the project design is refined and the Preliminary Environmental Information Report (PEIR), and ultimately the ES, are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the

assessment of impacts. Further mitigation measures may be proposed in response to the outcome of the impact assessment. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

305 Examples of mitigation measures which are likely to be considered include:

- Careful layout selection (which will be informed by detailed benthic surveys) will be undertaken to as far as possible to avoid or minimise effects on benthic features
- Inter-array cables will be buried to a target burial depth of 1m where possible (recognised industry good practice). A detailed Cable Burial Risk Assessment (CBRA) will also be required to confirm the extent to which cable burial can be achieved. Where it is not possible to achieve cable burial, additional cable protection (rock placement, concrete mattressing or grout bags) may be required, as discussed in Section 6.3
- Foundation and inter-array cable installation methods and equipment will be considered as far as possible to minimise potential effects on habitats and species of conservation importance
- Where potential effects on habitats and species of conservation importance cannot be avoided, it is likely that potential effects will need to be monitored during foundation and inter-array cable installation, and potentially longer term wind farm operation
- Detailed monitoring methods will be included in an In-Principle Monitoring Plan (IPMP) which will be developed during the pre-application stages and implemented
- An Offshore Decommissioning Plan will be developed post consent and implemented

306 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process.

8.4 Fish and shellfish ecology

8.4.1 Introduction

307 This section considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on fish and shellfish ecology receptors.

8.4.2 Study area

308 The extent of the fish and shellfish ecology Study Area will provide a regional context on fish and shellfish ecology, and also cover potential effects outside of the windfarm site. For the majority of fish and shellfish species, the study area is focused on the windfarm site. For certain migratory species, a wider area is considered, to account for the mobile nature of these species.

309 The windfarm site is wholly within International Council for the Exploration of the Sea (ICES) rectangle 36E6. Thus, the fish and shellfish ecology Study Area also encompasses the ICES rectangles 36E6. The species targeted within these ICES rectangles are considered to be of commercial importance to the region.

8.4.3 Existing environment

310 An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

8.4.3.1 Fish

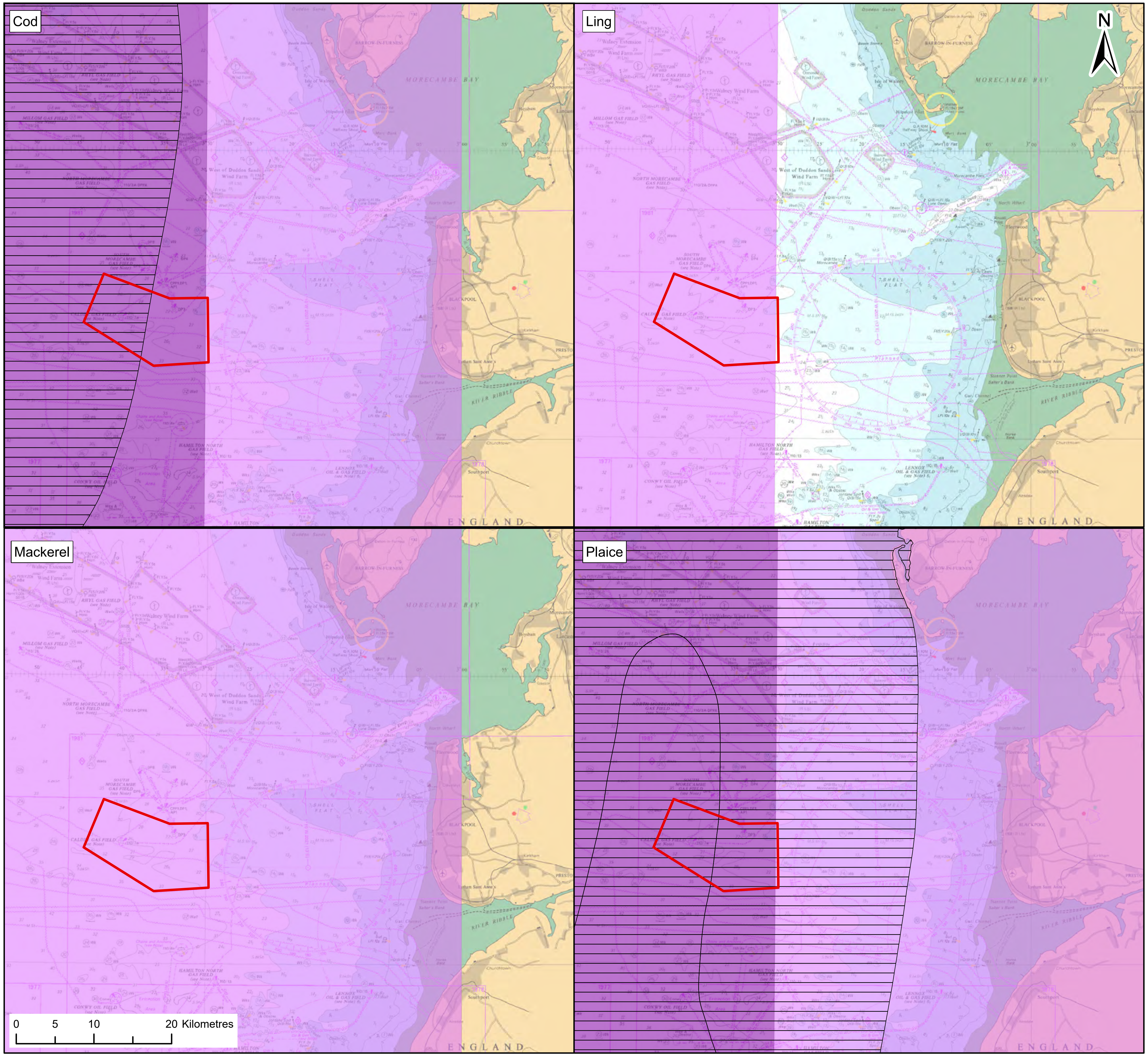
311 The eastern Irish Sea supports several ecologically and commercially important fish species, as well as supporting populations of estuarine and migratory fish species. A review has been undertaken to describe the use of the area by fish species in relation to key life stages, spawning and juvenile behaviour and migratory pathways and to identify spawning and nursey grounds.

312 The windfarm site overlaps, or is in close proximity to, a number of fish spawning and nursery grounds including sandeel, sole, plaice, cod, whiting and mackerel (see Figures 8.4a-c and 8.5a-d and Table 8.11). It is noted that herring spawning grounds, while not overlapping, are found approximately 40km to the north west of the windfarm site (Coull *et al*. 1998). The wider Irish Sea area also supports populations of elasmobranchs (sharks, skates and rays), including basking sharks and thornback ray which are of national significance.

Table 8.11 Spawning and nursery areas

Species	Hearing group	Areas overlapping the windfarm site		Commercial importance	Conservation designation
		Spawning	Nursery		
Sandeel sp.	Group 1: Fish with no swim bladder or other gas chamber	Y (high intensity)	Y (low intensity)	Low	The lesser sandeel is a Priority Species under the UK Post-2010 Biodiversity Framework.
Sole *Solea solea*	Group 1: Fish with no swim bladder or other gas chamber	Y (high intensity)	Y (high intensity)	Medium	International Union for Conservation of Nature (IUCN): data deficient
Plaice *Pleuronectes plattessa*	Group 1: Fish with no swim bladder or other gas chamber	Y (high intensity)	Y (low intensity)	High	IUCN (least concern)
Cod *Gadhus morhua*	Group 3: Fish in which hearing involves a swim bladder or other gas volume	Y (high intensity)	Y (high intensity)	Medium	IUCN Status Global: VU (Vulnerable) Europe: LC (Least Concern)
Whiting *Merlangius merlangus*	Group 3: Fish in which hearing involves a swim bladder or other gas volume	Y (low intensity)	Y (high intensity)	Medium	UK Biodiversity Action Plan (BAP), IUCN (least concern)
Mackerel *Scomber scombrus*	Group 1: Fish with no swim bladder or other gas chamber	Y (low intensity)	Y (low intensity	Low	UK BAP, IUCN (least concern)

Species	Hearing group	Areas overlapping the windfarm site		Commercial importance	Conservation designation
		Spawning	Nursery		
Ling *Molva molva*	Group 3: Fish in which hearing involves a swim bladder or other gas volume	Y (low intensity)	N	Low	UK BAP
Herring *Clupea harengus*	Group 3: Fish in which hearing involves a swim bladder or other gas volume	N	Y (high intensity)	Low	UK BAP, IUCN (least concern)
Spurdog *Squalus acanthias*	Group 1: Fish with no swim bladder or other gas chamber	N	Y (high intensity)	Medium	UK BAP, OSPAR, IUCN (vulnerable)
Anglerfish *Lophius pisccatorius*	Group 1: Fish with no swim bladder or other gas chamber	N	Y (low intensity	Medium	UK BAP
Tope shark *Galeorhinus galeus*	Group 1: Fish with no swim bladder or other gas chamber	N	Y (low intensity	Low	UK BAP, IUCN (vulnerable)
Thornback ray *Raja clavata*	Group 1: Fish with no swim bladder or other gas chamber	N	Y (low intensity	High	OSPAR, IUCN (near threatened)
Spotted ray *Raja montagui*	Group 1: Fish with no swim bladder or other gas chamber	N	Y (low intensity	Medium	UK BAP, IUCN (least concern)



Legend:

Morecambe Offshore Windfarm Site

Spawning Grounds (*Coul et al, 1998*)

Spawning Grounds (*Ellis et al, 2010*)

Intensity

High

Low

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Spawning Grounds Overlapping the Fish and Shellfish Ecology Study Area

Figure: 8.4a | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0058

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: WGS 1984 UTM Zone 30N

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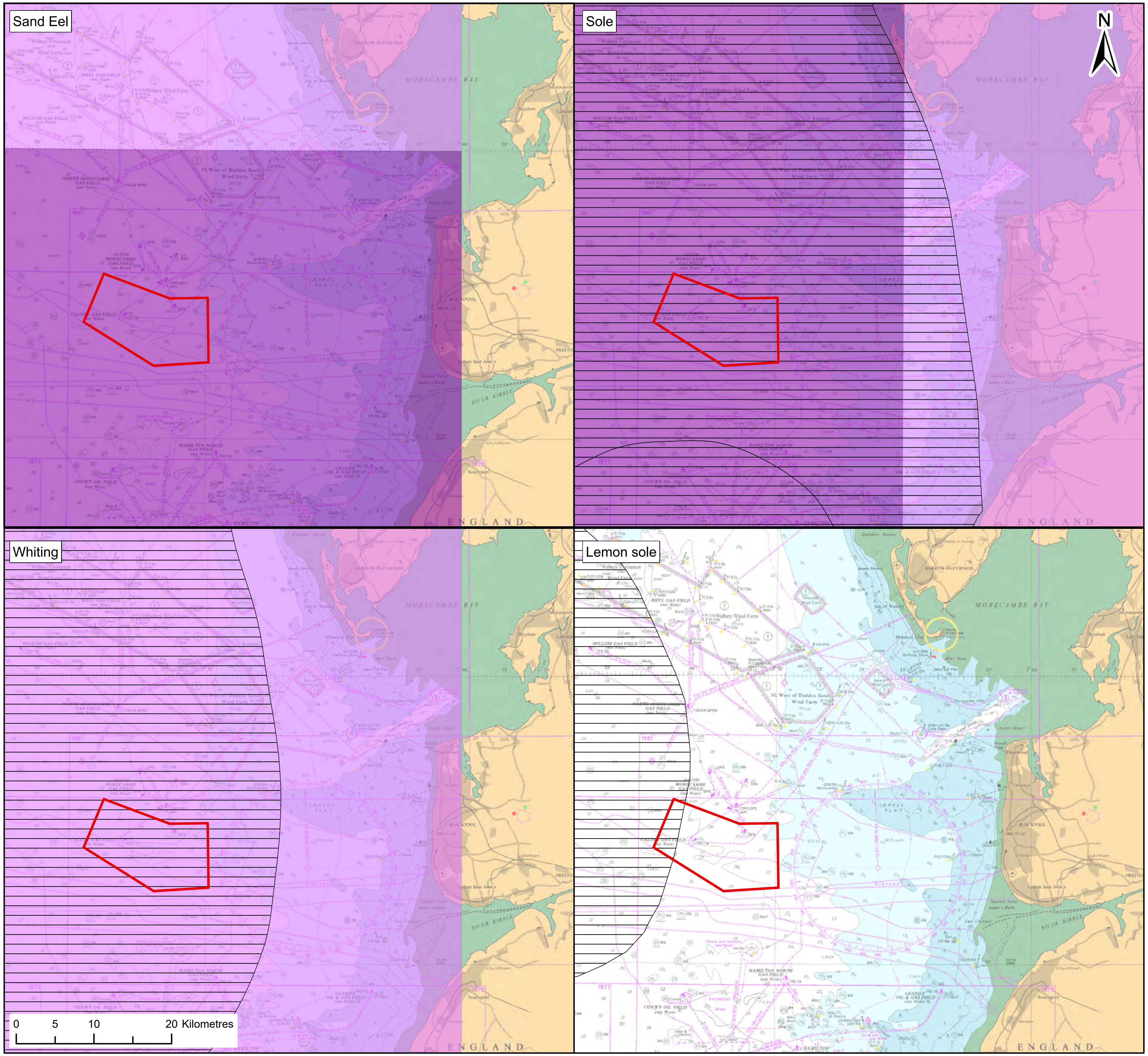

Legend:

Morecambe Offshore Windfarm Site

Spawning Grounds (*Coul et al, 1998*)

Spawning Grounds (*Ellis et al, 2010*)

Intensity

High

Low

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Title: Spawning Grounds Overlapping the Fish and Shellfish Ecology Study Area

Figure: 8.4b

Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0058

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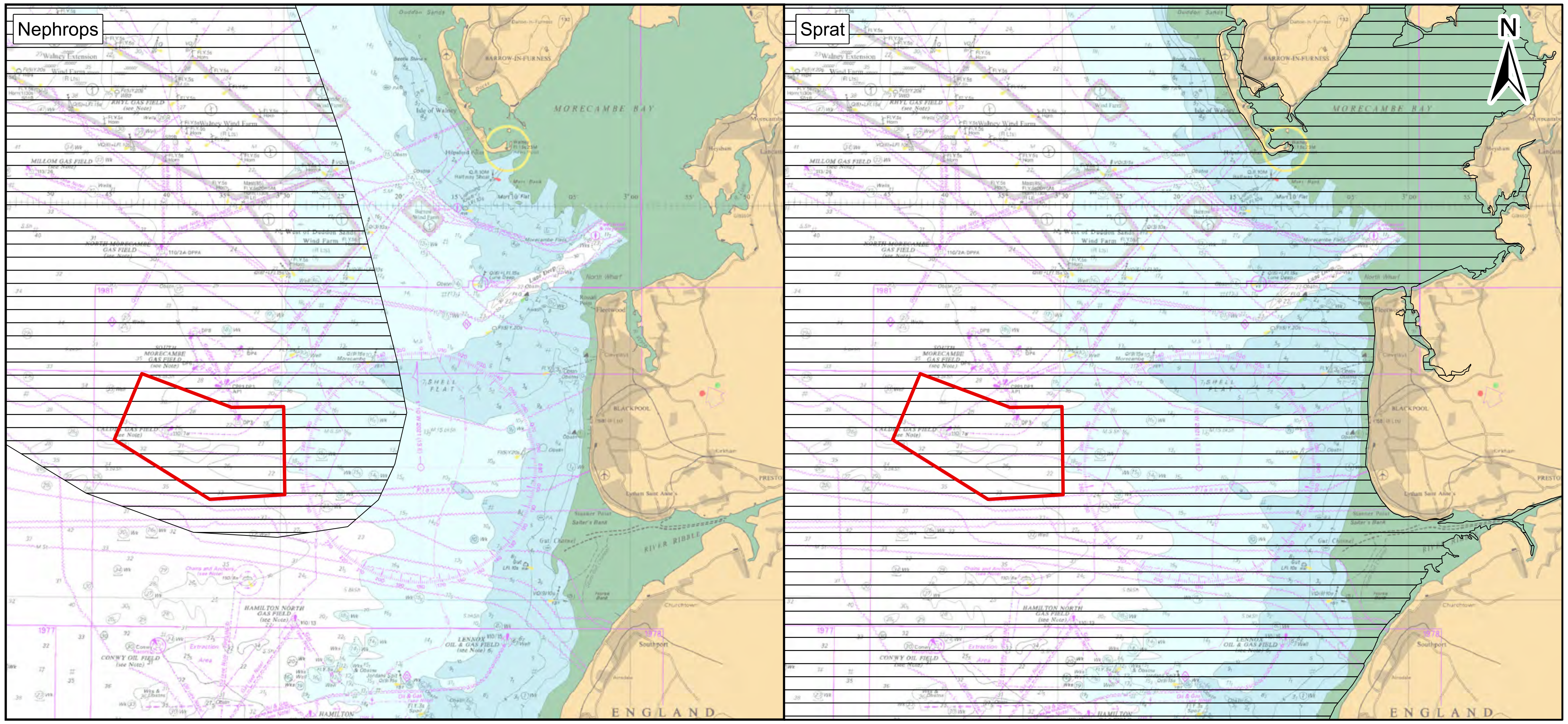

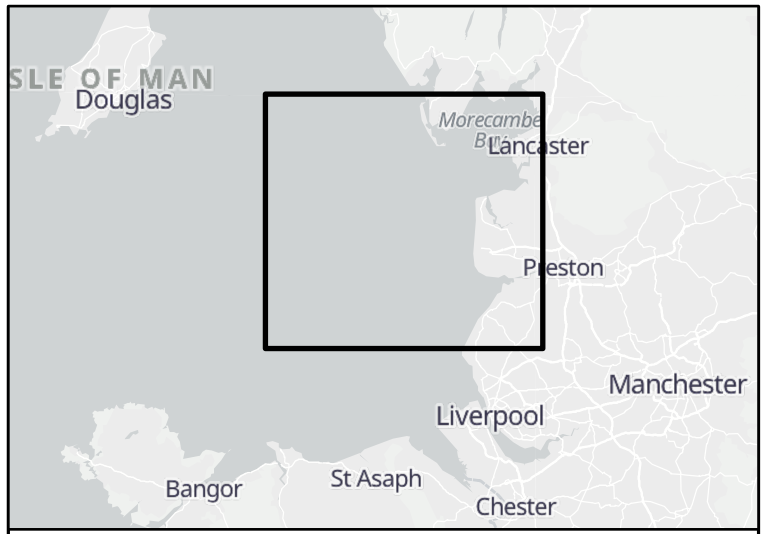

Legend:

Morecambe Offshore Windfarm Site

Spawning Grounds (*Coul et al, 1998*)

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Title: Spawning Grounds Overlapping the Fish and Shellfish Ecology Study Area

Figure: 8.4c | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0058

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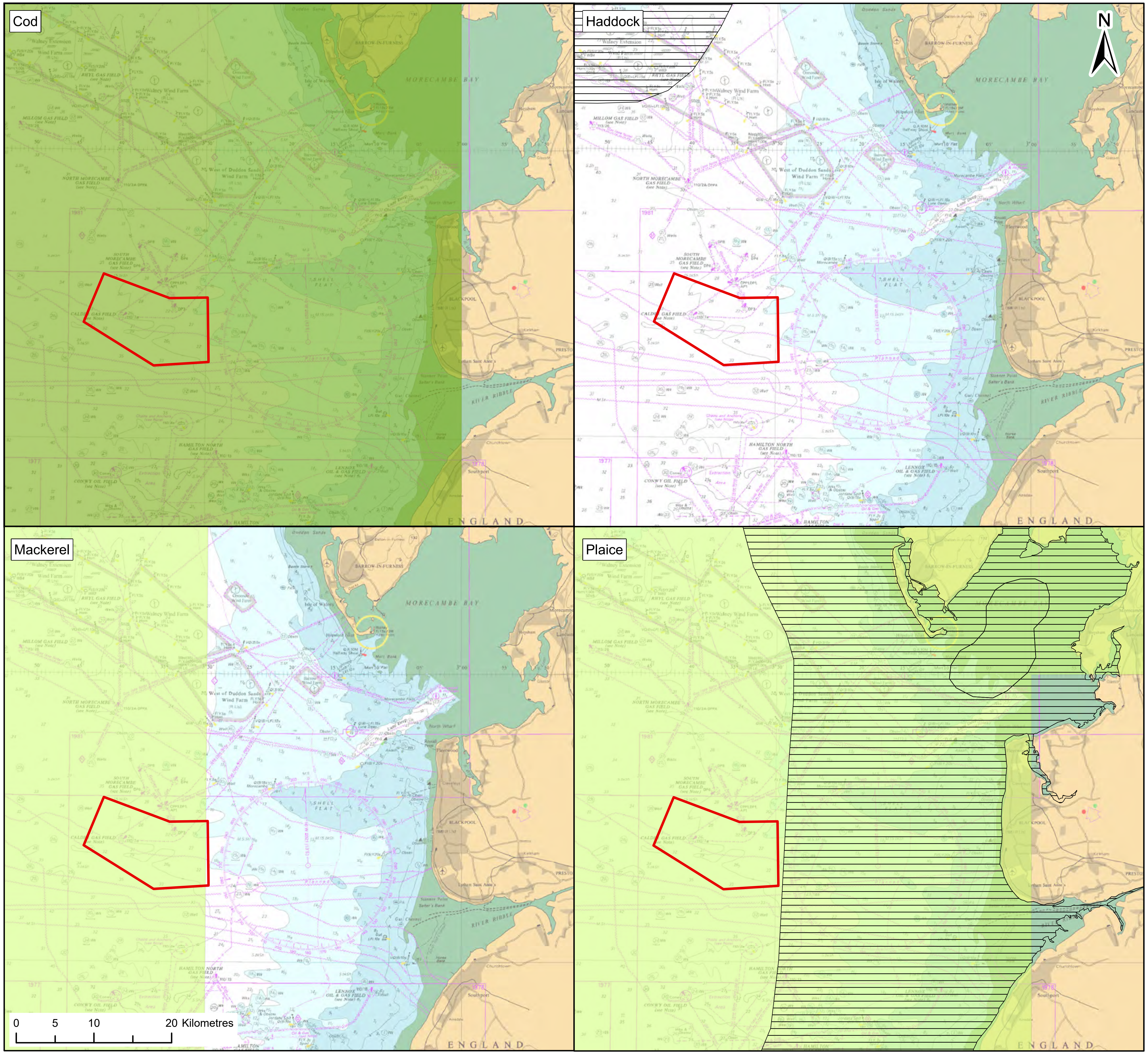

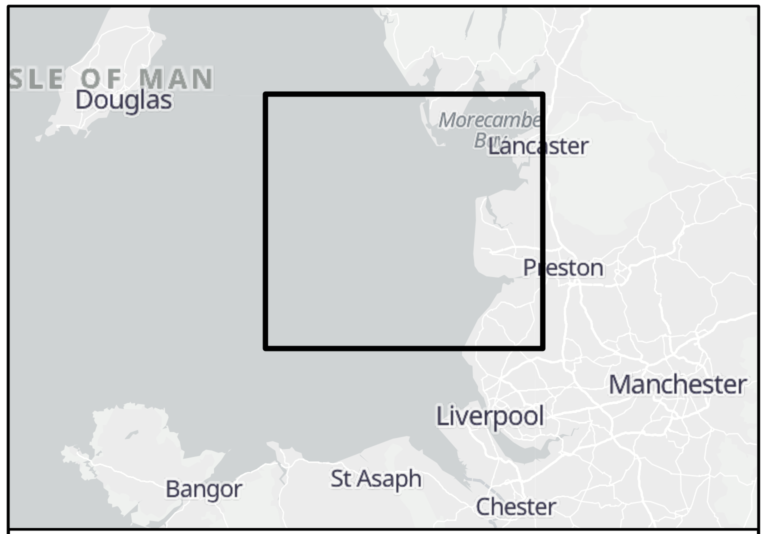

Legend:

Morecambe Offshore Windfarm Site

Nursery Grounds (*Coul et al, 1998*)

Nursery Grounds (*Ellis et al, 2010*)

Intensity

High

Low

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Title: Nursery Grounds Overlapping the Fish and Shellfish ecology Study Area

Figure: 8.5a	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0059

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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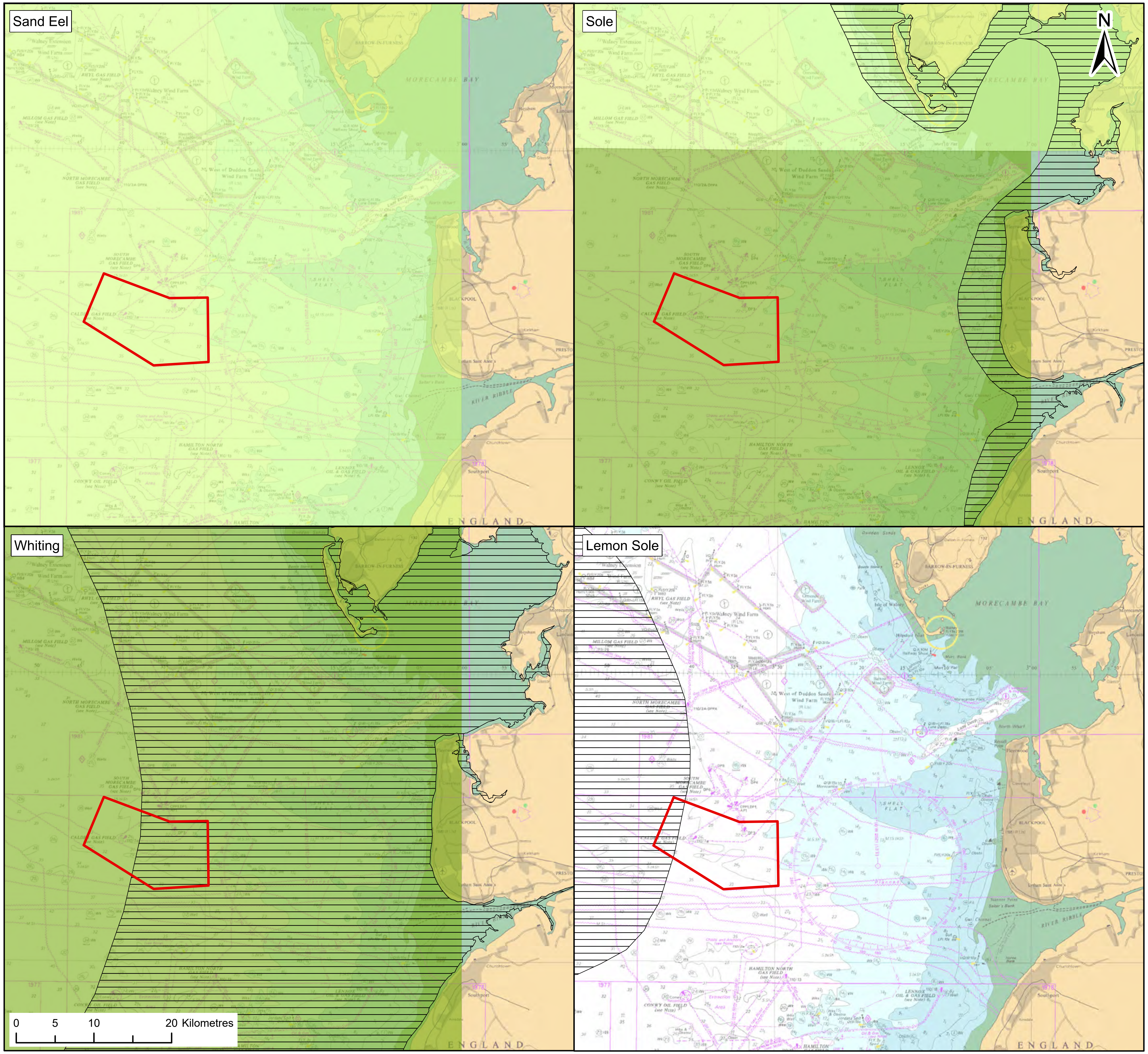

Legend:

Morecambe Offshore Windfarm Site

Nursery Grounds (*Coul et al, 1998*)

Nursery Grounds (*Ellis et al, 2010*)

Intensity

High

Low

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Title: Nursery Grounds Overlapping the Fish and Shellfish ecology Study Area

Figure: 8.5b | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0059

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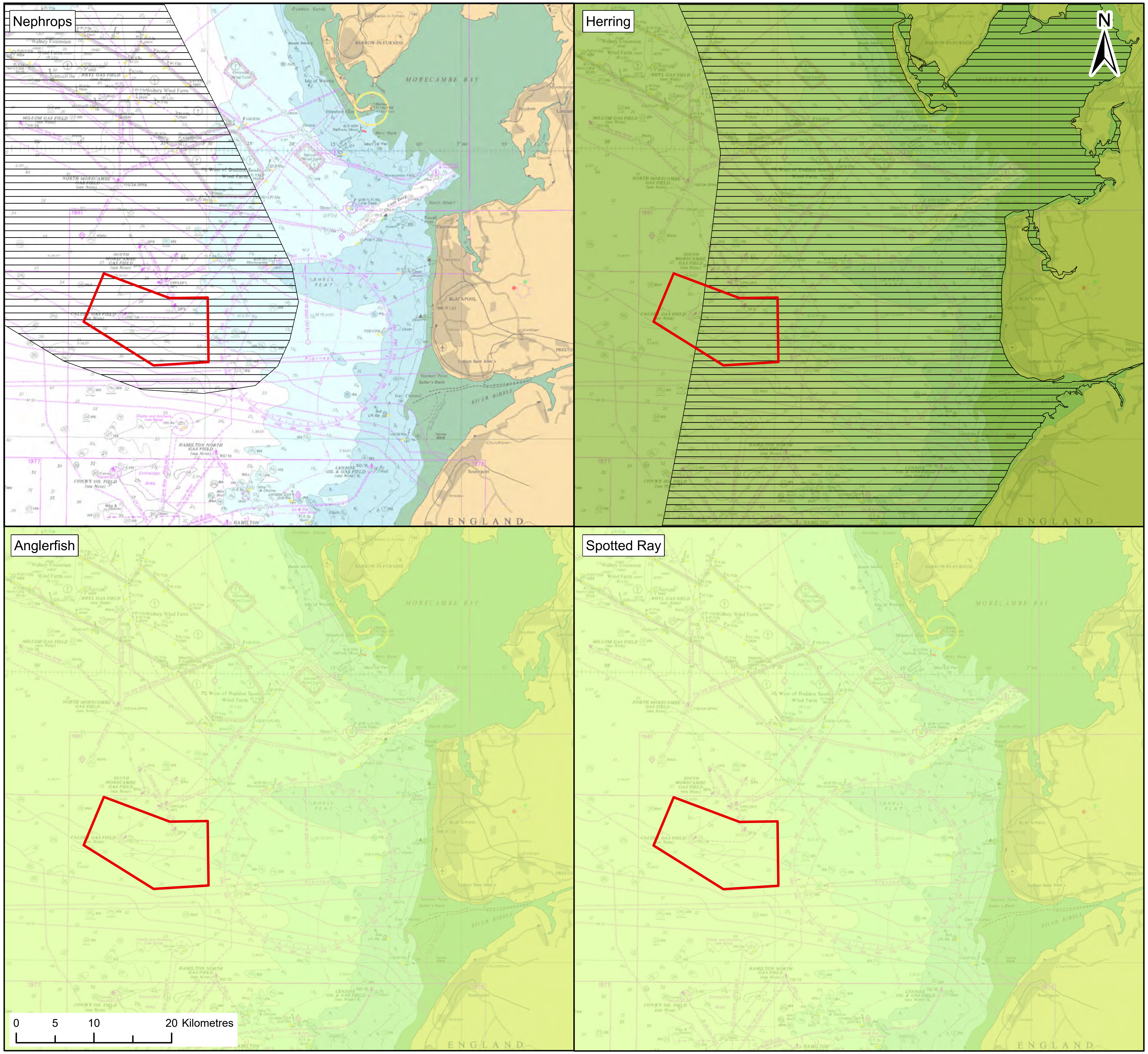

Legend:

Morecambe Offshore Windfarm Site

Nursery Grounds (*Coul et al, 1998*)

Nursery Grounds (*Ellis et al, 2010*)

Intensity

High

Low

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Title: Nursery Grounds Overlapping the Fish and Shellfish ecology Study Area

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Co-ordinate system: WGS 1984 UTM Zone 30N

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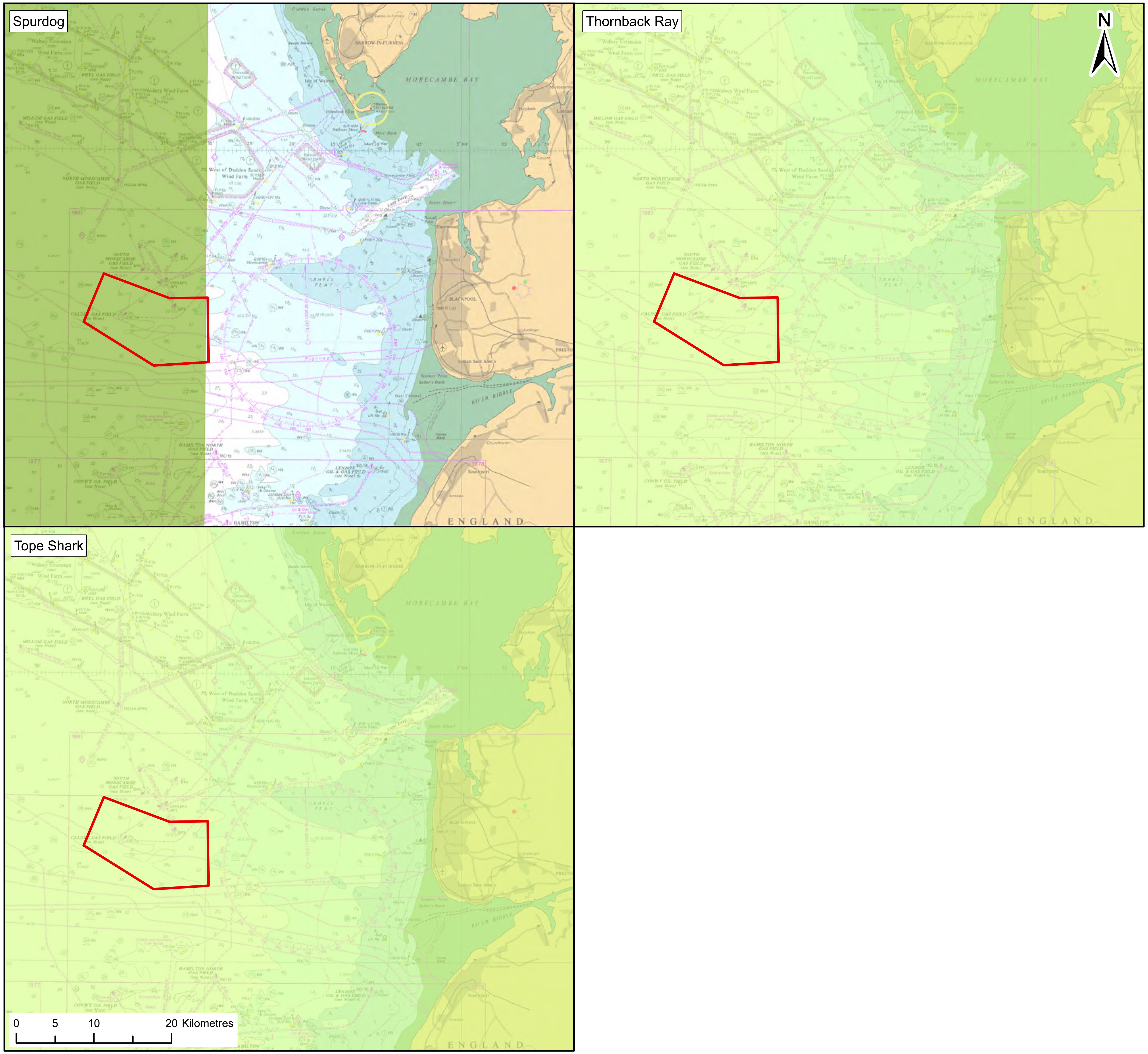

Legend:

Morecambe Offshore Windfarm Site

Nursery Grounds (*Ellis et al, 2010*)

Intensity

High

Low

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Nursery Grounds Overlapping the Fish and Shellfish ecology Study Area

Figure: 8.5d | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0059

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8.4.3.2 Shellfish

313 The fish and shellfish ecology Study Area is commercially important for Norway Lobster *Nephrops*, queen scallops *Aequipecten opercularis,* king scallops *Pecten maximus*, whelks *Buccinum undatum* and lobster *Nephropidae* and brown crab *Cancer pagurus*. Lockwood (2005) shows two shellfish resources within the Irish Sea. This includes a large scallop ground across the whole eastern Irish Sea, and a *Nephrops* resource located to the north of Liverpool Bay, between the Isle of Man and the Cumbria coast (this finding is supported by similar findings by the Northern Ireland Ground Fish Survey (NIGFS)).

8.4.3.3 Rare and protected species

314 A number of Annex II migratory fish species such as Atlantic salmon *Salmo salar*, sea trout *Salmo trutta,* smelt *Osmerus eperlanus* and European eel *Anguilla anguilla* may pass through the fish and shellfish ecology Study Area after leaving rivers in the area, during their more vulnerable life stage in March, April and early May (Atlantic salmon and sea trout) and early spring (smelt). Young eels (elvers) may also enter the rivers around Morecambe Bay in spring. Adult Atlantic salmon are observed to commence entry into the Leven, Kent, Lune and Wyre rivers during early spring, whilst sea trout commence entry in June (through until the autumn), although the upstream migration is not considered as extensive. Non-commercial species recorded from rivers and estuaries (Dee, Morecambe Bay, Conwy and Solway Firth) in the eastern Irish Sea include allis shad *Alosa alosa*, twaite shad *Alosa fallax* and sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluivatilis*.

315 As stated above, thornback rays have the potential to be present in the fish and shellfish ecology Study Area. These are listed as near-threatened under the IUCN Red List of Threatened Species owing to declines caused by fishing and exacerbated by their life history parameters (late maturation and low fecundity (ability to produce multiple offspring)).

316 Basking shark *Cetorhinus maximus* may be present within the fish and shellfish ecology Study Area. Basking shark are protected under Appendix III of the Bern convention and the Wildlife and Countryside Act (1981). They are also listed under the Convention on International Trade in Endangered Species (CITES).

8.4.3.4 Designated sites

317 The windfarm site is in proximity (within 30km) to the following sites:

- Morecambe Bay Special Area of Conservation (SAC), designated for sandbanks, which may represent spawning habitats for sandeel
- Shell Flat and Lune Deep SAC designated for sandbanks, which may represent spawning habitats for sandeel
- Fylde Marine Conservation Zone (MCZ) designated for subtidal sand and subtidal mud, which represents productive areas for crustacean, mollusc and flatfish species
- Wyre Lune MCZ, designated for smelt
- Ribble Estuary MCZ, designated for smelt
- West of Walney MCZ which is designated for subtidal sand, seapen and burrowing megafauna communities and subtidal mud, which represent highly productive areas for crustacean, mollusc and flatfish species
- West of Copeland MCZ which is designated for subtidal sand, subtidal coarse sediment and subtidal mixed sediment which support an array of species including crabs, sea mats and bivalve molluscs (such as venus clams *Chamelea gallina* and razor clams *Ensis ensis*)
- Liverpool Bay Special Protection Area (SPA), designated for a number of seabirds that may be indirectly impacted via impacts on prey fish and shellfish species

318 Further afield, at approximately 45km to the south west of the windfarm site is the North Anglesey Marine SAC, the primary reason for site designation is harbour porpoise *Phocoena phocoena*, of which herring and sandeel are key prey species. Y Fenai a Bae Conwy/ Menai Strait and Conwy Bay is located approximately 43km to the south of the Windfarm site, it is designated for sandbanks, which may represent spawning habitats for sandeel.

319 The above review has been undertaken to identify designated sites in proximity to the fish and shellfish ecology Study Area which are either designated for fish and shellfish interest or habitats/species which are dependent on or associated with fish or shellfish. It should be noted that a separate Habitat Regulations Assessment (HRA) and Marine Conservation Zone (MCZ) Screening Report is being produced which will cover in more detail matters associated with relevant designations.

320 As noted in Section 8.4.3.3, there is potential for salmon and lamprey species to pass through the fish and shellfish ecology Study Area from various rivers associated with SACs, further detail on relevant SACs will be provided within the HRA.

8.4.4 Approach to data collection

321 It is intended that during the EIA, full analysis of the baseline sources (desk based) listed in Table 8.12 is completed. Table 8.12 outlines existing primary data that has been used to inform this section.

Table 8.12 Existing datasets used to inform the fish and shellfish ecology assessment

Dataset	Spatial Coverage	Survey Year
MMO Landings Data (weight and value) by species	Irish Sea - Landings from ICES rectangles 36E6, 37E6 and 37E7	2009 - 2020
International Bottom Trawl Survey (IBTS)	Irish Sea	1965-2019
Irish Sea Annual Egg Production Method (AEPM) Plankton Survey	Irish Sea	2000
Cefas (2019) Young Fish Survey	North Sea, North East Atlantic, Irish and Celtic sea and Channel	1981-2010
Distribution of Spawning and Nursery Grounds as defined in Coull *et al*. (1998) and in Ellis *et al*. (2012)	North Sea, North East Atlantic, Irish and Celtic sea and Channel	1998 and 2010
Northern Ireland Ground Fish Survey (ICES)	Data coverage across the northern Irish Sea region	2005- 2018
North West Groundfish Survey (Cefas, 2013)	Data coverage of the Irish Sea	2013
Basking Shark Watch database	Data/information on relative abundance, distribution and behaviour of basking sharks in UK water	1987-2021
Manx Basking Shark Watch	Data/information on relative abundance, distribution and behaviour of basking sharks in Manx territorial waters	1987-2021
Bangor University's Fisheries and Conservation Science Group	Bangor University provide fisheries support to the Isle of Man	2007-2021
Manx Marine Environmental Assessment	Baseline environmental information in Manx territorial waters	2012
Barrow Offshore Windfarm Environmental Statement and	There have been many fish and shellfish surveys and desk	2002

Dataset	Spatial Coverage	Survey Year
associated technical supporting documents	studies undertaken for existing offshore windfarms which overlap with the fish and shellfish ecology Study Area. All fish and shellfish information and data related to the existing offshore wind farms will be used to inform the Project's EIA.	
Ormonde Offshore Windfarm Environmental Statement and associated technical supporting documents		2005
West of Duddon Sands Offshore Windfarm Environmental Statement and associated technical supporting documents		2006
Walney 1 & 2 Offshore Windfarm Environmental Statements and associated technical supporting documents		2006
Rhiannon Offshore Windfarm Preliminary Environmental Information Report		2012
Walney Extension Offshore Wind Farm Environmental Statement and associated technical supporting documents		2013
Awel y Môr Offshore Wind Farm Environmental Statement and associated technical supporting documents		2022
Any available basking shark sightings from the citizen science projects run by MarineLife (www.marinelife.org)	Data coverage across the northern Irish Sea region	As available

322 Other data and information available to inform the EIA include:

- Predictive European Nature Information System (EUNIS) seabed habitats, European Marine Observation and Data Network (EMODnet) (2021)
- Database containing information on the predicted seabed habitats present across Europe, mapped in accordance with the EUNIS habitat classification system, 2009 – 2013, 2013 – 2016 and 2017 – 2019
- North West Marine Plan documents (HM Government, 2021)

323 Given that fish are highly mobile, both temporally and spatially, a site specific survey only provides coverage of the species present in a particular area at a particular time. This has the potential to skew the baseline. Other datasets, as outlined in Table 8.12, with large-scale coverage are relevant for characterising the natural fish and shellfish resource.

324 Fisheries landings datasets provide sufficient information, detail and coverage to characterise and describe the fish and shellfish resource within the fish and shellfish ecology Study Area. Any previous monitoring from existing projects may also add to this information.

325 It is therefore proposed that given the volume of existing data and the low value of site-specific data collection, no site-specific survey is undertaken for the Project.

326 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.4.5 Approach to impact assessment

327 The specific assessment requirements for fish and shellfish ecology are in accordance with the overarching National Policy Statement (NPS) for Energy EN-1 and NPS for Renewable Energy infrastructure (EN-3), and with the draft versions that have been published for consultation. Requirements under the Eels (England and Wales) Regulations 2009 will also be agreed with relevant bodies during the EIA process.

328 A key source of information will be fisheries landings data (see Section 8.7); these provide both large spatial coverage and effort. These datasets will be complimented with existing site-specific data available from previous projects (listed in Table 8.12), additionally, numerous studies that have been undertaken in the region on this topic (see Section 8.4.4).

329 In addition, it is envisioned that the impact assessment will use existing and additional noise survey data (ambient noise) combined with appropriate guidance such as Popper *et al*. (2014); and the Environment Agency Informed Approach (Navitus Bay, 2014). This approach uses a combination of Popper *et al*. (2014), Hawkins & Popper (2014), and Hawkins (2014), to assess the level of potential noise impacts upon fish, including migratory fish and shellfish. As outlined in Section 8.5.5.1, site specific underwater noise

modelling will be undertaken for all potential noise sources that could impact fish and shellfish species.

330 The assessment of impacts on fish and shellfish ecology will be further informed by physical processes and geophysical and benthic data from the Project's benthic ecology assessments.

331 The assessment for fish and shellfish ecology will consider the Project Design Envelope (PDE), following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario' upon which the assessment will be made. The worst case scenario will be outlined in the PEIR.

8.4.6 Potential impacts

332 A range of potential impacts on fish and shellfish ecology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.4.6.1 Potential impacts during construction

333 Potential impacts during construction will arise from physical disturbance of seabed habitats and suspension of sediment during cable and foundation installation work (including seabed preparation). Impacts are:

- Temporary habitat loss / physical disturbance
- Increased suspended sediments and sediment re-deposition
- Remobilisation of existing contaminated sediments if present
- Underwater noise and vibration
- Barrier effects
- Changes in fishing activity

334 Impacts which span the life of the Project (e.g. long term habitat loss) will be considered as part of the operation and maintenance phase assessment (see below) and are therefore not considered in the construction phase assessment to avoid duplication.

Temporary habitat loss / physical disturbance

335 Demersal fish and shellfish (such as king and queen scallops, whelk, crab and lobster), including the egg and larval stages of certain species, will be prone to direct physical disturbance during the construction phase from the installation of the windfarm infrastructure (namely foundations, scour

protection and cables). This will especially be the case if disturbance coincides with key spawning or migration periods. The level of effect will be dependent upon the habitat in question, its distribution in the wider area and the presence of a species that is reliant on that habitat.

Increased suspended sediments and sediment re-deposition

336 During construction activities there may be a temporary increase in suspended sediment concentrations and deposition. Suspended sediment has the potential to impair respiratory, filter feeding or reproductive functions, including the disruption of migration/spawning activity. Sediment deposition, especially if it changes the characteristics of the existing seabed sediments, could affect the quality of spawning and nursery habitats.

Remobilisation of existing contaminated sediments if present

337 Potential impacts related to the resuspension of contaminants are currently scoped in for assessment. However, should the results of benthic sampling demonstrate low levels of contamination the Applicant would seek to scope these out of further assessment through the Evidence Plan Process (EPP). Water quality effects are also scoped in at this stage.

Underwater noise and vibration

338 Underwater noise generated by pile driving and other construction activities may result in disturbance and displacement of fish species and have the potential to affect spawning behaviour, nursery areas and migration patterns.

Barrier effects

339 Acoustic barrier effects (noting the potential presence of Annex II migratory species) may also arise as a result of underwater noise during construction and will be included as part of the underwater noise assessment.

Changes in fishing activity

340 The construction of offshore infrastructure could result in changes to fishing activity within the windfarm site but also in the wider area due to displacement of fishing activity into other areas. This could in turn result in changes to commercially targeted fish stocks.

8.4.6.2 Potential impacts during operation and maintenance

341 Potential impacts during operation will mostly result from loss of habitat and changes to seabed substrata from the physical presence of infrastructure (i.e. foundations and any cable protection above the seabed). Maintenance activities may result in disturbance to seabed habitats, these would be similar

to those during construction but at a lower magnitude. Associated with the activities above potential impacts include:

- Permanent habitat loss
- Increased suspended sediment concentrations
- Remobilisation of contaminated sediments
- Underwater noise and vibration
- Interactions of EMF
- Barrier effects
- Introduction of hard substrate
- Changes in fishing activity

Permanent habitat loss

342 The presence of foundations on the seabed and cable protection would result in a relatively small footprint of lost habitat in the context of the habitat from the surrounding region. Depending on whether the infrastructure is removed or left in-situ at the decommissioning stage this impact is either long term or permanent habitat loss. The level of effect will be dependent upon the habitat in question, its distribution in the wider area and the presence of a species that is reliant on that habitat. As a worst case scenario it is assumed it would be permanent habitat loss unless the Applicant commits to removing any areas of infrastructure at decommissioning.

Increased suspended sediment concentrations

343 Small volumes of sediment could be re-suspended during maintenance activities; the volumes would be lower than for construction. It is not expected that there would be significant effects, however the impact is scoped in to allow for further justification with full baseline information.

Remobilisation of contaminated sediments

344 Potential impacts related to the resuspension of contaminants are currently scoped in for assessment. However, should the results of benthic sampling demonstrate low levels of contamination the Applicant would seek to scope these out of further assessment through the EPP. Water quality effects are also scoped in at this stage.

Underwater noise and vibration

345 The main source of noise during operation (in addition to ambient noise) originates form the wind turbine generator gearbox and generator, in addition to any surface vessels undertaking operation and maintenance activities. Operational noise impacts are considered highly unlikely to cause physical

damage to fish or shellfish species (Nedwell *et al.*, 2007a,b; MMO, 2014) and it follows that any significant behavioural disturbance would be limited to the area immediately surrounding the wind turbine generator, however the impact is scoped in to allow for further justification with full baseline information.

Interactions of EMF

346 Potential impacts from Electromagnetic Fields (EMFs) from operational cables will also be considered. NPS EN-3 states that where cables are buried to "*a depth of at least 1.5m below the seabed, the applicant should not have to assess the effect of the cables on intertidal habitat during the operational phase of the offshore wind farm*". It is currently expected that where cables can be buried, the minimum target depth would be 1m but may range from 0.5 to 3m. There is also the potential that it is not possible to bury cables at all locations (e.g. at crossings or in hard substrate) and therefore there may be sections of surface laid cables with cable protection. The assessment will consider a worst case scenario based on the extent of cables with the potential to be buried at less than 1.5m depth.

Barrier effects

347 It is not expected that barrier effects would be significant during operation, given the scale of operational and maintenance activities, however the impact is scoped in to allow for further justification with full baseline information.

Introduction of hard substrate

348 Concrete and steel structures may be colonised by a range of benthic invertebrate species, potentially increasing ecological diversity and with the potential to act as fish aggregating devices. The potential effect on fish and shellfish species will be dependent on the foundation structure used, and the volume and type of scour protection used. The fish aggregation effect of introduced hard substrate may not always benefit the existing communities and species, for example there may be increased predation on existing benthic invertebrates.

Changes in fishing activity

349 The operation and maintenance of offshore infrastructure could result in changes to fishing activity within the windfarm site but also in the wider area due to displacement of fishing activity into other areas. This could in turn result in changes to commercially targeted fish stocks.

8.4.6.3 Potential impacts during decommissioning

350 It is anticipated that the decommissioning impacts would be similar in nature to those of construction, although the magnitude of effect is likely to be lower. For example, where construction may require drilling of foundations and/or seabed preparation, decommissioning would likely require cutting of foundations to seabed level and may potentially result in less seabed disturbance than construction.

8.4.6.4 Potential cumulative impacts

351 There may be potential for cumulative impacts to occur on fish and shellfish ecology as a result of other activities. The approach to assessment of potential cumulative impacts is set out in Section 7.7.

352 Offshore wind projects and other activities (such as oil and gas operations) relevant to the assessment of cumulative impacts on fish and shellfish ecology will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

353 The cumulative assessment for fish and shellfish will specifically consider cumulative noise impacts, habitat loss and changes to seabed habitat.

8.4.6.5 Potential transboundary impacts

354 The distribution of fish and shellfish species is independent of national geographical boundaries. The Environmental Impact Assessment (EIA) will be undertaken taking account of the distribution of fish stocks and populations irrespective of national jurisdictions. As a result, it is considered that a specific assessment of transboundary effects is unnecessary. This approach was adopted and accepted for several previous projects (e.g. East Anglia THREE (East Anglia THREE Ltd, 2015), East Anglia ONE North (East Anglia ONE North Ltd, 2019), Norfolk Vanguard (Planning Inspectorate, 2016) and Awel Y Mor (Planning Inspectorate, 2020).

8.4.6.6 Summary of potential impacts

355 Table 8.13 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.13 Summary of impacts relating to fish and shellfish ecology

Potential Impact	Construction	Operation and maintenance	Decommissioning
Temporary habitat loss / physical disturbance	✓	x	✓
Permanent habitat loss	x	✓	x
Increased suspended sediments and sediment re-deposition	✓	✓	✓
Remobilisation of contaminated sediments	✓	✓	✓
Underwater noise and vibration	✓	✓	✓
Electromagnetic fields.	x	✓	x
Barrier effects	✓	✓	✓
Introduction/removal of hard substrate	x	✓	✓
Changes in fishing activity	✓	✓	✓
Cumulative underwater noise	✓	✓	✓
Cumulative permanent habitat loss	x	✓	✓
Cumulative changes to seabed habitat	✓	✓	✓
Transboundary impacts	x	x	x

8.4.7 Potential mitigation measures

356 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the Preliminary Environmental Information Report (PEIR), and ultimately the Environmental Statement (ES), are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

357 Examples of mitigation measures which are likely to be considered include:

- Where seabed preparation is required (e.g. levelling) adoption of methods and equipment that have been designed to minimise potential for sediment suspension and dispersal.
- Application of foundation installation techniques using methods and equipment to minimise sediment suspension.
- Selection of cable installation methods and equipment most suitable for seabed conditions and designed to minimise sediment suspension into the water column.
- Preparation of Construction Method Statements (CMS), post consent, setting out detailed turbine foundation and cable installation methods and techniques (based on final project design).
- Cables will be buried to a target burial depth of 1 m where possible (recognised industry good practice). A detailed Cable Burial Risk Assessment (CBRA) will also be required to confirm the extent to which cable burial can be achieved. Where it is not possible to achieve cable burial, additional cable protection (rock placement, concrete mattressing or grout bags) may be required, as discussed in Section 6.3.
- A Marine Mammal Mitigation Protocol (MMMP) will be developed (see Section 8.5.7) and implemented which will include proposals for soft start and ramp-up of piling. A soft start and ramp up protocol for pile driving would allow mobile species to move away from the area of highest noise impact. A draft MMMP will be provided with the submitted DCO application.
    - A MMMP will detail the required mitigation measures to minimise the potential risk of physical and auditory injury (PTS) to marine mammals as a result of underwater noise during Unexploded Ordnance (UXO) clearance and piling. Any mitigation beneficial to marine mammals would also potentially reduce impacts on fish and shellfish ecology.
- An Offshore Decommissioning Plan will be developed post consent and implemented.

358 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process.

8.5 Marine mammal ecology

8.5.1 Introduction

359 This section considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on marine mammal receptors as well as marine turtles.

8.5.2 Study area

360 The marine mammals Study Area is based on the wider Irish Sea area to take into account the wide ranges and movements of marine mammals, turtles, and relevant Management Units[8] (MU).

8.5.3 Existing environment

361 Initial assessments of the distribution of marine mammals throughout the Irish Sea have identified six marine mammal species that could occur in and around the windfarm site and wider area (e.g. Hammond *et al.*, 2021; Paxton *et al.*, 2016; Waggitt *et al.*, 2019; Department of Energy and Climate Change (DECC) (now Department for Business, Energy and Industrial Strategy (BEIS) 2016; Special Committee on Seals (SCOS), 2020). These include:

- Harbour porpoise *Phocoena phocoena*
- Bottlenose dolphin *Tursiops truncatus*
- Risso's dolphin *Grampus griseus*
- Minke whale Balaenoptera acutorostrata
- Grey seal *Halichoerus* grypus
- Harbour seal *Phoca* vitulina

362 Other marine mammal species that have been recorded in the Irish Sea in lower numbers include short-beaked common dolphin *Delphinus delphis*, white-beaked dolphin *Lagenorhynchus albirostris*, humpback whale *Megaptera novaengliae* and fin whale *Balaenoptera physalus*.

363 A full assessment of the baseline conditions will be undertaken through the Environmental Impact Assessment (EIA) process, and will inform, alongside the results of the site specific aerial surveys, the species to be included in the EIA. However, it is expected that the six species listed above will be taken

[8] MUs provide an indication of the spatial scales at which impacts of plans and projects alone, cumulatively and in-combination, need to be assessed for the key cetacean species in UK waters, with consistency across the UK.

forward for assessment, based on the information and data currently available, as outlined below.

364 A large scale survey (the third in a series of surveys) of the presence and abundance of cetacean species around the north-east Atlantic, undertaken in the summer of 2016 (the Small Cetaceans in the European Atlantic and North Sea (SCANS) III survey; Hammond *et al.*, 2021), indicates harbour porpoise to be the only cetacean species present in the relevant survey block (Block F).

365 The Joint Cetacean Protocol (JCP) Phase III report (Paxton *et al.*, 2016) shows similar results, with only harbour porpoise present with relatively high density in the windfarm site, with lower densities of minke whale, Risso's dolphin and white-beaked dolphin.

366 Distribution maps of cetacean species within the north-east Atlantic (Waggitt *et al.*, 2019) also indicate that harbour porpoise would be the most likely species to be present within the windfarm site. Minke whale, Risso's dolphin and white-beaked dolphin are also observed within the windfarm site; bottlenose dolphin and short-beaked common dolphin may also be present in the wider area but in much lower numbers.

367 This is further supported by DECC (now BEIS) (2016), which states that five species are commonly encountered in the Irish Sea: harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin and minke whale. Grey and harbour seals are also regularly present in certain areas. Within the windfarm site, only harbour porpoise is considered to be common, whilst bottlenose dolphin, Risso's dolphin and minke whale are more commonly sighted seasonally further north, and short-beaked common dolphin is noted as uncommon for the windfarm site.

368 The Manx Whale and Dolphin Watch (MWDW) have conducted vessel-based surveys throughout the Manx territorial waters since 2007, most of which were conducted in the summer months between May and September. The surveys have reported five main species of marine mammals in Manx territorial waters: harbour porpoise, common dolphin, bottlenose dolphin, Risso's dolphin and minke whale (Howe, 2018).

369 A number of aerial surveys were undertaken for the Awel y Môr Offshore Wind Farm (located 28km to the southwest of the windfarm site) between March 2019 and February 2021. Unknown "dolphin/porpoise" was the most recorded category during the surveys followed by unidentified seal; harbour porpoise was the only identified marine mammal within these surveys (Sinclair *et al.*, 2021).

370 Both grey seal and harbour seal are present in the Irish Sea. Grey seal have a number of haul-out sites in the Irish Sea around Pembrokeshire, the Lleyn Peninsula, Anglesey, Liverpool Bay, the Solway Firth, northern Isle of Man, east Northern Ireland, the Firth of Clyde and the Dumfries and Galloway coast (DECC, 2016; SCOS, 2020). There are two main haul-out sites for grey seal in Northwest England MU, in the Dee Estuary on the Welsh-English border (Hilbre Island), and South Walney (SCOS, 2020). For grey seal, densities within the windfarm site are relatively low, with areas of increased densities near to the coast to the south and on the Irish coast, particularly near to Liverpool Bay and the Murlough Special Area of Conservation (SAC) (Carter *et al.*, 2020).

371 There are few harbour seal reported within the Irish Sea, except along the coast of Northern Ireland and in Southwest Scotland (Firth of Clyde), with no breeding sites known along the Welsh coast (DECC, 2016; SCOS, 2020). Harbour seal densities are very low across the eastern Irish Sea and the windfarm site, increasing slightly in the south near to Liverpool Bay and along the Northern Ireland coast (Carter *et al.*, 2020;).

372 Of the seven marine turtle species in the world, five have been recorded as rare vagrant species within UK water. Of these only one is regularly reported in UK waters, the leatherback turtle *Dermochelys coriacea*. Leatherback turtles are known to utilise the Irish Sea with sightings recorded off Anglesey and the Isle of Man (TURTLE database). Leatherback turtles are protected under Annex IV of Habitats Directive. Once further assessment of the presence of turtles within the marine mammals Study Area has been undertaken turtles may be scoped out of the assessment.

8.5.3.1 Site specific survey information

373 Aerial surveys commenced in March 2021 and will continue until February 2023. The surveys are being conducted monthly. In total 24 months of data will be collected for the site. The surveys for March 2021 to February 2022 recorded one known cetacean species (harbour porpoise) and identified two seal species (grey seal and harbour seal) in the survey area. (Table 8.14). No marine turtles have been identified during the aerial surveys.

Table 8.14 Species recorded during the HiDef aerial surveys between March 2021 to February 2022

Species	Number of individuals
Harbour porpoise	372
Grey seal	21
Harbour seal	1
Seal species	22
Cetacean species	1
Seal / small cetacean species	1

8.5.3.2 Designated sites

374 The closest harbour porpoise SAC is the North Anglesey Marine (Gogledd Môn Forol) SAC which is 45km from the windfarm site at the nearest point. Connectivity between the windfarm site and all SACs with harbour porpoise as a qualifying feature in the Celtic and Irish Sea MU will be considered during the Habitat Regulations Assessment (HRA) screening.

375 For bottlenose dolphin, connectivity between the windfarm site and all SACs with bottlenose dolphin as a qualifying feature in the Irish Sea MU will be considered during the HRA screening. The closest bottlenose dolphin SAC is Cardigan Bay SAC which is approximately 200km from the windfarm site.

376 For grey seal and harbour seal, tagging studies and information on species' movements will be reviewed to determine the potential for connectivity between the windfarm site and all SACs with grey and / or harbour seal as a qualifying feature in the Celtic and Irish Sea area and West Scotland area in the HRA screening. The closest SAC for grey and harbour seals is Lambay Island SAC which is approximately 150km from the windfarm site .

377 There are also two Marine Protected Areas (MPA) for minke whale (Sea of the Hebrides MPA approximately 300km away and Southern Trench MPA approximately 945km away), and one for Risso's dolphin (North-east Lewis MPA approximately 620km away) within the relevant species MU.

8.5.4 Approach to data collection

378 In addition to the site specific surveys (Section 8.5.3.1) and the data and information outlined above, other data and information sources that will be used to inform the EIA include, but will not be limited to:

- Small Cetaceans in the European Atlantic and North Sea (SCANS-III): Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys (Hammond *et al.*, 2021)
- The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area (Heinänen and Skov, 2015)
- Revised Phase III data analysis of JCP data resources (Paxton *et al.*, 2016)
- Offshore Energy Strategic Environmental Assessment (including relevant appendices and technical reports) (DECC, 2016)
- ObSERVE surveys (Rogan *et al.*, 2018)
- Distribution maps of cetacean and seabird populations in the North-East Atlantic (Waggitt *et al.*, 2019)
- MWDW surveys (Howe, 2018)
- MARINElife surveys from ferry routes across the Irish Sea area (MARINElife, 2021)
- Sea Watch Foundation volunteer sightings off North West England (Sea Watch Foundation, 2021)
- Welsh Marine Atlas (Baines and Evans, 2012)
- Management Units for cetaceans in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG), 2021)
- Seal telemetry data (e.g. Sharples *et al.* 2008; Russel and McConnell 2014; Barker *et al.* 2014; Vincent *et al.*, 2017)
- UK seal at sea density estimates and usage maps (Carter *et al.*, 2020)
- Other wind farm survey data (Awel y Môr OWF; Gwynt y Môr OWF; Walney Extension)
- SCOS annual reporting of scientific advice on matters related to the management of seal populations (e.g. SCOS, 2020)
- TURTLE database records (published and unpublished) of turtle stranding and sightings around the UK and the Republic of Ireland
- Manx Wildlife Trust seal information
- Manx Marine Environmental Assessment (2012)

379 The latest and most up to date references will be applied to the assessment, data used will also be supplemented with appropriate results of ongoing research and studies as it becomes available.

380 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.5.5 Approach to impact assessment

381 The specific assessment requirements for marine mammal ecology are in accordance with the overarching National Policy Statement (NPS) for Energy EN-1 and NPS for Renewable Energy infrastructure (EN-3), and with the draft versions that have been published for consultation.

382 The assessment for marine mammals will consider the Project Design Envelope (PDE, following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario' upon which the assessment will be made. The worst case scenario will be outlined in the PEIR.

8.5.5.1 Underwater noise modelling

383 Site specific underwater noise modelling will be undertaken for the Project for all potential underwater noise sources, including but not limited to:

- Installation of foundations for turbines and substations
- Other construction activities, including seabed preparations, rock placement and cable installation
- Vessels
- Operational noise
- Maintenance activities, including rock placement, cable installation and vessels

384 Underwater noise modelling will be used to determine the potential risk of physical injury, auditory injury, disturbance and any barrier effects resulting from underwater noise.

385 Underwater noise modelling will also be undertaken for the clearance of unexploded ordnance (UXO). However, any UXO clearance, if required, will be assessed as part of a separate Marine Licence and not part of the DCO submission. Therefore, worst-case impacts for UXO clearance will be included as an Appendix within the project ES for information only. A more detailed assessment will be undertaken for the separate Marine Licence when more information on the requirement for any UXO clearance are available.

386 Underwater noise modelling will be undertaken using the latest and best available information, in particular relating to criteria and thresholds for predicting the noise impact ranges for marine mammal species (Southall *et al.*, 2019) and turtles (Popper *et al.*, 2014):

- The peak Sound Pressure Level (SPL_{peak}), Sound Exposure Level for a single strike (SEL_{ss}) and cumulative exposure (SEL_{cum}) thresholds based on Southall *et al*. (2019) criteria for Permanent Threshold Shift (PTS) and Temporary Threshold Shit (TTS) in very high, high and low frequency cetaceans and pinnipeds in water

- The SEL_{cum} scenarios for marine mammals and turtles will be completed assuming a fleeing receptor.

8.5.5.2 Impact assessment methodology for marine mammals

387 The overall approach to the Environmental Impact Assessment (EIA) is presented in Section 1.7. The assessment for marine mammals and turtles follows this overall approach with some specific references applicable to marine mammals where appropriate as discussed in this section.

388 The impact assessment will use a matrix approach to assess the potential impacts for marine mammals and turtles following best practice and relevant EIA guidance. Each potential impact identified in Section 0 has been determined based on experience and using expert judgement. These impacts will be agreed through consultation via the Scoping process and Evidence Plan Process (EPP).

389 An assessment of the impact significance will be made based on the sensitivity, value and magnitude of effect, the definitions of which are outlined below and will be agreed in consultation during the EPP. Where possible, the magnitude of effect will be quantified.

390 The assessments will be undertaken in accordance with the relevant standards, legislation and guidance including Natural England (2022) Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards Phase III: Expectations for data analysis and presentation at examination for offshore wind applications.

Sensitivity

391 The sensitivity of a receptor is determined through its ability to accommodate change and on its ability to recover if it is affected. The sensitivity level of marine mammals to each type of impact is justified within the impact assessment and is dependent on the following factors:

- Adaptability – The degree to which a receptor can avoid or adapt to an effect
- Tolerance – The ability of a receptor to accommodate temporary or permanent change without a significant adverse effect
- Recoverability – The temporal scale over and extent to which a receptor will recover following an effect

Table 8.15 Definitions of sensitivity levels for marine mammals

Sensitivity	Definition
High	Individual receptor has very limited capacity to avoid, adapt to, tolerate or recover from the anticipated impact.
Medium	Individual receptor has limited capacity to avoid, adapt to, tolerate or recover from the anticipated impact.
Low	Individual receptor has some tolerance to avoid, adapt to, tolerate or recover from the anticipated impact.
Negligible	Individual receptor is generally tolerant to and can tolerate or recover from the anticipated impact.

Value

392 In addition, for some assessments the 'value' of a receptor may also be an important element to add to the assessment where relevant – for instance if the receptor is designated or has an economic value.

393 It is important to understand that high value and high sensitivity are not necessarily linked within a particular impact. A receptor could be of high value but have a low or negligible physical/ecological sensitivity to an effect. Similarly, low value does not equate to low sensitivity and is judged on a receptor by receptor basis.

394 In the case of marine mammals, most species are protected by a number of international commitments as well as European and UK law and policy. All cetaceans in UK waters are European Protected Species (EPS) and, therefore, are internationally important. Harbour porpoise, bottlenose dolphin, grey seal and harbour seals are also afforded international protection through the designation of Natura 2000 sites. As such, all species of marine mammal can be considered to be of high value.

395 Table 8.16 provides definitions for the value afforded to a receptor based on its legislative importance. The value will be considered, where relevant, as a modifier for the sensitivity assigned to the receptor, based on expert judgement.

Table 8.16 Definitions of the different value levels for marine mammals

Value	Description	Definition
High	Internationally or nationally important.	Internationally protected species that are listed as a qualifying interest feature of an internationally protected site (i.e. Annex II protected species designated feature of a European designated site) and protected

Value	Description	Definition
		species (including EPS) that are not qualifying features of a European designated site.
Medium	Regionally important or internationally rare.	Protected species that are not qualifying features of a European designated site but are recognised as a Biodiversity Action Plan (BAP) priority species either alone or under a grouped action plan, and are listed on the local action plan relating to the marine mammal study area.
Low	Locally important or nationally rare.	Protected species that are not qualifying features of a European designated site and are occasionally recorded within the study area in low numbers compared to other regions.
Negligible	Not considered to be particularly important or rare.	Species that are not qualifying features of a European designated site and are never or infrequently recorded within the study area in very low numbers compared to other regions.

Magnitude

396 The thresholds for defining the potential magnitude of effect that could occur from a particular impact will be determined using expert judgement, current scientific understanding of marine mammal population biology, and Joint Nature Conservation Committee (JNCC) *et al*. (2010) draft guidance on disturbance to EPS species. The JNCC *et al*. (2010) EPS draft guidance suggests definitions for a 'significant group' of individuals or proportion of the population for EPS species. As such this guidance has been considered in defining the thresholds for magnitude of effects.

397 The JNCC *et al*. (2010) draft guidance provides some indication on how many animals may be removed from a population without causing detrimental effects to the population at Favourable Conservation Status (FCS). The JNCC *et al*. (2010) draft guidance also provides limited consideration of temporary effects, with guidance reflecting consideration of permanent displacement.

398 Temporary effects are considered to be of medium magnitude at greater than 5% of the reference population. The JNCC *et al*. (2010) draft guidance considered 4% as the maximum potential growth rate in harbour porpoise, and the 'default' rate for cetaceans. Therefore, beyond natural mortality, up to 4% of the population could theoretically be permanently removed before population growth could be halted. In assigning 5% to a temporary impact in

this assessment, consideration is given to uncertainty of the individual consequences of temporary disturbance.

399 Permanent effects with a greater than 1% of the reference population being affected within a single year are considered to be high in magnitude in this assessment. This is based on Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) (2015) and Department for Environment, Food and Rural Affairs (Defra) advice (2003) relating to impacts from fisheries by-catch (i.e. a permanent effect) on harbour porpoise. A threshold of 1.7% of the relevant harbour porpoise population above which a population decline is inevitable has been agreed with Parties to ASCOBANS, with an intermediate precautionary objective of reducing the impact to less than 1% of the population (Defra, 2003; ASCOBANS, 2015).

Table 8.17 Definitions of levels of magnitude for marine mammals

Magnitude	Definition
High	Permanent irreversible change to exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 1% of the reference population are anticipated to be exposed to the effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the Project). Assessment indicates that more than 5% of the reference population are anticipated to be exposed to the effect. OR Temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that more than 10% of the reference population are anticipated to be exposed to the effect.
Medium	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.01% and 1% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the Project). Assessment indicates that between 1% and 5% of the reference population are anticipated to be exposed to the effect. OR Temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 5% and 10% of the reference population anticipated to be exposed to effect.

Magnitude	Definition
Low	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that between 0.001% and 0.01% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more, but not permanent (e.g. limited to operational phase of the Project). Assessment indicates that between 0.01% and 1% of the reference population are anticipated to be exposed to the effect. OR Intermittent and temporary effect (e.g. limited to the construction phase of development) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that between 1% and 5% of the reference population anticipated to be exposed to effect.
Negligible	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that less than 0.001% of the reference population anticipated to be exposed to effect. OR Long-term effect for 10 years or more (but not permanent, e.g. limited to lifetime of the Project). Assessment indicates that less than 0.01% of the reference population are anticipated to be exposed to the effect. OR Intermittent and temporary effect (limited to the construction phase of development or Project timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that less than 1% of the reference population anticipated to be exposed to effect.

Impact Significance

400 Following the identification of receptor sensitivity and the magnitude of the effect, the impact significance will be determined using expert judgement. The probability of the impact occurring is also considered in the assessment process. If doubt exists concerning the likelihood of occurrence or the prediction of an impact, the precautionary approach is taken to assign a higher level of probability to adverse effects.

401 The matrix provided in Table 8.18 below will be used as a framework to aid determination of the impact assessment. Definitions of impact significance are provided in Table 8.19. For the purposes of this EIA and specifically the marine mammal assessment, 'major' and 'moderate' impacts are deemed to be significant. However, whilst 'minor' impacts would not be deemed significant in their own right, they may contribute to significant impacts cumulatively or through inter-relationships.

Table 8.18 Impact significance matrix

		Negative Magnitude				Beneficial Magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Table 8.19 Impact significance definitions

Significance	Definition
Major	Very large or large change in receptor, either adverse or beneficial, which are important at a population (national or international) level because they contribute to achieving national or regional objectives, or, expected to result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate or large change in receptor, which may to be important considerations at national or regional population level. Potential to result in exceedance of statutory objectives and / or breaches of legislation.
Minor	Small change in receptor, which may be raised as local issues but are unlikely to be important at a regional population level.
Negligible	No discernible change in receptor.

Mitigation and residual impacts

402 Following initial assessment, if the impact does not require additional mitigation (or none is possible) the residual impact will remain the same. If, however, additional mitigation is proposed there will be an assessment of the post-mitigation residual impact.

8.5.6 Potential impacts

403 A range of potential impacts on marine mammals and turtles have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

404 The potential impacts during the construction, operation, maintenance and decommissioning phases are outlined below and summarised in Table 8.20.

405 All of the potential impacts scoped in for further assessment will be related to the potential area of impact, using marine mammal density information from site specific surveys where possible and the most recent and robust density information publicly available from other sources. This will be used to determine the number of marine mammals that could potentially be impacted, and assessed in the context of the relevant reference populations (MUs) in order to identify the potential for any population effects.

406 In addition, the potential for cumulative and transboundary impacts, as well as inter-relationships and interactions between impacts for the Project will also be determined and assessed.

8.5.6.1 Potential impacts during construction

407 The potential impacts for marine mammals and turtles during construction scoped in for further assessments in the EIA are:

- Underwater noise
- Vessel interaction
- Disturbance at seal haul-out sites
- Changes to prey resources
- Change to water quality

Underwater noise

408 The key potential impacts during construction are expected to be those from underwater noise. Activities that have the potential to generate underwater noise associated with the construction of the Project are:

- Installation of foundations
- Other construction activities such as seabed preparation, cable laying and rock placement
- Vessels

409 The potential for a barrier effect as a result of disturbance and displacement due to underwater noise will be considered. The assessment of barrier effects will take account of the maximum potential area of noise impacts, in particular the predicted extent towards the coastline. The maximum duration of underwater noise impacts will also be considered. The worst-case scenario in relation to barrier effects as a result of underwater noise will be based on the maximum spatial and temporal (i.e. longest duration) scenarios.

410 As outlined in Section 8.5.5, site specific underwater noise modelling will be undertaken for all potential noise sources that could impact marine mammals and turtles.

411 The potential impacts associated with underwater noise (including PTS, TTS, disturbance and behavioural effects, impacts on prey species and barrier effects) will be assessed in the EIA, taking into account the most recent and robust research, guidance and information available.

412 The Marine Noise Registry and Marine Online Assessment Tool will be used to inform the baseline noise environment, where possible.

413 As previously outlined, any UXO clearance, if required, will be assessed as part of a separate Marine Licence and not part of the DCO submission. Therefore, worst-case impacts for UXO clearance will be included as an Appendix for information only. A more detailed assessment will be undertaken for the separate Marine Licence when more information on the requirement for any UXO clearance are available.

Vessel interaction

414 Despite the potential for marine mammals to detect and avoid vessels, ship strikes are known to occur (Wilson *et al.*, 2007). An increase in vessels could potentially lead to an increase in vessel collision risk.

415 The increased risk of collision with marine mammals and turtles has been scoped in and will be assessed in the EIA, taking into account the most recent and robust research, guidance and information available.

Disturbance at seal haul-out sites

416 Disturbance from vessel transits to and from the Project and the local port also has the potential to disturb seals at haul-out sites, depending on the route

and proximity to the haul-out sites. The potential for disturbance at seal haul-out sites has been scoped in and will be assessed in the EIA, taking into account the most recent and robust research, guidance and information available.

417 The potential for any disturbance of seals from haul-out sites foraging at sea will also be determined.

Changes to prey resource

418 As outlined in Section 8.4.6, the potential impacts on fish species and therefore the prey resource for marine mammals during construction can result from:

- Temporary habitat loss/physical disturbance
- Increased suspended sediments and sediment re-deposition
- Re-mobilisation of existing contaminated sediment, if present
- Underwater noise and vibration
- Barrier effects
- Changes in fishing activity

419 The potential for any changes to the prey resource for marine mammals during construction has been scoped in and will be assessed further in the EIA.

Changes to water quality

420 Potential impacts related to changes in water quality are currently scoped in for assessment. However, once further information is available on the potential for water quality changes, and the release of contaminants, (including the management measures that would be put in place) the scoping out of water quality impacts from further assessments would be considered and agreed through the EPP.

8.5.6.2 Potential impacts during operation and maintenance

421 The potential impacts for marine mammals and turtles during operation and maintenance (O&M) scoped in for further assessments in the EIA are:

- Underwater noise
- Vessel interaction
- Disturbance at seal haul-out sites
- Changes to prey resources
- Change to water quality

422 Potential impacts during O&M will mostly result from the presence of routine vessels within the windfarm site (leading to an increase in vessel interactions/collision risk and/or disturbance), underwater noise (including operational turbines) and the impacts on prey species during any maintenance activities.

423 The potential impacts for marine mammals during operation and maintenance scoped out for further assessments in the EIA are:

- Physical barrier effects
- Electromagnetic Fields (EMFs)

Underwater noise

424 Potential sources of underwater noise during the operation and maintenance phase include:

- Operational noise of the wind turbine generators
- Maintenance activities, such as cable re-burial and any additional rock placement
- Operation and maintenance vessels

425 The potential for disturbance from underwater noise during the operation and maintenance phase will be based on the underwater noise modelling and assessment of similar activities for the construction phase.

426 The potential impacts associated with underwater noise during operation and maintenance (including PTS, TTS, disturbance and behavioural effects, impacts on prey species and barrier effects) will be considered further in the EIA, taking into account the most recent and robust research, guidance and information available.

Vessel interaction

427 As outlined for construction, the increased risk of collision with marine mammals and turtles will be given further consideration in the EIA. It is anticipated that the impacts associated with vessel activities during operation and maintenance would be similar to, or less than those during the construction phase, due to a likely lower number of vessels.

Disturbance at seal haul-out sites

428 As outlined for construction, depending on the vessel routes, there is the potential for disturbance at seal haul-out sites.

429 The likelihood of increased vessels near to the locations of nearby seal haul-out sites will be used to determine the level of potential disruption and

behavioural impact caused to the seals. An expert judgement will be made using current scientific knowledge.

430 The potential for any disturbance of seals from haul-out sites foraging at sea will also be determined.

Changes to prey resource

431 As outlined in Section 8.4.6, the potential impacts on fish species and therefore the prey resource for marine mammals during operation and maintenance can result from:

- Permanent loss of habitat
- Increased suspended sediments
- Re-mobilisation of existing contaminated sediment, if present
- Underwater noise and vibration
- EMF
- Barrier effects
- Introduction of hard substrate
- Changes in fishing activity

432 The potential for any changes to the prey resource for marine mammals, during operation and maintenance will be assessed further in the EIA.

Changes to water quality

433 Potential impacts related to changes in water quality are currently scoped in for assessment. However, once further information is available on the potential for water quality changes, and the release of contaminants, (including the management measures that would be put in place) the scoping out of water quality impacts from further assessments would be considered, and agreed through the EPP.

Physical barrier effects – scoped out

434 Physical barrier effects from the windfarm alone will not be assessed further, however, the potential for cumulative barrier effects with other projects and infrastructure will be considered in the cumulative impact assessment.

435 The physical presence of a windfarm could be perceived as having the potential to create a physical barrier, preventing movement or migration of marine mammals between important feeding and/or breeding areas, or potentially increasing swimming distances if marine mammals circumvent the site.

436 The Project is not located on any known marine mammal migration routes.

437 Data from operational windfarms show no evidence of exclusion of marine mammals, including harbour porpoise and seals (for example, Diederichs *et al*., 2008; Lindeboom *et al*., 2011; Marine Scotland, 2012; McConnell *et al*., 2012; Russell *et al*., 2014; Scheidat *et al*., 2011; Teilmann *et al*., 2006; Tougaard *et al*., 2005, 2009a, 2009b).

438 Marine mammal species, including harbour porpoise and seals have been known to forage within operational windfarm sites (e.g. Lindeboom *et al*., 2011; Russell *et al*., 2014) indicating no restriction to movements.

439 As such physical barrier effects for the Project alone has been scoped out for further assessment, however, the potential for cumulative barrier effects with other projects and infrastructure will be considered in the cumulative impact assessment. Note that the potential for any acoustic barrier effects as a result of underwater noise during construction will be included as part of the underwater noise assessment.

Direct impacts of EMF – scoped out

440 The potential for direct impacts from EMF during operation have been scoped out. Once installed, operational EMF impacts are unlikely to be of sufficient range or strength to directly impact marine mammals. This is consistent with other recent projects (including for Norfolk Vanguard and Norfolk Boreas (Planning Inspectorate 2016; 2017b), East Anglia ONE North and East Anglia TWO (Planning Inspectorate 2017c; 2017d), and both the Dudgeon Extension and Sheringham Shoal Extension Projects (Planning Inspectorate; 2019)) as there is no evidence of any impact.

441 The potential for EMF to impact on marine mammal species directly has been scoped out from further assessment in the EIA, however, the potential for EMF to impact on marine mammal prey species will be considered.

442 Studies indicate that magnetic fields decrease rapidly with vertical and horizontal distance from subsea cables and that the reduction is greater the deeper cables are buried (Normandeau *et al*., 2011).

443 Although it is assumed that marine mammals are capable of detecting small differences in magnetic field strength, this is unproven and is based on circumstantial information. There is also, at present, no evidence to suggest that existing subsea cables influence cetacean movements.

444 Harbour porpoise are known to move in and out of the Baltic Sea, over several operating subsea cables in the Skagerrak and western Baltic Sea with no apparent effect to their migratory movements. There is also no evidence to suggest that seal species respond to EMF (Gill *et al*., 2005).

445 In addition, data from a number of operational windfarms show no evidence of exclusion of marine mammals, including harbour porpoise and seals (for example, Diederichs *et al.*, 2008; Lindeboom *et al.*, 2011; Marine Scotland, 2012; McConnell *et al.*, 2012; Russell *et al.*, 2014; Scheidat *et al.*, 2011; Teilmann *et al.*, 2006; Tougaard *et al.*, 2005, 2009a, 2009b).

446 Recent EIAs for other offshore windfarm projects only considered the impact of EMF on marine mammal prey species. Therefore, the potential for EMF to impact on marine mammal and turtle species directly has been scoped out from further assessment in the EIA, however, the potential for EMF to impact on marine mammal prey species will be considered further.

8.5.6.3 Potential impacts during decommissioning

447 It is anticipated that the decommissioning impacts would be similar in nature to those of construction.

8.5.6.4 Potential cumulative impacts

448 There may be potential for cumulative impacts to occur on marine mammal and marine turtle ecology as a result of other activities (such as oil and gas operations). The approach to assessment of potential cumulative impacts is set out in Section 7.7.

449 The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

450 The Cumulative Impact Assessment (CIA) will identify where the predicted impacts of the construction, operation, maintenance and decommissioning of the Project could interact with impacts from different plans or projects within the same region and impact marine mammals.

451 The types of plans and projects to be taken into consideration are:

- Offshore windfarms, including transmission asset infrastrucure
- Marine renewable energy (MRE) developments
- Aggregate extraction and dredging
- Licenced disposal sites
- Shipping and navigation
- Planned construction sub-sea cables and pipelines
- Potential port/harbour and nuclear developments

- Oil and gas development, operation and decommissioning, including seismic surveys
- UXO clearance and military exercises
- Geophysical and seismic surveys across all sectors

452 The plans and projects that will be considered in the CIA will be:

- Located in the relevant marine mammal MU
- Offshore projects and developments, if there is the potential for cumulative impacts during the construction, operation and maintenance or decommissioning of the Project

453 The CIA will consider projects, plans and activities which have sufficient information available to undertake the assessment.

454 The potential cumulative impacts that will be considered further in the EIA are:

- Underwater noise
- Vessel interaction
- Disturbance at seal haul-out sites
- Changes to prey resources
- Change to water quality
- Any barrier effects

8.5.6.5 Transboundary Impacts

455 There is a significant level of marine development being undertaken or planned by Ireland in the Irish Sea. Populations of marine mammals are highly mobile and there is potential for transboundary impacts especially when considering noise impacts.

456 Transboundary impacts will be assessed, where possible, in consultation with developers in other Member States to obtain up to date project information to feed into the assessment.

457 Transboundary impacts will be assessed, as with the other cumulative impacts, for the relevant marine mammal MUs. The potential for transboundary impacts will be addressed by considering the reference populations and potential linkages to international designated sites as identified through telemetry studies for seals and ranges and movements of cetacean species.

458 The assessment of the effect on the integrity of the transboundary European sites as a result of impacts on the designated marine mammal populations will be undertaken and presented in the information for the HRA.

459 Transboundary impacts will be considered within the cumulative and in-combination assessment.

8.5.6.6 Summary of potential impacts

460 Table 8.20 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.20 Summary of impacts relating to marine mammal ecology

Potential Impact	Construction	Operation and maintenance	Decommissioning
Underwater noise during foundation installation	✓	x	x
Underwater noise from other activities (for example rock placement and cable laying)	✓	✓	✓
Underwater noise and presence of vessels	✓	✓	✓
Underwater noise from operational wind turbine generators	x	✓	x
Barrier effects from underwater noise	✓	✓	✓
Collision risk with vessels	✓	✓	✓
Disturbance at seal haul-out sites	✓	✓	✓
Changes in water quality	✓	✓	✓
Changes to prey availability (including from habitat loss and EMF)	✓	✓	✓
Barrier effects from physical presence of windfarm	x	x	x
Electromagnetic fields direct effects	x	x	x
Cumulative impacts from underwater noise	✓	✓	✓
Cumulative impacts from vessel interaction	✓	✓	✓

Potential Impact	Construction	Operation and maintenance	Decommissioning
Cumulative barrier impacts	✓	✓	✓
Cumulative changes to water quality	✓	✓	✓
Cumulative disturbance at seal haul-out sites	✓	✓	✓
Cumulative changes to prey availability (including habitat loss)	✓	✓	✓
Transboundary impacts	✓	✓	✓

8.5.7 Potential mitigation measures

461 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the Preliminary Environmental Information Report (PEIR), and ultimately the Environmental Statement (ES), are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

462 As part of the design process for the Project a number of mitigation measures are proposed to reduce the potential for impacts on marine mammal receptors. These will evolve over the project development process as the EIA progresses and in response to consultation.

- A Marine Mammal Mitigation Protocol (MMMP) will be produced to reduce the risk of physical injury or permanent auditory injury (PTS) in marine mammals from underwater noise. A draft MMMP will be provided with the submitted DCO application. The final MMMP will be developed in the pre-construction period and based upon best available information, methodologies, industry best practice, latest scientific understanding, current guidance and detailed project design. The MMMP will be developed in consultation with the relevant stakeholders.
- If required, a wildlife licence application will be submitted prior to construction, for the protection of cetacean species from injury or significant disturbance.

463 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process. The results of the EIA and HRA would inform the need for any additional mitigation requirements over and above the standard measures typically used for offshore windfarm construction. Examples of additional measures that could be considered include (noting that more options may be available in the future):

- Noise Abatement Systems (NAS) to reduce noise at source for piling and UXO
- Use of Acoustic Deterrent Devices (ADDs) to ensure marine mammals are not within any potential permanent auditory injury zone
- Lower impact methods of construction, such as low-order detonation for UXO, alternate foundations and piling installation techniques
- Seasonal restrictions/timing considerations for noisy activities

8.6 Offshore ornithology

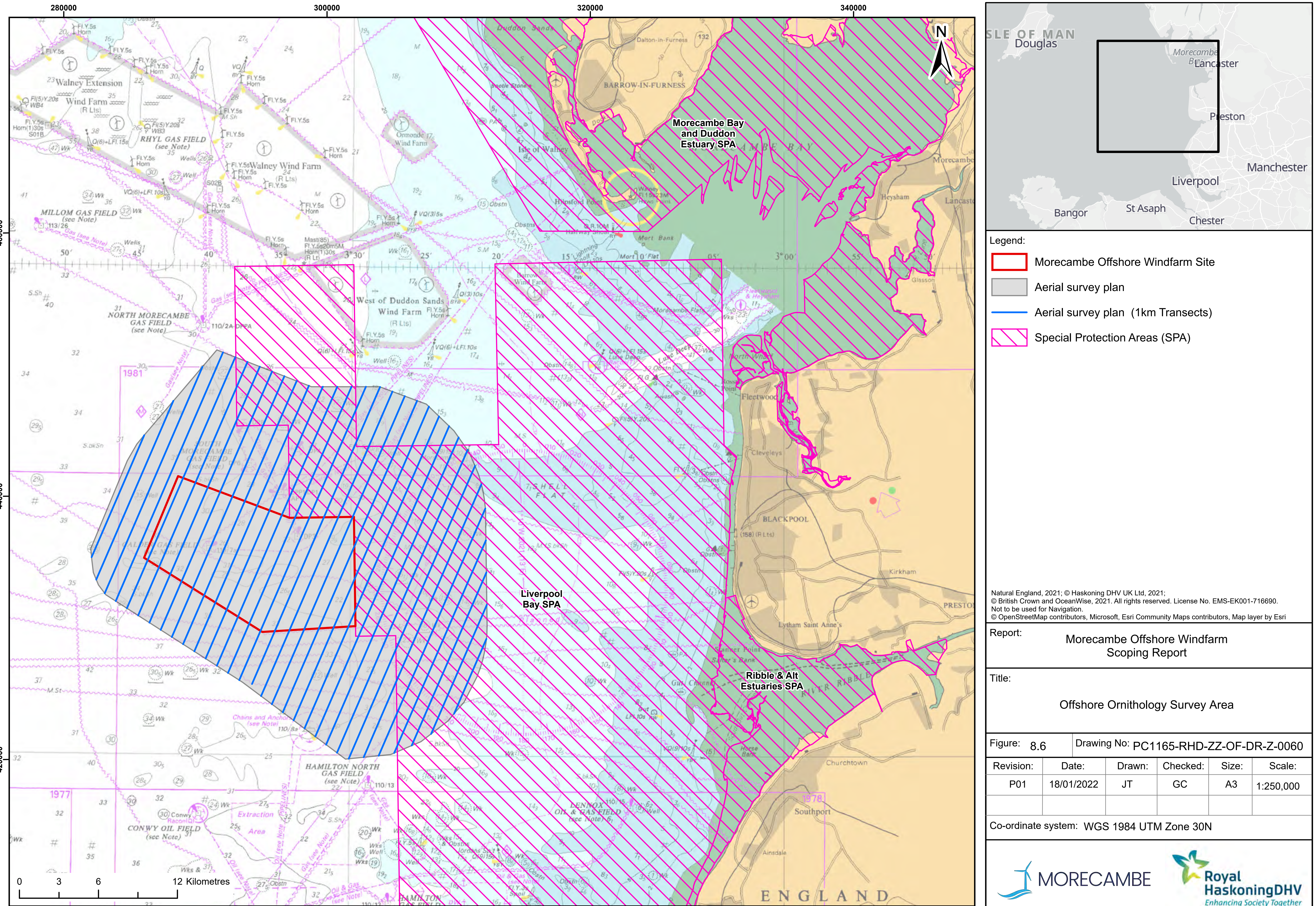
8.6.1 Introduction

464 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on offshore ornithological receptors. The offshore ornithology impact assessment will consider potential effects of the Project on seabirds and other bird species passing through offshore areas (migratory species). Offshore ornithology is a key constraint for offshore windfarms (OWFs), due to the potential for displacement of seabirds from offshore foraging areas, and collisions with operating wind turbine generators. While individual developments may have relatively small predicted effects, as more OWFs are taken forward, the cumulative impacts of multiple projects may have population level effects on seabirds.

465 The ornithology assessment will be informed by analysis of site-specific survey data and expert understanding of the seasonal distribution and movements of seabirds and migratory birds in the Irish Sea. As well as the regional populations of seabirds and migratory bird species, the assessment will consider the potential for connectivity of the windfarm site to statutory sites designated for nature conservation which have birds listed as qualifying features.

8.6.2 Study area

466 The location of the Project, and the offshore aerial survey area is shown in Figure 8.6.



Legend:

- Morecambe Offshore Windfarm Site
- Aerial survey plan
- Aerial survey plan (1km Transects)
- Special Protection Areas (SPA)

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Not to be used for Navigation.
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Report: Morecambe Offshore Windfarm Scoping Report

Title: Offshore Ornithology Survey Area

Figure: 8.6	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0060				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:250,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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8.6.3 Existing environment

467 This section presents an overview of the existing environment and key bird species likely to be present at the windfarm site. This is based on expert knowledge, species recorded to date during baseline surveys (which began in March 2021), available Environmental Statements (ESs) for OWFs which are close to the windfarm site, the location and reasons for designation of Special Protection Areas (SPAs) in the Irish Sea, and other cited sources of information.

468 The windfarm site is situated in the eastern Irish Sea, approximately 30km from shore at the nearest point, off the Lancashire Coast. The Irish Sea is important for seabirds throughout the year. It provides foraging grounds for seabirds breeding in adjoining coastal areas in the UK, Isle of Man and Ireland during the breeding season (many of them colonies of international importance designated as Special Protection Areas (SPAs)). Outside the breeding season seabirds from breeding colonies further afield, and migratory birds, occur on passage or overwinter, and sub-adult seabirds (pre-breeding age) may be present throughout the year.

469 At the time of writing, results from the Project monthly digital aerial surveys are available for the period March 2021 to February 2022 only. During this first survey year, the seabird species recorded regularly and in the largest numbers were (in order of decreasing abundance based on peak monthly (raw) counts):

- Guillemot *Uria aalge*
- Manx shearwater Puffinus puffinus
- Kittiwake Rissa tridactyla
- Gannet Morus bassanus
- Razorbill *Alca torda*
- Lesser black-backed gull *Larus fuscus*
- Herring gull Larus argentatus
- Common scoter Melanitta nigra
- Common gull *Larus canus*

470 Other seabird species recorded less frequently and/or in small numbers were:

- Puffin Fratercula arctica
- Little gull Hydrocoloeus minutus
- Red-throated diver *Gavia stellata*
- Sandwich tern Thalassues sandvicensis
- Fulmar Fulmaris glacialis
- Great black-backed gull *Larus marinus*

- Common tern Sterna hirundo
- Great skua Stercorarius skua
- Black-headed gull Chroicocephalus ridbundus
- Cormorant Phalacrocorax carbo
- Shag Gulosis aristotelis

471 These can be compared with bird species recorded during baseline surveys at the nearby Walney Extension OWF, the most recently consented OWF in relatively close proximity to the windfarm site. Walney Extension is approximately 18km north of the windfarm site and 19km from shore (at the nearest points). During baseline aerial surveys undertaken between 2010 and 2012 (NIRAS, 2013), the most abundant seabird species at Walney Extension were (in order of decreasing abundance):

- Guillemot
- Razorbill
- Kittiwake
- Manx shearwater
- Gannet
- Common gull
- Lesser black-backed gull
- Herring gull
- Great black-backed gull
- Puffin

472 Other species recorded in smaller numbers were:

- Common scoter
- Divers Gavia spp.
- Fulmar
- Cormorant
- Great skua
- Black-headed gull
- Little gull
- Arctic tern Sterna paradisaea

473 Thus, the list of seabird species recorded during the first year of offshore surveys at the windfarm site is very similar to those recorded during two years of aerial surveys at Walney Extension, and it seems unlikely that any additional seabird species would be recorded in significant numbers during the remainder of the Project aerial survey programme. However, it should be noted additional surveys to capture 24 months of data are essential to provide

details of seasonal variation in abundance and distribution of seabirds at the windfarm site.

474 The monthly counts for the above species is presented in Table 8.21 below.

Table 8.21 Monthly species count from first year of aerial survey

Species	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22
Guillemot	1775	563	346	431	2644	5016	933	1644	1921	151	823	832
Manx shearwater	1	9	56	2	3103	1221	12	0	0	0	0	0
Kittiwake	257	237	150	157	89	797	927	25	458	87	25	37
Gannet	7	8	33	9	208	436	90	8	12	0	0	0
Razorbill	220	165	10	3	11	6	1	294	276	95	75	206
Lesser black-backed gull	1	0	2	2	12	51	69	1	1	0	1	5
Herring gull	37	4	1	3	4	33	48	14	37	21	19	18
Common scoter	7	4	0	0	0	0	0	18	3	0	44	18
Common gull	18	0	2	0	0	0	4	6	28	38	41	17
Puffin	4	6	0	0	30	9	0	0	1	0	0	0
Little gull	26	2	0	0	0	0	0	0	8	2	6	18
Red-throated diver	0	2	0	0	0	0	0	0	2	21	0	2
Sandwich tern	0	2	0	0	0	0	17	3	0	0	0	0
Fulmar	2	1	0	1	3	17	0	0	0	0	1	0
Great black-backed gull	2	0	1	0	5	2	6	1	6	2	2	2
Common tern	0	0	0	2	0	2	5	0	0	0	0	0
Arctic tern	0	0	0	0	0	3	3	0	0	0	0	0
Great skua	0	0	1	0	0	3	0	0	0	0	0	0
(Snipe)	0	0	0	0	0	0	0	2	0	0	0	0
Black-headed gull	0	0	0	0	0	0	1	0	0	0	0	1

Species	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22
Cormorant	0	0	1	1	0	1	0	0	0	0	0	0
(Feral pigeon)	0	0	0	0	0	0	1	0	0	0	0	0
Shag	1	0	0	0	0	0	0	0	0	0	0	0
No ID	123	45	32	15	94	128	24	84	253	44	46	42
Total Birds	2481	1048	635	626	6203	7725	2141	2100	3006	461	1083	1198
No of seabird species	14	12	11	11	10	14	13	10	12	8	10	11

475 The windfarm site does not overlap with any designated sites for birds, although it is directly adjacent to the Liverpool Bay Special Protection Area (SPA), as shown in Figure 8.6. The part of the SPA adjacent to the windfarm site is part of an extension to the SPA which was identified on the basis of the distribution of the qualifying feature little gull (Natural England (NE), Natural Resource Wales (NRW) and Joint Nature Conservation Committee (JNCC), 2016) which may be vulnerable to collisions with OWFs.

476 Other qualifying species of the Liverpool Bay SPA include red-throated diver and common scoter, both species of which are considered particularly sensitive to displacement from anthropogenic disturbance and infrastructure. It should be noted that the areas of the SPA boundary closest to the windfarm site were not included in the SPA on the basis of the distribution of these two species (NE, NRW and JNCC, 2016).

477 The next closest SPA to the windfarm site is the Morecambe Bay and Duddon Estuary SPA, approximately 25km to the north east at the nearest point. Qualifying species include sandwich tern, common tern and lesser black-backed gull which are considered vulnerable to collision risk with operational wind turbine generators, and sensitive to disturbance and displacement from anthropogenic disturbance and infrastructure.

478 Further information on the location of the proposed development in relation to European Sites (SPAs and Ramsar sites) will be included in the Habitats Regulations Assessment (HRA) Screening Report which will be prepared in 2022.

8.6.4 Approach to data collection

479 Baseline digital aerial surveys of the windfarm site began in March 2021 and will continue until February 2023. The methodology is based on the industry standard for offshore surveys, involving 24 monthly transect surveys of the offshore windfarm site boundary and a buffer. For OWFs, the usual offshore ornithology survey area is the windfarm site plus a 4km buffer; in this case the survey area has been extended to 10km to the north and east due to the close proximity (0km at the nearest point) of the windfarm site to the Liverpool Bay SPA. This is based on advice from Statutory Nature Conservation Bodies (SNCBs) for OWFs within 10km of a marine SPA for red-throated diver (SNCBs 2022) and discussed with Natural England in a meeting on 3rd November 2021 (see Table 3.1). The survey area and transects are shown in Figure 8.6.

480 The surveys will provide information on the abundance, distribution, behaviour, location, numbers, sex and age (where possible) and flight direction of bird species (or species-groups if species identification is not

possible from aerial images). Detailed analyses of survey data will provide density and abundance estimates (with associated confidence intervals and levels of precision) for key ornithological receptors within the windfarm site and buffer.

481 Flight height data derived from the aerial surveys will be provided. However, the intention is that generic flight height data (Johnston *et al.*, 2014a; 2014b) will be used in the collision risk model.

482 The survey data will be used in the Environmental Impact Assessment (EIA) in conjunction with published guidance, research and datasets, including, but not limited to, the following:

- Sensitivity of birds to OWFs (Wade *et al.*, 2016; Furness *et al.*, 2013; Furness and Wade, 2012; Langston, 2010; Stienen *et al.*, 2007; Drewitt and Langston, 2006; Garthe and Hüppop, 2004)
- Displacement and barrier effects on birds (UK SNCBs, 2017, 2022; Dierschke *et al.*, 2016; Masden *et al.*, 2012, 2010; Speakman *et al.*, 2009)
- Collision risk modelling, flight heights and flight behaviour in the vicinity of wind turbine generators, and avoidance rates for birds and OWFs, including the Band deterministic model, the stochastic model and the migratory species model (Tjørnløv *et al.*, 2021; Bowgen and Cook, 2018; MacGregor *et al.*, 2018; Skov *et al.* 2018; Cook *et al.*, 2014; Johnston *et al.*, 2014a and b; SNCBs, 2014; Band, 2012; Wright *et al.*, 2012; Cook *et al.*, 2012, Natural England, 2022)
- Population viability analysis modelling tool for seabirds (Searle *et al.*, 2019)
- Seabird foraging ranges and distribution at sea (Cleasby *et al.*, 2020, 2018; Waggit *et al.*, 2019; Woodward *et al.*, 2019; Wakefield *et al.*, 2017, 2013; Kober *et al.*, 2010; Stone *et al.*, 1995);
    - including specific surveys and studies relevant to SPA populations in the eastern Irish Sea (Clewley *et al.*, 2021, 2017; NE, NRW and JNCC, 2016, Lawson *et al.*, 2016, NE and CCW, 2010, Dean *et al.*, 2013, 2015, Guilford *et al.*, 2008, Mackey and Giminez (undated))
- Bird population estimates (Furness, 2015; Mitchell *et al.*, 2004; JNCC seabird monitoring programme database; designated site citations/departmental briefs/conservation advice from the websites of SNCBs)
- Relevant documents from applications for other OWFs in UK offshore waters, in particular the Irish Sea
- Relevant ecological studies for species included in EIA including peer reviewed scientific papers and 'grey' literature

483 The above will be supplemented as appropriate with new guidance, studies and research as they become available.

484 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.6.5 Approach to impact assessment

485 The impact assessment methodology will be based on that described in Section 7, adapted to make it applicable to assessment of ornithological receptors.

486 The EIA baseline will identify the seasonal use of the windfarm site by the bird species recorded in aerial surveys. The key parameters will be density and abundance estimates (with associated confidence intervals and levels of precision) for key ornithological receptors within the windfarm site and relevant buffer areas.

487 The impact assessment will be undertaken in line with industry standard guidance (Chartered Institute of Ecology and Environmental Management (CIEEM), 2018). The sensitivity of each species to each of the potential impacts will be determined based on the size of its seasonal populations, its conservation status, its known sensitivity to offshore wind farms and its ecological characteristics (e.g. auk flight heights are almost exclusively below rotor height and therefore these species have negligible collision risk). Species identified as key ornithological receptors for a given impact will be subject to full assessment.

488 Quantitative assessment methods will be used, including:

- Displacement matrices combining ranges of displacement and mortality to obtain estimates of displacement mortality (SNCBs, 2017)
- Collision risk modelling based on Natural England (2022) and discussions at the first Expert Topic Group for offshore ornithology (25 May 2022), the stochastic model (McGregor, 2018, option 2) will be used (rather than the deterministic Band (2012) model)
- Population Viability Analysis to provide predictions of the population consequences of the impacts for the Project alone and also cumulatively with other wind farms. It is expected that the NE population modelling tool (Searle *et al.*, 2019) will be used

489 The detailed methodology and scope of the impact assessment, and reference population sizes for each species, will be based on the best available information at the time of undertaking the assessment and will be agreed with key stakeholders during the EPP.

490 The assessment for offshore ornithology will consider the Project Design Envelope (PDE, following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario' upon which the assessment will be made. The worst case scenario will be outlined in the PEIR.

8.6.6 Potential impacts

491 A range of potential impacts on offshore ornithology have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.6.6.1 Potential impacts during construction

492 The key potential impacts during construction will come from disturbance and consequent displacement of birds due to construction activities. These potential impacts during construction include:

- Direct disturbance and displacement due to work activity
- Indirect effects through effects on prey species/habitats of prey species

Direct disturbance and displacement due to work activity

493 The construction phase will require the mobilisation of vessels (day or night), helicopters and equipment and the installation of turbines, inter-array cables, and offshore substation platform(s). Construction will not occur across the whole of the windfarm site simultaneously or every day. Until wind turbine generators (and other structures) are installed, disturbance effects will occur only in the areas where construction traffic is operating at any given point.

494 During the construction phase, the Project therefore has the potential to impact offshore ornithology receptors through disturbance, leading to displacement of birds from construction sites and the areas that surround them. These potential impacts, which have the potential to last for the duration of the construction phase, effectively result in temporary habitat loss through reduction in the area available for behaviours such as foraging, loafing and moulting in the case of displacement, or commuting and migration in the case of barrier effects. Before wind turbines generators (and other structures)

are placed on foundations, the effects will occur only in the areas where vessels are operating at any given point and not the entire windfarm site. At such time as wind turbine generators (and other infrastructure) are installed onto foundations displacement and/or barrier effects would increase incrementally to the same levels as operational impacts.

495 Offshore ornithology receptors differ considerably in their sensitivity to anthropogenic disturbance in the marine environment (Fliessbach *et al.*, 2019; Furness *et al.*, 2013; Furness and Wade, 2012; Garthe and Hüppop, 2004; MMO, 2018), though uncertainty also exists surrounding displacement effects (Wade *et al.*, 2016).

496 Birds are considered to be most at risk from disturbance and displacement effects when they are resident in an area at any time of year, as opposed to birds on passage during migratory seasons. Birds that are resident in an area during the breeding season may regularly encounter and be displaced by an OWF that is under construction, during daily commuting trips to foraging areas from nest sites.

497 Birds on passage may encounter (and potentially be displaced from) a particular OWF that is under construction only once during a given migration journey. The costs of one-off avoidances during migration have been calculated to be relatively small, accounting for less than 2% of available fat reserves (Masden *et al.*, 2012, 2009; Speakman *et al.*, 2009). Therefore, the impacts of construction disturbance, displacement and barrier effects on birds that only migrate through the windfarm site (including seabirds, waders and waterbirds on passage) will likely be small, though the assessment will consider this in detail.

Indirect effects through effects on prey species/habitats of prey species

498 Indirect effects on offshore ornithology receptors may occur during the construction phase of the Project if there are impacts on prey species and/or their habitats. Potential indirect effects include those resulting from the production of underwater noise and the generation of suspended sediments that may cause injury or mortality to, or alter the behaviour or availability of prey species. Underwater noise may cause fish and mobile invertebrates to avoid the construction area and also affect their physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid the construction area and may smother and hide immobile benthic prey. These mechanisms may result in less prey being available to offshore ornithology receptors within the impact zone surrounding the construction area.

499 Potential effects on benthic invertebrates and fish will be assessed in their respective chapters, and the conclusions of those assessments will inform the assessment of indirect effects on offshore ornithology receptors.

8.6.6.2 Potential impacts during operation and maintenance

500 Potential impacts during operation will result from the presence of wind turbine generators and offshore infrastructure, these may include:

- Disturbance
- Displacement
- Barrier effects
- Collision risk
- Indirect effects

501 For the purposes of assessing impacts on designated sites within the National Site Network, apportionment of seabirds to appropriate SPA populations during the breeding and non-breeding season will be undertaken based on current industry guidance. Further detail will be provided in the HRA Screening Report.

Disturbance, displacement and barrier effects

502 Operational phase displacement is defined as a reduced number of birds occurring within or immediately adjacent to an OWF (Furness *et al.*, 2013), and involves flying birds and those on the water (UK SNCBs, 2017). Birds that do not intend to utilise an operational OWF but would have previously flown through it on the way to a feeding, resting or nesting area, and which either stop short or detour around it, are subject to barrier effects (UK SNCBs, 2017).

503 These potential impacts would result in reduction in the area available for behaviours such as foraging, loafing and moulting in the case of displacement, or commuting and migration in the case of barrier effects, and have the potential to last for the duration of the operational phase of the Project. Displacement and barrier effects will begin as turbines are installed during the latter part of the construction period and will persist into the decommissioning period until turbines are removed. The primary cause of displacement from operational OWFs is considered to be visual cues due to the presence of operational turbines and other infrastructure.

504 Offshore ornithology receptors differ considerably in their sensitivity to anthropogenic disturbance in the marine environment (Fliessbach *et al.*, 2019; Furness *et al.*, 2013; Furness and Wade, 2012; Garthe and Hüppop, 2004; MMO, 2018), though uncertainty also exists surrounding displacement effects (Wade *et al.*, 2016). As OWFs are relatively new features in the marine

environment, there is limited robust empirical evidence regarding disturbance and displacement effects of the operational infrastructure in the long term, although the number of available studies is increasing. The most applicable evidence available will be utilised by the assessment.

505 Birds are considered to be most at risk from disturbance and displacement effects when they are resident in an area at any time of year, as opposed to birds on passage during migratory seasons. Birds that are resident in an area may regularly encounter and be displaced by an OWF, for example during daily commuting trips to foraging areas from nest sites. In this assessment, the effects of displacement and barrier effects on the key resident species are considered together. Masden *et al.*, (2010) suggested that the energetic costs of extra flight during breeding season foraging trips to avoid an operational OWF appear to be much less than those imposed by low food abundance or adverse weather, though they could be additive.

506 Birds on passage may encounter (and potentially be displaced from) a particular OWF only once during a given migration journey. The costs of one-off avoidances during migration have been calculated to be relatively small, accounting for less than 2% of available fat reserves (Masden *et al.*, 2012, 2009; Speakman *et al.*, 2009). Therefore, the impacts on birds that only migrate through the site (including seabirds, waders and waterbirds on passage) are considered to be relatively small, though they will be considered in the assessment.

Collison risk

507 Birds which are not displaced and fly through an OWF at the height of the rotating blades will be at risk of collision with operational wind turbine generators. Collisions are likely to result in direct mortality. Studies indicate that collisions do occur but are rare events (e.g. Tjørnløv *et al.*, 2021,; Skov *et al.*, 2018), hence assessment involves modelling the risk of collision for individual species.

Indirect effects

508 Indirect effects on offshore ornithology receptors may occur during the operational phase of the Project if there are impacts on prey species and/or their habitats. These effects include those resulting from the production of underwater noise (e.g. from the turning of the wind turbine generators), electromagnetic fields (EMF) and the generation of suspended sediments (e.g. due to scour or maintenance activities) that may alter the behaviour or availability of prey species. Underwater noise and EMF may cause fish and mobile invertebrates to avoid the operational area and also affect their

physiology and behaviour. Suspended sediments may cause fish and mobile invertebrates to avoid particular areas and may smother and hide immobile benthic prey. All of these indirect effects could result in less prey being available within the Project to foraging seabirds. Changes in fish and invertebrate communities due to changes in presence of hard substrate (resulting in colonisation by epifauna) may also occur, and changes in fishing activity could influence the communities present.

509 Potential effects on benthic invertebrates and fish will be assessed in their respective chapters, and the conclusions of those assessments will inform the assessment of indirect effects on offshore ornithology receptors.

8.6.6.3 Potential impacts during decommissioning

510 During decommissioning the potential impacts are anticipated to be similar to those described above for the construction phase.

8.6.6.4 Potential cumulative impacts

511 There may be potential for cumulative impacts to occur on offshore ornithology as a result of other activities. The Project wide approach to assessment of potential cumulative impacts is set out in Section 7.7.

512 Offshore wind projects and other activities (such as oil and gas operations) relevant to the assessment of cumulative impacts on offshore ornithology will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

513 Given the wide ranging nature of many seabird species the cumulative impact assessment of the Project with other windfarms and relevant developments will be an essential element of the EIA and HRA for the Project. The cumulative assessment will focus on cumulative displacement/barrier effects and collision risk due to the presence of offshore infrastructure when considered alongside other OWF projects.

8.6.6.5 Potential transboundary impacts

514 Given the level of proposed OWF development in the Irish Sea (including projects off the east coast of Ireland and the Isle of Man as well as UK Round 4 projects), and the fact that birds are highly mobile and migratory, there is potential for transboundary impacts especially regarding displacement/barrier effects and collision risk during the operation and maintenance phase. Any

potential transboundary effects that are identified will be assessed as per other cumulative impacts.

8.6.6.6 Summary of potential impacts

515 Table 8.22 outlines the effects which are proposed to be scoped into/out of the EIA. This may be refined through the Evidence Plan Process as additional information and data become available.

Table 8.22 Summary of impacts relating to offshore ornithology

Potential Impact	Construction	Operation and maintenance	Decommissioning
Direct disturbance and displacement due to work activity (presence and movements of vessels and other plant, lighting)	✓	✓	✓
Disturbance/displacement/barrier effect due to presence of turbines and other infrastructure	x	✓	x
Collision risk from operational wind turbine generators	x	✓	x
Indirect effects through effects on prey species/habitats of prey species	✓	✓	✓
Cumulative impacts	✓	✓	✓
Transboundary impacts	x	✓	x

8.6.7 Potential mitigation measures

516 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined, and the PEIR, and ultimately the ES, are prepared. A number of mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation. To assess the efficacy of any mitigation measures, pre and post construction monitoring of seabirds may be required.

517 A key mitigation measure which may be considered is increasing the turbine air gap (i.e. the distance between the lower rotor blade tip and the sea

surface). This can have a marked effect in reducing the estimated collision risk for some species such as kittiwake and gannet, and to a lesser extent for large gull species.

518 It is also noted that there is ongoing strategic research and investigation into the behaviour of birds within and around OWFs. This includes studies aimed at providing further empirical evidence on collision rates and refining industry standard methods for estimating bird mortality from collisions; as well as understanding the mechanisms for and estimating the effects of bird displacement. Should any further findings of relevance to mitigation emerge during an appropriate timescale for the Project, these would also be considered.

8.7 Commercial fisheries

8.7.1 Introduction

519 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on commercial fisheries. This section should be read alongside the following chapters of this Scoping Report:

- Section 8.2: Fish and Shellfish Ecology, which includes consideration of potential impacts on species of commercial importance
- Section 8.8: Shipping and Navigation, which includes consideration of potential impacts on vessel routing and navigational safety (which includes commercial fishing vessels)
- Section 8.11: Infrastructure and Other Users, which includes consideration of potential impacts on charter angling businesses

8.7.2 Study area

520 The windfarm site is located within the southern portion of the International Council for the Exploration of the Sea (ICES) Division 7a (Irish Sea) statistical area; within United Kingdom (UK) Exclusive Economic Zone (EEZ) waters. For the purpose of recording fisheries landings, ICES Division 7a is divided into statistical rectangles which are consistent across all Member States operating in the Irish Sea.

521 The windfarm site is located outside the 12 NM territorial seas boundary, within ICES rectangle 36E6[9]. The commercial fisheries Study Area for this scoping exercise is therefore defined as ICES rectangles 36E6, and is shown in Figures 8.7, 8.8, and 8.9.

8.7.3 Existing environment

8.7.3.1 Baseline data

522 An initial desk-based review of literature and data sources was undertaken to support this scoping exercise, as presented in Table 8.23. Table 8.23 also identifies additional sources of information that would be expected to inform

[9] ICES standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is '30 min latitude by 1-degree longitude' in size (approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES statistical areas.

the assessment in the Preliminary Environmental information Report (PEIR) and Environmental Statement (ES).

Table 8.23 Key sources of data to inform the commercial fisheries assessment

Source	Summary	Coverage of study area
Landings statistics for the period 2016 to 2020. Sourced from the Marine Management Organisation (MMO) and the European Union Data Collection Framework (EU DCF). Note EU DCF data is only available up to 2016 by ICES rectangle.	Fisheries landings data for nationally registered fishing vessels landing to their home nation ports.	National dataset providing full coverage of the commercial fisheries study area
Vessel Monitoring System (VMS) data, for the period 2015-2019 Sourced from ICES (2017 data) and the MMO (2015-2019 data). Note that the most recent data (2017-2019) has been presented in this Scoping Report and is considered representative. Longer term datasets will be analysed within the PEIR and ES.	VMS data for fishing vessels greater than 12 or 15 m in length.	National dataset providing full coverage of the commercial fisheries study area.
Key species stock assessments. Sources includes ICES, the North Western Inshore Fisheries Conservation Authority (IFCA), Welsh Government and Bangor University. Data yet to be sourced, but will be used to inform the PEIR and ES.	Reports on the status of commercially fished species, which consider to what extent they are being exploited sustainably.	Coverage to be confirmed.

Source	Summary	Coverage of study area
Bangor University's Fisheries and Conservation Science Group	Bangor University provide fisheries support to the Isle of Man	Coverage of Isle of man territorial waters
Regional offshore wind farm PEIR and ES commercial fisheries assessments. Various sources.	Contextual information obtained from commercial fisheries impact assessment for other offshore wind farms located within and in proximity to the study area (e.g. Awel y Môr and Gwynt y Môr).	Partial overlap with the commercial fisheries study area.

523 It should be noted that the quantitative datasets identified in Table 8.23 may not capture all fishing activity in the commercial fisheries study area. For instance, the VMS datasets only covers vessels ≥12 m (ICES data) or ≥15 m (MMO data) in length. Note that UK vessels ≥12 m in length have VMS on board, however, to date, the MMO provide amalgamated VMS datasets for ≥15 m vessels only. In addition to VMS data, consultation with fisheries stakeholders and industry is expected to further inform assessment in the PEIR/ES. Consultation will be undertaken to seek to corroborate the findings of desk-based baseline data analysis and to provide insight into specific fishing grounds and activity of any vessels active in the area. Consultation will also be important to inform gear specifications for vessels active in the area, which will allow a full understanding of how different vessels and different gear configurations may be affected.

524 Variations and trends in commercial fisheries activity are an important aspect of the baseline assessment and is the principal reason for considering up to five years of key baseline data. Given the time periods considered in this scoping exercise (i.e., 2016 to 2020), existing baseline data captures potential changes in commercial fisheries activity resulting from the COVID-19 pandemic, notable through changes in fishing effort from 2019 to 2020. However, changes in fishing patterns resulting from the withdrawal of the UK from the EU would be expected in future data sets, which include data for 2021. Long term environmental and climatic changes may be expected to be detectable within the five year time series, but may benefit from longer-term analysis dependant on the target species. Inclusion of such longer term analysis will be informed by stakeholder consultation.

525 Following withdrawal, the UK and the EU have agreed to a Trade and Cooperation Agreement (TCA), applicable on a provisional basis from 1 January 2021. The TCA sets out fisheries rights and confirms that from 1 January 2021 and during a transition period until 30 June 2026, UK and EU vessels will continue to access respective Economic Exclusion Zone (EEZs), 12-2000 NM) to fish. In this period, EU vessels with historic access rights will also be able to fish in specified parts of UK waters between 6-12 NM.

526 The PEIR and ES will further consider likely changes to the future baseline, primarily associated with withdrawal from the EU, taking into account planned changes in quota allocation.

8.7.3.2 Baseline environment

527 Landings from the commercial fisheries Study Area (ICES statistical rectangle 36E6) by UK-registered vessels had an approximate average annual value of £2.29 million (based on five-years data from 2016 – 2020; MMO, 2021). The value of landings by foreign vessels is not accounted for in this total, though landings data indicates very limited foreign vessel activity (minimal landings by Irish vessels) (EU DCF, 2021).

528 Plate 9 shows the key species landed from the commercial fisheries Study Area by value; the proportion of value by vessel nationality and by species is shown. These landings statistics are published annually by the MMO and include vessels registered to the following UK administrations and British crown dependencies: England, Wales, Scotland, Northern Ireland, Isle of Man (IOM), Guernsey and Jersey. Commercial fishing vessels that are registered to the Isle of Man (IOM) are required to hold both IOM and UK fishing licences. The MMO iFISH database therefore provides commercial landing statistics for all vessels registered to UK administrations and crown dependencies catching from the specified ICES rectangles and is included in the data presented in this section.

529 Furthermore, for fisheries statistics by ICES rectangle, the data indicates the nation that vessel is registered to, rather than where it is landed for example queen scallop caught by an IOM registered vessel from ICES rectangle 36E6 may have been subsequently landed to England, Scotland, IOM etc.

530 Landings of shellfish species account for approximately 95% of total landings values across the 2016 to 2020 period. Landings data indicate that queen scallops *Aequipecten opercularis* and king scallops *Pecten maximus* are primarily landed by Scottish-registered dredgers of over 10m length; whelks *Buccinum undatum*, brown crab *Cancer pagurus* and lobster *Homarus gammarus* by primarily English-registered vessels deploying pots and traps;

and prawns *Nephrops norvegicus* by Northern Irish and English-registered otter trawlers; and brown shrimp *Crangon crangon* by English beam trawlers. Non-shellfish, primarily demersal species, are primarily landed by vessels registered in England using a variety of gear types, including fixed nets, trawls and gears using hooks.

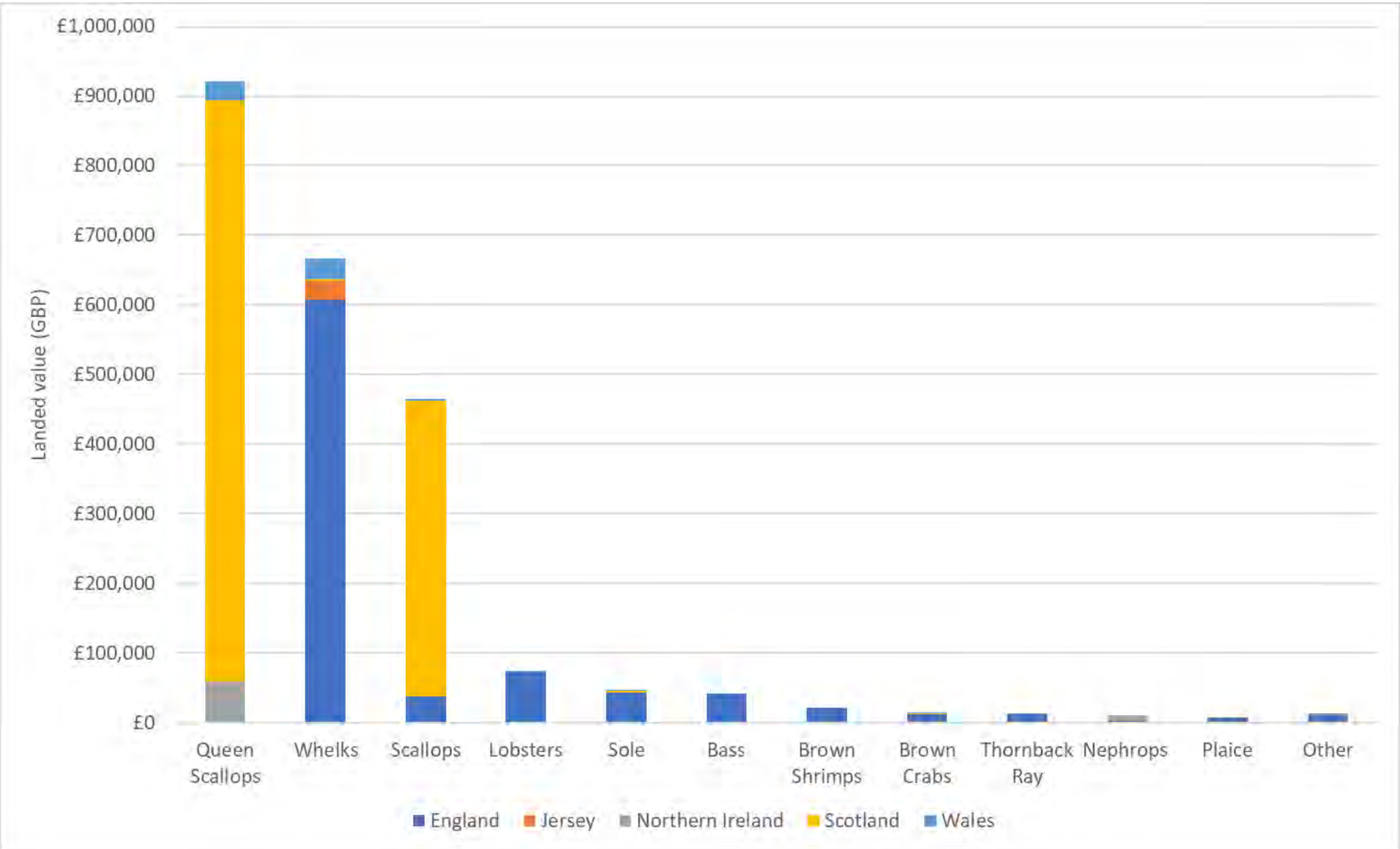


Plate 9 Average annual value of landings from commercial fisheries study area by species and vessel nationality between 2016 and 2020. Source: MMO, 2021

531 Trends in the landed weight of key species from the commercial fisheries Study Area are shown in Plate 10. Notably, landings of queen scallop have declined significantly over the five-year study period. A spike in queen scallop landings is noted in 2016, at 3,500 tonnes landed from the commercial fisheries Study Area, compared to approximately 500 tonnes on average from 2017 to 2020. The queen scallop in 2016 were landed by over 10m Scottish vessels targeting ICES rectangle 36E6 consistently throughout the whole year, with peaks in February, March and August. Landings of scallop (including king and queen) are known to fluctuate in approximately 7-year cycles, with large vessel UK scallop dredgers operating around the entirety of the UK offshore waters. This may explain the peak in queen scallop landings, which will be explored further through stakeholder consultation. Also of note, landings of whelk steadily increased up to 2019, subsequently showing slight decline in 2020, which may be as a result of the COVID-19 pandemic.

532 In addition to landings data, VMS data from 2019 for UK-registered vessels (including crown dependencies) have also been obtained for the commercial fisheries Study Area. The VMS data indicates that fishing activity by vessels over 15m in length takes place throughout the commercial fisheries Study Area, with areas of relatively greater activity located outside of the windfarm site. Figure 8.7 indicates scallop dredging activity in the southern portion of the windfarm site. Figure 8.8 indicates that some potting by vessels over 15m in length occurs within the windfarm site although greater activity by the over 15m potting fleet is noted towards the west and northwest of the windfarm site. Figure 8.9 indicates that otter trawling activity is focused in the northern half of the commercial fisheries Study Area, outside of the windfarm site.

533 The VMS dataset does not include vessels less than 15m in length, which form a significant portion of the UK and crown dependency fleets. Figures 8.7 to 8.9 are therefore highly likely to under-represent the fishing (particularly potting) activity in the region and additional data (e.g. surveillance and landings data), together with stakeholder consultation will inform the assessment of impacts on fleets for the PEIR and ES stages.

534 In summary, the key fleets operating across the commercial fisheries Study Area include (in no particular order):

- UK, predominantly Scottish, but also English, and Welsh scallop dredgers targeting queen and king scallop species
- UK, predominantly English, but also Welsh and Jersey potting vessels targeting whelks, lobsters and brown crabs
- UK, predominantly Northern Irish and English otter trawlers targeting Nephrops

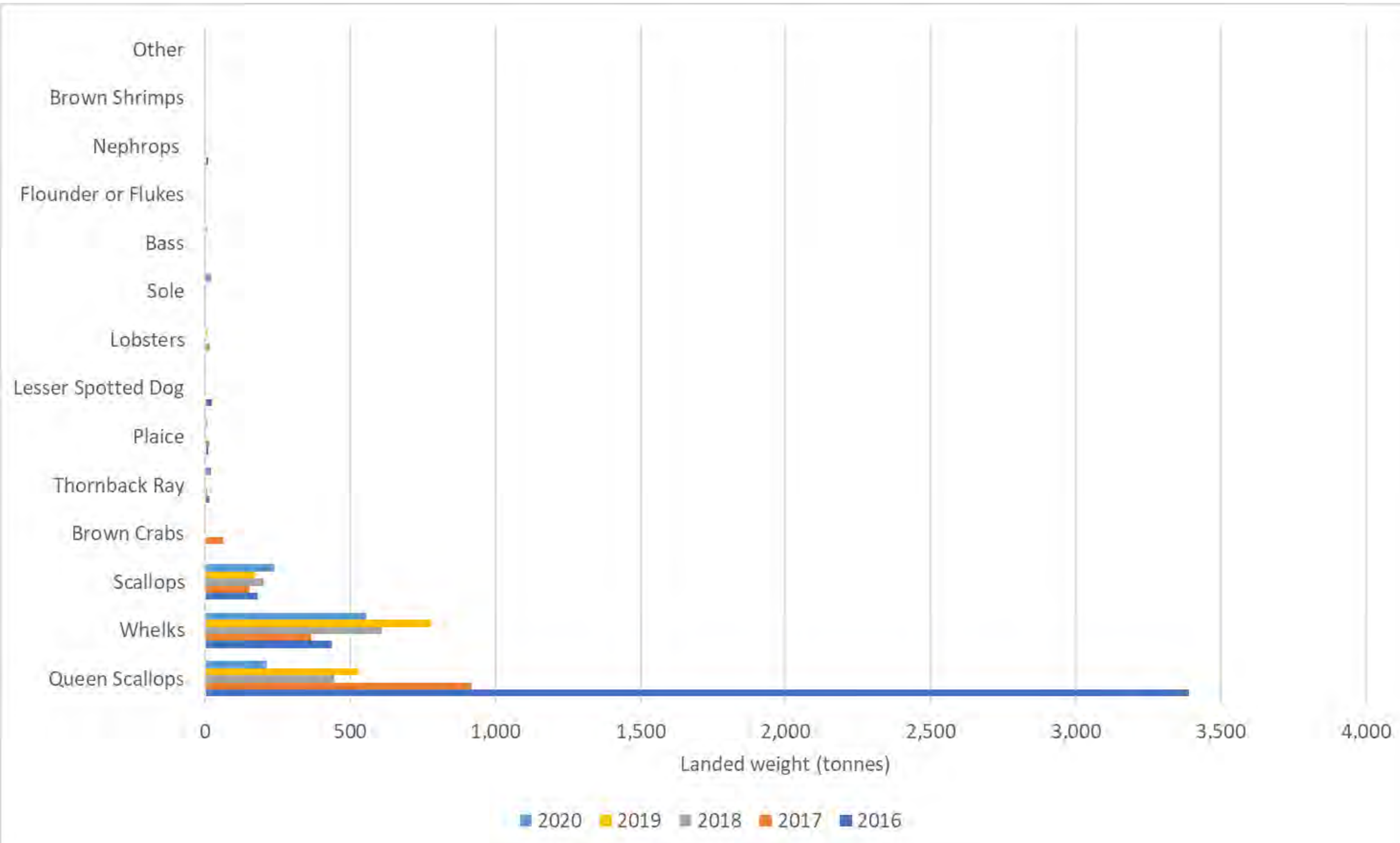
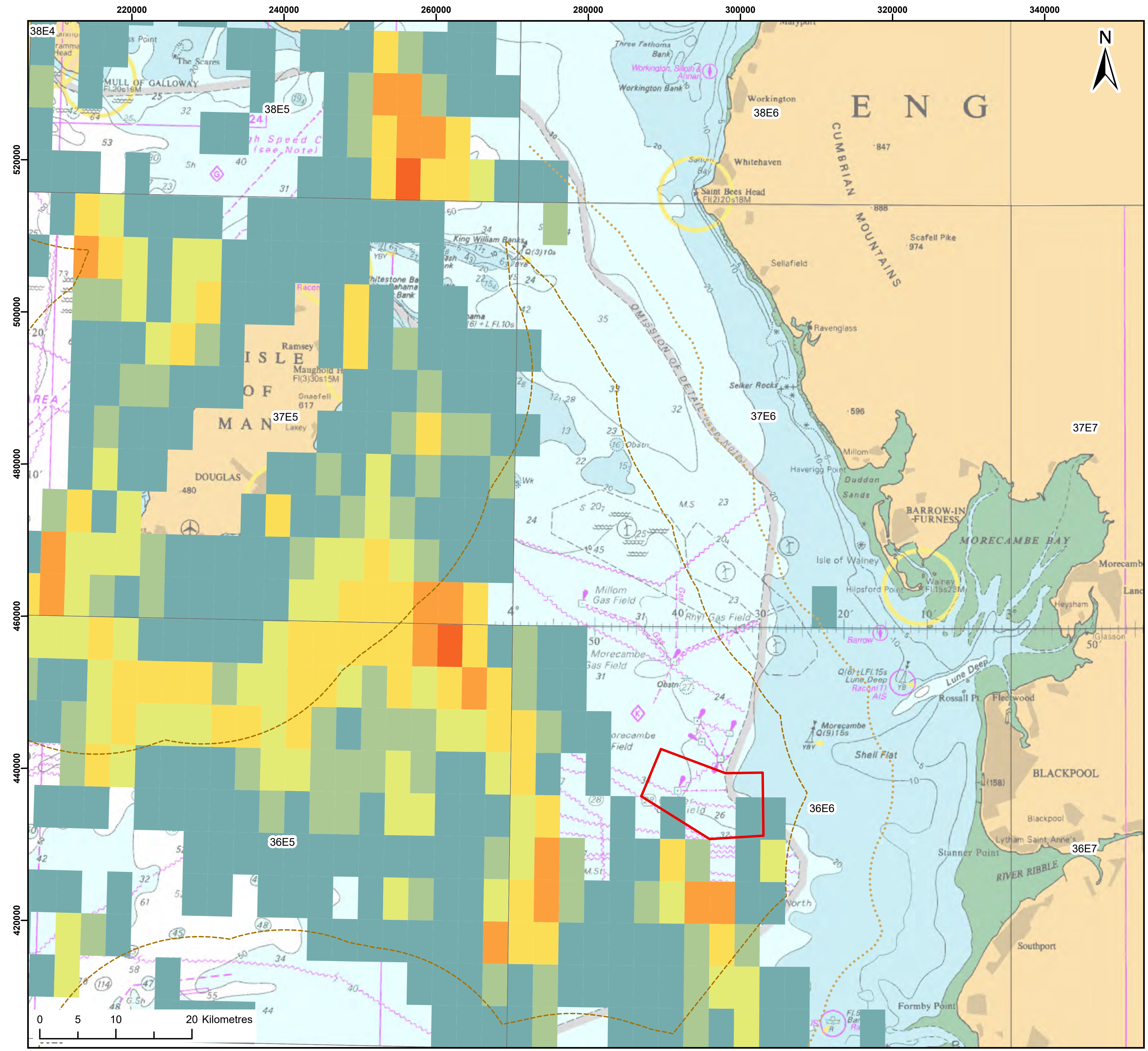


Plate 10 Annual weight of landings from the commercial fisheries study area by species. Source: MMO, 2021.



Legend:

- Morecambe Offshore Windfarm Site
- ICES Statistical Rectangles

Fishing Limits

- 6 NM
- 12 NM

UK Dredge Value (£), 2019 (vessels ≥15m)

- £1 - £5,000
- £5,001 - £10,000
- £10,001 - £20,000
- £20,001 - £50,000
- £50,001 - £100,000
- £100,001 - £150,000
- £150,001 - £232,000

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Dredge Landed Value (GBP) for UK ≥ 15m vessels in 2019

Figure: 8.7 | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0061

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:500,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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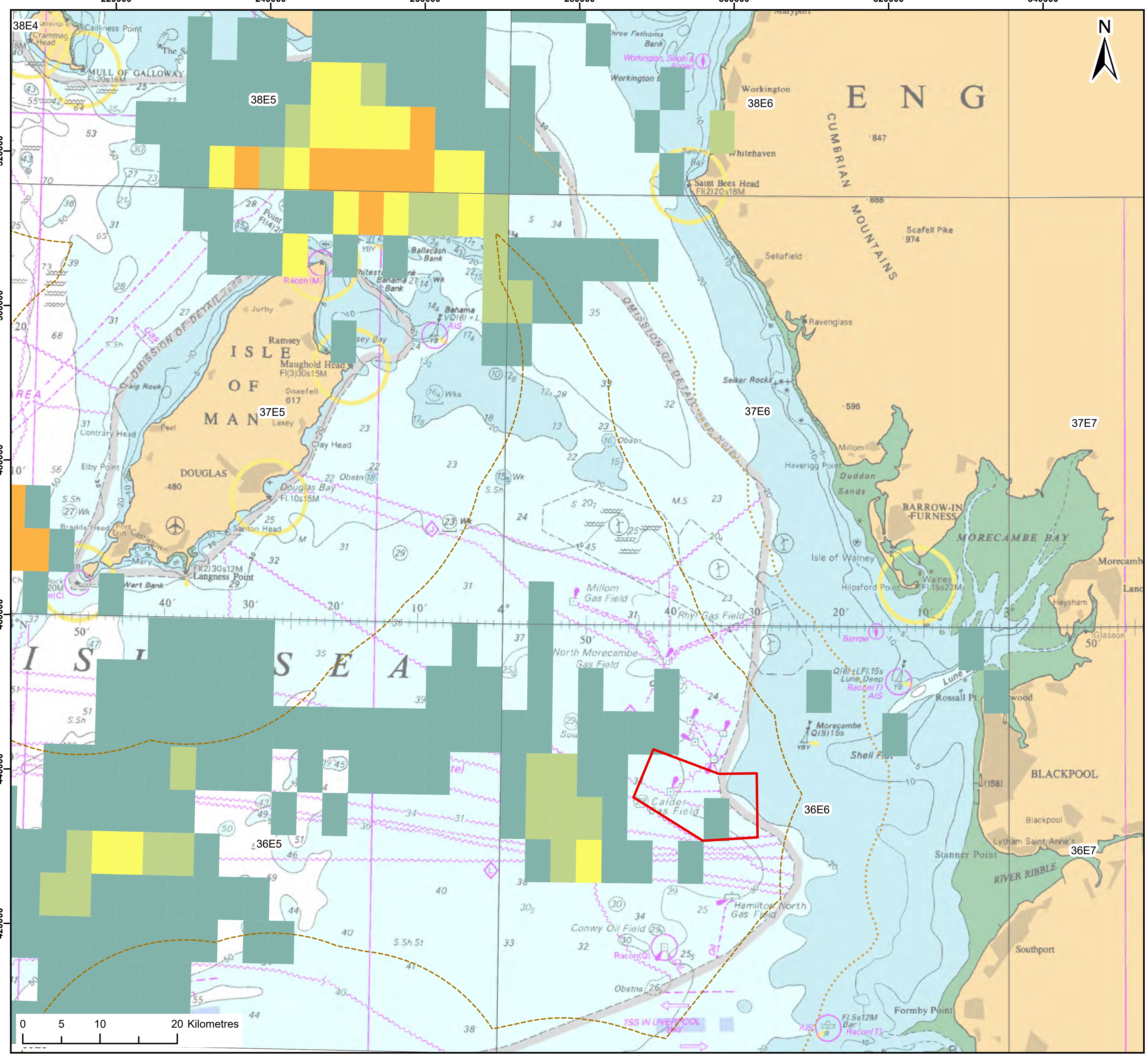

Legend:

- Morecambe Offshore Windfarm Site
- ICES Statistical Rectangles

Fishing Limits

- 6 NM
- 12 NM

UK Potting Value (£), 2019 (vessels ≥15m)

- £0 - £5,000
- £5,001 - £10,000
- £10,001 - £25,000
- £25,001 - £50,000
- £50,001 - £75,000
- £75,001 - £145,000

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Potting Landed Value (GBP) for UK ≥ 15m vessels in 2019.

Figure: 8.8	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0062				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: WGS 1984 UTM Zone 30N

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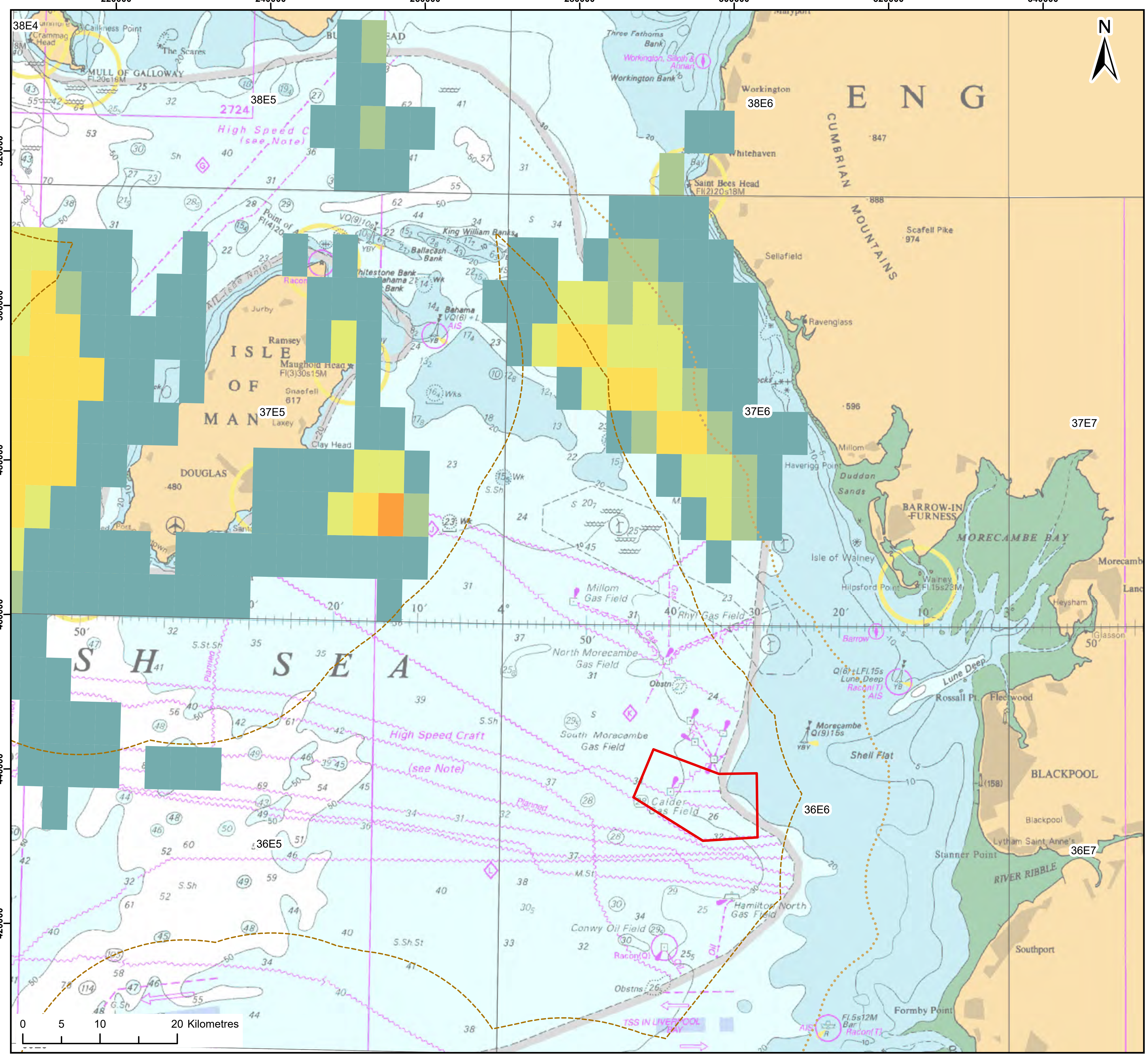

Legend:

Morecambe Offshore Windfarm Site

ICES Statistical Rectangles

Fishing Limits

6 NM

12 NM

UK Otter Trawl Value (£), 2019 (vessels ≥15m)

- £1 - £5,000
- £5,001 - £10,000
- £10,001 - £20,000
- £20,001 - £50,000
- £50,001 - £75,000
- £75,001 - £100,000
- £100,001 - £115,000

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Otter Trawl Landed Value (GBP) for UK > 15m vessels in 2019

Figure: 8.9	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0063				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:500,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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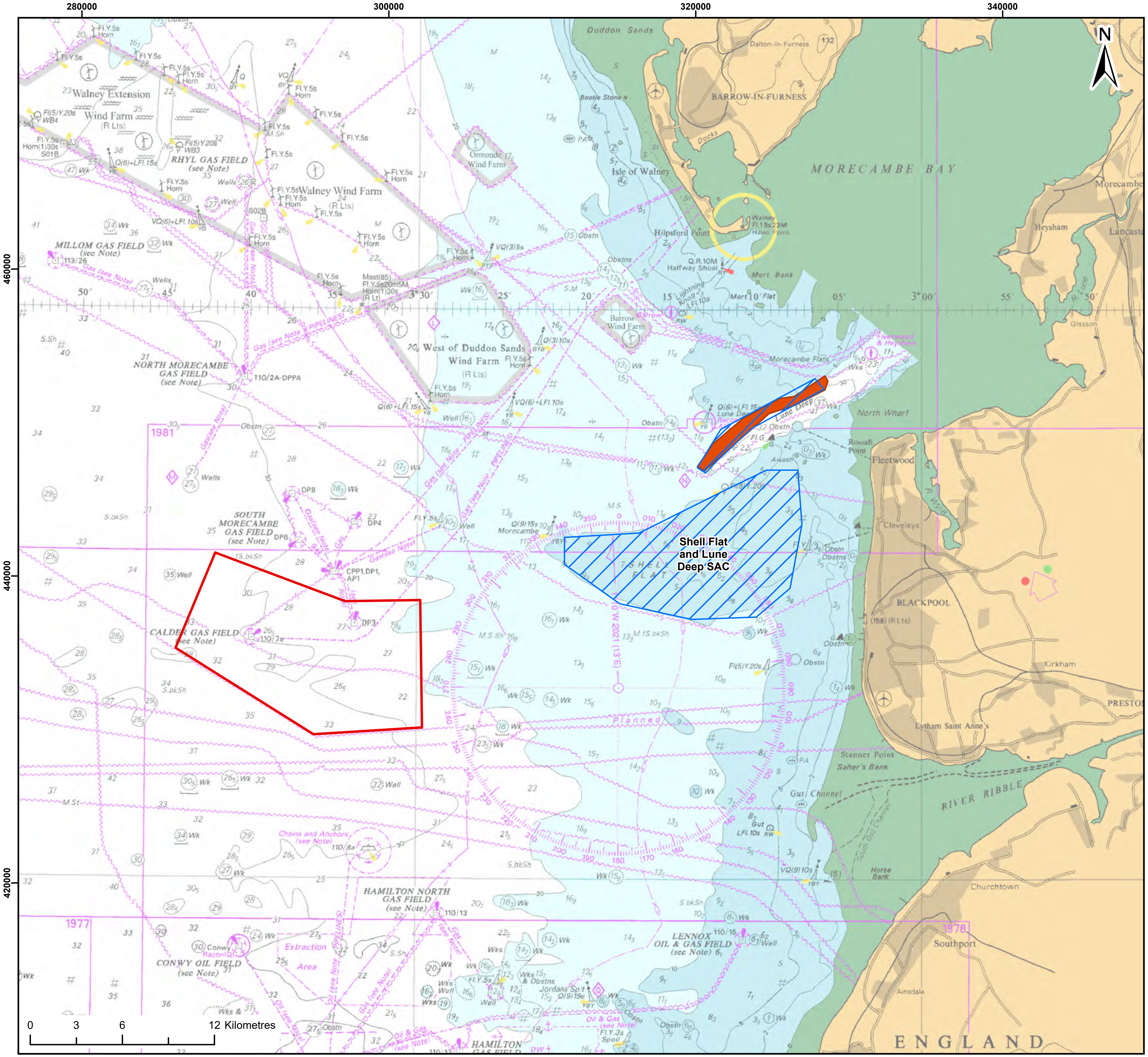
8.7.3.3 Designated sites

535 In order to protect particular features of designated sites, fisheries management mechanisms may be put in place. These mechanisms can include spatial closures, permit schemes, effort controls, vessel size and fishing gear restrictions and seasonal fishing restrictions. These mechanisms are implemented by the relevant Inshore Fisheries Conservation Authority (IFCA) in waters out to 6 NM and by the MMO in waters between 6 and 12 NM.

536 Within the designated sites that are in proximity to the windfarm site, spatial closures to protect designated site features have been established via IFCA byelaws that are relevant to fisheries activity within the regional study area. These include a reef area within Shell Flat and Lune Deep Special Area of Conservation (SAC), which is closed to bottom-towed fishing gear (including dredges, beam and otter trawls). Figure 8.10 presents the location of the Shell Flat and Lune Deep SAC, together with the closed area where bottom trawl fishing gear is prohibited as per North Western IFCA Byelaw 6.



Legend:

- Morecambe Offshore Windfarm Site
- Special Areas of Conservation (SAC)
- Closed Area: bottom trawl prohibited

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Area Closed to Bottom-towed Fishing Gear

Figure: 8.10	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0064				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:250,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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8.7.4 Approach to data collection

537 It is intended that during the EIA, acquisition and analysis of the baseline data sources listed in Section 8.7.3.1 is completed. Data analysis will then be corroborated and expanded upon by consultation with the fishing industry and other relevant stakeholders, including the following:

- MMO
- National Federation of Fishermen's Organisations (NFFO)
- Welsh Fishermen's Association
- Scottish Fishermen's Federation
- Anglo-North Irish Fish Producers Organisation
- Northern Ireland Fish Producers Organisation
- Manx Fish Producers Organisation
- Scallop Industry Consultation Group
- North Western IFCA
- Isle of Man Government
- Local Fishermen's Associations and Producer Organisations
- Any EU Member State representative organisations as identified during baseline data analysis
- Individual fishermen as identified by the Company Fisheries Liaison Officer/other means

538 Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.7.5 Approach to impact assessment

539 Detailed analysis of baseline datasets (see Section 8.7.3.1) will be undertaken to characterise long-term (i.e. over several years) patterns in commercial fisheries activity across the commercial fisheries Study Area and predict potential impacts upon commercial fishing activities. Consultation with the commercial fishing industry will be undertaken to ground-truth available baseline data and gain further understanding of fishing activity by smaller vessels. Analysis of data and the results of consultation will provide an extended baseline characterisation of the commercial fisheries Study Area, which will underpin impact assessment.

540 The commercial fisheries impact assessment will follow the EIA methodology set out in Section 7. Specific to commercial fisheries, the following guidance documents will also be considered:

- Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (United Kingdom Fisheries Economic Network [UKFEN] and Seafish, 2012)
- Fisheries Liaison with Offshore Wind and Wet Renewables group (FLOWW) Recommendations for Fisheries Liaison: Best Practice guidance for offshore renewable developers (FLOWW, 2014 and BERR, 2008)
- FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015)
- Options and opportunities for marine fisheries mitigation associated with wind farms (Blyth-Skyrme, 2010a);
- Developing guidance on fisheries Cumulative Impact Assessment for wind farm developers (Blyth-Skyrme, 2010b);
- Cumulative impact assessment guidelines, guiding principles for cumulative impacts assessments in offshore wind farms (RenewableUK, 2013);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Contract report: ME5403 (Cefas, 2012);
- Fisheries Liaison Guidelines - Issue 6 (UK Oil and Gas, 2015);
- Fishing and Submarine Cables - Working Together (International Cable Protection Committee, 2009); and
- Offshore Wind Farms – Guidance note for Environmental Impact Assessment in respect of Food and Environment Protection Act (FEPA) and Coast Protection Act (CPA) requirements (Centre for Environment, Fisheries and Aquaculture Science [CEFAS], Marine Consents and Environment Unit [MCEU], Department for Environment, Food and Rural Affairs [DEFRA] and Department of Trade and Industry [DTI], 2004)

541 Where relevant, impact assessment will be informed by the outcomes of the Fish and Shellfish Ecology and Shipping and Navigation assessments.

542 Impacts will be assessed for each relevant fleet/fishery active in the commercial fisheries Study Area.

543 The assessment for commercial fisheries will consider the Project Design Envelope (PDE, following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario' upon which the assessment will be made. The worst case scenario will be outlined in the PEIR.

8.7.6 Potential impacts

544 A range of potential impacts on commercial fisheries have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.7.6.1 Potential impacts during construction

545 The following potential impacts have been identified as relevant to the construction phase of the Project.

- Reduction in access to, or exclusion from established fishing grounds
- Displacement leading to gear conflict and increased fishing pressure on adjacent grounds
- Displacement or disruption of commercially important fish and shellfish resources
- Increased vessel traffic associated with the Project within fishing grounds leading to interference with fishing activity
- Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the windfarm site

Reduction in access to, or exclusion from established fishing grounds

546 Installation activities and physical presence of constructed infrastructure may lead to reduction in access to, or exclusion from established fishing grounds. There is potential for some loss of fishing opportunities over the construction period, though any effect is expected to be localised, and the operational range of relevant fleets will not typically be limited to the windfarm site.

Displacement leading to gear conflict and increased fishing pressure on adjacent grounds

547 Fishing activity may be displaced from the windfarm site, leading to gear conflict and increased fishing pressure on adjacent grounds. there is potential for displacement of fishing activity, though any effect is expected to be localised, and the operational range of relevant fleets will not typically be limited to the windfarm site.

Displacement or disruption of commercially important fish and shellfish resources

548 Construction activities may lead to displacement or disruption of commercially important fish and shellfish resources. Assessment will be informed by the outcomes of the Fish and Shellfish Ecology impact assessment (see Section

8.2) and it will be assumed that commercial fisheries will be affected as a result of any loss of resources. The conclusions presented in the Fish and Shellfish Ecology impact assessment regarding impact significance will be considered in determining the magnitude of impact on commercial fisheries.

Increased vessel traffic associated with the Project within fishing grounds leading to interference with fishing activity

549 Movement of vessels associated with the Project may add to the existing volume of marine traffic in the area, leading to interference with fishing activity. The assessment will be informed by the outcomes of the Shipping and Navigation impact assessment and the conclusions presented in the Shipping and Navigation impact assessment will be considered in determining the magnitude of impact on commercial fisheries.

Additional steaming time to alternative fishing grounds for vessels that would otherwise fish within the windfarm site

550 This effect will be localised to safety zones and construction activities and therefore limited deviations to steaming routes are expected. Assessment will be informed by consultation with the local fishing industry as to the nature and extent of alternative grounds and associated additional steaming requirements.

8.7.6.2 Potential impacts during operation and maintenance

551 The potential impacts identified as relevant to the operation and maintenance phase of the Project are as per those identified for the construction phase, with the addition of the potential for gear snagging.

- Reduction in access to, or exclusion from established fishing grounds
- Displacement leading to gear conflict and increased fishing pressure on adjacent grounds
- Displacement or disruption of commercially important fish and shellfish resources
- Increased vessel traffic associated with the Project within fishing grounds leading to interference with fishing activity
- Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the windfarm site

Reduction in access to, or exclusion from established fishing grounds

552 Operation and maintenance activities and physical presence of constructed infrastructure may lead to reduction in access to, or exclusion from established fishing grounds. It is assumed that fishing can resume to a degree within the windfarm site when the Project is operational. The effect will be long-term but

localised, and the operational range of relevant fleets will not typically be limited to the windfarm site.

Displacement leading to gear conflict and increased fishing pressure on adjacent grounds

553 Fishing activity may be displaced from the windfarm site, leading to gear conflict and increased fishing pressure on adjacent grounds, during operation and maintenance. It is assumed that fishing can resume to a degree within the windfarm site when the Project is operational. The effect will be long-term but localised, and the operational range of relevant fleets will not typically be limited to the windfarm site.

Displacement or disruption of commercially important fish and shellfish resources

554 Operation and maintenance activities may lead to displacement or disruption of commercially important fish and shellfish resources. Assessment will be informed by the outcomes of the Fish and Shellfish Ecology impact assessment (see Section 8.24) and it will be assumed that commercial fisheries will be affected as a result of any loss of resources. The conclusions presented in the Fish and Shellfish Ecology impact assessment regarding impact significance will be taken into account in determining the magnitude of impact on commercial fisheries.

Increased vessel traffic associated with the Project within fishing grounds leading to interference with fishing activity

555 Movement of vessels associated with the operation and maintenance of the Project may add to the existing volume of marine traffic in the area, leading to interference with fishing activity. The assessment will be informed by the outcomes of the Shipping and Navigation impact assessment; the conclusions presented in the Shipping and Navigation impact assessment will be considered in determining the magnitude of impact on commercial fisheries.

Physical presence of infrastructure leading to gear snagging

556 Standard industry practice and protocol in the design and construction of the offshore windfarm (e.g. seabed infrastructure will be buried where practicable and/or marked on nautical charts) will minimise the risk of gear snagging, but it remains likely to be an area of industry concern. This assessment will consider the loss or damage to fishing gear leading to reduced economic performance during operation and maintenance. Safety aspects associated with this impact, including potential loss of life due to potential snagging risk, will be assessed within the Shipping and Navigation impact assessment.

Additional steaming to alternative fishing grounds for vessels that would otherwise fish within the windfarm site

557 This effect will be localised to safety zones and installed structures and therefore limited deviations to steaming routes are expected. The assessment will be informed by consultation with the local fishing industry as to the nature and extent of alternative grounds and associated additional steaming requirements.

8.7.6.3 Potential impacts during decommissioning

558 The potential impacts identified as relevant to the decommissioning phase of the Project are as per or similar to those identified for the construction phase, with the addition of the potential for gear snagging any infrastructure left in situ.

8.7.6.4 Potential cumulative impacts

559 There may be potential for cumulative impacts to occur on commercial fisheries as a result of other activities in the marine environment. The approach to assessment of potential cumulative impacts is set out in Section 7.7.

560 Offshore wind projects and other activities relevant to the assessment of cumulative impacts on commercial fisheries will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

561 For the purposes of cumulative impact assessment, it will be assumed that already-operational offshore wind farms and active licensed activities constitute part of the existing baseline environment, as commercial fisheries would already be adapted to them and any effect they might have had will be reflected in the baseline characterisation undertaken to inform impact assessment.

562 The likely scope of other offshore wind projects and other activities to be included in cumulative impact assessment is set out immediately below, though this will be confirmed by the aforementioned screening exercise.

563 Offshore wind: Given the presence of several other offshore wind development within the eastern Irish Sea, there is the potential for small impacts associated with the Project to be part of a more significant cumulative

impact from multiple offshore wind farm developments in the Irish Sea. The cumulative impact assessment will consider other offshore wind farm projects across the region and the key cumulative impacts are expected to result from loss or restricted access to established fishing grounds and displacement of fishing activity.

564 Other activities: There is the potential for other activities occurring in the region surrounding the Project to create cumulative impacts; these include aggregate dredging activity, oil and gas activity (including decommissioning of existing platforms) and infrastructure, and subsea cabling. As for offshore wind projects, the key cumulative impacts are expected to result from loss or restricted access to established fishing grounds and displacement of fishing activity.

8.7.6.5 Potential transboundary impacts

565 Baseline data indicates limited foreign fishing fleet activity. Consultation with stakeholders in other relevant Member States, and data gathered from other relevant Member States, will inform the scope of any future transboundary impact assessment within the EIA.

8.7.6.6 Summary of potential impacts

566 Table 8.24 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.24 Summary of impacts relating to commercial fisheries.

Potential Impact	Construction	Operation and maintenance	Decommissioning
Reduction in access to, or exclusion from established fishing grounds	✓	✓	✓
Displacement leading to gear conflict and increased fishing pressure on adjacent grounds	✓	✓	✓
Displacement or disruption of commercially	✓	✓	✓

Potential Impact	Construction	Operation and maintenance	Decommissioning
important fish and shellfish resources			
Increased vessel traffic associated with the Project within fishing grounds leading to interference with fishing activity	✓	✓	✓
Physical presence infrastructure leading to gear snagging	x	✓	✓
Additional steaming to alternative fishing grounds	✓	✓	✓
Cumulative impacts	✓	✓	✓
Transboundary impacts	✓	✓	✓

8.7.7 Potential mitigation measures

567 As part of the design process for the Project a number of embedded measures are proposed to reduce the potential for impacts on commercial fisheries. Consultation with the commercial fishing industry will be undertaken to discuss and agree potential mitigation measures where relevant.

568 Measures adopted as part of the Project will include:

- The Applicant is committed to ongoing liaison with fishermen throughout all stages of the Project, based upon FLOWW (2014, 2015) guidance and the following:
  - Appointment of a company Fisheries Liaison Officer (FLO) to maintain effective communications between the project and fishermen
  - Appropriate liaison with relevant fishing interests to ensure that they are fully informed of development planning and any offshore activities and works
  - Timely issue of notifications including Notice to Mariners (NtMs), Kingfisher Bulletin notifications and other navigational warnings to the

fishing community to provide advance warning of project activities and associated Safety Zones and advisory safety distances
    - Development, prior to construction, of a Fisheries Liaison and Co-existence Plan (FLCP), setting out in detail the planned approach to fisheries liaison and means of delivering any other relevant mitigation measures. It is intended that a draft of this plan be submitted at the point of consent application
- The Applicant is committed to marking and lighting the project in accordance with relevant industry guidance and as advised by relevant stakeholders including the Maritime and Coastguard Agency (MCA), Civil Aviation Authority (CAA) and Trinity House. The Applicant will also ensure the project is adequately marked on nautical charts
- The Applicant will ensure that any objects dropped on the seabed during works associated with the project are reported and that objects are recovered where they pose a hazard to other marine users and where recovery is possible
- Where practicable, cable burial will be the preferred means of cable protection

569 The Applicant is committed to implementing these measures (noting they may evolve over the development process as the EIA progresses and in response to consultation), and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of the Project.

570 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process.

8.8 Shipping and navigation

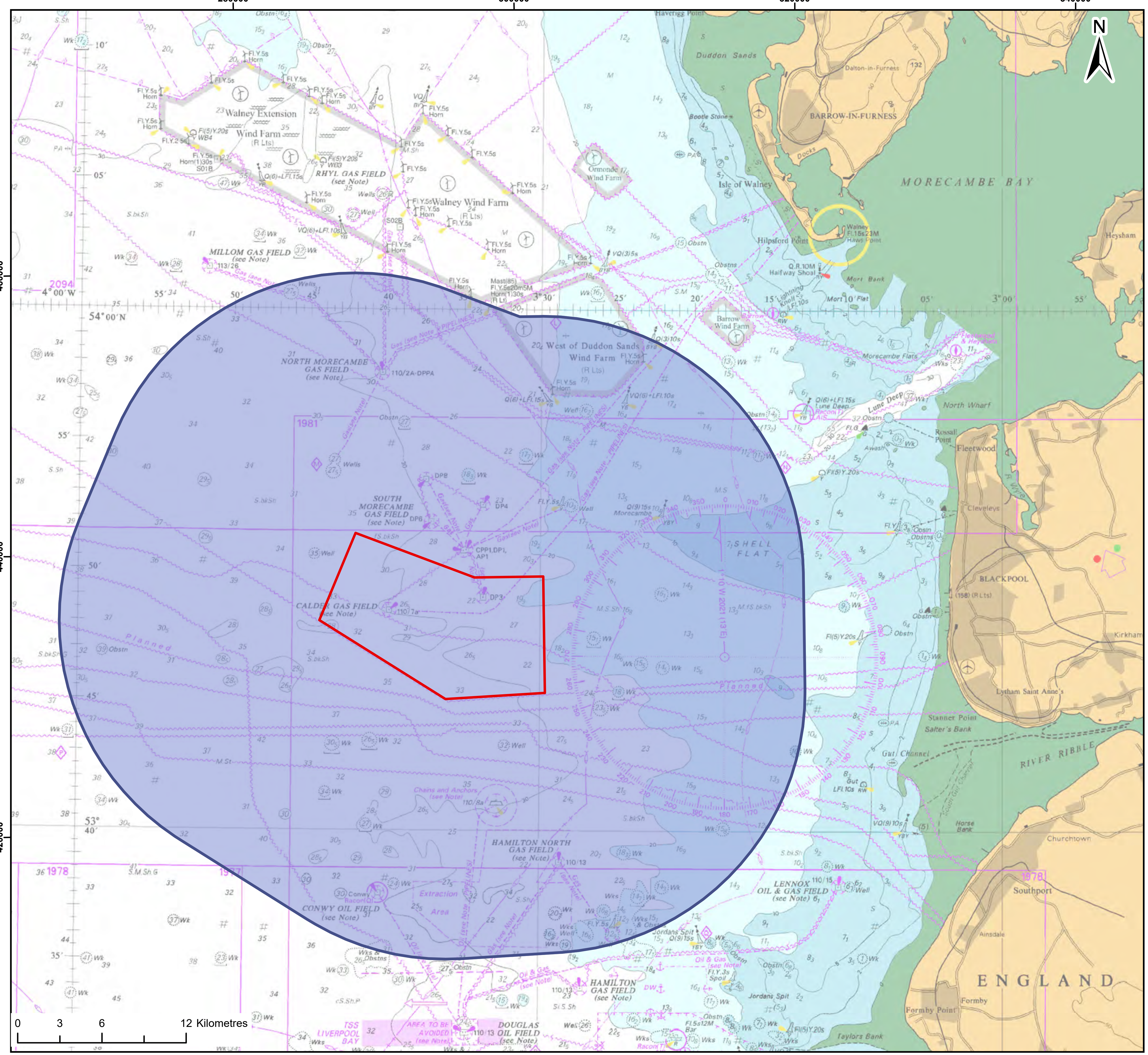
8.8.1 Introduction

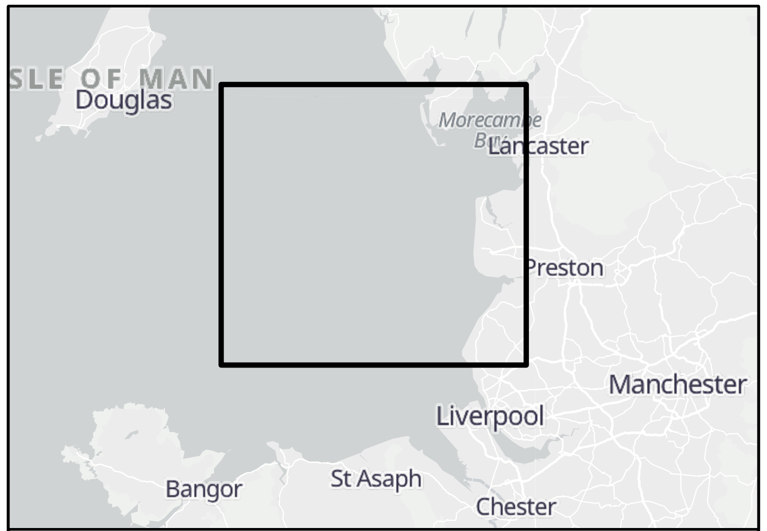
571 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on shipping and navigation. Shipping and navigation interfaces with several other topics and as such, it should be considered alongside the following chapters:

- Section 8.7: Commercial Fisheries, which includes consideration of potential impacts on commercial fisheries
- Section 8.10: Civil and Military Aviation, which includes consideration of potential aviation navigation
- Section 8.11: Infrastructure and Other Users, which includes consideration of potential impacts on other marine users such as existing oil and gas infrastructure and other offshore windfarms.

8.8.2 Study area

572 The shipping and navigation Study Area, as depicted in Figure 8.11 is ten nautical miles (nm) around the windfarm site.





Legend:

Morecambe Offshore Windfarm Site

Shipping and Navigation Study Area

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Shipping and Navigation Study Area

Figure: 8.11	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0065				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:275,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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8.8.3 Existing environment

573 The windfarm site is located in the Irish Sea in water depths of 19 – 40m. The closest distance from the windfarm site to shore is 30km (approximately 16nm). A full description of the Project is located in Section 6.

574 Key ports with greater than 1,000 vessel arrivals per year and with primary route approaches passing through or in proximity to the shipping and navigation Study Area are shown in Table 8.25.

Table 8.25 Key ports in proximity to the shipping and navigation Study Area

Port	Approximate distance from windfarm site(nm)	Total port ship arrivals (2020) Source: Transport for London (TfL)
Heysham	25	2,008
Liverpool	28	5,899
Douglas	33	Data not available
Manchester	>40	1,540
Holyhead	>40	2,811

8.8.3.1 Navigational Features

575 No International Maritime Organisation (IMO) traffic schemes are present within the shipping and navigation Study Area. The closest Traffic Separation Scheme (TSS), the Liverpool TSS, is 12nm south of the windfarm site boundary, approximately 0.5nm south of the shipping and navigation Study Area. No other TSS are in close proximity, with the Off Skerries TSS >22nm south west of the shipping and navigation Study Area. It is noted, however, that commercial vessels route between the Off Skerries TSS and Liverpool TSS to the south of the shipping and navigation Study Area.

576 There are no military Practice and Exercise Areas (PEXA) within the shipping and navigation Study Area, the nearest of which is located approximately 15nm to the north of the windfarm site.

577 There is one aggregate production licence area within the shipping and navigation Study Area, the Liverpool Bay Aggregate Production Area operated by Westminster Gravels Ltd. The licence area is located approximately 5nm south of the windfarm site.

578 There are no active disposal sites within the windfarm site. Further information is provided in Section 8.11.3.4.

579 There are oil and gas wells and infrastructure within and in proximity to the shipping and navigation Study Area. Further information is provided in Section 8.11.3.1.

580 The sea station for boarding and disembarking of pilots from and to pilot boats for commercial vessels on route to and from the Port of Liverpool is the Liverpool Bar Station in vicinity of the Bar Buoy. In poor weather or at the request of the Master, boarding may also occur at Lynas Station off Point Lynas, Anglesey.

581 The nearest Royal National Lifeboat Institution (RNLI) lifeboat stations are Blackpool and Lytham St Annes Lifeboat Stations. It is noted that the RNLI stations which host offshore capable lifeboats (smaller C and D class boats) are unlikely to operate out to the Project windfarm site.

8.8.3.2 Vessel Traffic

582 The primary data source for the analysis of vessel traffic is AIS data, an automatic vessel tracking system for the monitoring of vessel movements worldwide. The International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea (SOLAS) requires AIS to be fitted aboard international voyaging ships with 300 or more gross tonnage (GT), and all passenger ships regardless of size.

583 Commercial cargo and tanker AIS vessels tracks are shown in Figure 8.12. A number of shipping routes pass through the shipping and navigation Study Area. These are comprised primarily of vessels routeing to/from Dublin, Warrenpoint, Belfast and the Isle of Man to/from Heysham and Liverpool (Manchester).

584 Passage Plans are required for commercial vessels through either international resolution (IMO Resolution A.893(21)) for international shipping or national legislation for domestic commercial vessels. Passage plans are developed prior to a vessel commencing a passage and are detailed descriptions of a vessels route from start to finish including the intended route of the vessel (indicating positions of waypoints), key navigational features and hazards, and alternative routes options in the event of a change of plan is needed (either for operational or safety reasons).

585 Consultation was undertaken with key ferry companies operating in the vicinity of the site, which included the Isle of Man Steam Packet Company, Sea Truck and Stena Line. Through consultation, each ferry company provided their passage plans for their ferry routes that transit closest to the site (see Figure 8.13).

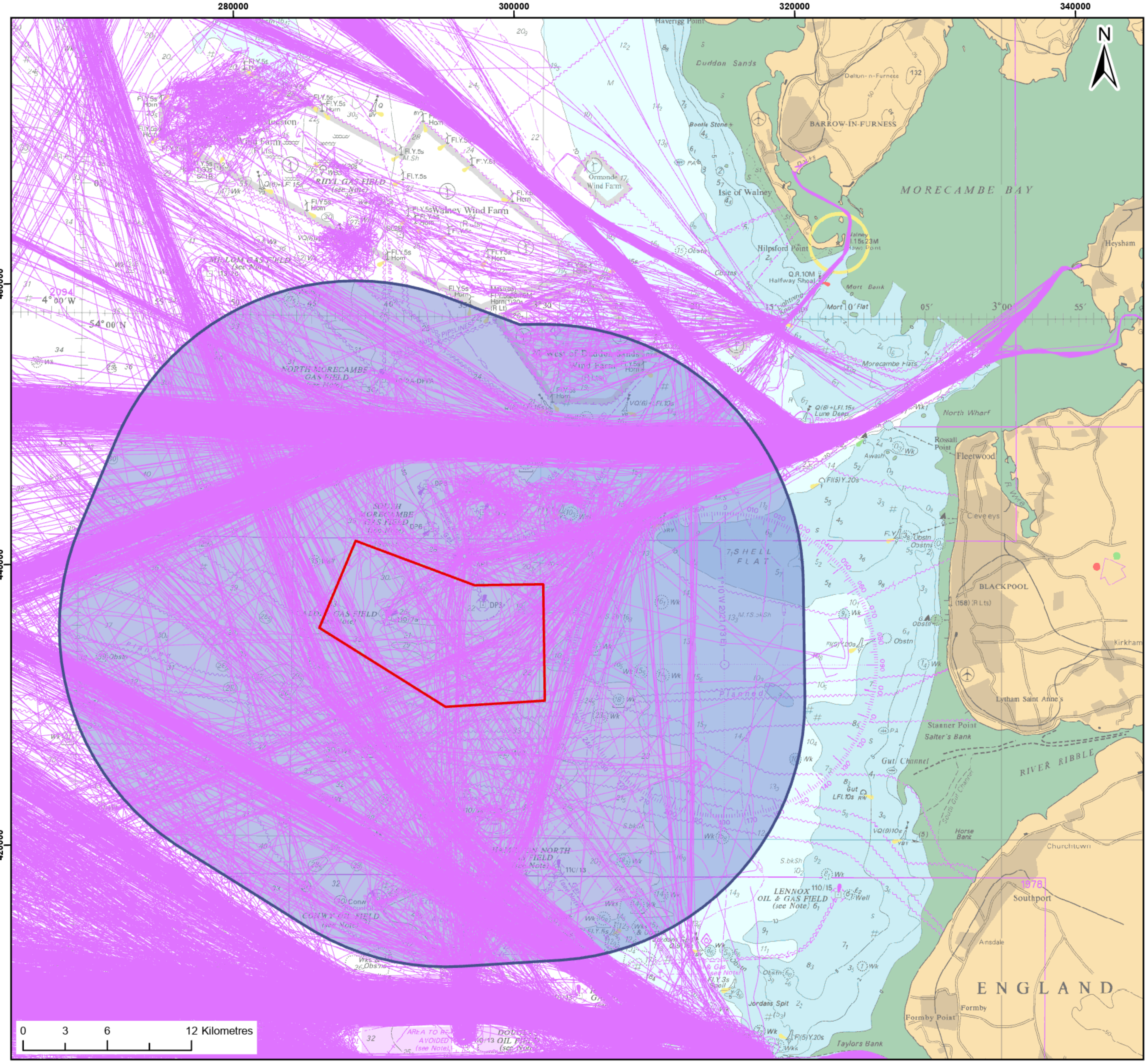
586 As can be seen from the analysis, one ferry route operates through the site – Stena Line Birkenhead to Belfast (North Route) and another route operates adjacent to the site – Isle of Man Steam Packet Company Birkenhead to Douglas. The Stena Line Birkenhead to Belfast route passes either to the north or south of the Isle of Man. When passing to the north, there are two possible routes - an inshore route that passes through the site and an offshore route that passes to the west of the site.

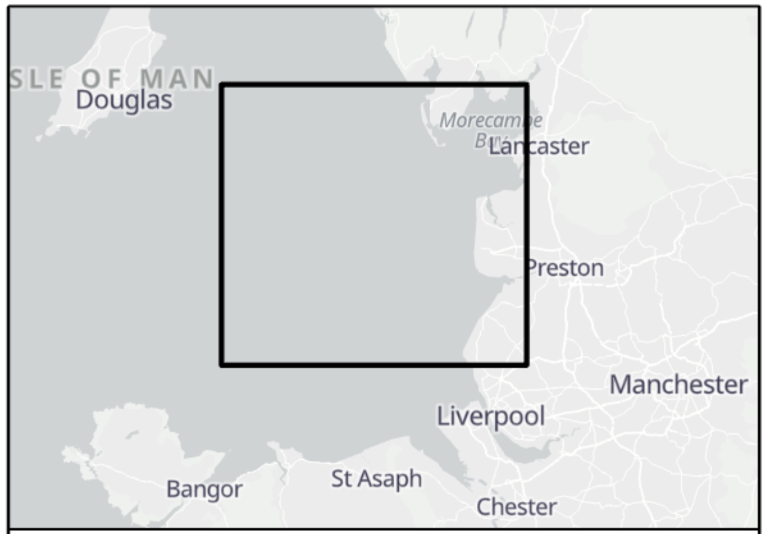
587 Whilst passage plan routes provide the detail of a planned passage, including waypoints a vessel will navigate to, it should be noted that tracks of vessels may deviate from the routes and waypoints for a number of different reasons, such as weather (vessel tracks may be offset by wind causing the vessel to navigate off the centre line of an intended route) and presence of other vessel traffic (e.g. vessels engaged in fishing in a particular area, or other commercial vessel navigating in the area).

588 The Automatic Information System (AIS) tracks of 'other' vessels, including port services vessels, dredgers, high-speed craft, Search and Rescue (SAR) and law enforcement vessels are shown in Figure 8.16. Vessels of this category within the shipping and navigation Study Area are primarily associated with the offshore windfarms located to the north, and oil and gas infrastructure.

589 The tracks of AIS carrying fishing vessels are shown in Figure 8.14 alongside Marine Management Organisation (MMO) Vessel Monitoring Systems (VMS) fishing effort data. Few AIS carrying fishing vessel transits are noted within the shipping and navigation Study Area. VMS fishing effort data indicates moderate fishing intensity within the shipping and navigation Study Area with the major commercial fishing areas located to the west and south west of the Isle of Man. Full RADAR traffic surveys will be undertaken to inform further assessments and to effectively map all (including non-AIS carrying) fishing vessel activity. Further information is contained in Section 8.8.

590 Recreational vessel transits of AIS carrying vessels are shown in Figure 8.15 overlaid on Royal Yachting Association (RYA) Coastal Atlas of recreational boating intensity data. Recreational vessel activity is greatest to the south of the windfarm site due to vessels navigating to/from clubs and marinas within the River Wyre and the Walney Channel. Full RADAR traffic surveys will be undertaken to inform further assessments to effectively map all, including non-AIS carrying, recreational vessel activity.





Legend:

Morecambe Offshore Windfarm Site

Shipping and Navigation Study Area

Anonymised AIS Derived Track Lines (2019)

Cargo and Tanker Vessel tracks

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Cargo and Tanker Vessel Tracks

Figure: 8.12	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0066				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:275,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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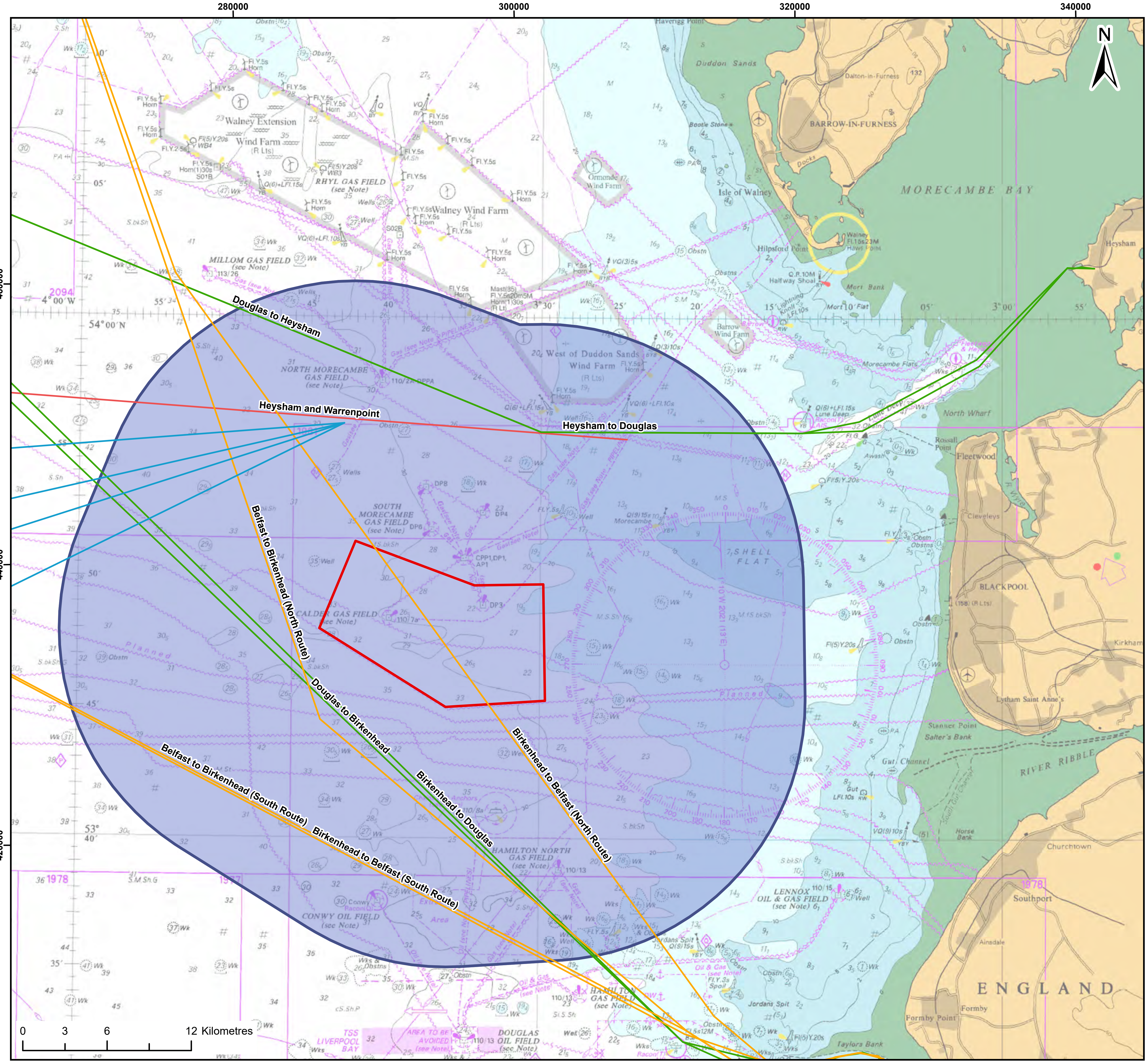

Legend:

- Morecambe Offshore Windfarm Site
- Shipping and Navigation Study Area

Passage Plan routes

- Sea Truck
- Sea Truck (Adverse Weather)
- Steam Packet
- Stena Line

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Passenger Vessel Tracks

Figure: 8.13 | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0067

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Co-ordinate system: WGS 1984 UTM Zone 30N

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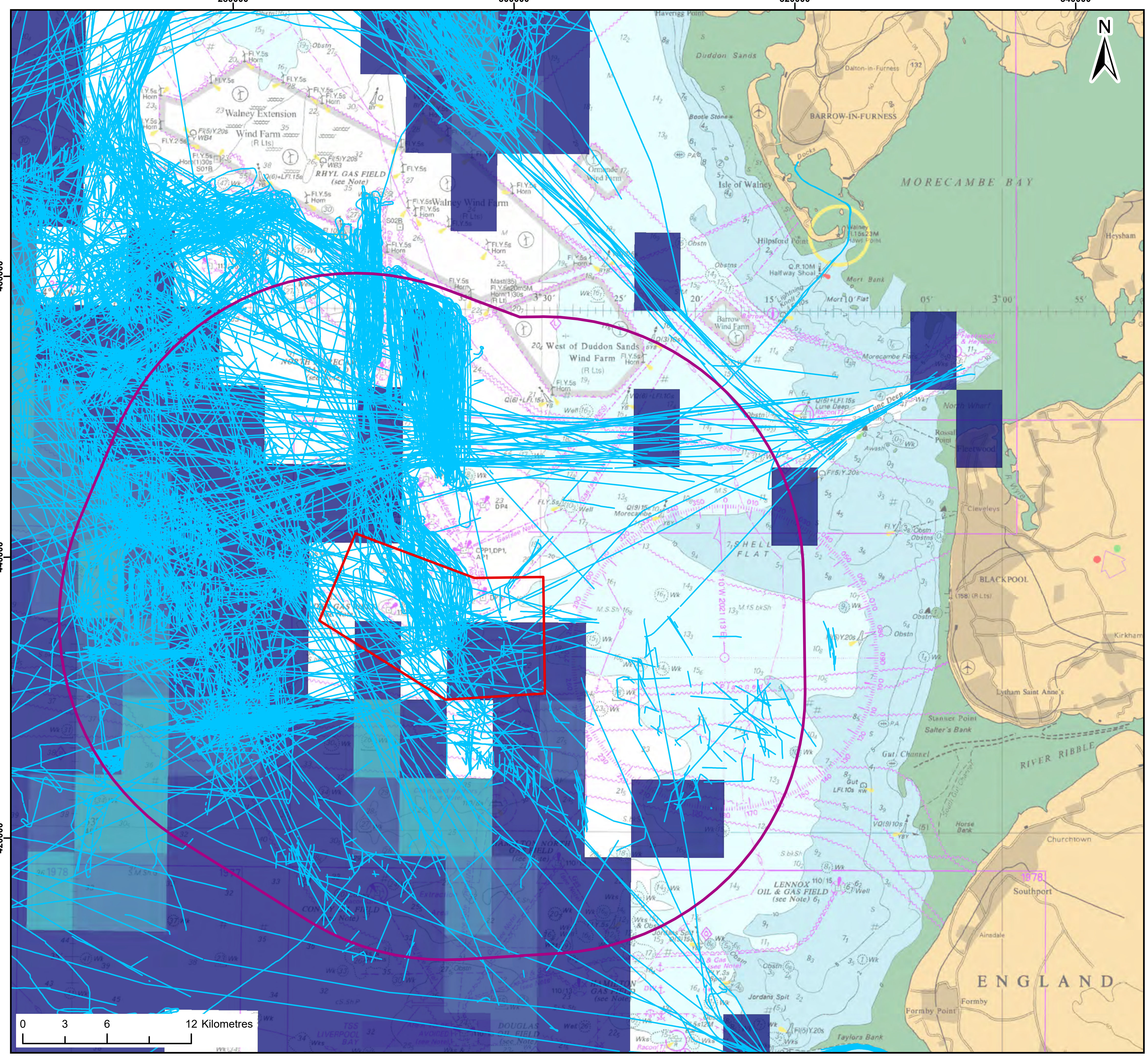

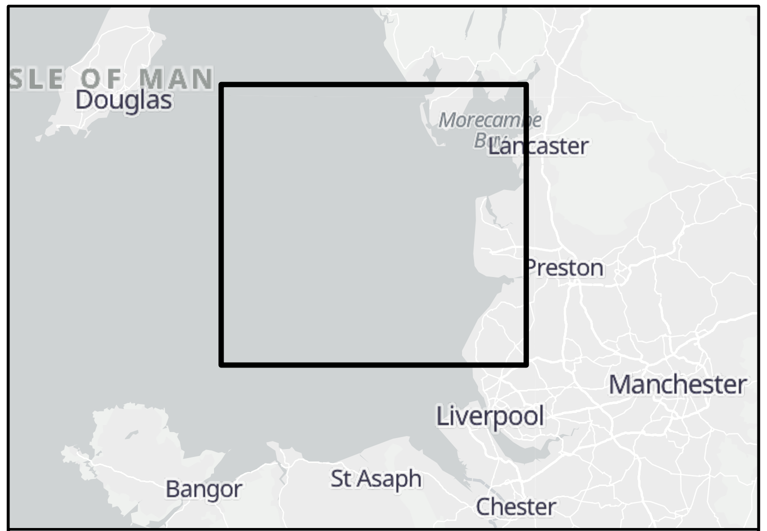

Legend:

- Morecambe Offshore Windfarm Site
- Shipping and Navigation Study Area

Anonymised AIS Derived Track Lines (2019)

- Fishing Vessel tracks

Total Value of >15m UK Vessel Landings, all gears (2019)

- > £0 - £10,000
- > £10,000 - £20,000
- > £20,000 - £40,000
- > £40,000 - £80,000
- > £80,000 - £160,000
- > £160,000 - £320,000
- > £320,000 - £640,000
- > £640,000 - £1.28 million
- > £1.28 - £2.56 million
- > £2.56 million

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Fishing Vessel Tracks Overlaid Over VMS fishing Intensity Grids

Figure: 8.14	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0068				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: WGS 1984 UTM Zone 30N

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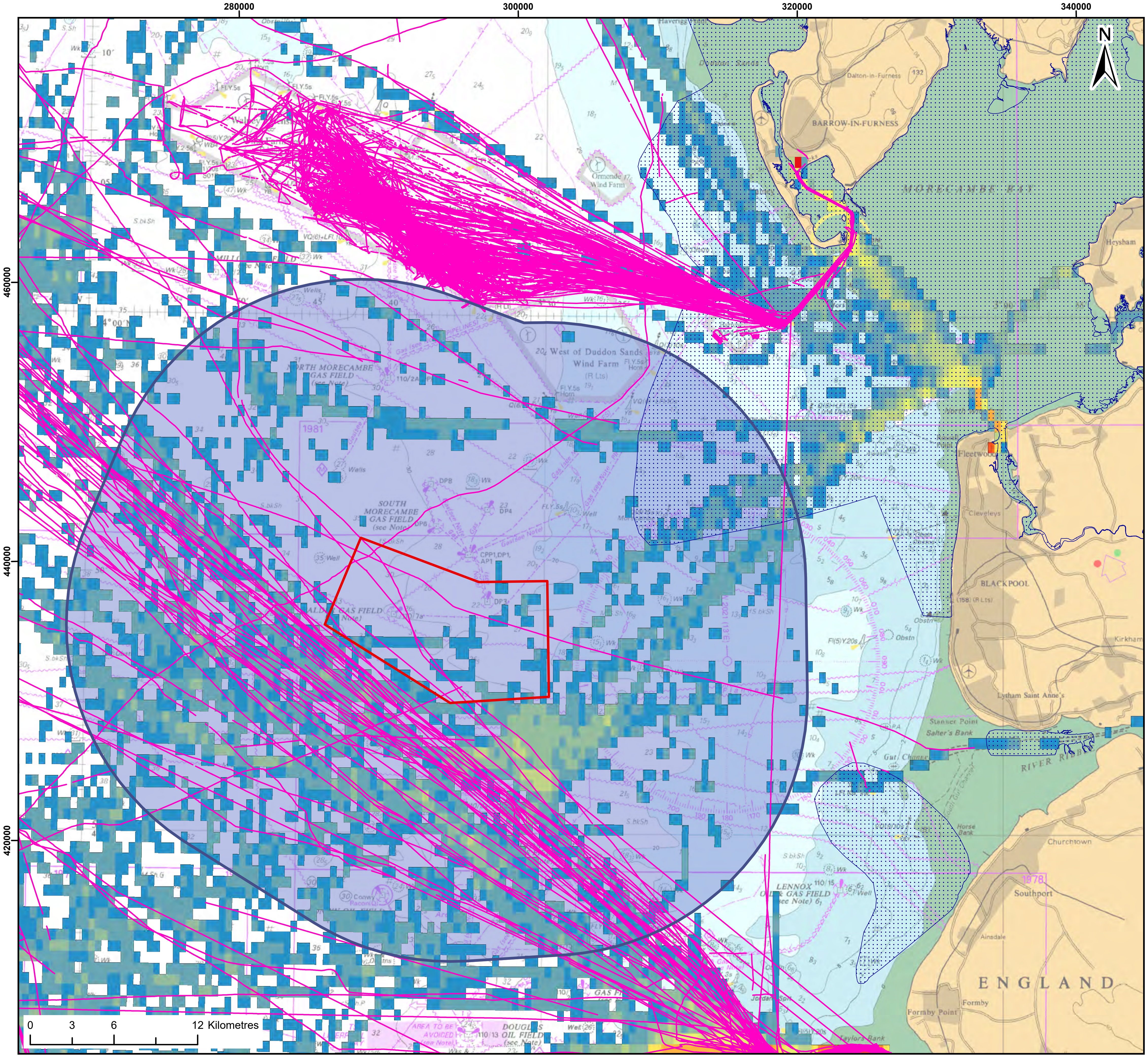

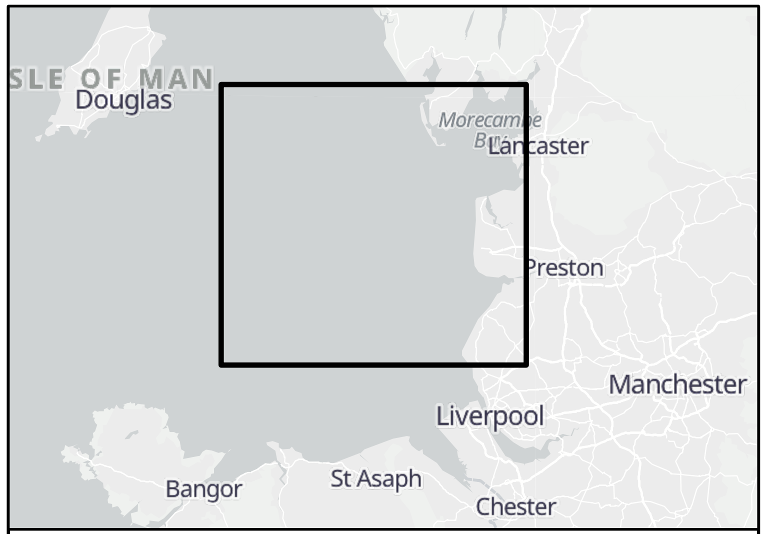

Legend:

- Morecambe Offshore Windfarm Site
- Shipping and Navigation Study Area

Anonymised AIS Derived Track Lines (2019)

- Recreational Vessel tracks
- General Boating Area

RYA UK Coastal Atlas of Recreational Boating AIS Intensity

- Low
- High

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Recreational Vessel Tracks Overlaid Over RYA Coastal Atlas

Figure: 8.15 Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0069

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:275,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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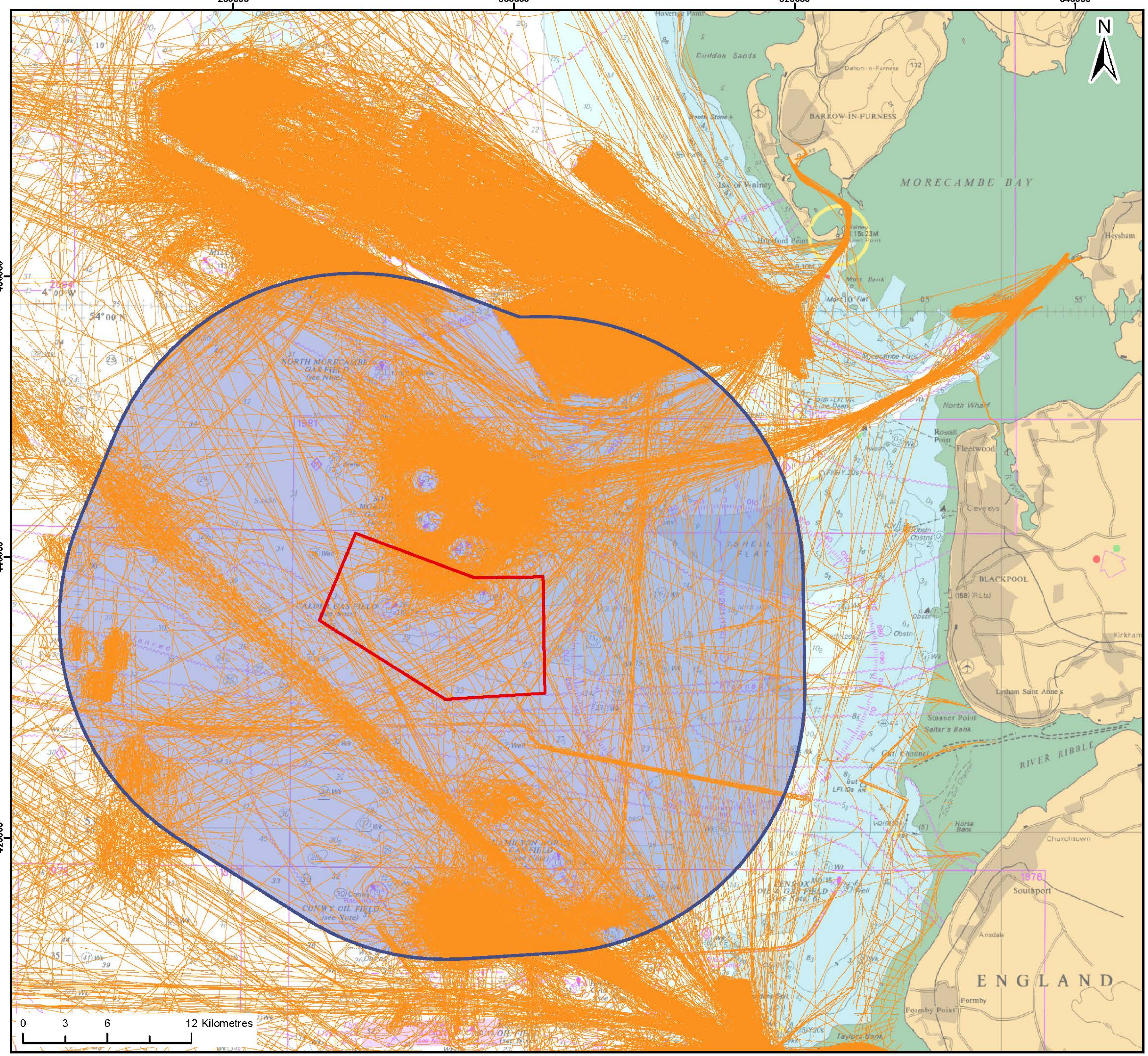

Legend:

Morecambe Offshore Windfarm Site

Shipping and Navigation Study Area

Anonymised AIS Derived Track Lines (2019)

Other Vessel Tracks

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Other Vessel Tracks

Figure: 8.16	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0070				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: WGS 1984 UTM Zone 30N

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8.8.3.3 Maritime Incidents

591 Royal National Lifeboat Institute (RNLI) data between 2008 and 2020 shows that one callout occurred within the windfarm site, a mechanical failure of a sailing vessel in 2011.

8.8.4 Approach to data collection

592 The data sources outlined in Table 8.26 have been analysed to establish the shipping and navigation baseline to inform the Scoping Report. It is intended that during the EIA, full analysis of the baseline sources (desk based) listed in Table 8.26 is completed.

Table 8.26 Data sources to inform the shipping and navigation assessment

Source	Duration	Description
UK Hydrographic Office (UKHO) Admiralty Charts No: 2010,1981,1320.	2020	Denoting natural and man-made features of significance to shipping and navigation
AIS Data	2017	Most recently available open source AIS data including all large commercial vessels (including passenger vessels), large fishing vessels and some recreational vessels allowing preliminary review of primary vessel routes. A further 28-day survey covering seasonal variations will be collected in 2022 to inform future assessments.
RNLI Call-out Data	2008 to 2020	All RNLI call outs, for any purpose, within the study area.
RYA UK Coastal Atlas of Recreational Boating	Summer 2014 and summer 2017	RYA heat map of AIS derived data including; general boating areas, clubs, marinas and training centres.
Transport for London (TfL) UK Port Ship Arrivals (Data derived from Lloyds List Intelligence / Maritime and Coastguard Agency)	2009 - 2020	UK wide port arrivals by cargo vessels (including passenger vessels)
MMO VMS data	2019	UK fishing monitoring data utilised by environmental and regulatory organisations to monitor commercial fishing vessel activities. Displayed by

Source	Duration	Description
		fishing effort per International Council for the Exploration of the Sea (ICES) rectangles.

593 In addition to the data sources outlined in Table 8.26 up to date AIS, RADAR and visual survey data will be acquired via two 14-day surveys (totally 28-days) survey to be undertaken in February 2022 and summer 2022 reflecting seasonal traffic variations. Survey approach and timings will be agreed in consultation with the Maritime and Coastguard Agency (MCA) in accordance with Marine Guidance Note (MGN) 654 to inform the EIA. The survey will be undertaken as two separate 14-day surveys, one in winter and one in summer to capture seasonal traffic variations. The RADAR and visual survey data will be utilised particularly to supplement the fishing and recreational vessel datasets, where reliance on AIS alone may underrepresent small vessel activities.

594 Marine Accident Investigation Branch (MAIB) incident data will additionally be reviewed to inform the EIA.

595 Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.8.5 Approach to impact assessment

596 The approach to assessment for shipping and navigation will be agreed with the MCA. A Navigation Risk Assessment (NRA) will be undertaken to inform the EIA process. The key guidance document that will be considered within the NRA will be MGN 654. The NRA will be undertaken in accordance with IMO Formal Safety Assessment (FSA) methodology (2018) and with due regard of the MCA's Methodology for Assessing Marine Navigational Safety (2021) as required by the MCA, to inform impact identification within the Preliminary Environmental Information Report (PEIR) and Environmental Statement (ES). The NRA will additionally identify mitigation measures aimed at reducing any unacceptable hazards to As Low As Reasonably Practicable (ALARP).

597 The NRA will be informed by stakeholder consultation, lessons learnt from other offshore windfarm projects, baseline data (including vessel traffic surveys, Section 8.8.4) and quantitative modelling to identify and assess key hazards.

8.8.6 Potential impacts

598 In line with regulations the EIA will consider impacts where there is a likely significant impact. The following section identifies effect-receptor pathways that may potentially lead to a significant impact. Where it is assessed that an effect-receptor pathway will not lead to a significant impact, a recommendation may be made for the impact be scoped out from assessment at EIA, ensuring a proportionate EIA approach.

599 Receptors are identified in Section 8.8.3.2 and include commercial vessels (cargo, tanker and passenger vessels, including ferries and cruise ships), fishing vessels (commercial and recreational), port and offshore services vessels (associated with the offshore industry), dredgers, high-speed craft, SAR vessels, law enforcement vessels, recreational vessels and vessels associated with the Project. The approach to the impact assessment and potential impacts will be discussed with relevant shipping and navigation consultees as the EIA is developed.

8.8.6.1 Potential impacts during construction

600 The primary impacts scoped in for further assessment at EIA during the construction phase are:

- Impact on collision risk (third-party vessel to third-party vessel/third-party vessel to construction vessel)
- Impact on contact (allision) risk (stationary project vessel or project infrastructure)
- Impacts on commercial vessel routeing (including poor weather routeing)
- Impact on anchor/fishing gear snagging risk
- Impact on SAR
- Impact on radar, communications and vessel navigation equipment

601 No identified shipping and navigation impacts are proposed to be scoped out during the construction phase.

Impact on collision and allision risk

602 Due to presence of Project infrastructure and vessel traffic associated with construction activities, there is potential for increased collision risk between both third party vessels and between third-party and project vessels. Contact (allision) risk with Project infrastructure, partially constructed structures or stationary vessels engaged in construction activities may also increase.

Impacts on commercial vessel routeing (including poor weather routeing)

603 The presence of the structures and construction safety zones may additionally impact existing vessel routeing including commercial shipping routes and potentially poor weather routeing (Figure 8.12 and Figure 8.13) and access to other marine infrastructure, for example oil and gas assets, potentially requiring deviations and altering transit times.

Impact on anchor/fishing gear snagging risk

604 The installation of cables/partially protected cables during construction may increase anchor and fishing gear snagging risk.

Impact on SAR

605 SAR emergency response capabilities may be impacted if adequate consideration is not given to the turbine layout. Turbine layouts must be designed to ensure safe transit of vessels (and aircraft) with consideration of multiple lines of orientation ensuring lines of sight are maintained in accordance with MGN 654 requirements. It should also be noted that as turbine design and size develop larger turbines are more widely spaced than turbines within existing windfarms. Structures and partially constructed structures should be appropriately marked as directed by Trinity House. Structure alignment in straight rows is preferred for the purposes of SAR.

Impact on radar, communications and vessel navigation equipment

606 Presence of the offshore infrastructure and construction vessels may impact on vessel radar, communications and navigation equipment.

8.8.6.2 Potential impacts during operation and maintenance

607 The primary impacts scoped in for further assessment at EIA during the operational phase are:

- Impact on collision risk (third-party vessel to third-party vessel/third-party vessel to maintenance vessel)
- Impact on contact (allision) risk (stationary project vessel or project infrastructure)
- Impacts on commercial vessel routeing (including poor weather routeing)
- Impact on anchor/fishing gear snagging risk
- Impact on SAR
- Impact on radar, communications and vessel navigation equipment

608 No identified shipping and navigation impacts are proposed to be scoped out during the operations and maintenance phase.

Impact on collision and allision risk and commercial vessel routeing (including poor weather routeing)

609 Impacts to shipping and navigation during the operation and maintenance phase may result from the presence of Project infrastructure and vessel traffic associated with maintenance activities potentially increasing collision risk between third party vessels, and third party and project vessels. The impact to contact (allision) risk may increase due to the presence of Project infrastructure and stationary vessels carrying out maintenance works. The presence of the structures and any safety zones (if required) may impact existing vessel routeing including commercial shipping routes and poor weather routeing (Figure 8.12 and Figure 8.13) and access to other marine infrastructure, for example oil and gas assets, potentially requiring deviations and altering transit times.

Impact on anchor/fishing gear snagging risk

610 Inter-array cables may increase impacts associated with anchor and fishing gear snagging and reduce the navigable depth in the event that adequate burial cannot be achieved.

Impact on SAR and radar, communications and vessel navigation equipment

611 Turbine layouts must be designed to ensure safe transit of SAR vessels (and aircraft) with consideration of multiple lines of orientation ensuring lines of sight are maintained in accordance with MGN 654 requirements. Additionally, the presence of the structures could impact on vessel radar, communications and navigation equipment.

8.8.6.3 Potential impacts during decommissioning

612 The potential impacts during decommissioning are anticipated to be similar to those described above for the construction phase although certain impacts will likely be reduced owing to experience of navigating in vicinity of the Project and along newly established routes where deviation was required.

8.8.6.4 Potential cumulative impacts

613 There may be potential for cumulative impacts to occur on shipping and navigation as a result of other activities (such as oil and gas operations). The project wide approach to assessment of potential cumulative impacts is set out in Section 7.7.

614 The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are

highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

615 The Cumulative Impact Assessment (CIA) will consider the potential for significant cumulative impacts to arise as a result of the construction, operation and decommissioning of the Project in the context of other developments that are existing, consented, or at application stage. These will be agreed in advance with relevant stakeholders. Existing developments form part of the baseline conditions.

616 Projects to be considered within the cumulative assessment may include:

- Other wind farm developments (which are not operational)
- Marine renewable energy developments, including the Project transmission assets
- Aggregate extraction and dredging licences
- Oil and gas platforms
- Potential port/harbour developments

617 The primary impacts for CIA assessment at EIA are likely to include:

- Impact on collision risk
- Impact on contact (allision) risk
- Impacts on commercial vessel routeing (including poor weather routeing)

618 Localised impacts of potential snagging risk (for example, those associated with the presence of the inter-array cables) are scoped out of the CIA as their impacts are of limited spatial influence.

8.8.6.5 Potential transboundary impacts

619 Given the international nature of shipping and navigation transboundary effects are possible. Commercial vessels on route to/from Dublin and Warrenpoint to/from Heysham and Liverpool transit through the study area. Further, there is a significant level of marine development being undertaken or planned in the Irish Sea that could cumulatively impact upon international routes. Consultation with stakeholders including commercial vessel operators will further inform the scope of the EIA transboundary assessment.

8.8.6.6 Summary of potential impacts

620 Table 8.27 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.27 Summary of impacts relating to shipping and navigation

Potential Impact	Construction	Operation and maintenance	Decommissioning
Impact on collision (third party to third party or third party to project vessel) risk	✓	✓	✓
Impact on contact (allision) risk	✓	✓	✓
Impact on vessel routeing	✓	✓	✓
Impact on snagging risk	✓	✓	✓
Impact on SAR	✓	✓	✓
Impact on marine navigation equipment	✓	✓	✓
Cumulative impact on collision risk (third party to third party or third party to project vessel)	✓	✓	✓
Cumulative impact on contact (allision) risk	✓	✓	✓
Cumulative impact on vessel routeing	✓	✓	✓
Cumulative impact on snagging risk	x	x	x
Cumulative impact on marine navigation equipment and SAR	x	x	x
Transboundary impacts	✓	✓	✓

8.8.7 Potential mitigation measures

621 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the PEIR, and ultimately the ES, are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

622 Examples of mitigation measures which should be considered include:

- Compliance with applicable national and international maritime law (mandatory legal requirement) including COLREGS (IMO, 1972), SOLAS (IMO, 1974) and MGN 654
- Appropriate lighting and marking agreed in consultation with Trinity House, MCA, and the Civil Aviation Authority (CAA) with consideration of IALA O-139 (IALA, 2013)
- Development of an Aid to Navigation (AtoN) Management Plan covering the construction phase secured through the Development Consent Order (DCO) and Deemed Marine Licence (DML) conditions
- Application for safety zones during the construction phase and during major maintenance
- Marine co-ordination and agreement of operational procedures for Project vessels transiting to and from site
- Layout agreement post-consent in consultation with the MCA with consideration of MGN 654 SAR requirements
- Promulgation of information, for example, via Notice to Mariners (NtM) providing advance warning of project activities and vessel movements to stakeholders
- Development of an Emergency Response Cooperation Plan (ERCoP) post-consent in consultation with the MCA
- Update of navigational charts including the windfarm area and cables prior to construction
- Cable burial / cable burial risk assessment (to be produced post-consent) and periodic monitoring to ensure under keel clearance and burial/protection remains adequate to reduce snagging risk to anchors and fishing gear
- Agreement of construction and post-construction monitoring arrangements with the MCA

623 The Applicant is committed to implementing these measures (noting they may evolve over the development process as the EIA progresses and in response to consultation), and also various standard sectoral practices and procedures. It is therefore considered that these measures are inherently part of the design of the Project.

624 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process.

8.9 Marine archaeology and cultural heritage

8.9.1 Introduction

625 This section considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on marine archaeological and cultural heritage receptors.

8.9.2 Study area

626 The existing baseline is described below considering both the near-field (within the windfarm site) and far-field (beyond the windfarm site as well as across the wider regional (seabed (Irish Sea)) environment. Together, this comprises the marine archaeology and cultural heritage Study Area, as shown on Figure 8.17.

8.9.3 Existing environment

627 An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

628 The marine archaeology and cultural heritage Study Area is characterised by its proximity to major shipping lanes around Liverpool Bay and the west coast of the UK mainland. The area of Liverpool Bay was largely all above water during the Palaeolithic period and is known to have been characterised by a landscape of open tundra and floodplains cut by numerous watercourses draining from the surrounding highlands into large shallow lakes (Fitch and Gaffney, 2011).

629 The post glacial environment was cold and dry, while some areas of ice may still have survived. The large floodplains would have supported grazing animals, such as the prehistoric giant elk *Megaloceros*. The area would have supported occupation and exploitation by early hominins (Dyfed Archaeological Trust, 2018).

630 It has been noted most of the offshore area in the Irish Sea is formed of Devensian glacial till covered in tens of metres of marine deposits (Fleming, 2005). However, the palaeoenvironmental analysis of boreholes undertaken c.30km east of the former proposed Rhiannon Windfarm (which was not ultimately taken forward as a development project), and in proximity to the Project windfarm site, recovered pollen sequences relating to the upper Palaeolithic (c. 34,000 BP (Before Present), an archaeologically important period). This suggests that isolated pockets of material from this date could survive in the Array Area site (Wessex Archaeology, 2011).

631 Palaeographic research of the Irish Sea and Liverpool Bay area has shown that the windfarm site is associated with shallower bathymetry than further west in the Irish Sea (Fitch and Gaffney, 2011). Additionally, the windfarm site is in proximity to the general position of the Mesolithic coastline dating to c.10,000 BP (Fitch and Gaffney, 2011). This area is more likely to contain submerged and buried coastal peaty sediments of higher archaeological potential. The potential for encountering preserved artefacts and archaeological material in general in the east of the Irish Sea and Liverpool Bay is also significantly higher. Finds of this nature could be of high archaeological importance.

632 Evidence of the Mesolithic in the Irish Sea and Liverpool Sea area and coastal regions comes from several sites along the coast including at Greasby, Irby, Holyoake, New Brighton, Heysham Head occupation site and Formby Point where over 145 footprints of humans and animal have been identified (Bailey et. al., 2020). Similarly, a human skeleton was located beneath peats in the Liverpool Bay area and radiocarbon-dated between 7,500 and 7,000 cal BP (calibrated years BP) (Bailey et. al., 2020).

633 By the Neolithic period, the Irish Sea and Liverpool Bay area had become inundated, with sea-levels around the UK having risen to a level approximate to their current position. As such, evidence from the Neolithic onwards is likely to be of an increasingly maritime nature. Examples of Neolithic log boats have been recorded in the UK and Ireland. Additionally, several Neolithic sites have been identified in the coastal regions at Oxton and Neston.

634 Liverpool, to the southeast of the marine archaeology and cultural heritage Study Area, was a major trading hub to Europe, North America and the West Indies following the expansion of the British Empire. It was a principal location for shipbuilding, sugar refining, the coal industry and the slave trade. As such, there is potential for vessels associated with this to be present within the marine archaeology and cultural heritage Study Area.

635 Similarly, a large number of vessels and aircraft were lost during both World Wars with remains possibly present within the marine archaeology and cultural heritage Study Area.

636 Within the marine archaeology and cultural heritage Study Area there are no nationally important wrecks protected under the Protection of Wrecks Act 1973. Likewise, there are no known wrecks or aviation crash sites protected under the Protection of Military Remains Act 1986.

637 Within the windfarm site there are a total of 3 UKHO records, as shown in Figure 8.17 and summarised below:

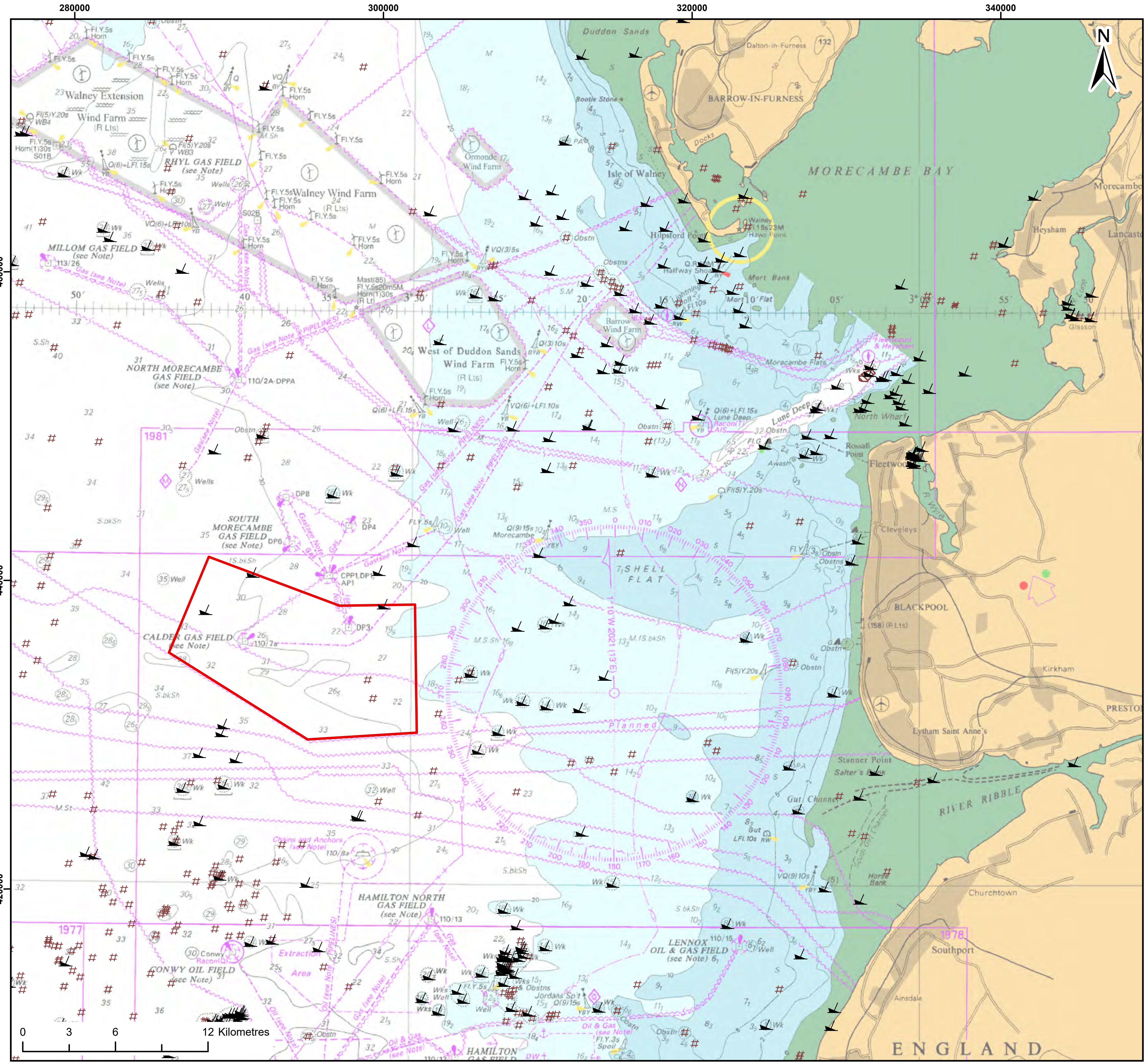
- One 'dead' wreck
- Two records described as 'foul ground'

638 Dead wrecks are defined as wrecks that have not been detected by repeated surveys, so are therefore considered not to exist. Although classified as dead, the potential for fragmentary or buried remains to exist at the latter recorded locations cannot be discounted. This may be because they have become dispersed or buried over time, and have therefore not been seen in survey data, possibly due to changes in sediment cover or degradation of remains. As such, they are retained archaeologically.

639 The highest concentrations of UK Hydrological Office (UKHO) records are towards the coasts of Fleetwood, Crosby, and Middleton. There is also potential for previously unrecorded wrecks, wreck remains, and aircraft remains to be present within the marine archaeology and cultural heritage Study Area.

640 The potential receptors that may be present within the marine archaeology and cultural heritage Study Area are summarised as:

- Palaeolandscape features and sub-seabed deposits of palaeoenvironmental interest
- Prehistoric occupation sites
- Wreck and aviation remains.



Legend:

- Morecambe Offshore Windfarm Site
- Obstruction
- Obstruction
- Wreck

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Recorded Wrecks and Obstructions

Figure: 8.17	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0071				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: WGS 1984 UTM Zone 30N

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8.9.4 Approach to data collection

8.9.4.1 Data sources

641 The data sources that will be accessed to characterise the existing historic environment with respect to marine archaeology and cultural heritage are set out in Table 8.28 below.

Table 8.28 Data sources to inform marine archaeology and cultural heritage assessment

Data source	Data contents
UKHO	Records of wrecks and obstructions data including 'dead' and salvaged wrecks that are no longer charted as navigational hazards.
British Geological Survey (BGS)	Historic borehole logs and the wider geological background for the region.
National Historic Seascape Characterisation	GIS data and character texts for the Historic Seascape Character (HSC) of coastal and marine areas around England, mapped through a series of projects funded by Historic England and consolidated into a single national database.
Existing archaeological studies and published sources	Background information on the archaeology of the Irish Sea and Liverpool Bay, including the results of archaeological assessments carried out for Celtic Array Offshore Wind Farm, Rhiannon Wind Farm, Walney 1, 2 and Walney Extension, West of Duddon Sands, and recent work undertaken in the wider Irish Sea.
West Coast Palaeolandscapes Survey	Study mapping submerged landscapes contained within an area of the Irish Sea using wide variety of seismic data sources.

642 In addition to the data presented in Table 8.28 the data presented in Table 8.29 will be collected for the EIA assessment.

Table 8.29 Proposed baseline surveys

Data set	Spatial coverage	Survey timings
Geophysical (multibeam echosounder, side scan sonar & sub bottom profiling) survey	Windfarm site	Completed in 2021

Data set	Spatial coverage	Survey timings
Geotechnical (Cone Penetration Testing (CPT), vibrocore and borehole) surveys	Windfarm site	2022/2023
Grab sampling and drop-down video	Windfarm site	Completed in 2022

643 The marine geophysical survey data, has been and is currently being archaeologically assessed by MSDS Marine Ltd. This is in accordance with industry good practice set out in available guidance such as Marine Geophysics Data Acquisition, Processing, and Interpretation (Historic England, 2013).

644 The data acquired consisted of Side Scan Sonar (SSS), Sub Bottom Profiler (SBP), Magnetometer (Mag) and Multi-beam bathymetry. The SSS was acquired at 100% coverage with other data acquired on the same lines. An audit of the data collected has been undertaken by MSDS Marine. This was to determine the coverage, quality, and the appropriateness of the data for archaeological assessment to inform the Environmental Impact Assessment (EIA) process. This concluded that the data is considered to be of an appropriate specification, coverage, and quality, to undertake a robust archaeological assessment to inform the EIA process.

645 Regarding geotechnical investigations if any engineering led boreholes are undertaken, allowance will be made for archaeological involvement in the planning of the survey and the samples will be made available for geoarchaeological assessment by a qualified and experienced archaeological contractor if required.

646 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.9.5 Approach to impact assessment

647 The specific assessment requirements for marine archaeology and cultural heritage are in accordance with the overarching National Policy Statement (NPS) for Energy (EN-1) and NPS for Renewable Energy infrastructure (EN-3), and with the draft versions that have been published for consultation.

648 The marine archaeology assessment will be informed by the interpretation of the geophysical survey data (bathymetry and Side Scan Sonar (SSS) data to identify seabed features, such as wrecks, magnetometry data to identify magnetic anomalies and SBP data to identify palaeolandscape features).

649 A marine Archaeological Desk-Based Assessment (ADBA) will be undertaken to establish the baseline for both known and potential heritage assets within the windfarm site based upon the desk-based sources listed in Table 8.28. This may include a review of heritage assets which may require a setting assessment.

650 The ADBA and assessment of geophysical data will be used to identify a strategy for mitigation including the avoidance of identified heritage assets through the application of Archaeological Exclusion Zones where appropriate. Additional mitigation measures are further discussed in Section 8.9.6.6.

651 The methodology of the assessment will also take account of guidance including:

- Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development (JNAPC and The Crown Estate 2006)
- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology 2007)
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology 2008)
- Chartered Institute for Archaeologists' Standard and Guidance for Historic Environment Desk-Based Assessments (2014a) and Code of Conduct (2014b)
- Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) (2021)
- Institute of Environmental Management and Assessment (IEMA) Principles of Cultural Heritage Impact Assessment (2021)

652 Consideration of the Project is based on a 'Project Design Envelope' (PDE) approach following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018). The utilisation of a PDE is intended to identify key design parameters for the Project, setting out a realistic 'worst case scenario' for the different elements within the windfarm site, in order for this to be assessed.

8.9.6 Potential impacts

653 A range of potential impacts on marine archaeology and cultural heritage have been identified which may occur during the construction, operation and

maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

654 Heritage assets may be affected by direct physical changes or by changes to their setting (Historic England, 2015b).

655 Direct impacts to heritage assets present on the seafloor, or buried within seabed sediments, may result in damage to, or the destruction of, any archaeological material, or the relationship between that material and the wider environment (stratigraphic context or setting). Relationships between archaeological material and the wider environment are crucial to developing a full understanding of such material. These impacts may occur if heritage assets or material are present within the footprint of the proposed scheme (i.e., foundations or cables) or from construction related activities (i.e., seabed preparation and vessel anchoring).

656 There is also the potential for the project to change the local and regional hydrodynamic and sedimentary process regimes directly and indirectly as outlined in Section 8.1.6. Changes in physical processes can lead to the re-distribution of erosion and accretion patterns. For example, changes in tidal currents may affect the stability of nearby morphological and archaeological features. Indirect impacts to heritage assets may occur if buried heritage assets become exposed to increased wave/tidal action, as these will deteriorate farther than assets protected by sediment. Conversely, if increased sedimentation results in an exposed site becoming buried, it may add some protection and considered a beneficial impact.

657 Impacts to the significance of a heritage asset may also occur if a development changes the setting of the asset (the surrounding in which the heritage assets is located, experienced, and appreciated).

658 Similarly, historic character may also be affected if the proposed scheme results in a change to the prevailing character of the area and/or alters perceptions of the seascape.

8.9.6.1 Potential impacts during construction

659 Potential impacts during construction on archaeological and cultural heritage receptors include:

- Direct impacts to heritage assets
- Indirect impacts to heritage assets associated with changes to marine physical processes

- Change to the setting of heritage assets, which could affect their heritage significance
- Change to character which could affect perceptions of the HSC

Direct impacts

660 Direct impacts may occur if archaeological material is present within the footprint of the proposed development (e.g., cabling, foundations, footprint of jack-up vessels).

Indirect impacts

661 Indirect impacts to heritage assets may occur if the physical presence of construction vessels and offshore infrastructure impacts the hydrodynamic regime. Similarly, if seabed preparation associated with foundation and cable installation leads to localised effects upon sedimentary processes this could lead to indirect impacts to heritage assets. Similarly, indirect impacts to heritage assets may occur through cable protection measures such as rock dumping. This could lead to heritage assets being covered and crushed.

Change to the setting/character of heritage assets

662 There would also be potential for impacts to the setting of heritage assets and to the historic seascape character from the presence of vessels associated with the installation of offshore infrastructure.

8.9.6.2 Potential impacts during operation and maintenance

663 Potential impacts during operation and maintenance on archaeological and cultural heritage receptors include:

- Direct impacts to heritage assets
- Indirect impacts to heritage assets associated with changes to marine physical processes
- Change to the setting of heritage assets, which could affect their heritage significance
- Change to character which could affect perceptions of the HSC

Direct impacts

664 Direct impacts may occur if archaeological material is present within the footprint of works required for routine maintenance activities which disturb the seabed (for example, seabed contact by legs of jack-up vessels and/or anchors). Similarly, this can occur in exceptional circumstances such as the replacement of cabling.

665 However, given the areas where such activities would be undertaken would already have been disturbed during construction, there would be limited further impact.

Indirect impacts

666 Indirect impacts to heritage assets may occur if the physical presence of the installed infrastructure impact the hydrodynamic or sedimentary regime. This includes the potential for increased scour around foundations.

Change to the setting/character of heritage assets

667 There would also be potential for impacts to the setting of heritage assets and to the historic seascape character from the presence of the installed infrastructure and ongoing maintenance activities.

8.9.6.3 Potential impacts during decommissioning

668 If cables and foundations are left in place there would be no potential for direct impact. However, if these and other infrastructure needed to be removed there would be potential for direct impacts. Direct impacts to heritage assets may occur if the cables, foundations and turbines infrastructure are removed. This is not anticipated as any remains at the locations of the installed infrastructure will already have been impacted/mitigated during the construction phase.

669 If archaeological material is present within the footprint of jack-ups or vessel anchors deployed during decommissioning activities, direct impacts may also occur.

8.9.6.4 Potential cumulative impacts

670 There may be potential for cumulative impacts to occur on marine archaeology and cultural heritage receptors as a result of other activities (such as oil and gas operations). The Project wide approach to assessment of potential cumulative impacts is set out in Section 7.7.

671 Offshore wind projects and other activities relevant to the assessment of cumulative impacts on marine archaeology and cultural heritage receptors will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

672 Individual heritage assets would not be subject to cumulative direct impacts from other known plans or projects as there would be no physical overlap of different infrastructure as individual assets are discrete. However, although individual assets may be discrete, taken together they could have collective heritage significance. For example, if several vessels are known to have been lost in the same event across a large area the individual vessels could be impacted by different projects. As the vessels are known to have been lost in the same event, they would have a collective heritage significance. Therefore, multiple impacts upon similar assets could occur cumulatively.

673 In addition, there is potential for multiple developments to affect the larger-scale archaeological features such as palaeolandscapes. The setting of heritage assets and the historic seascape character of the Irish Sea may also be affected.

674 There is also the potential for cumulative indirect impacts associated with changes to marine physical processes. There is, therefore, the potential for cumulative impacts to heritage assets.

8.9.6.5 Potential transboundary impacts

675 Direct transboundary impacts may occur during construction if wrecks or aircraft of non-British nationality are subject to impact from development. Such wrecks may fall within the jurisdiction of another country, and may include, for example, foreign warships lost in UK waters. Similarly, where palaeolandscapes within the Irish Sea cross international boundaries, direct transboundary impacts may occur.

676 Indirect transboundary impacts, associated with changes to marine physical processes, where those changes cross an international boundary, are not expected to occur as the proposed scheme is located well within the UK Economic Exclusion Zone (EEZ) boundary. As such it is proposed to scope out indirect transboundary effects on Marine Archaeology and Cultural Heritage.

8.9.6.6 Summary of potential impacts

677 Table 8.30 outlines the impacts which are proposed to be scoped into the EIA. This may be refined through the Evidence Plan Process (EPP) as additional information and data become available. The specific approach to impact assessment will be discussed through the EPP and this approach will be detailed in the PEIR.

Table 8.30 Summary of impacts relating to marine archaeology and cultural heritage.

Potential Impact	Construction	Operation and maintenance	Decommissioning
Direct impacts to heritage assets	✓	✓	✓
Indirect impacts to heritage assets associated with changes to marine physical processes	✓	✓	✓
Change to the setting of heritage assets, which could affect their heritage significance	✓	✓	✓
Change to character which could affect perceptions of the HSC	✓	✓	✓
Cumulative impacts	✓	✓	✓
Transboundary impacts (direct)	✓	✓	✓
Transboundary impacts (indirect)	x	x	x

8.9.7 Potential mitigation measures

678 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the PEIR, and ultimately the ES, are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

679 Examples of mitigation measures which are likely to be considered include:

- Preparation of Written Scheme of Investigation (WSI) (of which an outline will be submitted with the DCO application) and Protocol for Archaeological Discoveries (PAD) in consultation with Historic England setting out process and procedures to be put in place on discovery of any marine archaeological features during construction, operation and maintenance or decommissioning. Where more detailed surveys of potential anomalies are required post-consent but pre-construction, these would need to be carried out in accordance with the WSI and PAD.

- Archaeological Exclusion Zones (AEZs), as outlined in the Outline Offshore WSI, will be implemented to protect any known and identified marine archaeological receptors
- Avoidance of known wrecks or identified heritage sites through final wind turbine generator layout and routing and application of standard mitigation measures
- More detailed geophysical and geotechnical survey acquisition and assessment may be required post-consent e.g. using remotely operated vehicles (ROVs) for investigations of anomalies of potential archaeological interest (usually undertaken as part of Unexploded Ordnance (UXO) clearance) to confirm nature and potential heritage importance/value of any anomalies identified from the review of the geophysical data
- Commitment to undertake a full archaeological review and assessment of all relevant geophysical and geotechnical data collected pre-construction

680 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process.

8.10 Civil and military aviation

8.10.1 Introduction

681 This section considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on civil and military aviation.

682 Wind turbine generators have the potential to cause a variety of adverse effects on aviation interests. They can cause issues for the radars used by civilian and military air traffic controllers because the characteristics of moving turbine blades are similar to those of aircraft, leading to spurious returns, or clutter, on radar displays. This can affect the safe provision of air traffic services. Wind turbine generators can also present a physical obstruction for aviation activities such as military low flying.

8.10.2 Existing environment

683 An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

8.10.2.1 Civil aviation

684 The UK civil airport nearest to the windfarm site is Blackpool Airport, which is approximately 31km east of the windfarm site. Walney Airport is 37km to the north-east and Isle of Man Airport is 65km north-west of the windfarm site, while to the south-east are Liverpool Airport (63km), Hawarden Airport (73km) and Manchester Airport (93km). These airports are shown in Figure 8.18.

685 Airports with published Instrument Flight Procedures (IFPs) have associated Minimum Sector Altitudes (MSAs). An MSA defines the minimum safe altitude an aircraft can descend to above all objects located in the area contained within a sector of a circle of radius 25 nautical miles, approximately 46km. These Sectors provide obstacle clearance protection of at least 1,000ft to aircraft within that area. This allows pilots of aircraft flying under Instrument Flight Rules the reassurance of properly designated obstacle and terrain clearance protection whilst making an approach and landing at an airport in poor weather. The Blackpool Airport MSA extends over the windfarm site and is 2,000ft above mean sea level (AMSL).

686 Isle of Man, Liverpool, Hawarden, and Manchester are airports equipped with primary surveillance radars (PSRs). A preliminary radar line of sight (RLoS) analysis indicates that the Isle of Man PSR would have visibility of all wind turbine generators within the windfarm site while the Hawarden PSR would have visibility across more than a third of the windfarm site. Preliminary

analysis indicates that the Liverpool and Manchester PSRs would not detect wind turbine generators within the windfarm site.

687 The airspace above and adjacent to the windfarm site is used by civil and military aircraft and lies within the London Flight Information Region (FIR) for air traffic control, the airspace regulated by the UK Civil Aviation Authority (CAA), as shown in Figure 8.19.

688 From sea level to Flight Level (FL) 195, approximately 19,500ft AMSL, the airspace is Class G uncontrolled airspace. This airspace is used predominantly by low-level flight operations and generally by aircraft flying under Visual Flight Rules (VFR). Under VFR flight the pilot is responsible for maintaining a safe distance from terrain, obstacles, and other aircraft.

689 To the north and south of the windfarm site are two Transponder Mandatory Zones (TMZs), Walney TMZ to the north and Burbo Bank TMZ to the south, as shown in Figure 8.19. Within a TMZ the carriage and operation of aircraft transponder equipment is mandatory. The TMZs are in the vicinity of two large offshore windfarms and are used to mitigate the impact the associated wind turbine generators on PSRs. The establishment of a TMZ over the windfarm site is one of a number of potential mitigation measures to be considered during the Project design process.

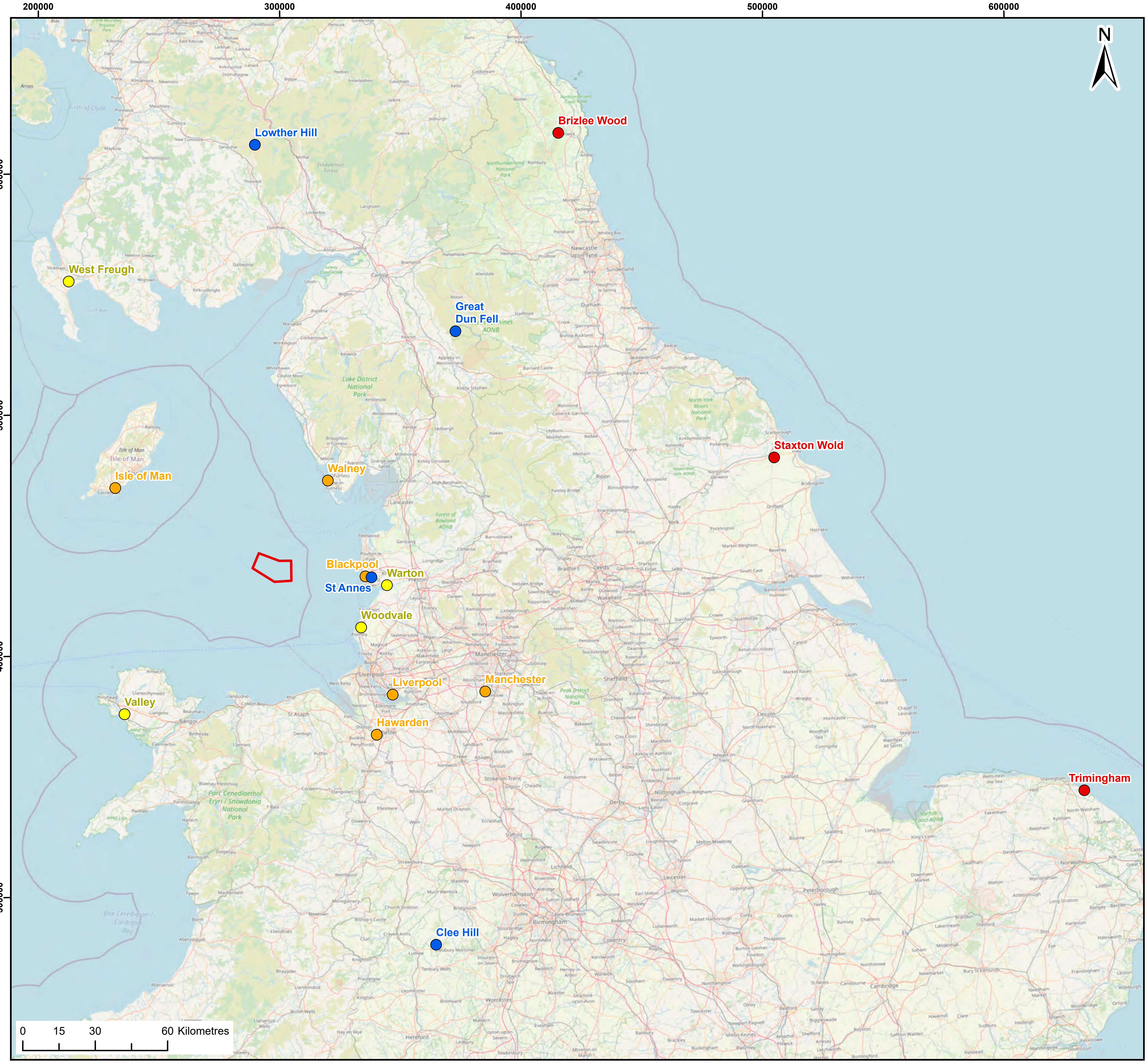
690 Above FL195 is Class C controlled airspace in the form of a Temporary Reserved Area (TRA), as shown in Figure 8.19. This airspace, TRA 004, has an upper vertical limit of FL245, approximately 24,500ft AMSL, and is available for use by both military and civil aircraft, though its main use is to accommodate VFR military flying activity. The Holyhead Control Area, which lies between 4km and 6km to the west and south of the windfarm site, is also Class C controlled airspace from a minimum level of FL45, approximately 4,500ft AMSL, up to FL195. Embedded within this airspace are multiple Air Traffic Service routes connecting the Manchester, Birmingham and London regions with the Isle of Man and Northern Ireland.

691 The boundary of the London FIR with the Shannon FIR (regulated by the Irish Aviation Authority (IAA)) lies 116km to the west of the windfarm site at its nearest point.

692 NATS (En Route) plc (NERL) provides en-route civil air traffic services within the London FIR. NERL operates a network of radar facilities which provide en route information for both civil and military aircraft. The closest NERL radars to the windfarm site are based at St Annes, 33km to the east, Great Dun Fell, 117km to the north-east, Clee Hill, 162km to the south, and Lowther Hill, 169km to the north.

693 Preliminary RLoS analysis indicates that all wind turbine generators within the windfarm site would be visible to St Annes radar. Great Dun Fell radar would have visibility of wind turbine generators within the eastern extent of the windfarm site while Lowther Hill radar would have turbine visibility within the western extent. The preliminary analysis indicates that Clee Hill radar would not detect wind turbine generators within the windfarm site. NERL radar facilities are combined PSR and Secondary Surveillance Radar (SSR) systems. NATS do not consider the impact of wind turbine generators on SSR to be material or relevant for wind turbine generators that are beyond 15NM, approximately 28km, from their SSR facilities. Furthermore, the CAA Civil Aviation Publication (CAP) 764: Policy and Guidelines on Wind Turbines (CAA, 2016) states that wind turbine effects on SSR *"... are typically only a consideration when the turbines are located very close to the SSR i.e. less than 10km."* The nearest SSR facility, at St Annes, is 33km from the windfarm site and therefore SSR is scoped out from further analysis.

694 In summary, the civil radars that have been identified as being potentially impacted by wind turbine generators within the windfarm site are the PSRs at Isle of Man and Hawarden airports, and the NERL facilities at St Annes, Great Dun Fell and Lowther Hill.



Legend:

- Morecambe Offshore Windfarm Site
- Air Defence Radars
- Civil Airports
- Military Airfields
- NERL Radars

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Airports and Radars within the Aviation Study Area

Figure: 8.18 | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0072

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Co-ordinate system: WGS 1984 UTM Zone 30N

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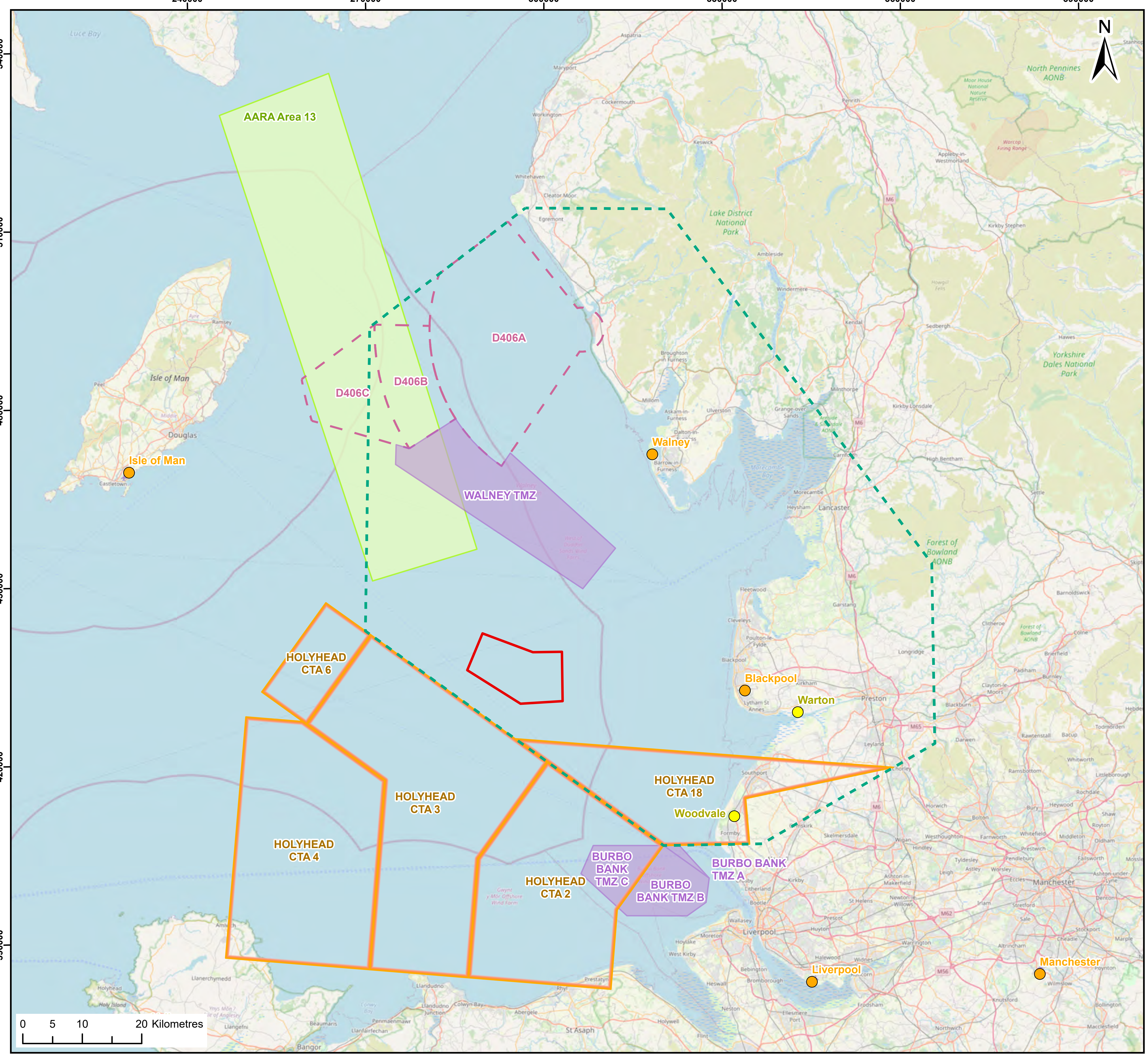

Legend:

- Morecambe Offshore Windfarm Site
- Air to Air Refuelling Area
- Holyhead Control Area
- Eskmeals Danger Area
- Transponder Mandatory Zones
- Warton Advisory Radio Area
- Military Airfields
- Civil Airports

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Airspace within the Aviation Study Area

Figure: 8.19 | Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0073

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Co-ordinate system: WGS 1984 UTM Zone 30N

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8.10.2.2 Military aviation

695 The only military radar that has been identified as being potentially impacted by wind turbine generators within the windfarm site is the PSR at Warton Aerodrome.

696 The nearest PSR-equipped military airfields to the windfarm site are Warton Aerodrome, 40km to the east, and Royal Air Force (RAF) Valley, 81km south-west. A PSR is also installed at Ministry of Defence (MoD) West Freugh, a weapons range that is 138km north-west of the windfarm site. Preliminary RLoS analysis indicates that Warton PSR would have visibility of all wind turbine generators within the windfarm site while neither the Valley nor West Freugh PSRs would detect any turbines.

697 RAF Woodvale is 35km south-east of the windfarm site and does not have a radar facility.

698 The MSA associated with Warton Aerodrome published IFPs extends over the windfarm site and is 1,800ft AMSL.

699 The windfarm site is within the Warton Advisory Radio Area. Considerable test flight activity is undertaken within this airspace, which exists between FL95, approximately 9,500ft AMSL, and FL190, approximately 19,000ft AMSL. Such flights will receive a radar service from Warton.

700 To the north of the Walney TMZ are the Eskmeals Danger Areas D406A, D406B and D406C, within which ordnance, munitions and explosives, and unmanned aircraft system activities take place. It is unlikely that these activities will be impacted by the Project due to their distance, more than 28km, from the windfarm site.

701 An Air-to-Air Refuelling Area, designated Area 13, with vertical limits of FL150, approximately 15,000ft AMSL, to FL240, approximately 24,000ft AMSL, is approximately 14km north-west of the windfarm site at its closest point.

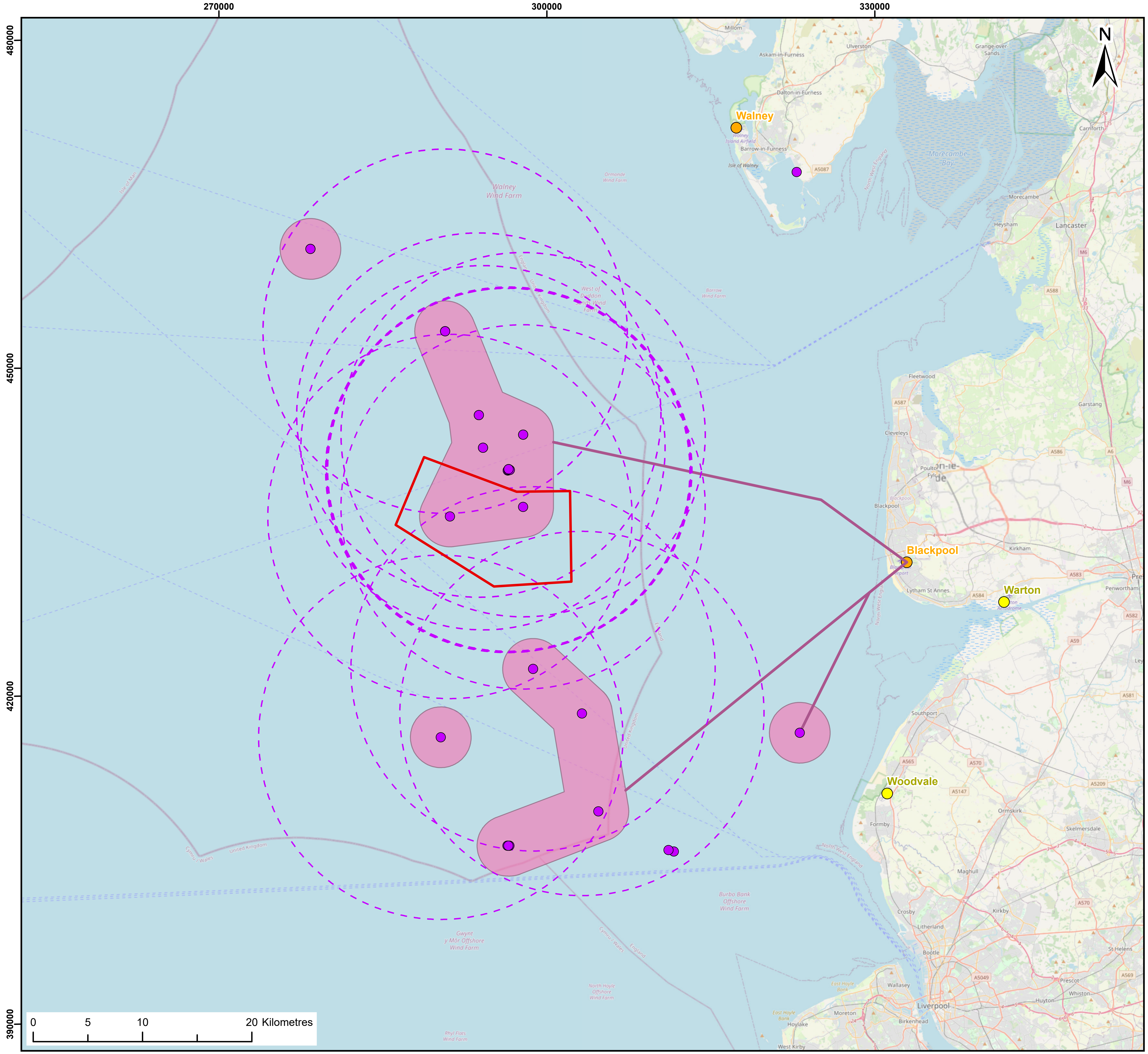
702 The nearest MOD air defence radars to the windfarm site are based at Remote Radar Head (RRH) Staxton Wold, 205km to the east, RRH Brizlee Wood, 209km to the north-east, and RRH Trimingham, 342km to the south-east. Preliminary RLoS analysis indicates that these radars would not have visibility of wind turbine generators within the windfarm site.

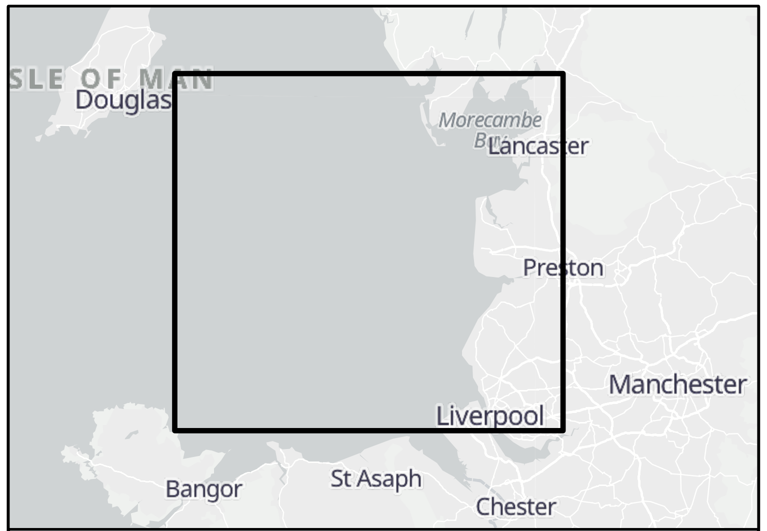
8.10.2.3 Offshore helidecks

703 To help achieve a safe operating environment, a 9NM consultation zone for planned obstacles exists around offshore helicopter destinations, as shown on Figure 8.20. Within 9NM, obstacles such as wind turbine generators can

potentially impact upon the feasibility of helicopters to safely fly low visibility or missed approach procedures at the associated helideck site. There are ten platforms within 9NM of the windfarm site, two of which, Calder CA1 and South Morecambe DP3, are inside the windfarm site boundary (however, the DP3 platform no longer has an operational helideck). As stated in CAP 764, a document which details CAA wind turbine policy and guidelines, this zone does not prohibit development, but is a trigger for consultation with offshore helicopter operators, the operators of existing installations and exploration and development locations to determine a solution that maintains safe offshore helicopter operations alongside proposed developments. The CAA advises wind energy lease holders, oil and gas developers, and petroleum licence holders to discuss their development plans with each other to minimise the risks of unanticipated conflict.

704 Helicopter Traffic Zones (HTZs) are established around the Morecambe Bay and Liverpool Bay gas fields to notify of helicopters engaged in platform approaches, departures and inter-platform transits. The HTZ airspace is from sea level to 2,000ft AMSL and extends to 1.5NM from the platform helidecks. Bi-directional routes are established for helicopter support flights from Blackpool Airport to these HTZs, with a normal operating height of 1,000ft AMSL. Whilst these routes have no official classification in airspace terms, they are published on aeronautical charts to alert other airspace users to the potential for frequent low-level helicopter traffic.





Legend:

- Morecambe Offshore Windfarm Site
- Helicopter Traffic Zone Routes
- Helicopter Traffic Zones
- 10NM Buffer of Offshore Platforms
- Oil and Gas Surface Infrastructure
- Military Airfields
- Civil Airports

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Oil and Gas Infrastructure and associated Airspace within the Aviation Study Area

Figure: 8.20	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0074				
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8.10.3 Approach to data collection

705 The primary source of aviation related data to be used during desk-based studies in support of the EIA is the UK Aeronautical Information Publication (AIP). The AIP contains details on airspace and en-route procedures as well as charts and other air navigation information It is intended that during the EIA, full analysis of the baseline sources (desk based) listed in Table 8.31 is completed.

Table 8.31 Data sources to inform the civil and military aviation assessment

Source	Summary
CAP) 032: UK AIP (CAA, 2021)	Contains information on facilities, services, rules, regulations, and restrictions in UK airspace.
CAP 168: Licensing of Aerodromes (CAA, 2019)	Sets out the standards required at UK licensed aerodromes relating to management systems, operational procedures, physical characteristics, assessment and treatment of obstacles, and visual aids.
CAP 437: Standards for Offshore Helicopter Landing Areas (CAA, 2021)	Provides the criteria applied by the CAA in assessing offshore helicopter landing areas for worldwide use by helicopters registered in the UK.
CAP 670: Air Traffic Services Safety Requirements (CAA, 2019)	Highlights the requirements to be met by providers of civil air traffic services and other services in the UK in order to ensure that those services are safe for use by aircraft.
CAP 764: Policy and Guidelines on Wind Turbines (CAA, 2016)	Details the CAA policy and guidelines associated with wind turbine impacts on aviation that aviation stakeholders and wind energy developers need to consider when assessing a development's viability.
CAP 1616: Airspace Change (CAA, 2021)	Explains the CAA's regulatory process for changes to airspace.
CAP 2038A00: Air Navigation Order 2016 (CAA, 2021)	Sets out the Rules of the Air and includes the application of lighting to wind turbine generators in UK territorial waters (articles 222 and 223).
UK Military AIP (MOD, 2021)	The main resource for information and flight procedures at all military aerodromes.

Source	Summary
MOD Obstruction Lighting Guidance (Low Flying Operations Flight, 2020)	Includes requirements for the lighting of offshore developments.
MCA Marine Guidance Note (MGN) 654: Safety of Navigation: OREIs – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2021)	Highlights issues to consider when assessing navigational safety and emergency response, caused by Offshore Renewable Energy Installation (OREI) developments.

706 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.10.4 Approach to impact assessment

707 The Environmental Impact Assessment (EIA) process will be supported by further desk-based studies, including Radar Line of Sight (RLoS) modelling, that will identify and examine in greater detail sensitive aviation and radar receptors. Studies will be undertaken in parallel with consultation with relevant stakeholders to provide a detailed understanding of potential impacts. It is expected that consultation will be an iterative process, allowing for any concerns that are raised to be considered in the wind farm design optimisation process. Stakeholders to be consulted include NATS and the MoD, together with the Air Navigation Service Providers at the airports whose radars and IFPs are potentially impacted, including Blackpool, Hawarden, Isle of Man and Warton.

708 The assessment for civil and military aviation and radar will consider the Project Design Envelope (PDE, following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)) and establish a topic specific and receptor led realistic 'worst case scenario' upon which the assessment will be made. The worst case scenario will be outlined in the PEIR.

8.10.5 Potential impacts

709 In both construction and operational phases wind turbine generators have the potential to affect civil and military aviation (fixed-wing and helicopters), either through their physical dimensions limiting access and affecting safeguarding or safe passage, or through their effects on PSRs.

710 The creation of a new obstacle environment increases the risk of collision for military low flying aircraft, helicopters in support of the oil and gas industry, and Search and Rescue operations.

711 Radar impacts are caused by the characteristics of rotating wind turbine generator blades being similar to aircraft, leading to spurious clutter on radar displays.

712 Helicopter traffic due to planned activities in support of the Project may raise the overall level of air traffic in the area and increase the likelihood of aircraft-to-aircraft collision. However, all pilots would be expected to fly in compliance with the Rules of the Air regulations as stated in the UK Air Navigation Order (CAA, 2012), and any increase in air traffic would be managed by the existing Air Traffic Services infrastructure provided in accordance with regulatory requirements.

8.10.5.1 Potential impacts during construction

713 Potential impacts during construction on civil and military aviation and radar include:

- Impacts on civil and military PSR systems
- Creation of an aviation obstacle environment for civil and military aircraft due to tall crane vessels and wind turbine generators
- Increased air traffic in the area related to wind farm activities

714 Potential impacts on civil and military aviation and radar during the construction phase are associated with the presence of tall crane vessels and recently erected fully or partially constructed structures, increasing the risk of collision with low-flying aircraft, extending aircraft routing to avoid obstructions, and causing permanent interference on civil and military radars.

715 Before the operation phase wind turbine generator blades will be mainly stationary, but not always as they need to be rotated to maintain their bearings. Therefore, a potential impact on civil and military radars is possible.

716 Helicopter traffic associated with the construction phase increases the likelihood of aircraft-to-aircraft collision.

8.10.5.2 Potential impacts during operation and maintenance

717 Potential impacts during operation and maintenance on civil and military aviation and radar include:

- Impacts on civil and military PSR systems

- Creation of an aviation obstacle environment for civil and military aircraft due to tall crane vessels and wind turbine generators
- Increased air traffic in the area related to wind farm activities

718 Potential impacts on civil and military aviation and radar during operation are associated with the presence of wind turbine generators increasing the risk of collision with low-flying aircraft, extending aircraft routing to avoid obstructions, and causing permanent interference on civil and military radars.

719 Helicopter traffic associated with maintenance activities during operation increases the likelihood of aircraft-to-aircraft collision.

720 As identified in construction impacts, the proximity of Blackpool airport gives rise to potential effects during operation which will be assessed in the EIA.

8.10.5.3 Potential impacts during decommissioning

721 Potential impacts on civil and military aviation and radar during the decommissioning phase are similar to those during construction and are associated with the presence of tall crane vessels and partially dismantled structures, increasing the risk of collision with low-flying aircraft, and extending aircraft routing to avoid obstructions.

722 Helicopter traffic associated with the decommissioning phase increases the likelihood of aircraft-to-aircraft collision.

723 The blades of decommissioned wind turbine generators will cease rotating, therefore radar impacts will gradual be reduced until the last wind turbine generator ceases operation.

8.10.5.4 Potential cumulative impacts

724 There may be potential for cumulative impacts to occur on civil and military aviation and radar as a result of other activities. The Project wide approach to assessment of potential cumulative impacts is set out in Section 7.7.

725 Offshore wind projects and other activities relevant to the assessment of cumulative impacts on civil and military aviation and radar will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

726 The cumulative assessment will consider the impacts in combination with other offshore windfarms and associated aviation activities, including increased collision risk and cumulative impacts on radar.

8.10.5.5 Potential transboundary impacts

727 The airspace around the array is used by international civil aviation and is adjacent to the Shannon FIR. However, the potential impacts of wind turbine generators on aviation are localised and the distance between the windfarm site and the FIR boundary is 119km. The Project is beyond the 60NM range of Ireland's PSRs and is outside the IAA's area of responsibility. As such, transboundary impacts will not exist. It is proposed that transboundary impacts are scoped out of the EIA.

8.10.5.6 Summary of potential impacts

728 Table 8.32 summarises the potential impacts to be scoped into the EIA.

Table 8.32 Summary of impacts relating to civil and military aviation

Potential Impact	Construction	Operation and maintenance	Decommissioning
Impacts on civil and military PSR systems	✓	✓	✓
Impacts on SSR systems	x	x	x
Creation of an aviation obstacle environment for civil and military aircraft due to tall crane vessels and wind turbine generators	✓	✓	✓
Increased air traffic in the area related to wind farm activities	✓	✓	✓
Cumulative impacts on civil and military radar systems	✓	✓	✓
Cumulative creation of an aviation obstacle environment for civil and military aircraft	✓	✓	✓
Transboundary impacts	x	x	x

8.10.6 Potential mitigation measures

729 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the PEIR, and ultimately the ES, are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

730 Examples of mitigation measures which are likely to be considered include:

- Technological solutions (e.g. radar blanking)
- Implementing aids to navigation (including lighting) deployed in line with latest available industry guidance as advised by NLB, MCA, CAA and MOD
- Application of latest available industry guidance as advised by NATS and the CAA
- Potential change to the designation of the airspace above the array area through agreement with the CAA. For example, the raising of MSAs or the establishment of a TMZ
- An Offshore Decommissioning Plan will be developed post consent and implemented

731 Potential mitigation measures for civil and military aviation will be consulted upon with stakeholders throughout the EIA process and will also reflect appropriate measures that are being discussed at an industry level.

8.11 Infrastructure and other users

8.11.1 Introduction

732 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on infrastructure and other users. This section considers infrastructure and other users within the Irish Sea and interactions with industries not already covered as EIA topics in their own right. Commercial fisheries (Section 8.7) and Shipping and Navigation (Section 8.8) are not covered within this section.

8.11.2 Study area

733 The study area for infrastructure and other users is a 50km radius from the windfarm site as shown in Figures 8.21 and 8.22.

8.11.3 Existing environment

734 An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

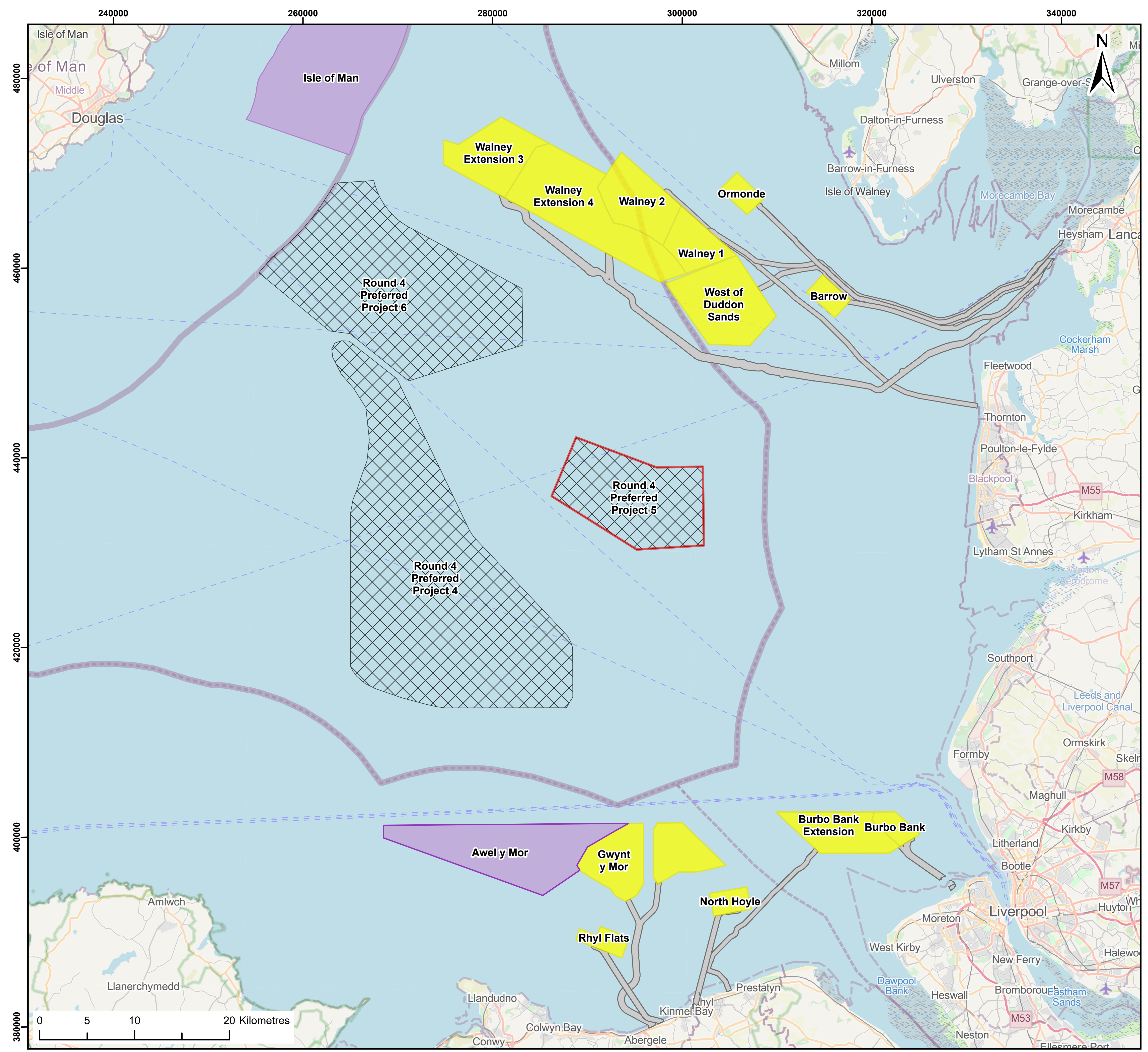
8.11.3.1 Offshore wind infrastructure

735 Offshore wind developments (at pre consent stage to operational) in the vicinity (50km buffer) of the windfarm site are summarised in Table 8.33 and shown on Figure 8.21.

Table 8.33 Offshore windfarm projects within 50km of the Project

Offshore windfarm	Distance from Morecambe windfarm site (km)
Mona (Consortium of EnBW and bp)	8.9
Morgan (Consortium of EnBW and bp)	11.2
West of Duddon Sands	12.9
Walney Extension 4	18.4
Walney 1	20.3
Barrow	21.0
Walney 2	22.1
Walney Extension 3	26.4
Ormonde	27.0
Gwynt y Mor	28.9

Offshore windfarm	Distance from Morecambe windfarm site (km)
Awel y Mor	28.9
Burbo Bank Extension	29.1
Burbo Bank	33.4
North Hoyle	36.3
Isle of Man	38.3
Rhyl Flats	40.0



Legend:

- Morecambe Offshore Windfarm Site
- Offshore Wind Cable Agreements

Wind farm status

- Active/In Operation
- Pre-planning Application
- Preferred Project – Subject to HRA

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Offshore Windfarm Projects within 50km of the Project

Figure: 8.21		Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0075			
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Co-ordinate system: WGS 1984 UTM Zone 30N

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8.11.3.2 Oil and gas infrastructure

736 There are a number of offshore oil and gas fields present in the region. The windfarm site overlaps with the Morecambe South Gas Fields (Morecambe South CPC active gas platforms and DP3 are owned and operated by Spirit Energy) and the Calder Gas Field (Calder CA1 is owned by Harbour Energy and operated by Spirit Energy). These fields are supported by offshore infrastructure (platforms, pipelines, cables and wells) and onshore facilities for extracting, transporting and processing reserves. The wells and pipelines associated with these fields overlap with the windfarm site.

737 An AfL with the Crown Estate was awarded for the Gateway Gas Storage Facility in 2018, which covers offshore rights in the east of the Irish Sea for a 1.5 billion cubic metres (bcm) salt cavern gas storage facility. It is proposed that natural gas is stored in artificially created salt caverns, connected to the shore at Barrow-in-Furness via a pipeline. No development activities have taken place to date and the storage facility is located to the south of the windfarm site with no direct overlap.

738 ENI UK Limited (Eni) were awarded a carbon dioxide (CO2) appraisal and storage licence (CS licence). CS licence covers an area located within the Liverpool Bay area of the East Irish Sea. Under the CS licence, Eni plans to reuse and repurpose depleted hydrocarbon reservoirs (the Hamilton, Hamilton North and Lennox fields) and associated infrastructure to permanently store CO2 captured in north west England and north Wales. These fields are located to the south of the windfarm site and there is no direct overlap.

739 A number of developers for oil and gas may have a requirement to undertake seismic surveys, to identify sub surface geological structures that might hold reserves of oil and gas and to further site investigation.

740 The HRA undertaken for the offshore oil and gas licensing 31st seaward round (BEIS, 2019) noted that none of the indicative work programmes for the Irish Sea region included the option to conduct 3D seismic survey, with activity restricted to drilling and well evaluation (e.g. site survey, vertical seismic profiling, rig and vessel movement, possible conductor piling).

8.11.3.3 Sub-sea cables

741 The Irish Sea has a significant number of cables, primarily telecommunication connections between the UK and the Isle of Man and Ireland, as well as numerous export cables from existing offshore windfarms.

742 A live telecommunication cable, GTT/Hibernia Atlantic, traverses the windfarm site in a west-east direction and the southern boundary of the windfarm site

follows the Lanis-1 telecommunication cable which connects the Isle of Man to the Lancashire coast, coming ashore to the south of Blackpool.

743 The Isle of Man/UK Interconnector, operated by Manx Electricity Authority, crosses to the north of the windfarm site in a west–east direction and there is also an out of service cable located to the south of this. Numerous export cables from offshore windfarms, come ashore in proximity to the windfarm site.

8.11.3.4 Dumping, disposal and aggregate sites

744 There are no aggregate licences nor disposal or dumping sites in proximity to the windfarm site.

8.11.3.5 Ministry of defence activities

745 There is no overlap with known practice and exercise areas (PEXA) and the windfarm site. Eskmeals (D406) PEXA Danger area (the closest PEXA to the Project) is approximately 28km north of the windfarm site at its nearest point.

746 There is also potential for wartime UXO within the Irish Sea. Exact locations of any UXO would be determined post-consent and mitigation agreed in consultation with Natural England and MMO.

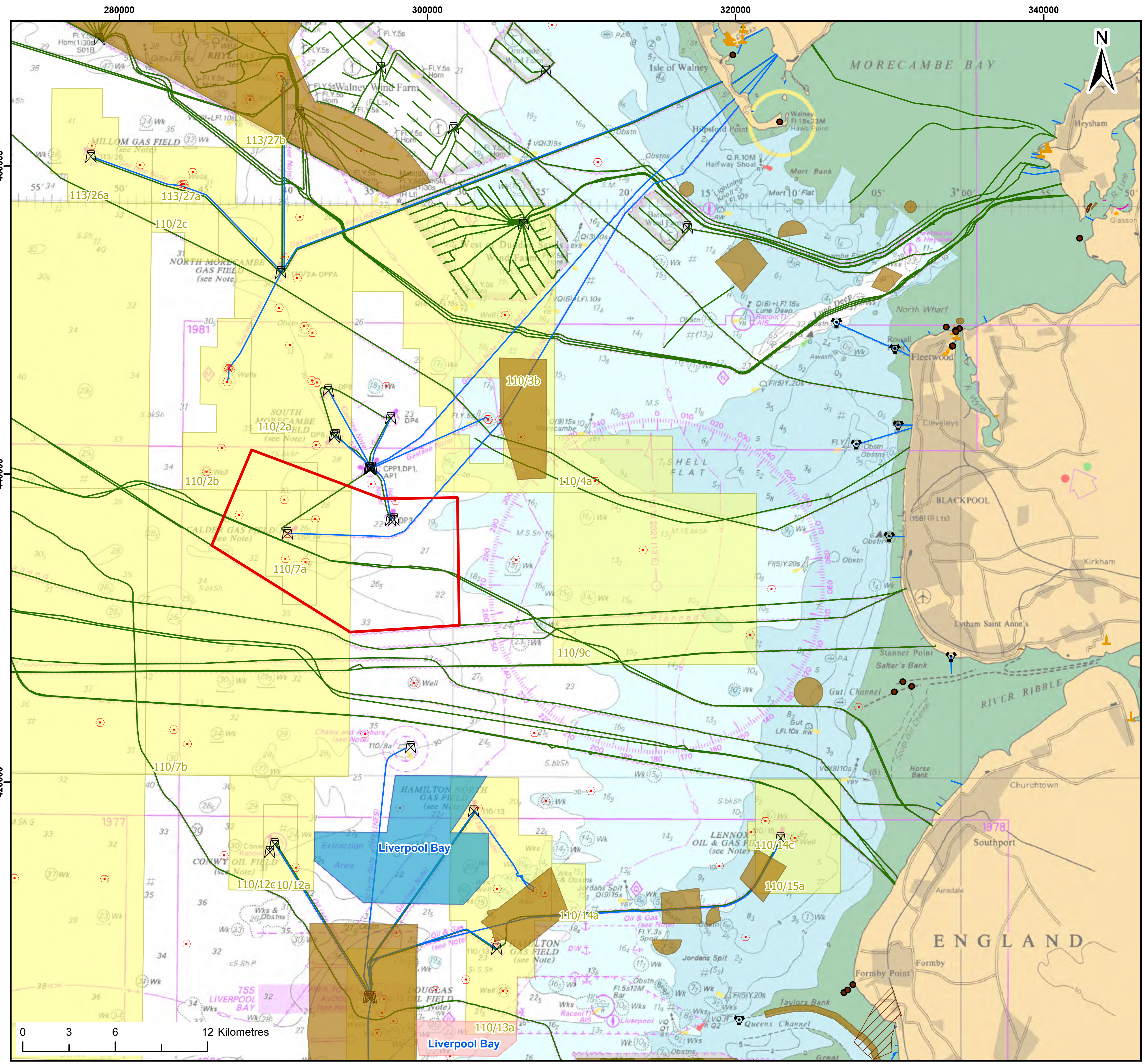
8.11.3.6 Nuclear power stations

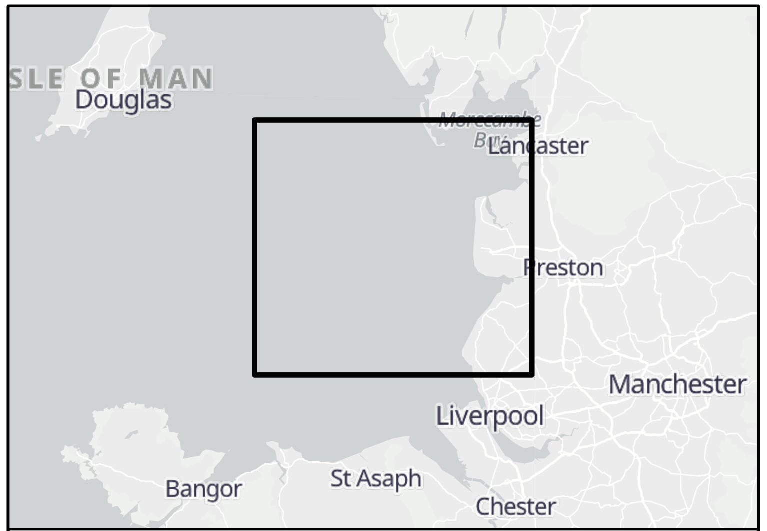
747 Three nuclear power stations are found along the coastline of the Irish Sea; Heysham in Morecambe, Sellafield and Calder Hey on the Cumbrian coast. There is no overlap with any infrastructure that could result in impacts on or from these facilities.

8.11.3.7 Tourism and recreation

748 The Irish Sea is a popular recreational boating area with cruising and racing routes from between points on the English, Welsh, Scottish and Irish coasts as well as to and from the Isle of Man. The Royal Yachting Association (RYA) atlas (RYA, 2019) identifies low intensity routes across the Irish Sea and boating areas along the coastline.

749 Recreational fishing in the area includes shore anglers, private boat anglers and commercial charter boat operators with shellfish collection particularly along the nearshore areas in Morecambe Bay. Commercial charter boats are vessels that can be hired by recreational anglers for fishing trips. There are four registered charter boats in the English north west region and several more registered in the north Wales coast. Further information on commercial fishing can be found in Section 8.7.





Legend:

	Morecambe Offshore Windfarm Site		Diffuser
	Harbour facility		Harbour facility
	Marine farm/culture		Offshore platform
	Subsea cable		Pile
	Fishing facility		Wellhead
	Harbour facility		Oil & Gas Licensed Blocks
	Pipeline		Disposal Sites
			Military PEXA Danger Areas

Minerals & Aggregates Site Agreements

- Exploration and Option Area
- Production Agreement Area

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Offshore Activities

Figure: 8.22	Drawing No: PC1165-RHD-ZZ-OF-DR-Z-0076				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	18/01/2022	JT	GC	A3	1:250,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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8.11.4 Approach to data collection

750 The Infrastructure and Other Users assessment will be informed by the latest GIS datasets such as those shown in the Figures 8.21 and Figure 8.22. Where there is potential for interactions with other users, the Applicant will liaise with the relevant infrastructure owners/operators. Relevant GIS datasets include:

- Oil & Gas Authority (2021) – Licenced blocks
- CEFAS (2021) – disposal sites
- The Crown Estate (2021) – aggregate sites
- UK Hydrological Office (2021) – PEXA areas
- Marine Themes (2021) – all other infrastructure and other users data
- Potential for UXO will be initially established through geophysical surveys pre consent and pre-construction surveys will be undertaken to identify exact locations and numbers of confirmed UXO.

751 Data analysis will be corroborated and expanded upon by consultation with relevant stakeholders. Consultation will not only seek to validate the baseline, but also to identify any other additional data sources and understand stakeholder concerns to inform the impact assessment. Further information regarding consultation is provided in Section 3.

8.11.5 Approach to impact assessment

752 The specific assessment requirements for infrastructure and other users are in accordance with the overarching NPS for Energy EN-1 and NPS for Renewable Energy infrastructure (EN-3), and with the draft versions that have been published for consultation.

753 The Applicant will undertake consultation with all relevant developers, operators and marine users within the vicinity of the windfarm site to ascertain any concerns relating to the Project. Any areas of concern will be identified and considered within the EIA. However, it is likely that any impacts will either be non-significant or able to be fully mitigated after consultation with the relevant parties as discussed above.

754 The EIA will be based on existing data and supplementary information gathered through consultation. The EIA will focus on the windfarm site and consider infrastructure or users that overlap with these boundaries. The assessment will consider agreed or best practice mitigation.

755 Consideration of the Project is based on a 'Project Design Envelope' (PDE) approach following the guidelines from Planning Inspectorate Advice Note

Nine: Rochdale Envelope (2018). The utilisation of a PDE is intended to identify key design parameters for the Project, setting out a realistic 'worst case scenario' for the different elements within the windfarm site, in order for this to be assessed.

8.11.6 Potential impacts

756 A range of potential impacts on infrastructure and other users have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.11.6.1 Potential impacts during construction

757 Potential impacts during construction on infrastructure and other users include:

- Potential impacts on other windfarms or developments/activities
- Potential impacts on oil and gas infrastructure and future exploration
- Physical impact on subsea cables and pipelines
- Potential impacts on disposal and aggregates site
- Potential impact on tourism and recreation

758 Construction works such as the installation of cables or wind turbine generators and offshore substation platform(s) foundations have the potential to impact on other marine infrastructure and users within the construction footprint or adjacent. The physical presence of infrastructure has the potential to disturb, displace, or exclude users from the area. The presence of increased vessel numbers during construction may also impact on other marine users. Cable crossings with cable owners and operators will also be required for which agreement will be sought.

8.11.6.2 Potential impacts during operation and maintenance

759 Potential impacts during operation and maintenance on infrastructure and other users include:

- Potential impacts on other windfarms or developments/activities
- Potential impacts on oil and gas infrastructure and future exploration
- Physical impact on subsea cables and pipelines
- Potential impacts on disposal and aggregates site
- Potential impact on tourism and recreation

760 The presence of permanent offshore infrastructure has the potential to impact projects either within or adjacent to the windfarm site. Vessel movements during operation and maintenance may also affect neighbouring activities.

8.11.6.3 Potential impacts during decommissioning

761 During decommissioning the potential impacts are anticipated to be similar to those described above for the construction phase although on a smaller scale.

8.11.6.4 Potential cumulative impacts

762 The potential impacts of the project site on infrastructure and other users are expected to be non-significant or able to be fully mitigated after consultation with the relevant parties (i.e. through the development of crossing agreements or similar). It is proposed that these impacts are scoped in at this stage but following consultation may be able to be scoped out at a later stage.

8.11.6.5 Potential transboundary impacts

763 The only potential transboundary receptors are cables owned by international operators, these will be covered in the assessments outlined above, and therefore there will be no separate transboundary assessment.

8.11.6.6 Summary of potential impacts

764 Table 8.34 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.34 Summary of impacts relating to infrastructure and other users

Potential Impact	Construction	Operation and maintenance	Decommissioning
Potential impacts on other windfarms	✓	✓	✓
Potential impacts on oil and gas infrastructure and future exploration	✓	✓	✓
Physical impact on subsea cables and pipelines	✓	✓	✓
Potential impacts on disposal and aggregates sites	✓	✓	✓
Potential impact on tourism and recreation	✓	✓	✓

Potential Impact	Construction	Operation and maintenance	Decommissioning
Potential impacts on nuclear power stations	x	x	x
Potential impacts on MoD activities	x	x	x
Cumulative impacts	✓	✓	✓
Transboundary impacts	x	x	x

8.11.7 Potential mitigation measures

765 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the PEIR, and ultimately the ES, are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

766 Examples of mitigation measures which are likely to be considered include:

- Safety Zones will be implemented to avoid interaction with any existing oil and gas infrastructure where possible.
- Avoidance of existing infrastructure through final wind turbine generator layout and routing

767 Potential mitigation measures will be consulted upon with stakeholders throughout the EIA process.

8.12 Seascape, landscape and visual amenity

8.12.1 Introduction

768 This section of the Scoping Report considers the potential effects of construction, operation and maintenance, and decommissioning of the Project on seascape, and landscape. Section 8.9 covers the potential effects of the Project on Cultural Heritage.

8.12.2 Study area

769 The seascape, landscape and visual impact assessment (SLVIA) Study Area for the Project covers a radius of 50km from the proposed windfarm site, as illustrated in Figure 8.23. Beyond the boundary of the windfarm site, the SLVIA will generally focus on locations from where it may be possible to see the offshore wind turbine generators and other infrastructure.

770 A 50km radius SLVIA Study Area has been selected for a number of reasons. Although wind turbine generators of the height proposed could theoretically be visible at distances beyond 50km, the EIA regulations require assessment of the 'likely significant effects' of the Project. Therefore, the SLVIA Study Area should extend far enough to include all areas within which likely significant effects may occur. It need not cover all areas where there may be effects. In considering this, the sensitivity of the receiving landscape and visual receptors has been reviewed taking particular account of the Landscape Planning Designations and Defined Areas, as shown on Figure 8.24, and Visual Receptors within the Study Area.

771 Blade tip Zone of Theoretical Visibility (ZTV) analysis has been generated by Geographical Information System (GIS) software (Figures 8.25 and 8.26a-o). This demonstrates the relative number of turbines that may theoretically be seen from any point in the SLVIA Study Area. It is based on theoretical visibility of any part of a grid of turbines across the windfarm site and placed around the boundary using the maximum turbine tip height of 345m above Highest Astronomical Tide (HAT). The ZTV then represents the area over which any part of the windfarm site could theoretically be visible. The purpose of the ZTV is to inform stakeholders of the approximate area within which it may be theoretically possible to have visibility of the Project. The ZTV illustrates where there would be no visibility at all or where there would be low to high numbers of turbines theoretically visible, but it does not indicate the extent to which each turbine may be visible. The ZTV illustrates the 'bare ground' situation and does not take into account the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility.

772 Relevant guidance (White *et al.*, 2019), professional experience, ZTV analysis (Figures 8.25 and 8.26a-o), published visibility studies (e.g. Bureau of Ocean Energy Management, 2013) and Met Office visibility frequency data all indicate that the threshold at which significant visual effects would diminish is likely to be within this proposed 50km radius area. In reality, significant seascape, landscape and visual effects are more likely to occur from locations at closer proximity; and less likely to occur towards the outer edges of the SLVIA Study Area at long distances.

773 The blade tip ZTV (Figures 8.25 and 8.26a-o) indicates that the visibility of the Project from the land will become very restricted and dispersed at distances beyond 50km. Furthermore, actual visibility from inland areas would be further fragmented by either landform, vegetation or built features/settlements that screen visibility of the Project. At distances over 50km, the lateral spread of the windfarm site will occupy a very small portion of available views, which would generally also contain operational wind farms located either to the side of or in the foreground of the windfarm site. The vertical height of the wind turbine generators would appear relatively small, therefore significant visual effects are unlikely to arise at greater than this distance (even if the wind turbine generators are visible – in excellent visibility conditions).

774 Taking the above factors into account it is considered that the Project is unlikely to result in significant effects at distances over 50km. Seascape, landscape and visual effects as a result of the Project are proposed to be scoped out beyond 50km.

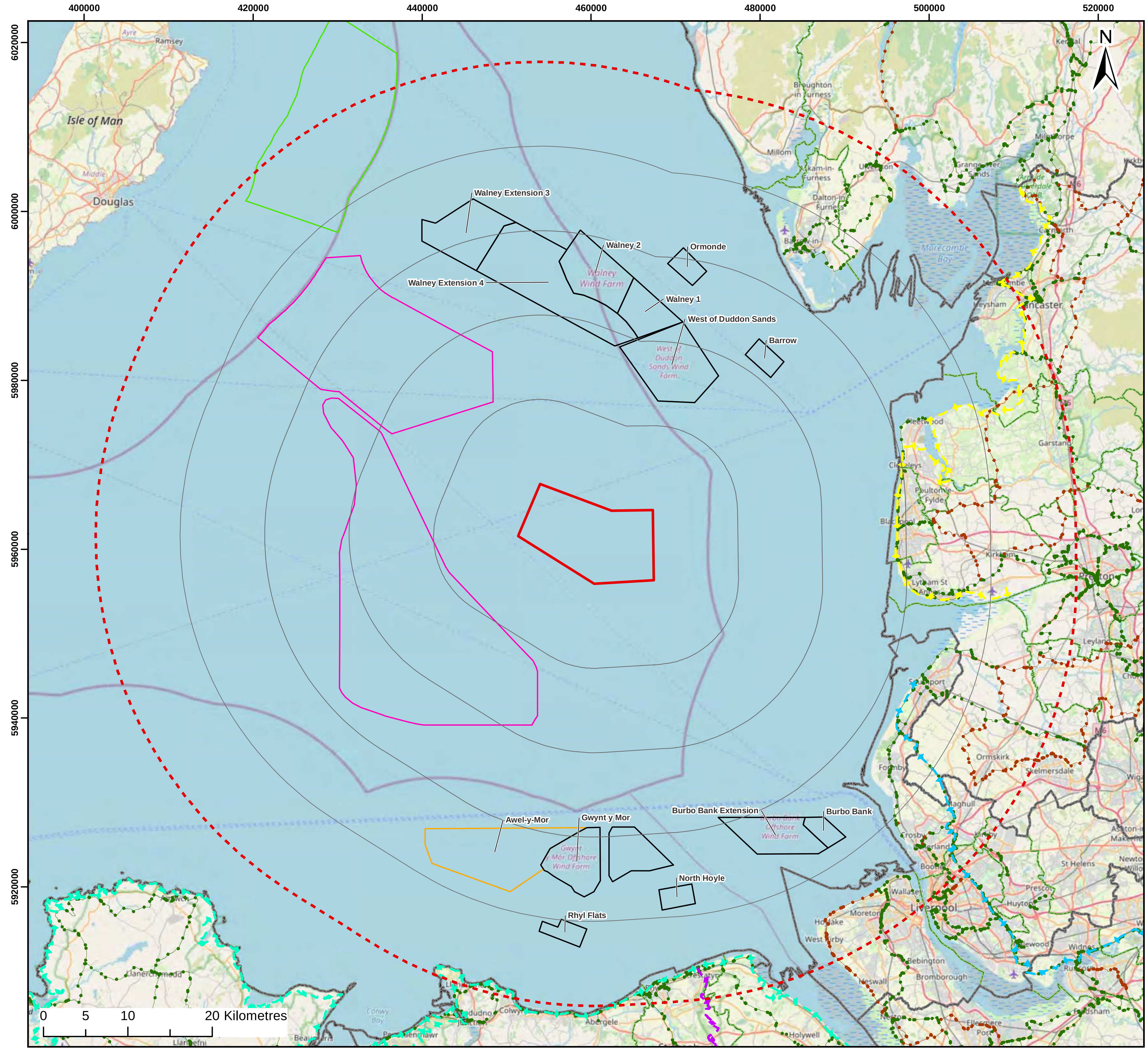
775 Within the SLVIA Study Area, the assessment will focus primarily on the assessment of seascape, landscape and visual effects of the Project within England due to its proximity to the windfarm site and its location within an English Marine Plan area. There are a number of existing operational offshore windfarms off the Lancashire and Cumbria coast which have an intervening and closer range influence on these developed sections of the coast, ensuring that significant effects are less likely to occur.

776 The SLVIA Study Area also includes seascape, landscape and visual receptors along the coast of Wales at distances of over 45km from the windfarm site. There are a number of existing operational offshore windfarms off the North Wales coast which have an intervening and closer range influence on these developed sections of the coast, ensuring that significant effects are less likely to occur.

777 The SLVIA Study Area may be reviewed and revised following further consultation responses, as a result of any amendments to the windfarm site

or the identification of additional constraints (environmental and/ or engineering).

778 Consideration of the Project is based on a 'Project Design Envelope' (PDE) approach following the guidelines from Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018). The utilisation of a PDE is intended to identify key design parameters for the Project, setting out a realistic 'worst case scenario' for the different elements within the windfarm site, in order for this to be assessed.



Legend:

- Morecombe Offshore Windfarm Site
- 10km Radii
- 50 km Study Area
- Windfarm Status
- Active / In Operation
- Scoping / Pre-application
- Round 4 Project Zone
- IoM AfL Boundary
- Lancashire Coastal Way
- Offas Dyke
- Trans Pennine Trail
- Wales Coastal Path
- National Cycle Network
- Regional Cycle Network
- County Boundary
- District Boundary

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Offshore Seascape, Landscape & Visual Impact Assessment Study Area

Figure: 8.23	Drawing No: 211609				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:450,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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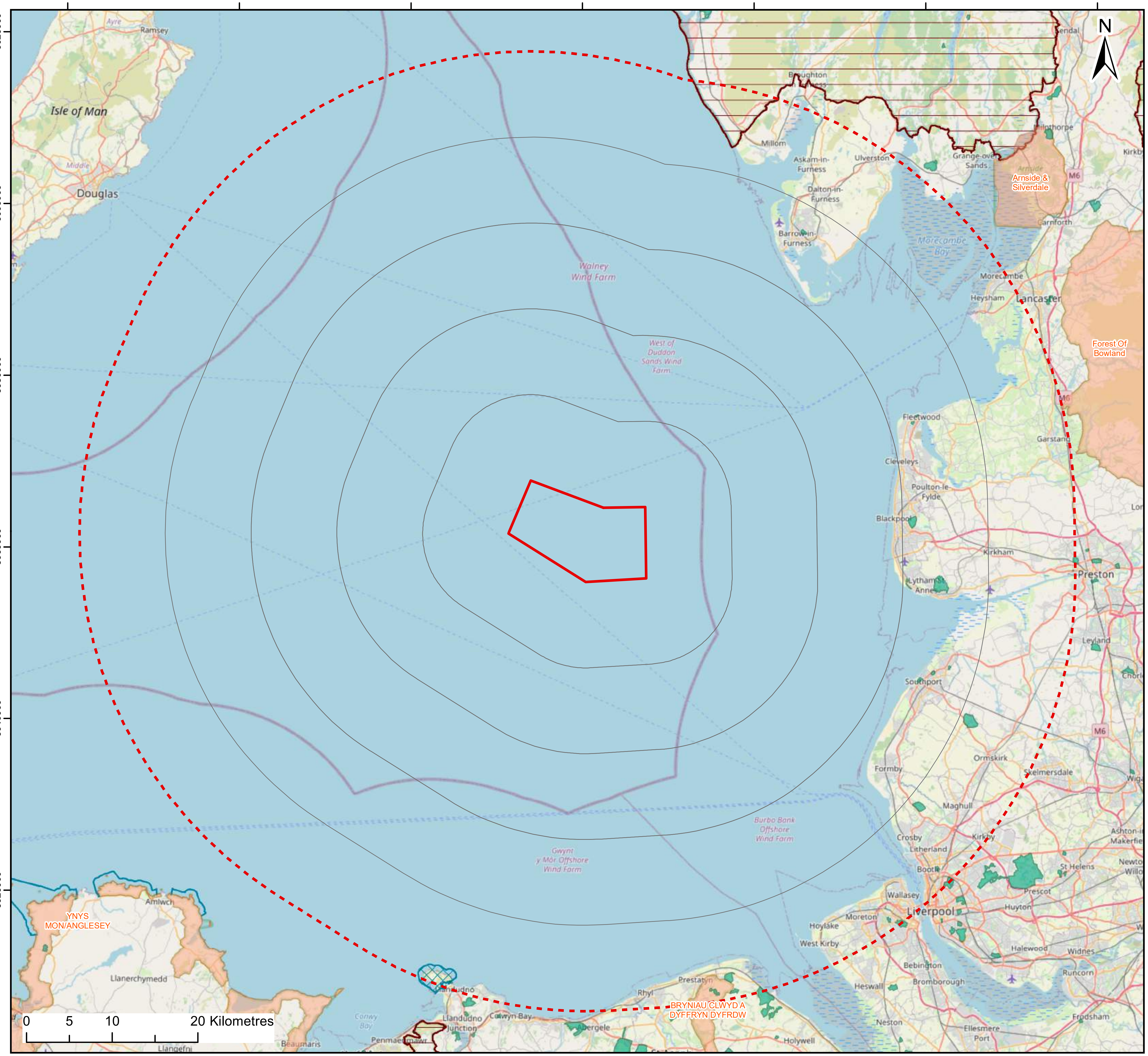

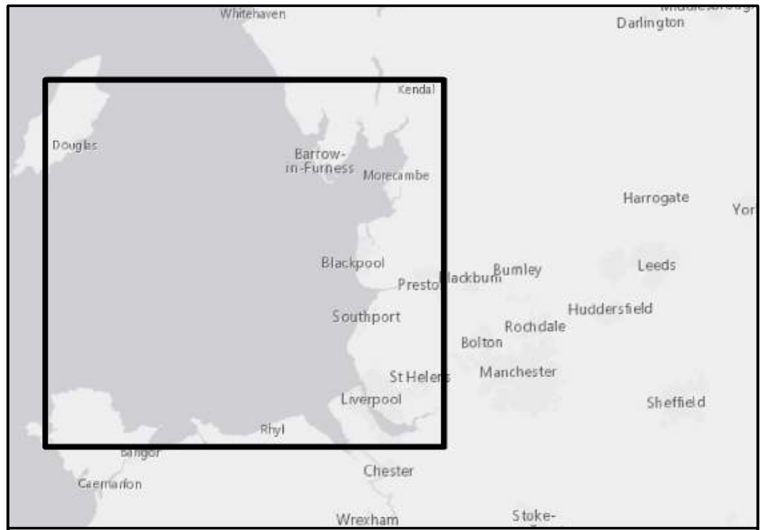

Legend:

- Morecambe Offshore Windfarm Site
- 10km Radii
- 50 km Study Area
- Heritage Coast
- Parks and Gardens
- Area of Outstanding Natural Beauty
- National Parks

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Landscape Planning Designations

Figure: 8.24 | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:450,000

Co-ordinate system: WGS 1984 UTM Zone 30N

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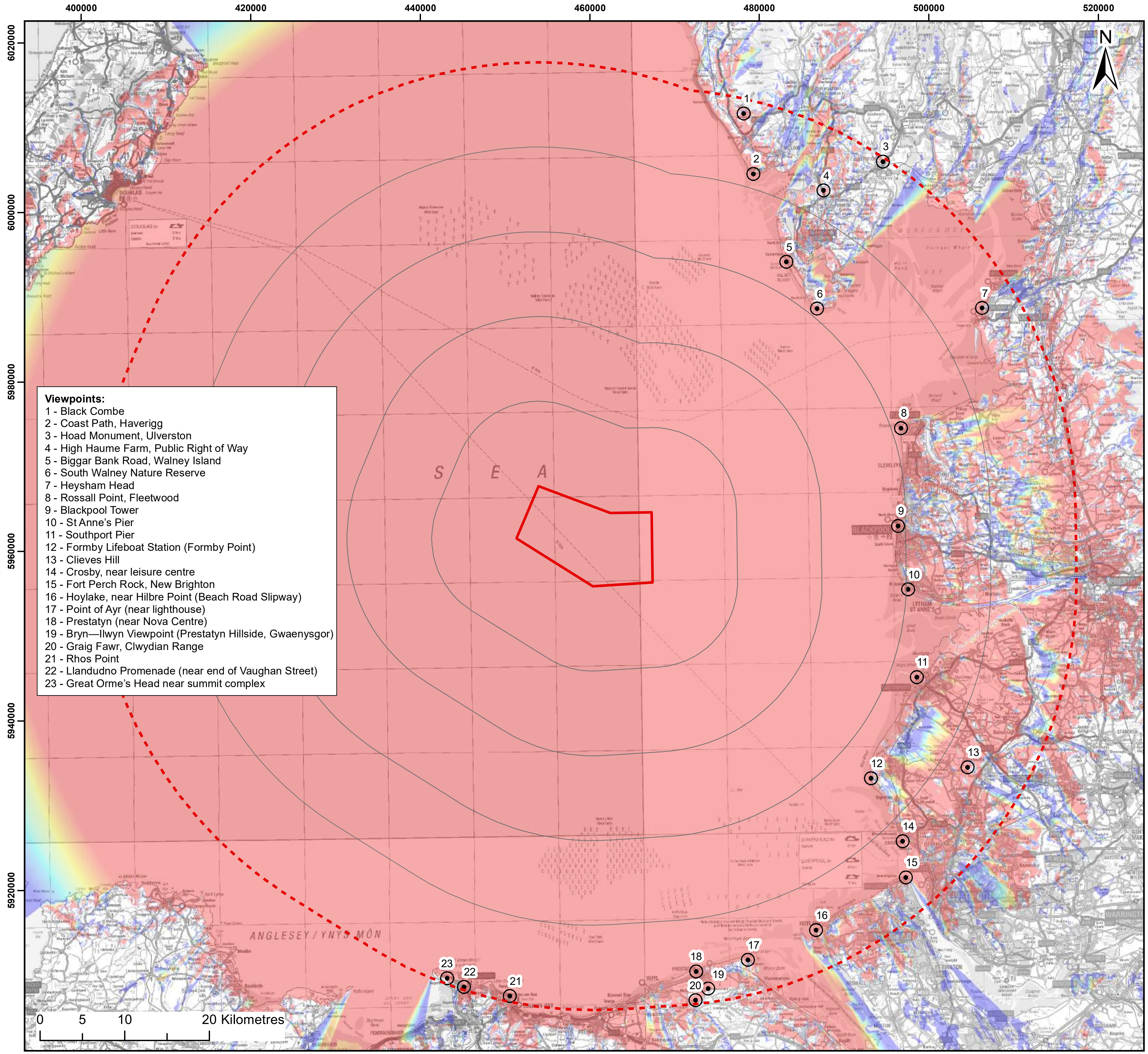

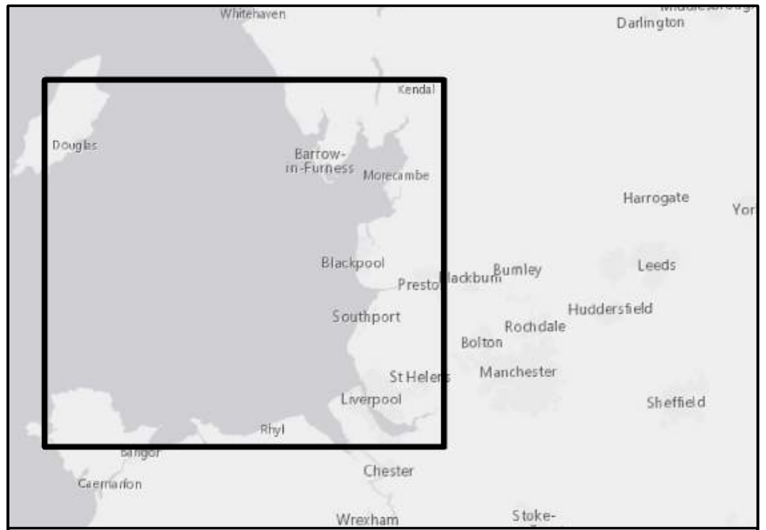

Legend:

- Viewpoint Locations
- Morecambe Offshore Windfarm Site
- 10km Radii
- 50 km Study Area

Zone of Theoretical Visibility
Higher Visibility
Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations

Figure: 8.25 | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:450,000

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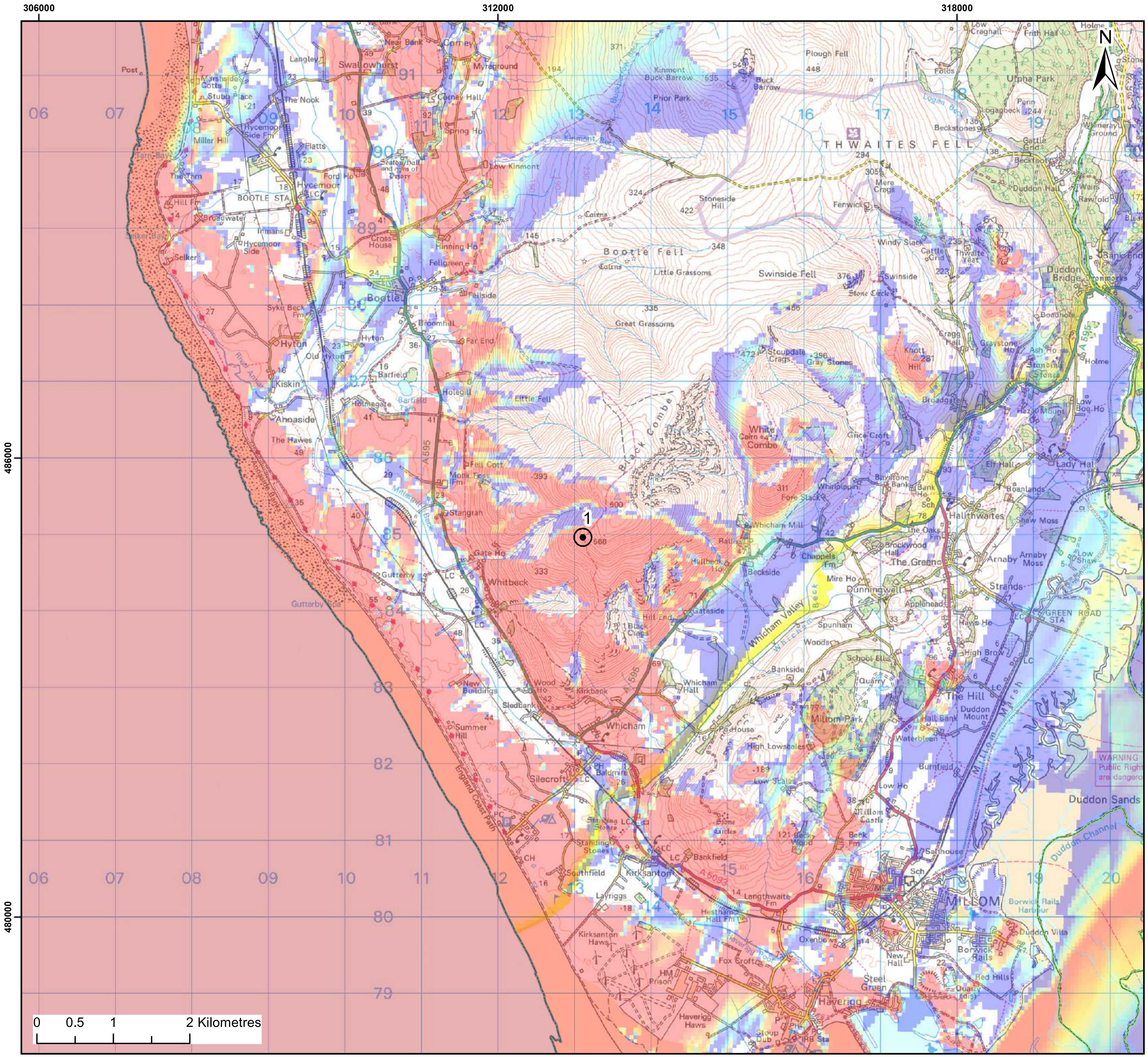

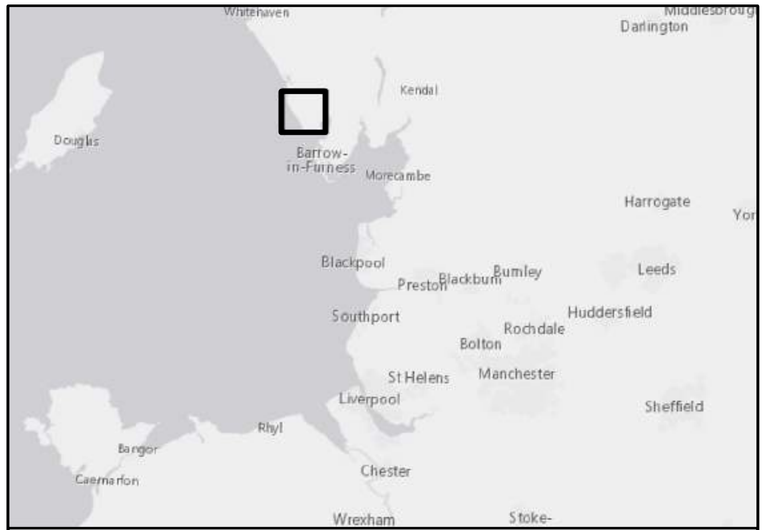

Legend:

- Viewpoint Location (1)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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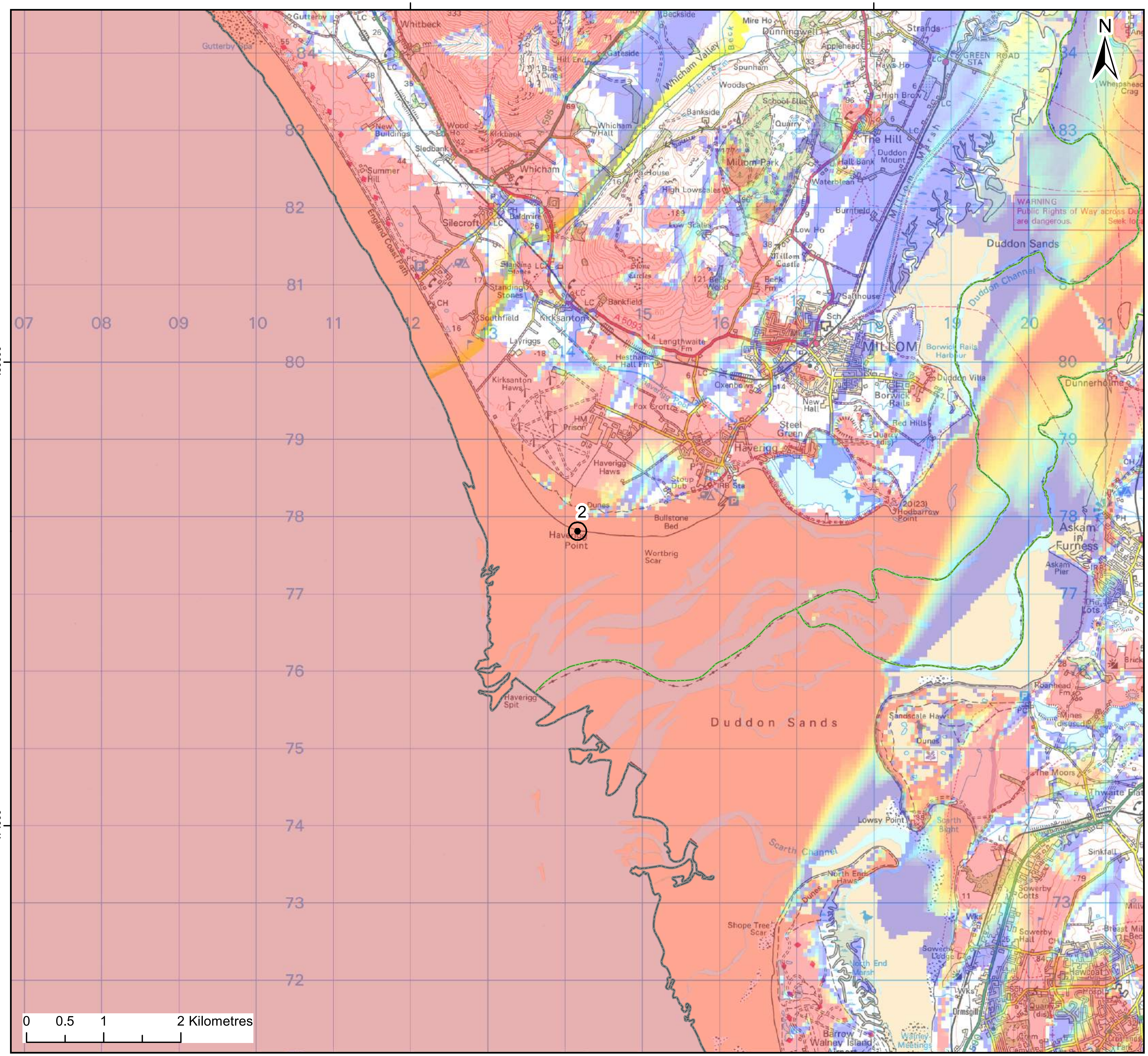
Report: Morecambe Offshore Windfarm Scoping Report

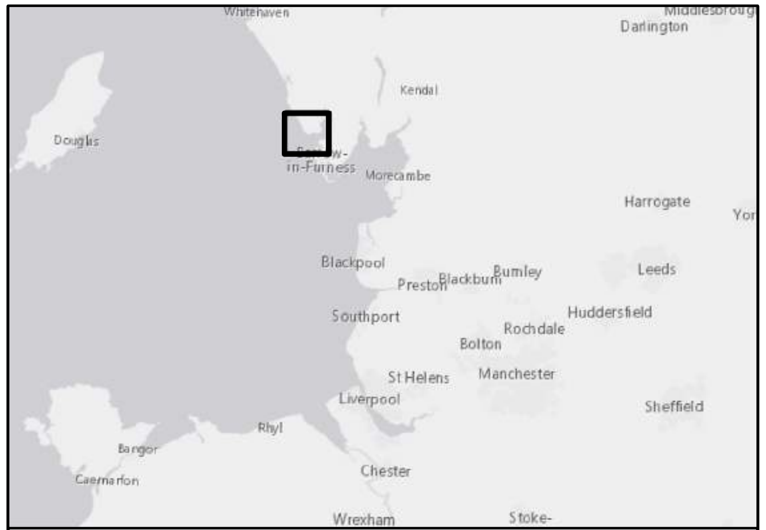
Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26a | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid





Legend:

- Viewpoint Location (2)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26b Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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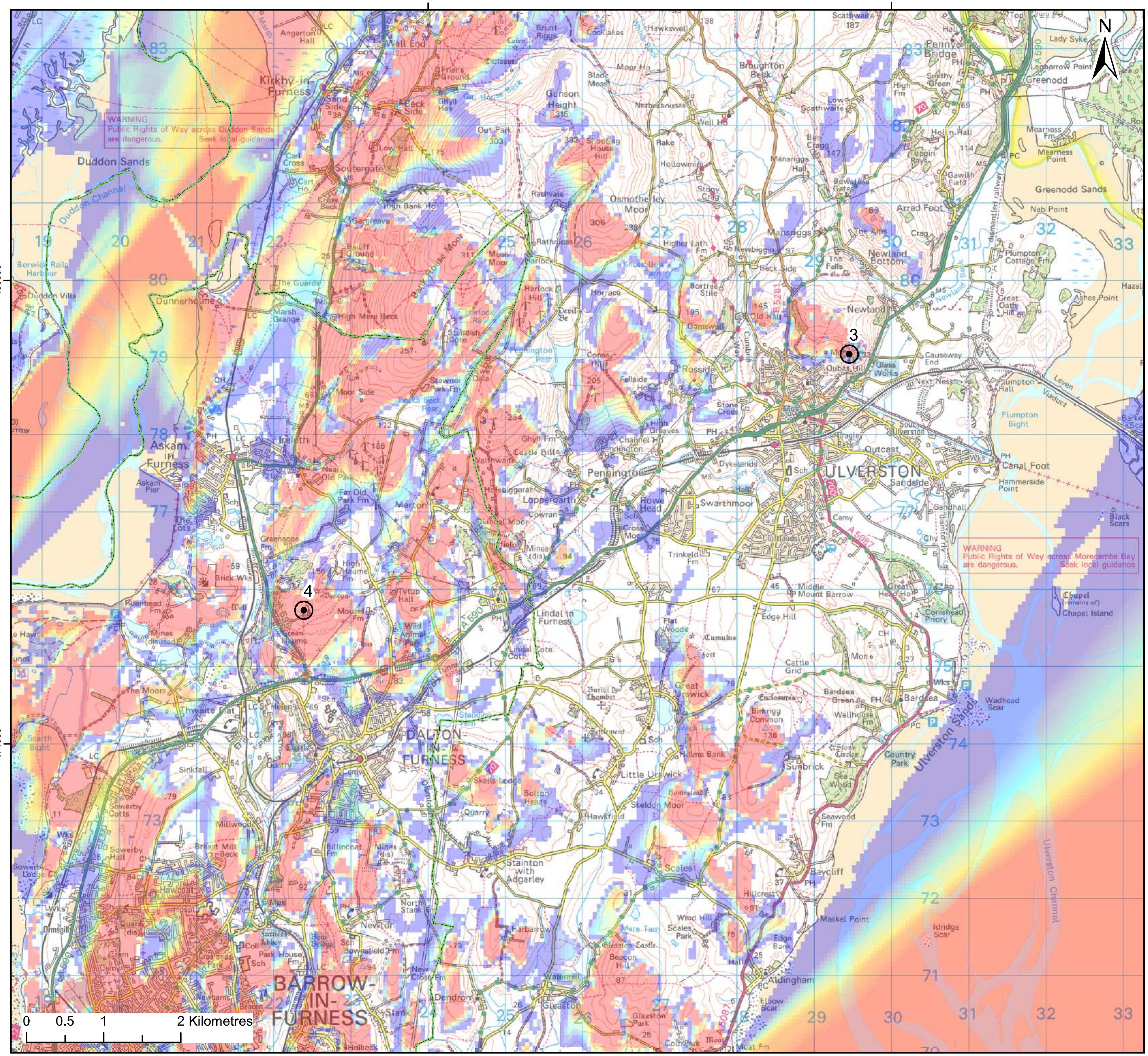

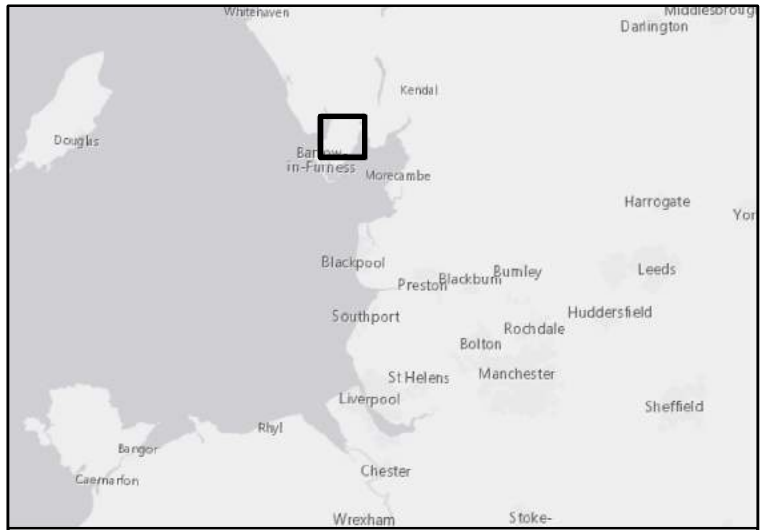

Legend:

- Viewpoint Location (3-4)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26c | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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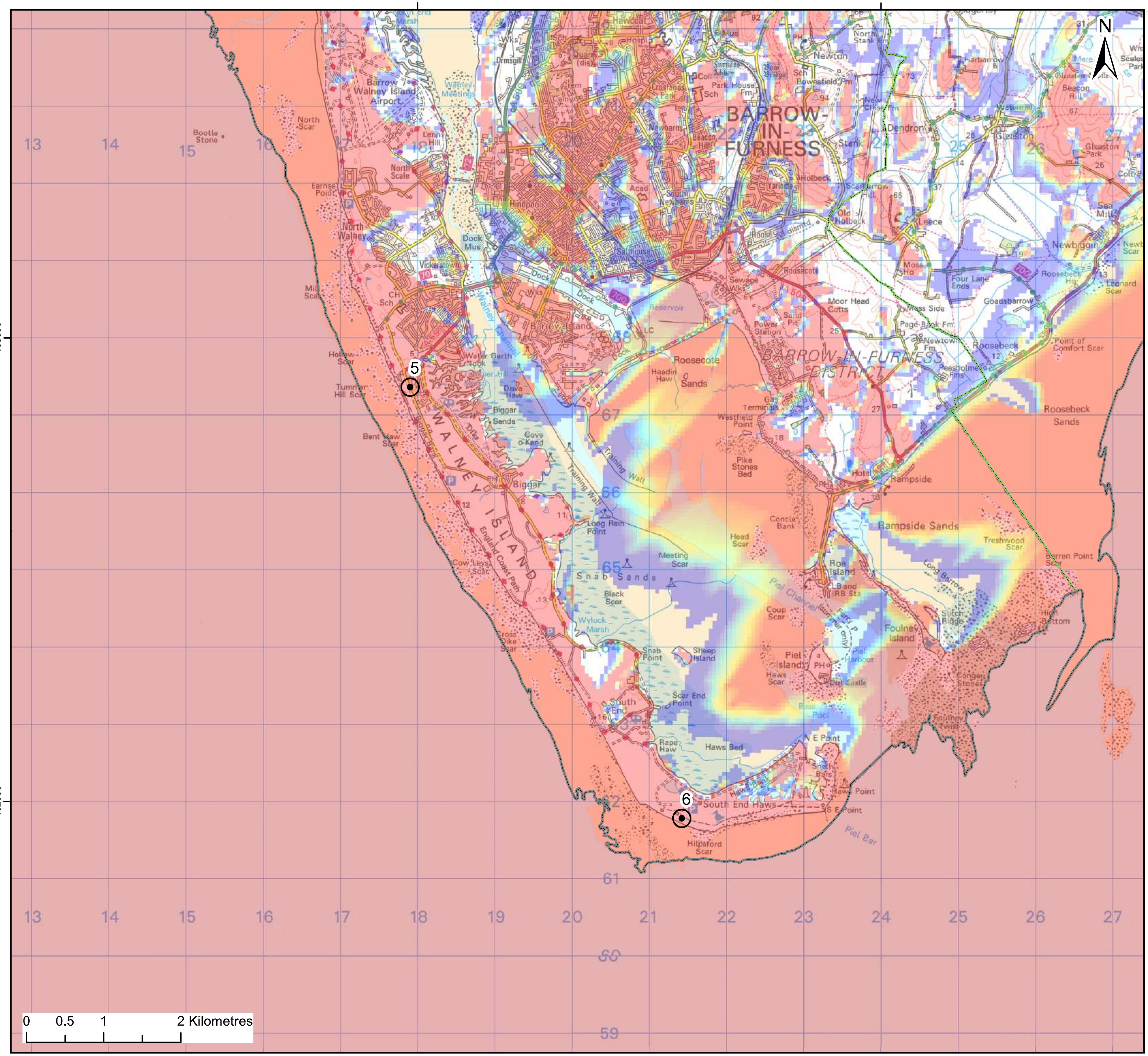

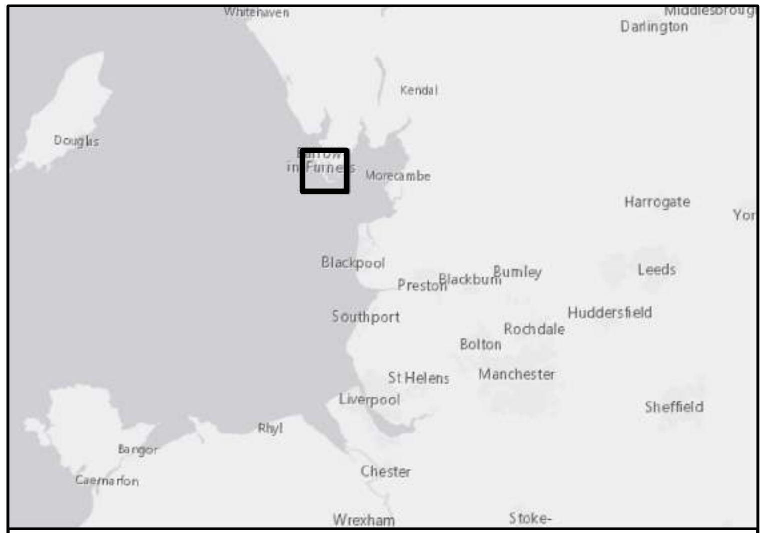

Legend:

- Viewpoint Location (5- 6)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26d | Drawing No: 211609

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Co-ordinate system: British National Grid

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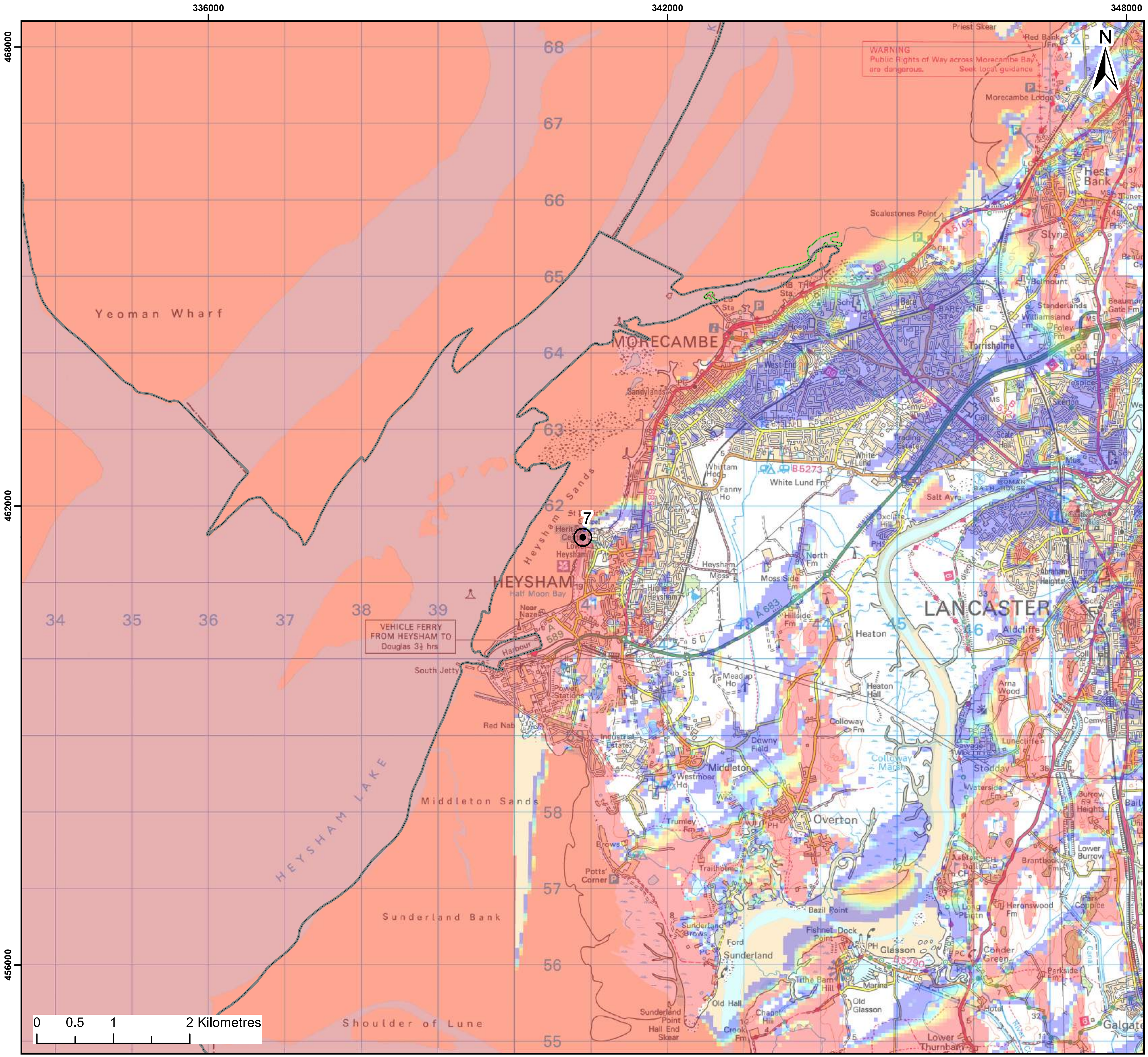

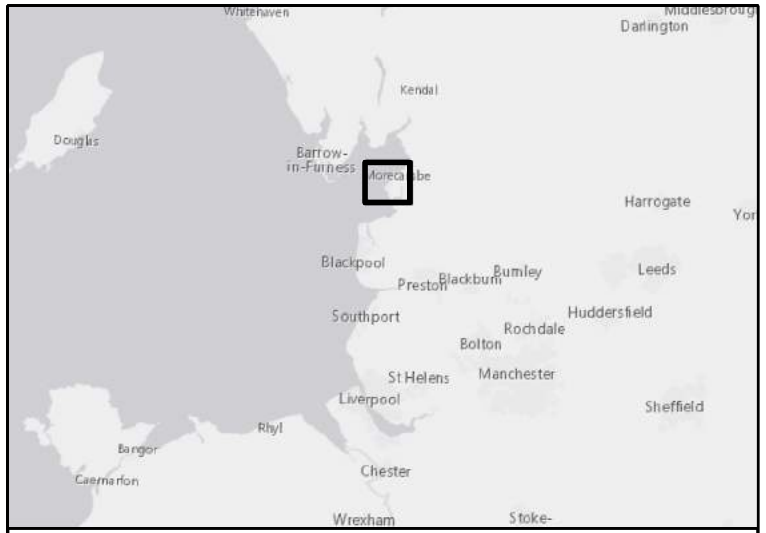

Legend:

- Viewpoint Location (7)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26e | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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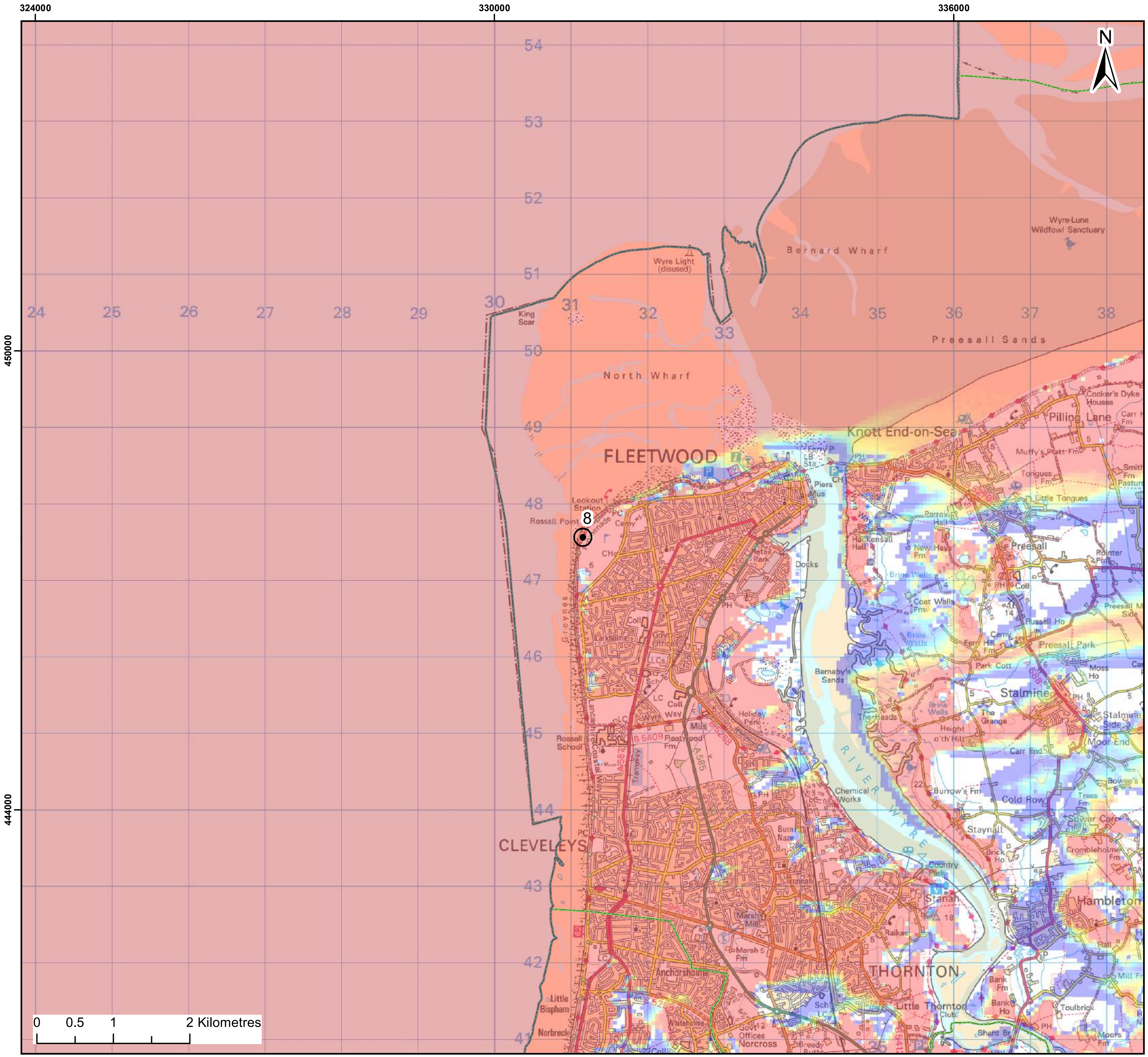

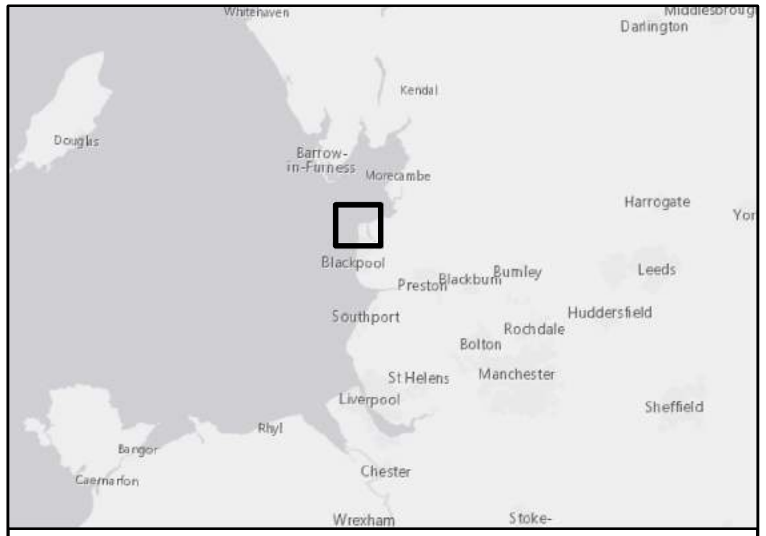

Legend:

- Viewpoint Location (8)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26f | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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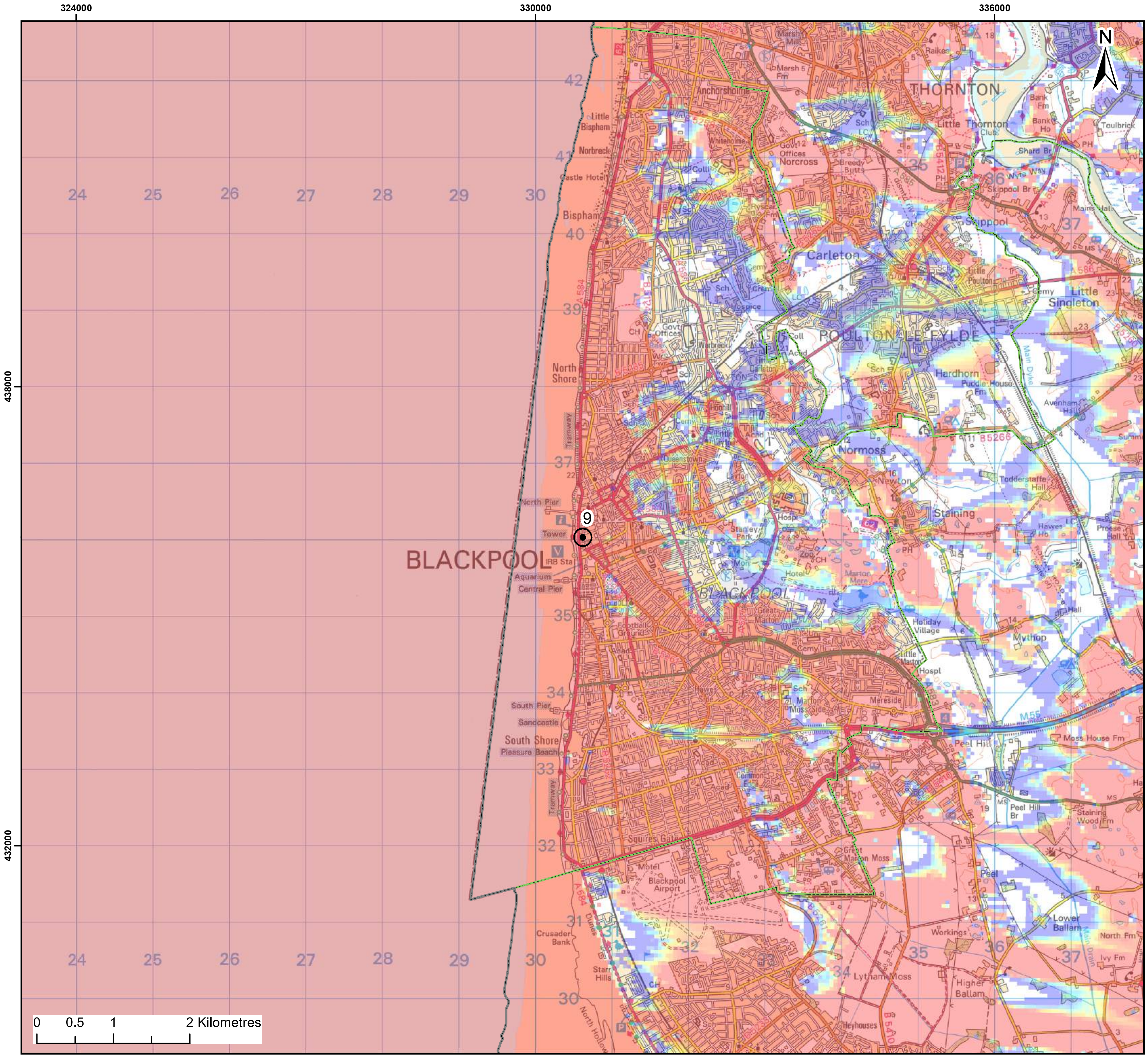

Legend:

- Viewpoint Location (9)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

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DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26g | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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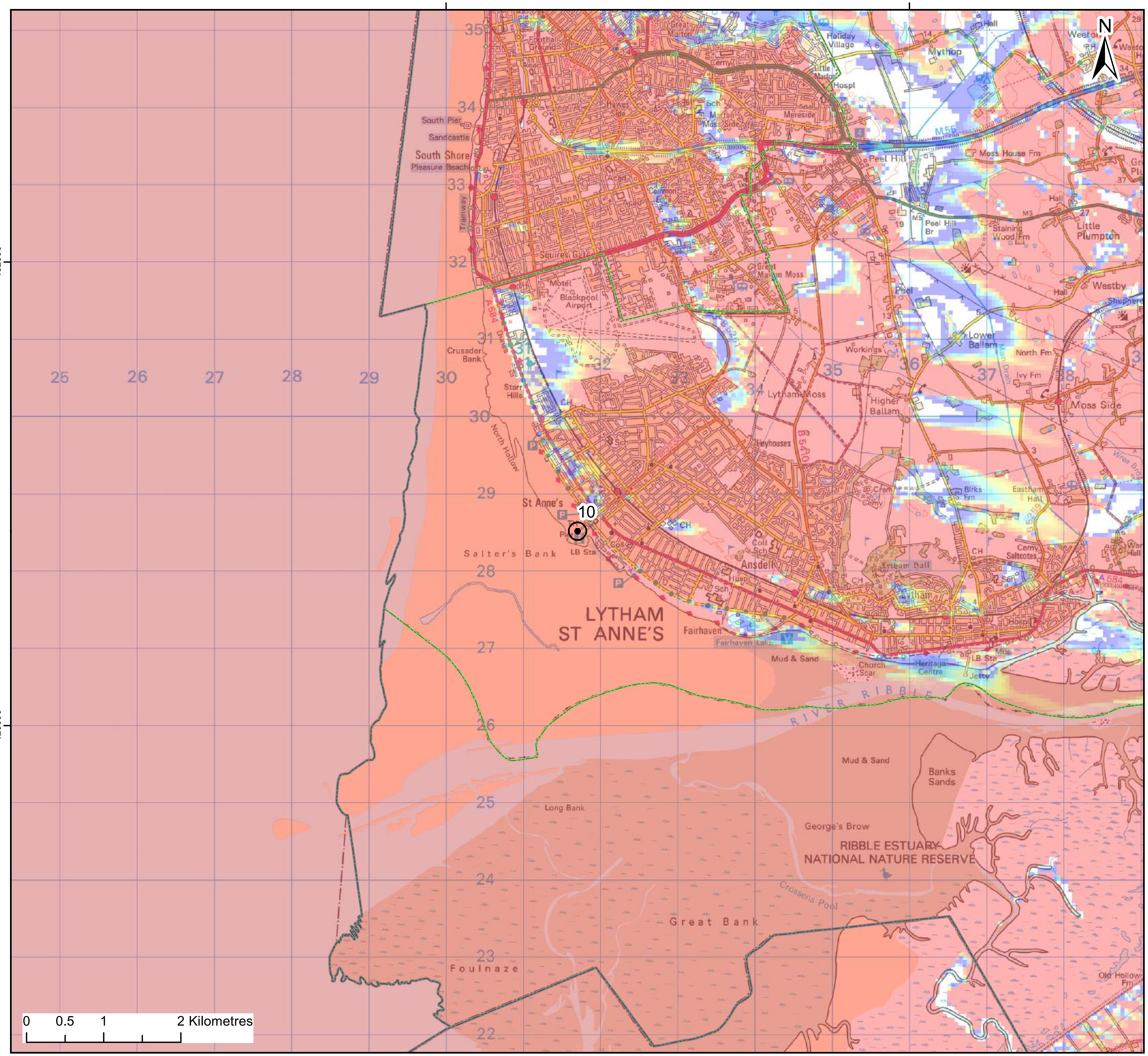

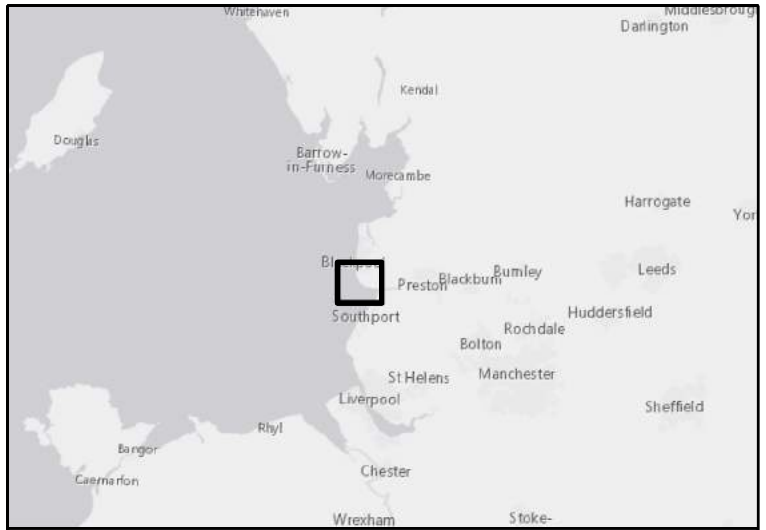

Legend:

- Viewpoint Location (10)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

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DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26h | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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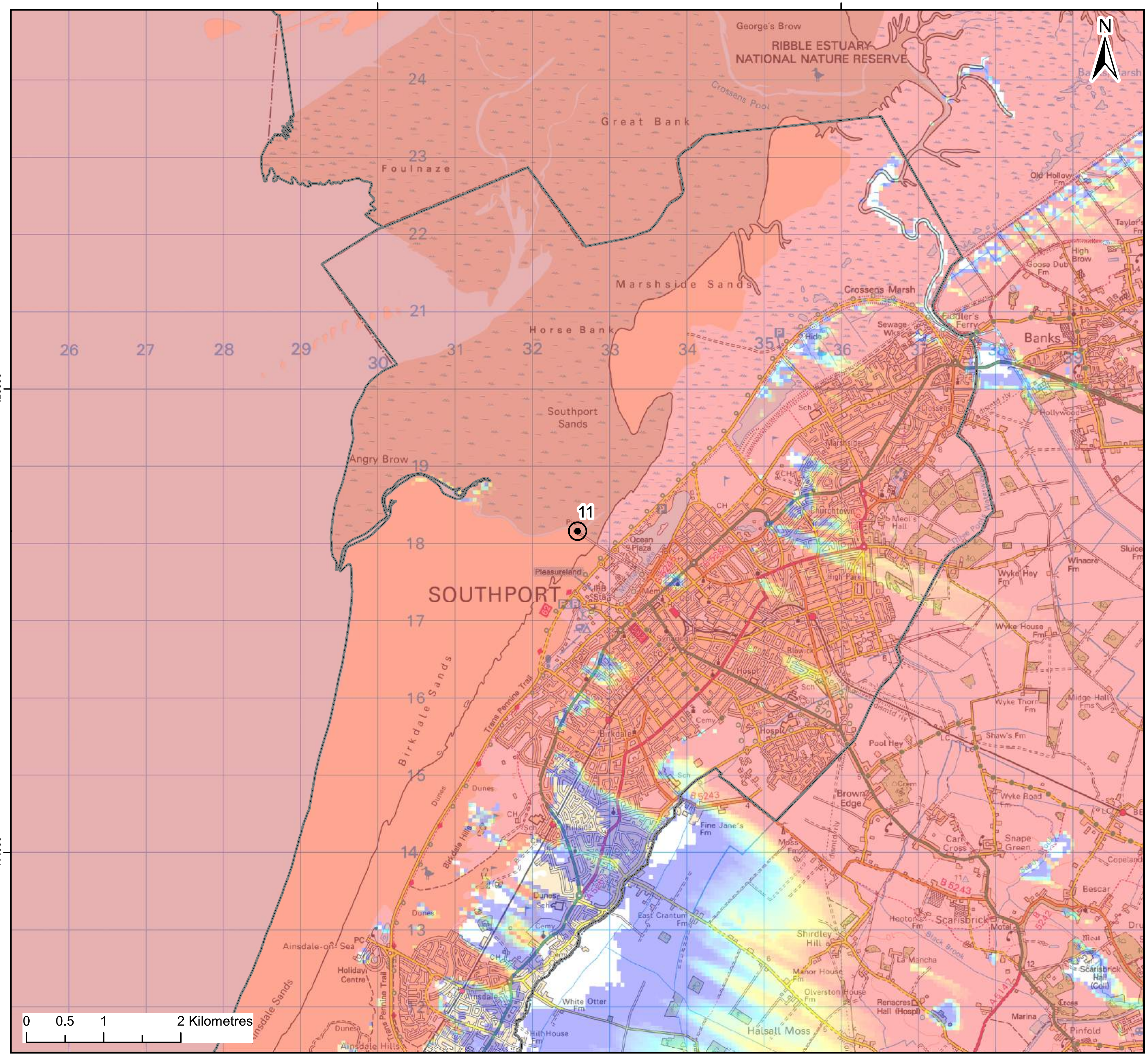

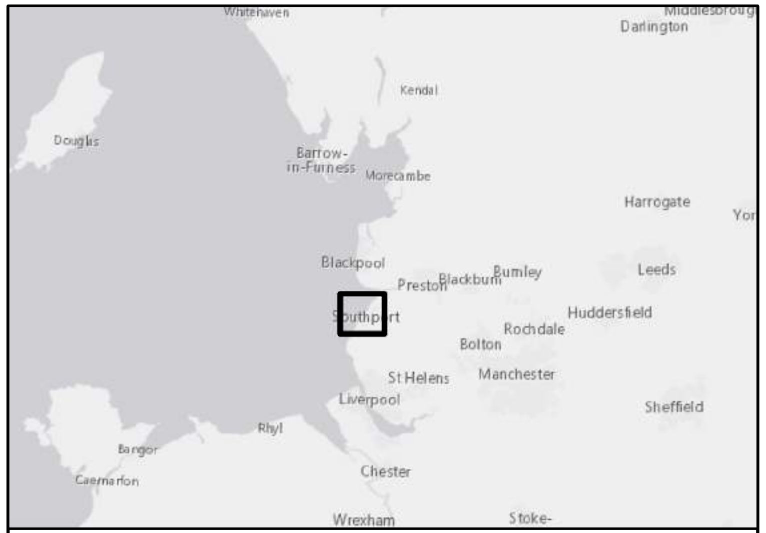

Legend:

- Viewpoint Location (11)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

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DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure:	8.26i	Drawing No:	211609		
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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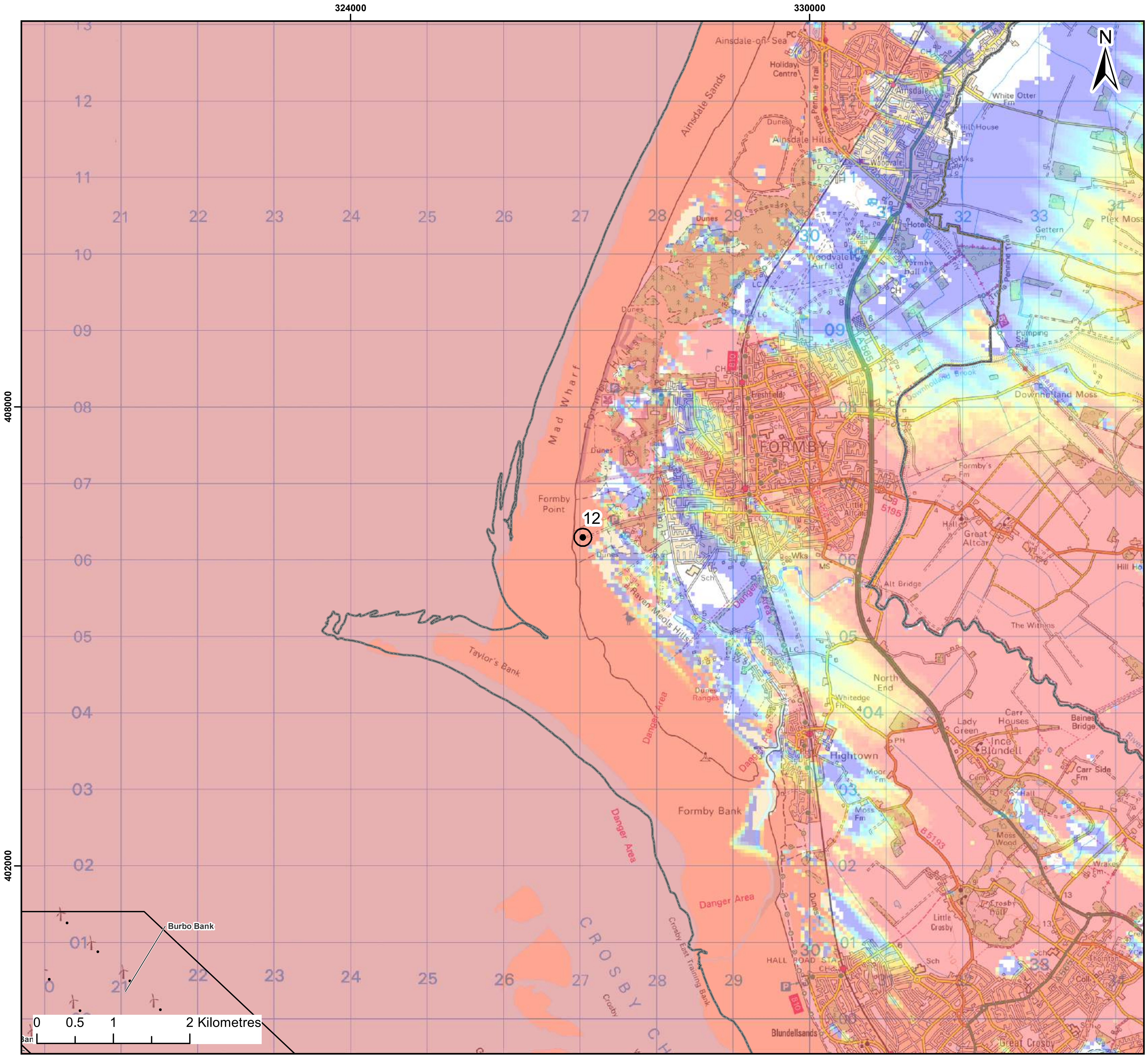

Legend:

- Viewpoint Location (12)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26j	Drawing No: 211609				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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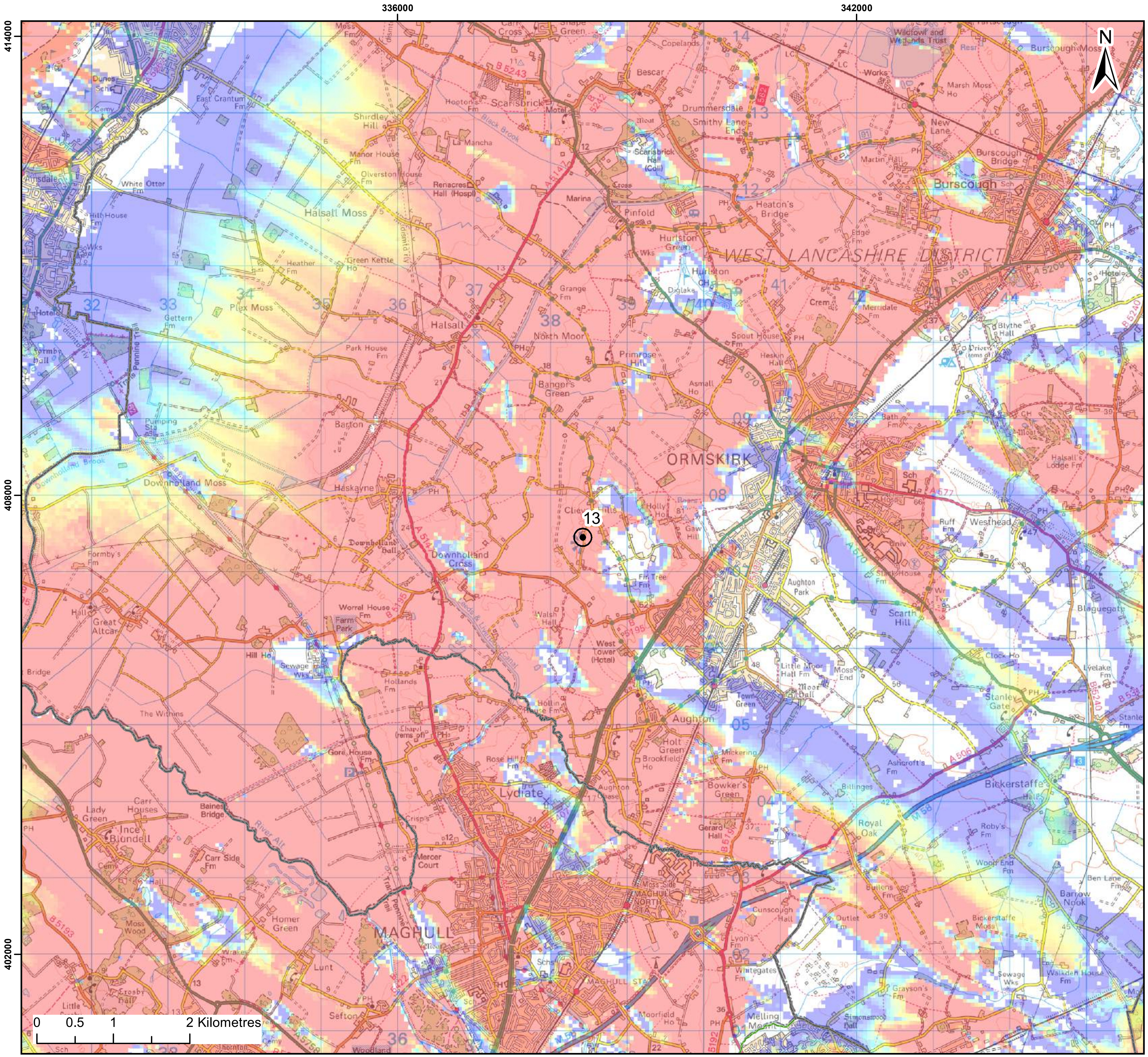

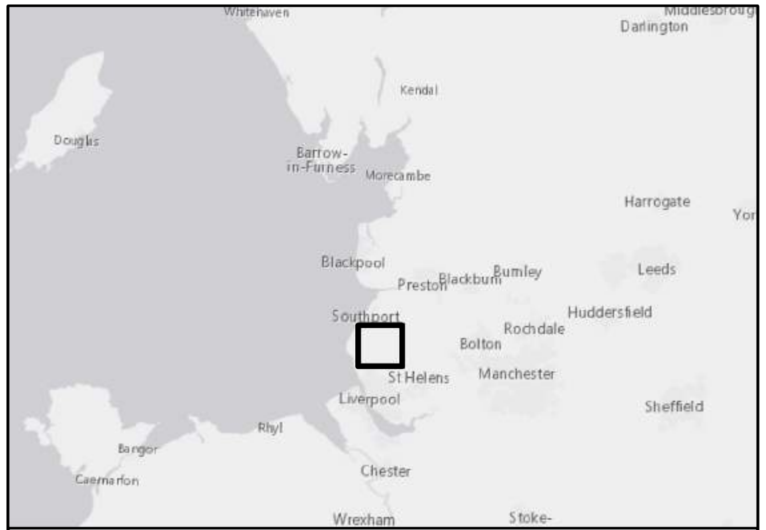

Legend:

- Viewpoint Location (13)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26k | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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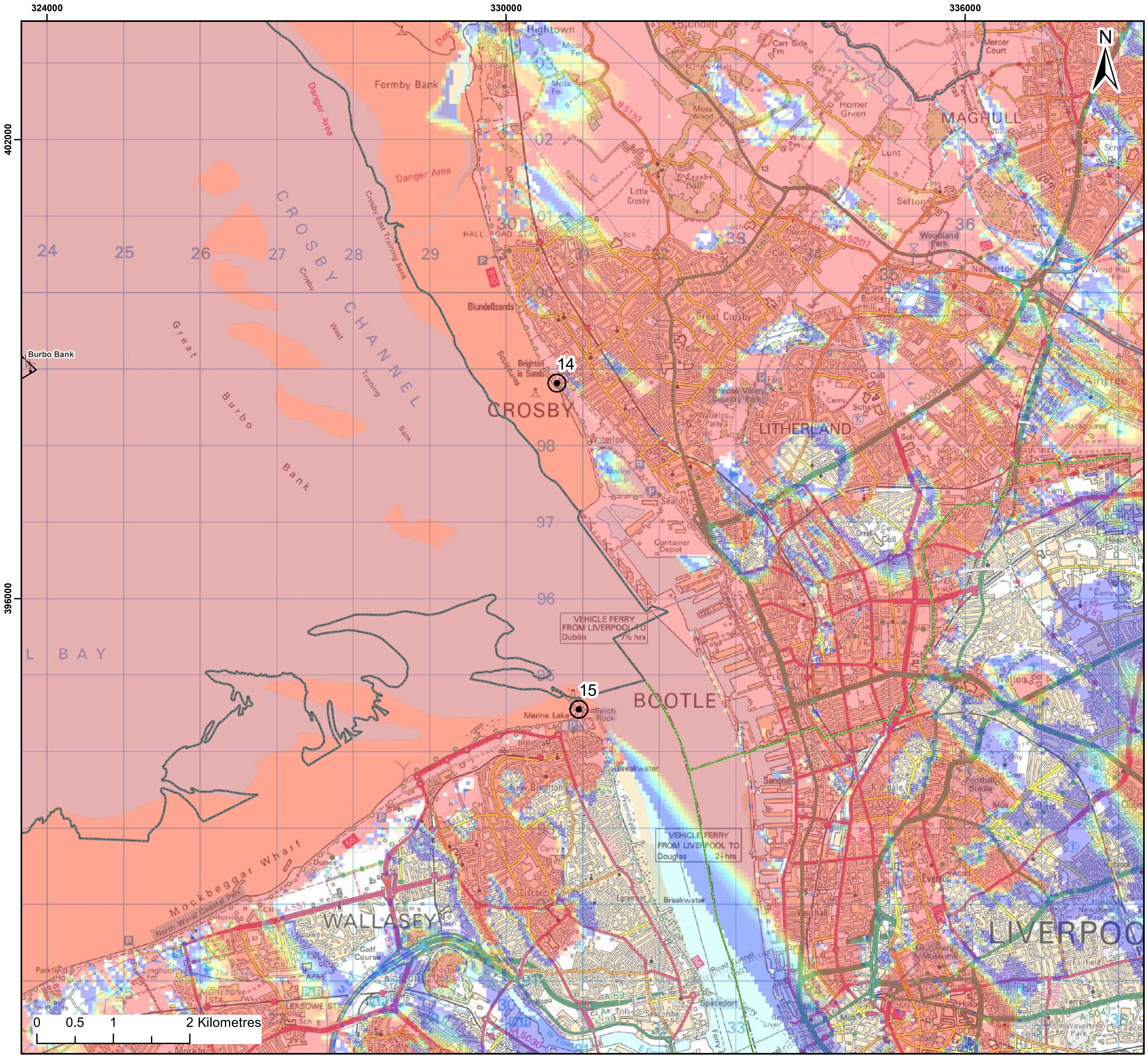

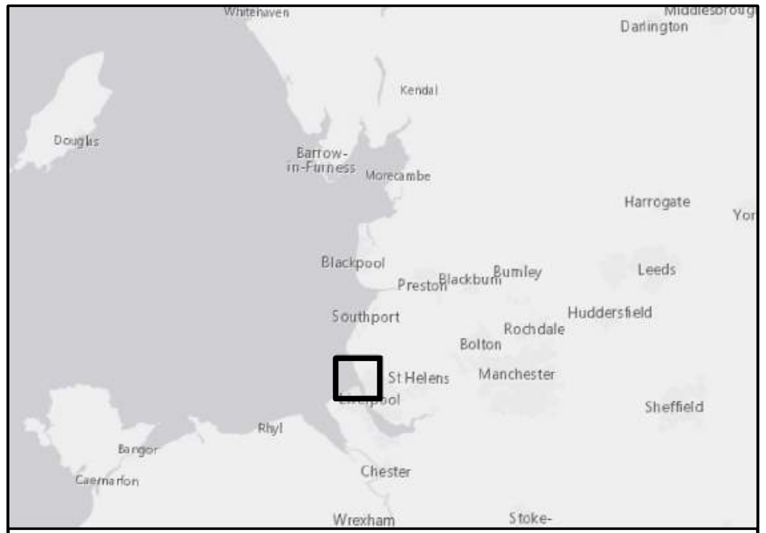

Legend:

- Viewpoint Location (14-15)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26l | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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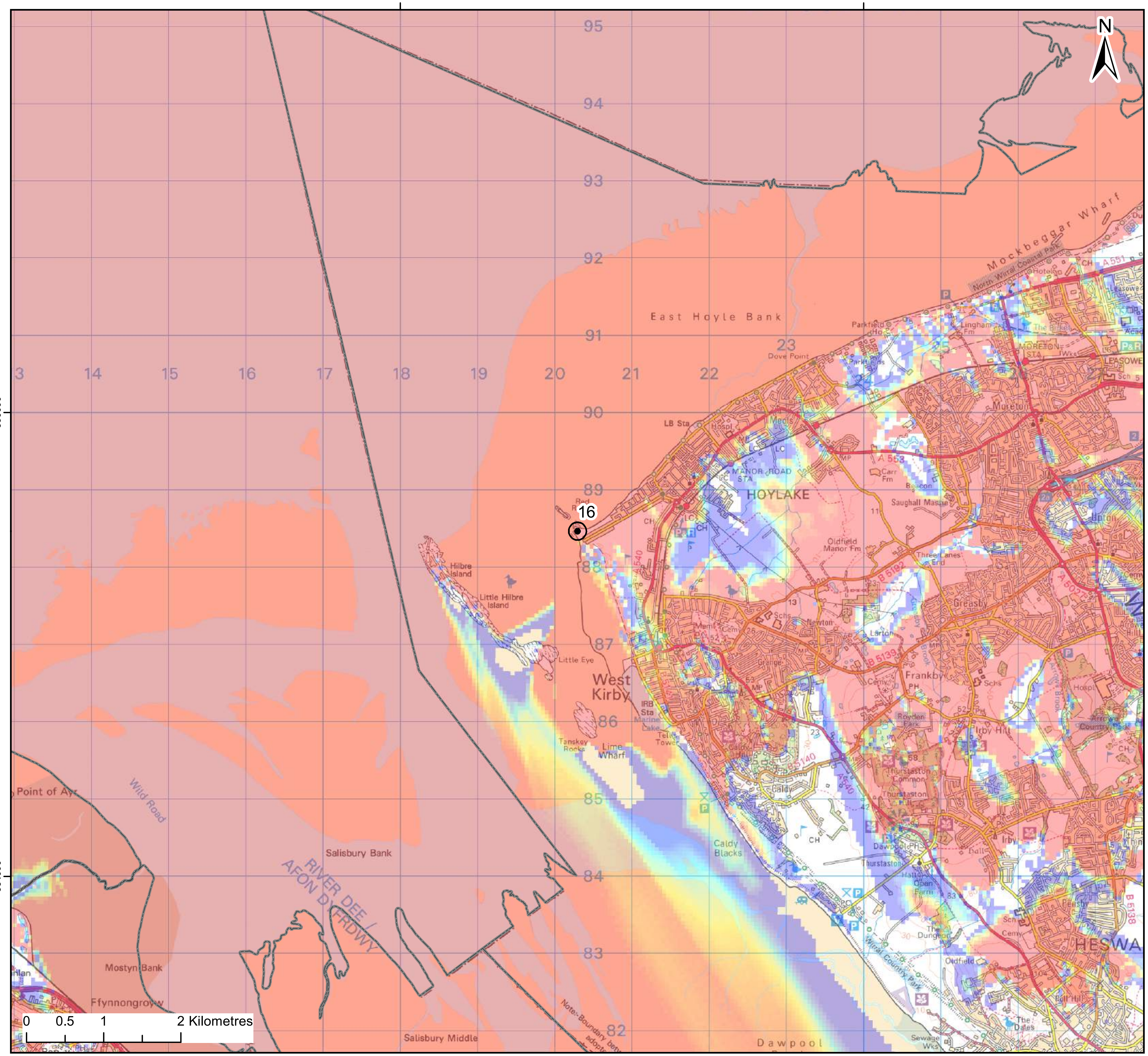

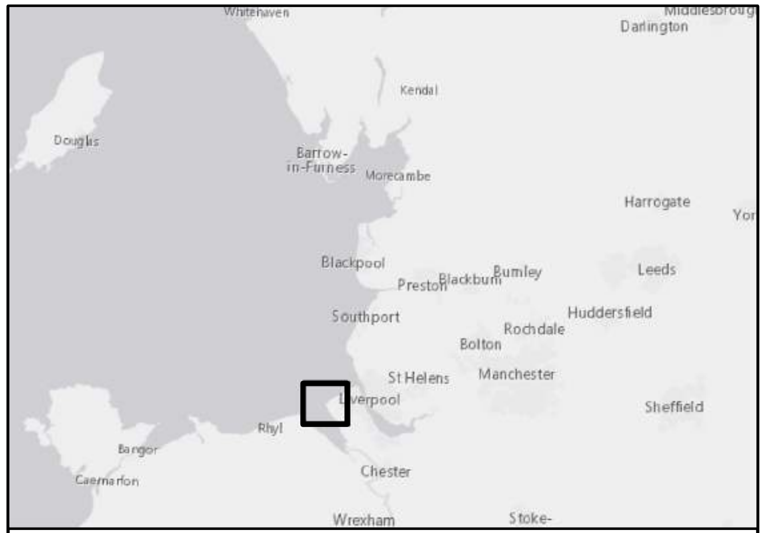

Legend:

Viewpoint Location (16)

County Boundary

District Boundary

Zone of Theoretical Visibility

Higher Visibility

Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26m	Drawing No: 211609				
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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306000 312000

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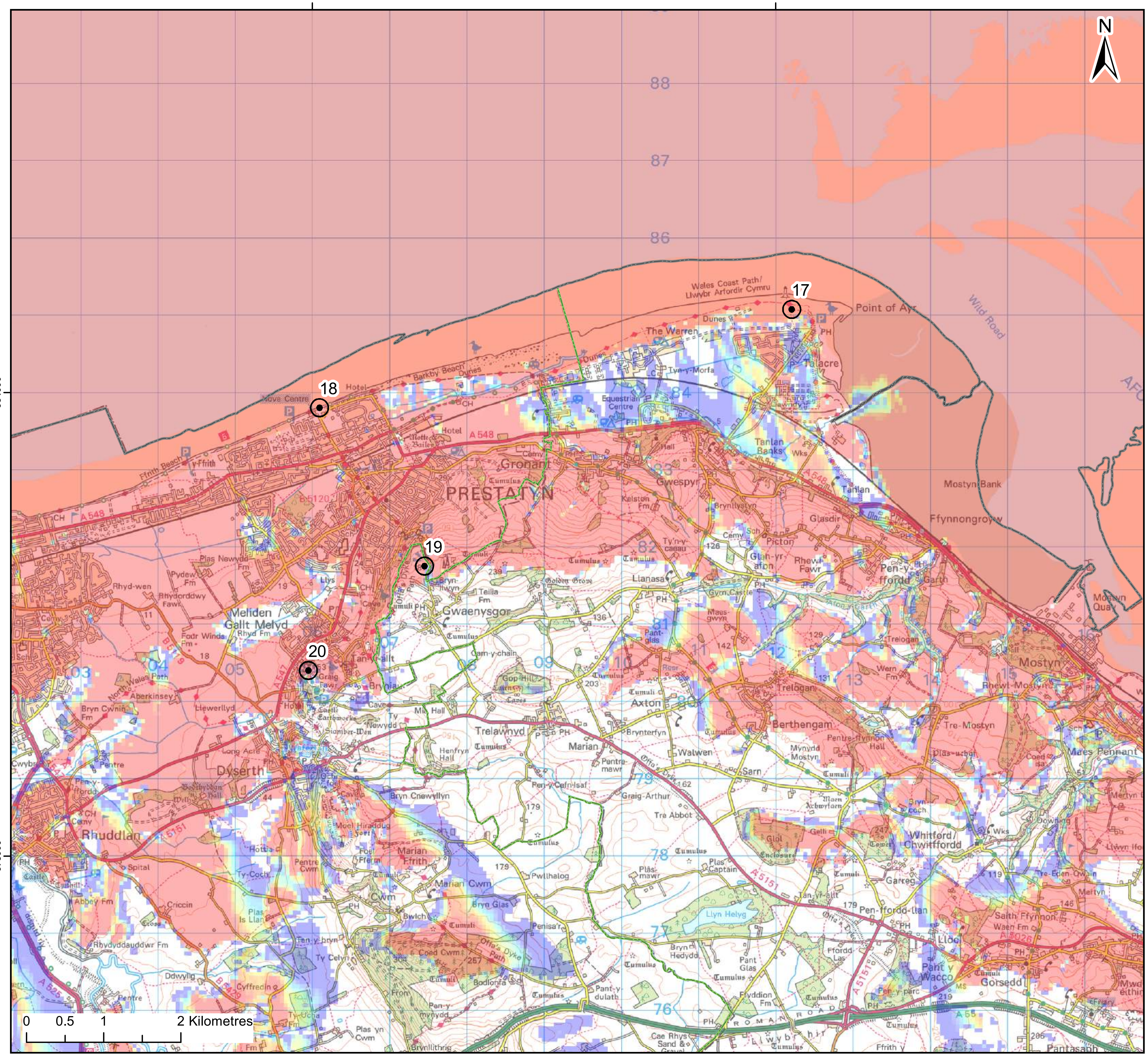
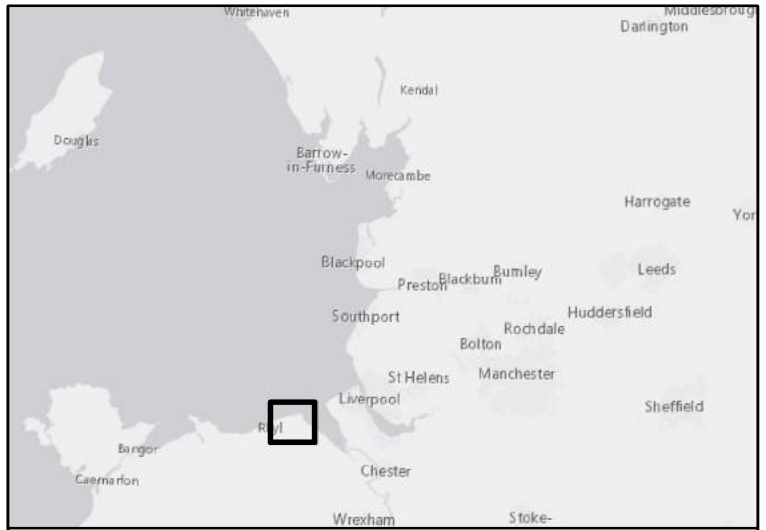
378000





Legend:

Viewpoint Location (17-20)

County Boundary

District Boundary

Zone of Theoretical Visibility

Higher Visibility

Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26n | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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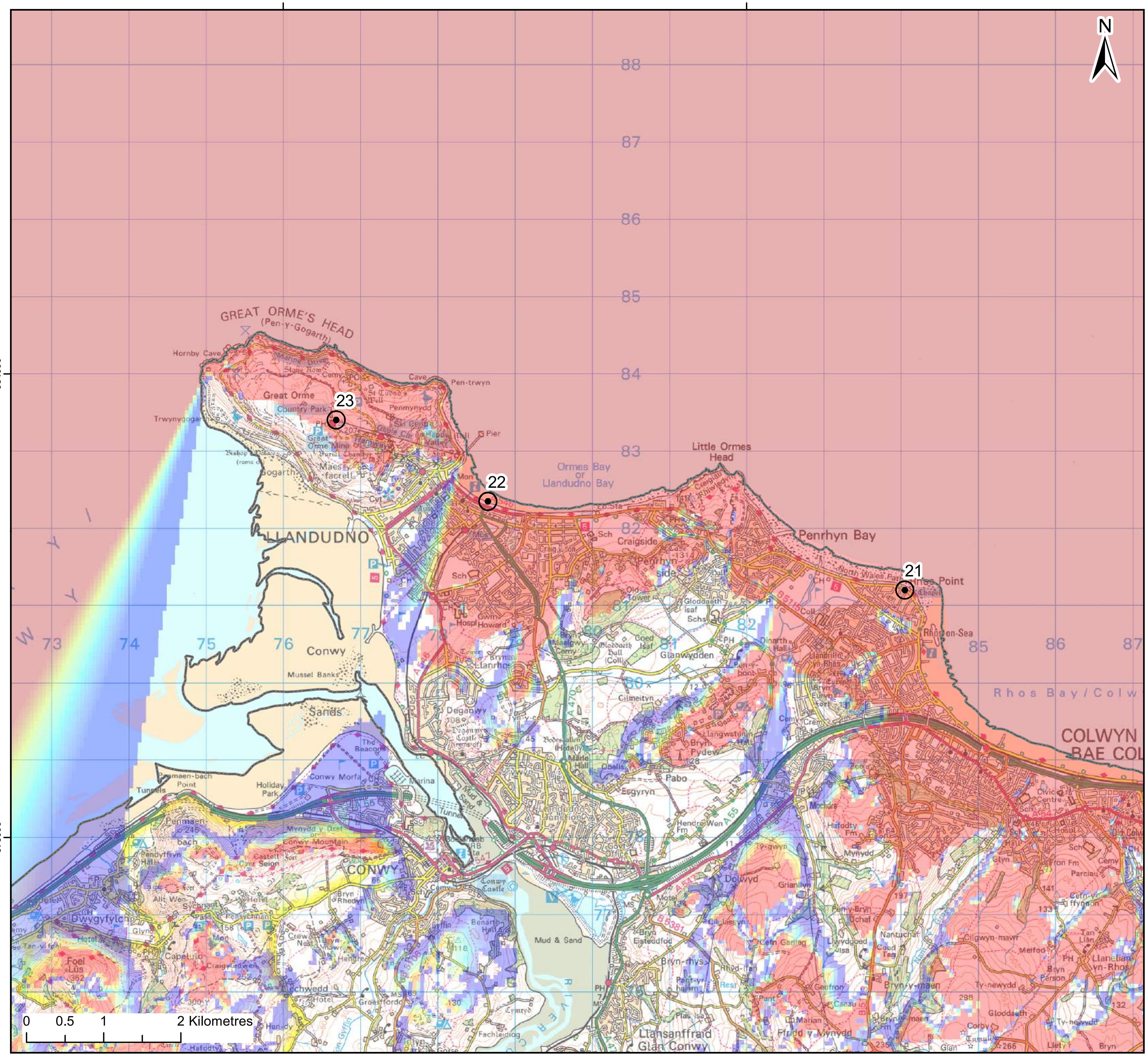

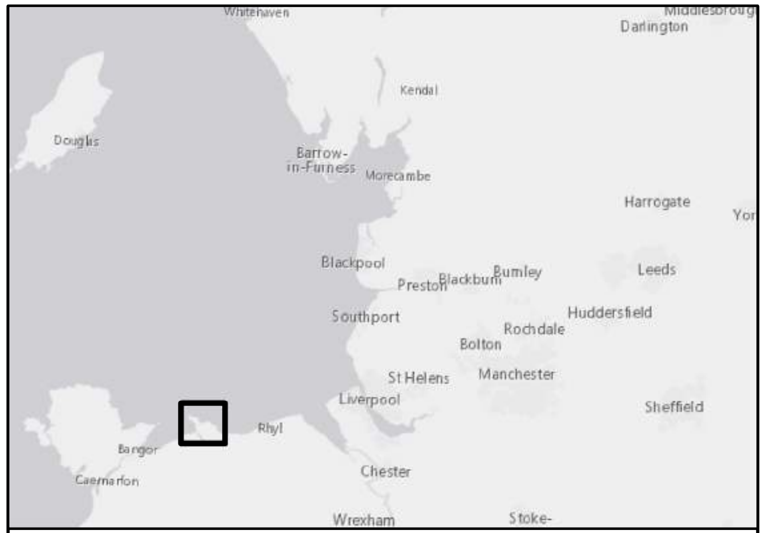

Legend:

- Viewpoint Location (21-23)
- County Boundary
- District Boundary

Zone of Theoretical Visibility

- Higher Visibility
- Lower Visibility

Blade tip:	345m above HAT	Observer height:	2m
DTM:	OS Terrain 50 + IoM SRTM 30	Surface features:	Excluded
DTM resolution:	50m	Earth curvature:	Included

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Report: Morecambe Offshore Windfarm Scoping Report

Title: Blade Tip ZTV with Viewpoint Locations Enlarged Plans

Figure: 8.26o | Drawing No: 211609

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	06/01/2022	RH	LT	A3	1:50,000

Co-ordinate system: British National Grid

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8.12.3 Existing environment

779 An initial desk-based review of existing literature and data sources was undertaken to support this scoping exercise.

8.12.3.1 Seascape character

780 The majority of the SLVIA Study Area is covered by the sea and consists of both English and Welsh National Marine Character Areas. Following the approach set out by Natural England (Natural England, 2012, p7, Box 1) the National Seascape Assessment for England includes the areas identified as being within the North West Inshore and North West Offshore Marine Plan Areas. The National Marine Character Areas for Wales are defined within the inshore waters and extend 12 nautical miles from the high water mark.

781 A national level seascape character assessment for the English sector of the Study Area has been prepared for the Marine Management Organisation (MMO) namely MMO 1134: Seascape Character Assessment for the North West Inshore and Offshore marine plan areas, 2018.

782 At a national scale, the Welsh part of the Study Area is covered by the National Seascape Assessment for Wales, Natural Resources Wales (NRW) Evidence Report No: 80, 2015. In addition, NRW has recently published the Seascape and visual sensitivity to offshore wind farms in Wales: Strategic assessment and guidance (White *et al.*, 2019).

783 The MMO (2018) Seascape Character Assessment for the North West Inshore and Offshore marine plan areas defines the windfarm site as lying largely within Marine Character Area (MCA) 38: Irish Sea South (England). The overall character of this area is described as:

> 'The southern part of the Irish Sea is a busy area, with multiple offshore activities including fishing, main shipping routes, oil and gas extraction and dredging. Offshore wind farms extend into the north-west of the MCA. These activities also influence the night-time character with lighting on the main offshore platforms and wind turbine generators across the area. The sea is shallow, generally less than 40m deep, and is sheltered with low tidal flows. Due to the intensity of human activity there is limited nature conservation interest, though the mud and sand in the less disturbed north of the area provides key subtidal habitats. The offshore area is distant from low-lying coasts, and is not widely visible except from the ferry routes which link England with Ireland and the Isle of Man, although it is overlooked in distant views from the Lake District fells.'

784 A small area in the north-east of the windfarm site and the area of seascape that separates the windfarm site from the closest section of the coast is located within MCA 34: Blackpool Coastal Waters and Ribble Estuary. Its overall character is described as:

'Wide, sandy beaches, resulting from a combination of shallow waters and a high tidal range, characterise the length of the MCA, but there are distinct differences between the Sefton Coast, which is dominated by sand dunes, and the more urban coastline to the north of the Ribble, centred on Blackpool. The Ribble Estuary is noted for its wildfowl, waders and seabirds. Further offshore, the Lennox oil and gas field reflects the importance of the Irish Sea for energy production.'

785 The English and Welsh National Marine Character Areas are complemented by the existing National Landscape Character Areas, which extend to the low water mark to provide seamless character assessment coverage between land and sea.

786 In order to ensure consistency with this approach and baseline characterisation the SLVIA will assess seascape effects on seascape character areas (SCAs) that are seaward of the high water mark, which include beaches and intertidal areas. Landscape effects will be assessed on landscape character areas (LCAs) lying to the landward side of the low water mark and coastlines within LCAs covering the coast and those LCAs covering inland terrestrial areas with views of the Project that may materially alter its character.

8.12.3.2 Landscape character

787 There is a hierarchy of published Landscape Character Assessments that describe the baseline landscape character of the landscape in the SLVIA Study Area, at the national and local level.

788 The English and Welsh Landscape is classified at the national level by National Character Areas (NCA) and National Landscape Character Areas (NLCAs) respectively. The 159 NCAs, which cover England, have been revised and developed by Natural England into NCA profiles, which provide a recognised, national, spatial framework. Similarly, the descriptive profiles for the 48 individual NLCAs identified and described in Wales by Natural Resource Wales (NRW) highlight what distinguishes one landscape from another, with reference to their regionally distinct natural, cultural and perceptual characteristics.

789 The north-eastern landscape within this SLVIA Study Area comprises part of NCA 7: West Cumbrian Coastal Plain. It is an area of diverse natural habitats

and land uses separating the Irish Sea to the west from the Lake District mountains. Parts have been reclaimed from mining and the energy and shipbuilding industries are apparent particularly in the south around Barrow-in-Furness.

790 The SLVIA Study Area includes small areas of both NCA 19: South Cumbria Low Fells and NCA 8: Cumbria High Fells parts of which are covered by the Lake District National Park (LDNP). The South Cumbria Low Fells lie to the south and south-east of the central core of the Lake District (the Cumbria High Fells NCA). There is a sudden change in the underlying rock from the harder volcanic rock to the softer sedimentary rock which creates a dramatic change in landscape: the rugged high fells give way to gentler undulating hills, dissected by pastoral river valleys, woodland and linear lakes. The Cumbria High Fells NCA is a dramatic upland landscape carved by past glaciation into a series of rugged peaks, ridges and open fells separated by U shaped valleys with lakes and rivers.

791 The lowland landscape that arcs around the north and east around Morecambe Bay is within NCA 20: Morecambe Bay Limestones. It consists of conspicuous limestone hills separated by areas of low-lying undulating farmland and settlement. The dynamic coastal landscape is dominated by an intertidal foreshore consisting of wide and extensive areas of mudflat, sand flat and salt marsh backed by low limestone cliffs, pebble beaches or manmade defences. To the south of Morecambe Bay lies NCA 31 Morecambe Coast and Lune Estuary. It includes areas of high population including Heysham, Morecambe and the City of Lancaster but is also described as having areas of high tranquillity. Its identity is strongly linked to the coastal environment around Morecambe Bay and inland through the estuaries of the Lune and Keer. Away from the coast the landscape is characterised by pastoral agriculture.

792 In the east of the SLVIA Study Area a large part of the coastal and inland landscape is defined as NCA 32: Lancashire and Amounderness Plain, which is an area of high-grade agricultural land. The northern Fylde (or Amounderness) coastal plain is an area of improved pasture with isolated arable fields of medium to large scale and contains several rivers and the estuary of the River Wyre. To the south of the Ribble Estuary the plain is predominantly highly productive arable land in a pattern of large, open, rectilinear fields with a prevalence of drainage features indicating the transformation from a former marshland.

793 NCA 57: Sefton Coast is a narrow strip of land that runs along the coast from the mouth of the Ribble Estuary in the north to the edge of Crosby in the south, backed by the Lancashire and Amounderness Plain to the east. It is

characterised by intertidal sand flats and mudflats, coastal sand dunes, coastal dune heathland and conifer plantations, with areas of farmland inland. It contains a series of coastal settlements that include Southport, Ainsdale, Formby and Hightown.

794 The Merseyside Conurbation is defined as NCA 58 and is a predominantly urban and suburban landscape with a dense settlement pattern of housing and large scale industry including extensive docks and warehouses interlinked by extensive transport infrastructure.

795 The Wirall NCA 59 is defined by a peninsula formed by the Mersey and Dee estuaries. Its unique character is based on the formal landscapes of former large country estates, rural areas, natural coastal scenery and wooded sandstone ridges. It is a rich pastoral landscape interspersed with settlements.

796 To the west side of the River Dee lies the Welsh coast. Within the SLVIA Study Area it extends from the Point of Ayr in the east to the prominent headland of the Great Orme in the west. This stretch of coastline is characterised by a number of other headlands and distinctive small hills and upland areas. To the west these separate indented bays, many of which are characterised by towns and villages such as Llandudno and Ross-On-Sea that are popular with tourists. The eastern section of the coast is more uniform and provides the setting for Rhyl and Prestatyn. Inland from the coast the land rises providing containment and less developed uplands. This is with the exception of the lower lying Vale of Clwyd which runs away from the coast set below the Clwydian Range. The northern part of the Clwydian Range is within the Study Area. It separates the lower lying valley landscapes of Deeside and Wrexham which form the most easterly extent of Wales in the north.

797 Due to the distance of the windfarm site at over 45km from the Welsh coast and the prevalence of closer range, intervening offshore windfarms it is considered that significant effects on the landscape character of Wales would not arise as a result of the Project. This takes into account the higher value and therefore sensitivity of the landscapes within the Clwydian Range and Dee Valley Area of Outstanding Natural Beauty (AONB) and Great Orme Heritage Coast. It is therefore proposed that effects on landscape character within Wales are scoped out of the SLVIA.

8.12.3.3 Landscape planning designations and defined areas

798 The windfarm site is not within the boundary of any area subject to international, national or regional landscape designation intended to protect landscape quality.

799 Certain landscapes found within the onshore SLVIA Study Area have been designated or defined due to their scenic landscape as shown on Figure 8.23 and some of their defined special qualities relate to their setting, which may include seascape.

800 Of importance in this SLVIA are the Lake District National Park and the Clwydian Range and Dee Valley AONB, which are located at approximate distances of 43.5km and 46.5 km from the windfarm site respectively.

801 The Lake District National Park (LDNP) is the largest National Park in England. It is host to a collection of breath-taking lakes and high mountains, picturesque valleys and a sandy coastline. The south-western extents of the LDNP lies within the SLVIA Study Area. This is an area that includes the small settlement of Silecroft, a small section of the coastal plain and the steeply rising landform up to the summit of Black Combe.

802 The Clwydian Range and Dee Valley AONB is described in the AONB management plan as 'the dramatic upland frontier to North Wales embracing some of the country's most wonderful countryside. The Clwydian Range is an unmistakeable chain of heather clad summits topped by Britain's most strikingly situated hillforts. Beyond the windswept Horseshoe Pass, over Llantysilio Mountain, lies the glorious Dee Valley with historic Llangollen a famous market town rich in cultural and industrial heritage.'

803 The northern extents of the Clwydian Range and Dee Valley AONB lies within the SLVIA Study Area.

804 There is an area of Heritage Coast covering the Great Orme, which is not part of an AONB. There are no statutory requirements or powers associated with the Heritage Coast definition. However, reference will be made in the assessment of the effects of the Project in relation to the Conwy Local Development Plan 2007-2022 and the Great Orme Country Park and Local Nature Reserve Management Plan 2011-2016.

805 There are several Registered Parks and Gardens (RPG) in the English parts of the Study Area (Figure 8.23), the closest to the windfarm site are located in Lytham St Anne's (Ashton Gardens and Promenade Gardens Lytham St Anne's) at a distance of just over 30km from the windfarm site. The key reference material for consideration of these receptors is the Historic England 'Register of Parks and Gardens of Special Historic Interest in England'. This is an online resource that can be accessed through the National Heritage List for England (NHLE).

806 Cadw has prepared a statutory register of Historic Parks and Gardens (HPG) in Wales which has now replaced the non-statutory register.

807 The SLVIA will undertake an assessment of the visual effects on the registered RPG and HPG only where access to the public is provided. The Cultural Heritage assessment in the Environmental Impact Assessment (EIA) will consider the effects on the historic and cultural aspects of the RPG and HPG properties and their settings.

808 In England parts of the landscape within the SLVIA Study Area have been identified as local landscape designations through their Local Development Plans (LDP). Similarly, Special Landscape Areas have been designated locally by Conwy Borough Council. These will be mapped in the SLVIA and the associated value of the landscape within these areas will be considered in the assessment of sensitivity. The LANDMAP visual and sensory landscape evaluation categories will also be considered.

8.12.3.4 Visual receptors

809 The principal visual receptors in the SLVIA Study Area are likely to be found along the closest sections of the English and Welsh coastline. These include people within settlements, driving on roads, visitors to tourist facilities or historic environment assets and people engaged in recreational activity such as those using walking and cycle routes as well as coast and beach users. A detailed assessment will be undertaken in the SLVIA for those visual receptors that are most susceptible to changes, which may experience significant visual effects as a result of the Project and will focus on visual receptors on the land where the sea is a strong influence in the baseline view, along the English and Welsh coastline and immediate hinterland.

810 There are numerous ferry routes through the SLVIA Study Area emanating from both Liverpool and Heysham and parts of the SLVIA Study Area are also used by recreational vessels. The effects on the views of people in vessels using these routes and areas will be considered in the SLVIA.

8.12.4 Approach to data collection

811 Data to inform the SLVIA will be collected using both desk based study and analysis and extensive field work within the SLVIA Study Area including photography for the preparation of visualisations and impact assessment using those visualisations as an aid to defining seascape, landscape and visual effects.

812 Baseline data will be used to define and describe the seascape, landscape and visual receptors that will be considered in the SLVIA. Data will be gathered from official, reliable and up-to-date sources. These will include Ordnance Survey map-based data, as well as data on seascape and landscape

characterisation, landscape designations and other Governmental and local authority data of relevance.

813 In addition, the EIAs for other nearby offshore windfarms may also be referred to.

8.12.4.1 Seascape character

814 A national level seascape character assessment for the English sector of the SLVIA Study Area has been prepared for the MMO namely MMO 1134: Seascape Character Assessment for the North West Inshore and Offshore marine plan areas, 2018.

815 At a national scale, the Welsh part of the SLVIA Study Area is covered by the National Seascape Assessment for Wales, NRW Evidence Report No: 80, 2015. In addition, NRW has recently published the Seascape and visual sensitivity to offshore wind farms in Wales: Strategic assessment and guidance (White, *et al.*, , 2019).

816 It is these documents that will be used as the primary sources for the mapping and characterisation of the seascape.

8.12.4.2 Landscape character

817 The landscape of the onshore parts of the SLVIA Study Area within England will be described and assessed in relation to the following documented landscape character assessments and other reference material:

- Lancashire County Council (2000). A Landscape Strategy for Lancashire Landscape Character Assessment
- Cumbria County Council (2011). Cumbria Landscape Character Guidance and Toolkit, Part One – Landscape Character Guidance and Part Two – Landscape Character Toolkit
- Lake District National Park Partnership (2021). Lake District National Park Landscape Character Assessment and Guidelines
- Sefton Council (2003). Supplementary Planning Guidance in Sefton, Landscape Character of Sefton
- Wirral Metropolitan Borough Council (2019). Wirral Landscape Character Assessment.

8.12.4.3 Landscape planning designations

818 The following documents will inform the understanding of the baseline characteristics and qualities of the nationally designated areas of landscape:

- Lake District National Park Partnership Management Plan 2020-2025
- Clwydian Range and Dee Valley AONB Management Plan 2014-2019

- RPG in England from the National Heritage List for England (NHLE)
- Local Development Plans
- Great Orme Country Park and Local Nature Reserve Management Plan 2011-2016
- LANDMAP Wales visual and sensory data

8.12.4.4 Visual receptors

819 Visual receptors will be identified using ZTV analysis. Preliminary ZTV analysis has been conducted as shown in Figures 8.25 and 8.26a-o. The ZTV shows the main area in which the Project would theoretically be visible, highlighting the different groups of people who may experience views of wind turbine generators located within the windfarm site and assisting in the identification of viewpoints where they may be affected.

820 The SLVIA will assess the Project Design Envelope which has the maximum effect on seascape, landscape and visual receptors and this will be agreed with relevant consultees.

821 The preliminary ZTV overlaid on OS mapping shows that the main areas of theoretical visibility of the offshore elements of the Project will be across the open sea and extending across much of the English coast and the settlements and urban areas located along it. The closest point is around Blackpool at a distance of approximately 28km from the windfarm site. In the north-east of the SLVIA Study Area the ZTV extends across patches of higher land, including across the edge slopes and summits within the LDNP. Views from this part of the SLVIA Study Area would have closer range views of the intervening operational offshore windfarms.

822 In the east and south-east of the SLVIA Study Area the ZTV is shown across more extensive areas of low lying land. Actual visibility of the Project from within these areas will be reviewed in the field, however, much of it is likely to be locally screened by intervening vegetation and built form. Where visible out to sea the Project would be viewed within a relatively open area of the seascape with peripheral views of other operational windfarms.

823 Further south, along the Wirral coast in England and within Wales from the coasts of Denbighshire and Flintshire there is long range theoretical visibility of the Project. In addition, there is theoretical visibility shown along the high ground formed by the Clwydian Range and the estuary of the River Dee as well as along the Conwy coastline, including from Llandudno Bay and the Great Orme at distances of over 48km.

824 As well as OS mapping, the following datasets, information and stakeholder consultation will be used to inform the identification and analysis of visual receptors during the EIA:

- Local and County Planning Authorities
- NRW
- Cadw
- Natural England
- Historic England
- Sustrans UK
- ROW maps
- Local Development Plans prepared by the Planning Authorities

825 Viewpoint photography will be taken at a number of representative viewpoints to be agreed with relevant consultees through the scoping process, further consultation and the Evidence Plan Process (EPP). In compiling the preliminary list presented in Table 8.35, reference has been made to the agreed viewpoints used in the SLVIAs for the Walney, Walney Extension, Burbo Bank, Gwynt y Mor and Awel y Mor SLVIAs where these are located within the SLVIA Study Area for the Project and may have clear views of it.

Table 8.35 Preliminary representative viewpoint list

No	Location	Easting	Northing	Distance to windfarm site (km)
1	Black Combe[W]	313109	484961	48.32
2	Coast Path, Haverigg[W]	314161	477812	41.72
3	Hoad Monument, Ulverston[W]	329454	479042	49.61
4	High Haume Farm, Public Right of Way[W]	322391	475727	43.07
5	Biggar Bank Road, Walney Island[W]	317904	467362	33.58
6	South Walney Nature Reserve[W]	321423	461782	30.98
7	Heysham Head[W]	340893	461589	45.88
8	Rossall Point, Fleetwood[W]	331152	447563	31.13
9	Blackpool Tower[W]	330618	436032	29.11
10	St Anne's Pier[B]	331701	428516	30.22
11	Southport Pier[B]	332585	418160	33.17
12	Formby Lifeboat Station (Formby Point)[G]	327035	406295	34.68
13	Clieves Hill[B]	338420	407450	43.13

No	Location	Easting	Northing	Distance to windfarm site (km)
14	Crosby, near leisure centre [G]	330665	398815	42.52
15	Fort Perch Rock, New Brighton [B]	330950	394550	45.90
16	Hoylake, near Hilbre Point (Beach Road Slipway) [B]	320295	388465	45.37
17	Point of Ayr (near lighthouse) [B] *	312206	385074	45.95
18	Prestatyn (near Nova Centre) [A] *	306092	383798	46.19
19	Bryn—Ilwyn Viewpoint (Prestatyn Hillside, Gwaenysgor	307450	381750	48.38
20	Graig Fawr, Clwydian Range	305948	380398	49.56
21	Rhos Point	284050	381200	49.32
22	Llandudno Promenade (near end of Vaughan Street)	278650	382350	49.64
23	Great Orme's Head near summit complex [A]	276686	383403	49.32

[W] denotes viewpoint used in Walney or Walney Extension SLVIA

[G] denotes viewpoint used in Gwynt y Môr SLVIA

[B] denotes viewpoint used in Burbo Bank SLVIA

[A] denotes viewpoint used in Awel y Môr SLVIA (Preliminary Environmental Information Report)

8.12.4.5 Visibility

826 The Met Office visibility data collected from the Blackpool, Squires Gate and Rhyl weather stations will be used to inform the assessment of the likelihood of effects.

827 The likelihood of the seascape, landscape and visual effects arising will be described in relation to the Met Office definitions for the different ranges of visibility. These are found on the Met Office website and range from 'very poor' to 'excellent' as follows:

- Very poor visibility - range is less than 1km
- Poor visibility - range is 1 to 4km
- Moderate visibility - range is 4 to 10km
- Good visibility - range is 10 to 20km
- Very good visibility - range is 20 - 40km

- Excellent visibility - range is over 40km

828 This suggests that from the English parts of the SLVIA Study Area there would require to be 'very good visibility' or 'excellent visibility' conditions for the Project to be visible and for visibility from the Welsh coast 'excellent visibility' conditions.

8.12.4.6 Cumulative windfarms and other relevant development

829 Details regarding projects assessed as being relevant to the cumulative assessment will be obtained from the Crown Estate Offshore Wind Farm locational mapping data, data obtained from planning portals, and data provided by the Applicant and other developers. These will be used to inform the cumulative windfarm mapping and assessment, where there is sufficient information available.

830 The key development types likely to be included for assessment are offshore windfarms, onshore windfarms, above sea oil and gas installations and offshore wave and tidal energy developments.

831 The Ormonde, Barrow, West of Duddon Sands, Walney, Walney Extension, Gwynt y Môr, Rhyl Flats, North Hoyle, Burbo Bank and Burbo Bank Extension operational offshore windfarms (shown on Figure 8.23) as well as numerous onshore windfarms form part of the baseline environment.

8.12.5 Approach to impact assessment

832 The assessment will be undertaken in accordance with the methods outlined in the following best practice guidance documents:

- The Landscape Institute with the Institute of Environmental Management and Assessment (2013). Guidelines for Landscape and Visual Impact Assessment. Third Edition
- Planning Inspectorate (2018) Advice Note Nine: Rochdale Envelope
- Planning Inspectorate (2019). Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects
- Natural England (2012). An Approach to Seascape Character Assessment
- Natural England (2014). An Approach to Landscape Character Assessment
- Landscape Institute (2019). Visual Representation of Development Proposals Technical Guidance Note 06/19
- Scottish Natural Heritage (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments
- Scottish Natural Heritage (2017). Visual Representation of Windfarms: Version 2.2

- Natural Resources Wales (2021). Guidance Note 046 Using LANDMAP in Landscape and Visual Impact Assessments (LVIA)
- SNH (2017) - Siting and Designing Windfarms in the Landscape, Guidance (Version 3)

833 Although some of this guidance has been derived from publications by bodies located in other UK nations it is commonly drawn on for work carried out in England and Wales where no equivalent guidance exists.

834 The objective of the seascape, landscape and visual assessment of the Project will be to predict the likely significant effects on the seascape, landscape and visual resource. In accordance with the EIA Regulations 2017, the SLVIA effects will be assessed to be either significant or not significant. The methodology to undertake the SLVIA will reflect the 'Guidelines for Landscape and Visual Impact Assessment: Third Edition' (Landscape Institute, 2013) (GLVIA 3)

835 The significance of effects will be assessed through a combination of two considerations – the sensitivity of the landscape or visual receptor/view and the magnitude of change that will result from the Project. In accordance with the Landscape Institute's GLVIA 3, the SLVIA methodology requires the application of professional judgement, but generally, the higher the sensitivity and the higher the magnitude of change the more likely that a significant effect will arise.

836 The objective of the cumulative SLVIA is to describe, visually represent and assess the ways in which the Project will have additional effects when considered together with other existing, consented or application stage developments and to identify related significant cumulative effects arising. The guiding principle in preparing the cumulative SLVIA will be to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process.

8.12.6 Potential impacts

837 A range of potential impacts on SLVIA have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

838 As shown in Figure 8.23 there are a number of existing offshore windfarms which have been in operation for many years in the SLVIA study area, and the

Project is located in an area (MCA 38: Irish Sea South) which is already characterised to some degree by other offshore windfarm developments. The Seascape Character Assessment for this MCA recognises that offshore windfarms are part of the seascape character of this area.

839 In addition, there is a transition from a seascape in some areas characterised by oil and gas energy infrastructure to one more characterised by offshore windfarms.

8.12.6.1 Potential impacts during construction

840 Potential impacts during construction on seascape, landscape and visual amenity include:

- Impact (daytime) of the Project on seascape character
- Impact of daytime visibility of the Project on landscape character and landscape planning designations
- Impact of daytime visibility of the Project on visual receptors
- Impact of night-time visibility of the Project on visual receptors

841 There may be impacts on seascape character through the construction of the Project. In addition, impacts may arise as a result of views of this construction from surrounding areas of the seascape, landscape and visual resource. Impacts on the seascape, landscape and visual resource would result only from above sea elements of the construction with the main impacts arising from a concentration of construction vessels as well as the offshore substation platform(s) and wind turbine generators as they are constructed. Impacts may arise during the day and night due to construction and safety lighting at the offshore construction site .

Impact of the Project on seascape character

842 The Project activities and structures will alter the seascape character of the windfarm site itself and within the wider area through visibility of the changes within the windfarm site.

Impact of the Project on landscape character / visual receptors

843 The Project activities and structures will be visible from the coast during good to excellent visibility conditions and may therefore affect the character of the landscape as part of its context.

8.12.6.2 Potential impacts during operation and maintenance

844 Potential impacts during operation and maintenance on seascape, landscape and visual amenity include:

- Impact (daytime) of the Project on seascape character
- Impact of daytime visibility of the Project on landscape character and landscape planning designations
- Impact of daytime visibility of the Project on visual receptors
- Impact of night-time visibility of the Project on visual receptors

845 There may be impacts on seascape character through the operation of the Project. In addition, impacts may arise as a result of views of the operation of the Project from surrounding areas of the seascape, landscape and visual resource. Impacts would result only from above sea elements of the operation including aspects of the Project's maintenance and management. Impacts may arise during the day and at night due to operational aviation light markers and activity and safety lighting maintenance (see Sections 8.8 and 8.10) of the offshore infrastructure, which may include Civil Aviation Authority (CAA) and marine navigation lighting, which may affect night time views.

Impact of the Project on seascape character

846 The Project activities and structures will alter the seascape character of the windfarm site itself and within the wider area through visibility of the changes within the windfarm site.

Impact of the Project on landscape character / visual receptors

847 The Project activities and structures will be visible from the coast during good to excellent visibility conditions and may therefore affect the character of the landscape as part of its context.

8.12.6.3 Potential impacts during decommissioning

848 There may be impacts on seascape character through the decommissioning of the Project. In addition, impacts may arise because of views of decommissioning activity from surrounding areas of the seascape, landscape and visual resource. Impacts on the seascape, landscape and visual resource would result only from above sea elements of the decommissioning. The main impacts would arise from a concentration of decommissioning vessels as well as the offshore substation platforms and wind turbine generators as they are decommissioned. Impacts may arise during the day and night due to construction and safety lighting.

8.12.6.4 Potential cumulative impacts

849 There may be potential for cumulative impacts to occur on SLVIA as a result of other activities (such as oil and gas operations). The Project wide approach to assessment of potential cumulative impacts is set out in Section 7.7.

850 Offshore wind projects and other activities relevant to the assessment of cumulative impacts on SLVIA will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised (i.e. they occur only within the windfarm site) or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

851 The Project activities and structures will alter the seascape character of the windfarm site itself. This may result in cumulative effects on seascape character through the addition of the Project to a seascape affected by other cumulative offshore developments. In addition, visibility of the addition of the Project to other cumulative development may result in cumulative impacts on landscape character and visual receptors.

8.12.6.5 Potential transboundary impacts

852 There are unlikely to be any transboundary SLVIA impacts due to the distance of the Project from other jurisdictions i.e. over 50km.

8.12.6.6 Summary of potential impacts

853 Table 8.36 outlines the impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.36 Example Summary of impacts relating to SLVIA

Potential Impact	Construction	Operation and maintenance	Decommissioning
Impact (daytime) of the Project on seascape character	✓	✓	✓
Impact of daytime visibility of the Project on landscape character and landscape planning designations	✓	✓	✓
Impact of daytime visibility of the Project on visual receptors	✓	✓	✓
Impact of night-time visibility of the Project on visual receptors	✓	✓	✓

Potential Impact	Construction	Operation and maintenance	Decommissioning
Cumulative impacts	x	✓	x
Transboundary impacts	x	x	x

8.12.7 Potential mitigation measures

854 As discussed in Section 7.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the Preliminary Environmental Information Report (PEIR), and ultimately the Environmental Statement (ES), are prepared. Several mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

855 Mitigation of seascape, landscape and visual effects could occur through a reduction in the horizontal or vertical extent of the Project within the windfarm site or increasing the distance of the turbines from the coast within the windfarm site. These potential mitigation measures would constrain the Project and potentially reduce its renewable energy output and therefore its contribution to reducing climate change impacts; the Applicant will look to balance these two carefully.

856 Mitigation of the effects of civil aviation lighting may also be possible through agreement with the CAA.

857 The requirement and feasibility of any mitigation measures will be consulted upon with relevant consultees throughout the EIA process.

8.13 Air quality

8.13.1 Existing environment

858 The main source of existing offshore atmospheric emissions is likely to be from vessels (exhaust emission) operating within the Irish Sea. The typical pollutants associated with vessel emissions are nitrogen oxides (NOx), particulate matter (PM) and sulphur dioxide (SO2). Intermittent emissions may also occur from flaring associated with the Morecambe gas fields; however, this is expected to be infrequent and of a relatively short duration in comparison to emissions from vessels.

859 The International Maritime Organisation (IMO) has enacted regulations to reduce vessel emissions under Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL). The revised Annex VI of MARPOL introduced a more stringent sulphur limit in fuel globally from 1st January 2020 (known as 'IMO 2020') which required fuel to contain no more than 0.5% sulphur by mass. Whilst the Irish Sea is not currently a dedicated Emission Control Area under MARPOL, vessels operating within it will be required to comply with the IMO 2020 limit.

860 The relevant UK health-based air quality Objectives[10] only apply where there is representative exposure. There are few human receptors offshore, and marine-based ecological designations are unlikely to be sensitive to air pollution impacts, or they are usually dominated by other sources of inputs (Centre for Ecology and Hydrology 2021). Receptors may, therefore, only be affected where there are isolated locations of relevant human exposure (e.g., residences) and/or land-based designated ecological sites close to the shoreline.

8.13.2 Potential impacts

8.13.2.1 Potential impacts during construction, operation and maintenance and decommissioning

861 Vessel movements during the construction, operation and decommissioning phases of the Project may give rise to pollutant emissions offshore. However, in the context of the existing vessel traffic operating within the Irish Sea the Project contribution would form a small percentage. The majority of construction and operation and maintenance works would be undertaken at a

10 These are limits on the acceptable presence of contaminants in the atmosphere. The way the Objectives are to be measured is set out in the UK Air Quality (England) Regulations (2000).

significant distance from land (at the windfarm site) and therefore would be unlikely to impact upon landside human or ecological receptors. The majority of vessel movements would be during the construction phase, these construction activities are temporary in nature anticipated to take place over a period of two-and-a-half-years.

862 The main source of emissions would be exhaust emissions from vessels, and due to the nature and location of the Project, associated vessel movements would only generate a small increase in emissions in all phases. This is unlikely to result in significant effects to land based human and ecological receptors and given the limitations on sulphur content in marine fuel and the distance to sensitive receptors, it is considered that impacts would not be significant.

863 Any potential impacts associated with the transportation of materials onshore will be considered separately in a Port Access and Transport Plan which will be submitted with the Development Consent Order application

8.13.2.2 Potential cumulative impacts

864 As described above, most offshore works would be undertaken at a significant distance from any landside sensitive receptors. As such, it is considered unlikely that any significant cumulative effects would occur with other offshore emission sources (i.e., vessels) used for any other plans or projects within the windfarm site.

8.13.2.3 Potential transboundary impacts

865 It is considered unlikely that emissions from Project vessels operating within the Irish Sea would give rise to any significant transboundary effects, based on the distances to EU Member States.

866 As a result of the nature and location of the Project, associated vessel movements would only generate a small increase in emissions, which is unlikely to result in significant effects to land based human and ecological receptors for all phases. As such, due to the limited pathway for offshore air quality to impact receptors, it is proposed that air quality is scoped out of the EIA for further consideration.

8.14 Airborne noise

8.14.1 Existing environment

867 Two main sources of noise are considered to characterise the offshore environment:

- Natural – noise generated by wind, wave and precipitation
- Anthropogenic noise from vessel traffic and other users (oil and gas infrastructure)

8.14.2 Potential impacts

868 Construction, operation, maintenance and decommissioning activities have the potential to increase airborne noise from within the windfarm site. The main sources of noise would be from increased vessel activity, cable laying and foundation installation and subsequent operation and maintenance of infrastructure.

869 The windfarm site is approximately 30km from shore at its nearest point, and it is therefore highly unlikely that onshore receptors (i.e. coastal recreation users, coastal ecological designated sites and coastal settlements) will be affected by increases in noise from construction or operational activities in the windfarm site, in the context of the existing noise sources.

870 Any potential impacts associated with the transportation of materials onshore will be considered separately in a Port Access and Transport Plan which will be submitted with the Development Consent Order application

871 Disturbance to offshore biological receptors (including fish and marine mammals) from offshore airborne noise (including underwater noise) will be considered within the relevant sections for these topics and disturbance to birds is covered in offshore ornithology.

872 Due to the limited pathway for offshore airborne noise to impact receptors it is proposed that offshore airborne noise is scoped out of the EIA for further consideration. Noting that the main impacts from noise to ecological receptors occur from underwater noise, which is to be assessed in other relevant aspects chapters.

8.15 Human health

873 The human health assessment within the Project Environmental Statement (ES) will bring together the relevant conclusions of the impact assessments made in other topics of the Environmental Impact Assessment (EIA). The key inter-relationships occur in relation to marine water and sediment quality, commercial fisheries, shipping and navigation, seascape, landscape and visual amenity, infrastructure and other users and socio-economics, tourism and recreation.

874 The scope of the assessment will consider the World Health Organisation (WHO) definition of health, which states that health is "*a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*". The focus of human health within EIA will be on community health and wellbeing and not on occupational health and safety. The potential for Major Accidents and Disasters arising from the Project is considered separately in Section 8.18.

875 The Study Area for the assessment on human health will focus on a site specific (Project limits) study area. The assessment will also be informed by the zones of influence and receptors impacted or potentially impacted by the commercial fisheries, shipping and navigation, offshore seascape landscape and visual amenity, and socio-economics, tourism and recreation. This will enable the effects on human health to be better understood. As these Study Areas do not necessarily define the boundaries of potential health effects, the assessment will use Study Areas from other topics to broadly define representative population groups instead of setting boundaries on the extent of potential effects.

876 At this scoping stage there is not a fixed location for the port/harbour from which offshore workforce and vessels will operate during construction or the operational phase of the Project. The health considerations in relation to port activities are therefore scoped at a high level. As the final port decision may not be taken before application for development consent, it is anticipated that any issues relating to the port will be addressed by Development Consent Order (DCO) condition.

8.15.1 Existing environment

877 The wider determinants of health and health inequalities are key considerations when undertaking an assessment of human health as part of EIA. The following population groups are present and will be considered:

- The 'general population' including residents, workers, service providers, and service users

- The 'vulnerable group population' including potential vulnerability due to: young age, older age, low income, poor health status, social disadvantage, restricted access or geographic proximity to Project activities

878 The community receptors for the assessment are often onshore communities. However, the scope of population health outcomes arising from the Project link to activities that are undertaken offshore.

879 Human health will be informed by the quantitative and qualitative analysis within relevant topics, including:

- Commercial fisheries
- Shipping and navigation
- Offshore seascape, landscape and visual amenity
- Socio-economics, tourism and recreation

880 The human health chapter will also consider wider determinants of health (which are detailed within Table 8.37) not covered by other EIA chapters.

881 A population health approach will be taken, informed by discussion of receptors within the topic specific EIA chapters. For each determinant of health, the human health EIA chapter will identify relevant inequalities through consideration of the differential effect to the 'general population' of the Study Area and effects to the 'vulnerable population group' of that Study Area. The vulnerable population group being comprised of relevant sensitivities for that determinant of health. This is in line with guidance and good practice.

882 No bespoke baseline human health surveys are proposed to be undertaken as part of the assessment. The health analysis will be informed by project wide consultation.

8.15.2 Approach to impact assessment

883 The Health Impact Assessment (HIA) will be embedded within the EIA in line with good practice. There will be parity between physical health and mental health within the assessment. The HIA methodology will use best practice as published by:

- The Institute of Public Health (IPH), Health Impact Assessment Guidance, Standalone HIA and health in environmental assessment (2021) (Pyper et al., 2021). This guidance for Northern Ireland and the Republic of Ireland can be applied more broadly and is the only UK HIA guidance that provides detail on the analysis and reporting of human health in EIA.
- International Association for Impact Assessment (IAIA) and European Public Health Association (EUPHA), Human health: Ensuring a high level

of protection. A reference paper on addressing Human Health in Environmental Impact Assessment (2020) (Cave et al., 2021). This reference paper informed the IPH guidance.

- IEMA, Health in Environmental Impact Assessment: A Primer for a Proportionate Approach (outlined in Cave et al., 2017). This sets broad principles that have been developed in more detail by the IPH guidance.
- Public Health England (PHE) guidance, Health Impact Assessment in spatial planning (PHE, 2020). This sets a broad context, including that HIA be integrated into EIA.
- PHE, Advice on the content of Environmental Statements accompanying an application under the Nationally Significant Infrastructure Planning (NSIP) Regime (2021). This confirms a wider determinants of health approach in EIA.
- It is noted that the Office of Health Improvement and Disparities (OHID), (previously PHE) and IEMA are in the process of producing updated guidance on the coverage of human health within EIA. Regard will be made to that work.

884 The EIA human health assessment will be a qualitative analysis, following the IPH 2021 guidance approach, which draws on qualitative and quantitative inputs from other EIA topic chapters. This is considered the most appropriate methodology for assessing wider determinants of health proportionately, consistently and transparently.

8.15.3 Potential impacts

885 Potential impacts and scoping conclusions for the Project are based on the tools used by IPH (IPH, 2021). Table 8.37 details the determinants of health which are scoped in or out for further assessment.

Table 8.37 Wider determinants of health scoping exercise

Determinant of health	Rationale
Scoped in	
Healthy lifestyles: Physical activity and leisure	Healthy lifestyles will be considered within the EIA in relation to mental health and physical activity. Consideration will be given to the offshore infrastructure's influence on recreational sailing and similar marine activities, as set out in Shipping and Navigation, Section 8.8. If, once further information is available, the scale of change does not have the potential for a likely significant population health effect, this will be explained in the EIA health chapter. This issue is therefore currently scoped in, but in line with proportionate assessment will be kept under review.
Education: Workforce upskilling	The Project offers the potential to support positive upskilling and career development in relation to its workforces, as discussed in Section 4.1.3. This may include apprenticeships and adult learning.
Socioeconomic status: Employment and investment	The employment opportunities of the Project may benefit workers directly and their dependants. Levels of construction and operational employment will be reported by the EIA socio-economic chapter. The health assessment will consider the potential population health effects of direct and indirect employment, including exploring opportunities and inequalities. Should there be any negative implications, these will also be discussed. For example, the Projects' effects on commercial fishing grounds, as assessed in Section 8.7.
Environmental conditions: Climate change	The health effects of climate change are recognised and are a source of concern. The Project would be a part of a wider positive energy sector transition that reduces the severity of climate change. The benefits to population health will be discussed.
Environmental conditions: Water	Due to the presence and movements of construction vessels/equipment there is the potential for spills and leaks which could result in changes to water quality and pollution of the environment as discussed in Section 8.2.6. Reference will be made to the Marine Water and Sediment Quality assessment when considering potential health impacts. If, once further information is available, the scale of change does not have the potential for a likely significant population health effect, this will be explained in the EIA

Determinant of health	Rationale
	health chapter. This issue is therefore currently scoped in, but in line with proportionate assessment will be kept under review.
Safe and cohesive communities: Community identity	Visual change can affect mental health and wellbeing with psychological and physiological responses. The nearest point from the windfarm site to shore is approximately 30km. The operational visual impacts of the Project are expected to be limited, but may affect a wide area of the coast. If, once further information is available, the scale of change does not have the potential for a likely significant population health effect, this will be explained in the EIA health chapter. This issue is therefore currently scoped in, but in line with proportionate assessment will be kept under review.
Wider societal benefits	The Project provides important energy infrastructure that supports many aspects of public health. Energy security providing a reliable supply of electricity is recognised as an essential service enabling, thermal comfort, healthcare, learning, income generation and social networking. The benefits of the Project in supporting these wider societal benefits will be noted. The Project's benefits in reducing the effects of climate change is also noted.
Scoped Out	
Safe and cohesive communities: Housing	No new housing is proposed as part of the Project. The workforce will have housing requirements, but it is expected that a high proportion will be resident in the local region of the loadout port, or would be based aboard their vessels, unless traveling to their usual place of residence.
Safe and cohesive communities: Transport	During construction, the vast bulk of material will arrive by ship at the loadout port a port location associated with the offshore construction for marshalling and loadout to the Project. Whilst the Port will be busy there would be limited effect on the local road network from offshore construction activities. Although the port has not been determined, the road infrastructure to ports in general is good. There will be a commitment to produce a Port Traffic Management Plan (PTMP). On the basis of an effective PTMP it is proposed that this determinant is scoped out of the health assessment.

Determinant of health	Rationale
Safe and cohesive communities: Community safety	There are not anticipated to be community safety or security issues associated with worker behaviour in ports or communities.
Environmental conditions: Air quality	Offshore works are likely to have a very limited effect on onshore air quality. Section 8.13 proposes to scope air quality out of the EIA. The health assessment would take a consistent approach.
Environmental conditions: Noise	Airborne noise, Section 8.14 identifies that there is limited potential for the majority of offshore infrastructure installation to give rise to noise effects at onshore human receptors and proposes to scope airborne noise out of the EIA. The health assessment would take a consistent approach.
Environmental conditions: Radiation	The Project is not located in proximity to people, other than project works. Relevant occupational safeguards would be followed. Electromagnetic Frequency (EMF) risks to human health associated with the Project is therefore considered unlikely.
Health and social care services	It is not expected that a high proportion of offshore workers would move to the Project area with dependants requiring social care. Demand for social care service is scoped out. Health protection measures such as screening and immunisations are expected to continue from the offshore workers' usual place of residence so would not be affected by the Project. Similarly, routine dental appointments are assumed to be with the offshore worker's dental practice close to their usual place of residence. Sexual health services are not expected to be affected as no largescale in-migration is expected and the workforce of skilled technical roles would return to their usual places of residence when ashore. Prolonged offshore shift working in confined quarters has potential to affect mental health. It is however expected that any requirement for mental health would be met via the usual primary care gatekeepers at the workers' registered GP close to their usual place of residence. Appropriate occupational mental health support would be available. In relation to preparedness for emergency scenarios, this is most relevant to offshore shipping and port storage/loading. In line with proportionate assessment, it is proposed to scope emergency planning implications of the Project out of the human health chapter. Relevant occupational practices and emergency planning procedures

Determinant of health	Rationale
	would be required by law. Section 8.18 discusses the EIA approach to the Major Accidents and Disasters topic area.

886 The inter-related effects between determinants of health will also be considered, including how these are distributed temporally, geographically and in terms of vulnerable population groups.

8.15.3.1 Potential transboundary impacts

887 Transboundary effects in relation to human health are not expected. Port activities within another jurisdiction, if required, would be expected to operate within their existing consented levels of activity. Any international supply chain would be expected to operate appropriate policies that safeguard against significant population challenges to equality, health and safety, for both workers and, as appropriate, the public.

8.15.3.2 Summary of potential impacts

888 Table 8.38 outlines the human health related impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.38 Summary of impacts relating to human health

Potential Impact	Construction	Operation and maintenance	Decommissioning
Healthy lifestyles	✓	✓	✓
Transport	x	x	x
Education	✓	✓	✓
Socio-economic status	✓	✓	✓
Climate change	x	✓	x
Air quality	x	x	x
Water	✓	x	✓
Noise	x	x	x
Radiation	x	x	x
Health and social care services	x	x	x
Community identity	✓	✓	✓
Wider societal benefits	x	✓	x
Cumulative effects	✓	✓	✓
Transboundary	x	x	x

8.15.4 Potential mitigation measures

889 As discussed in Section 1.7.2.4, mitigation measures will be developed as site specific information becomes available, the project design is refined and the Preliminary Environmental Information Report (PEIR), and ultimately the ES, are prepared. A number of mitigation measures that may be appropriate for the Project could be embedded within the design and accounted for within the assessment of impacts. Further mitigation measures may be proposed in response to impact assessments. These will evolve as the Project design develops and the EIA progresses, and/or in response to consultation.

890 Mitigation measures which are likely to of relevance to human health are linked to other topics including:

- Marine water and sediment quality
- Commercial fisheries
- Shipping and navigation
- Offshore seascape, landscape and visual amenity
- Socio-economics, tourism and recreation

891 Health mitigation may compromise; design elements aimed at reducing impacts; commitment to adoption of specific best practice and consultation.

8.16 Socio-economics and tourism and recreation

892 This section of the Scoping Report identifies the potential effects of construction, operation and maintenance, and decommissioning of the Project on socioeconomics, tourism and recreation. Socio-economic, tourism and recreation receptors relevant to the Project are also identified.

893 The assessment will bring together the conclusions of assessments made in other relevant chapters of the environmental impact assessment (EIA). For example effects to socio-economics, tourism and recreational assets are estimated with reference to water and sediment quality, shipping and navigation, archaeology and cultural heritage, infrastructure and other users, and offshore seascape, landscape and visual amenity.

8.16.1 Existing environment

894 The existing environment relevant to the EIA will consider two receptor groups:

- Economic receptors, i.e. people or businesses that would benefit from or be adversely affected by the Project and associated development
- Social receptors, which are the social infrastructure relevant to a community, that would benefit from or be adversely affected by the Project. Impacts on social receptors subsequently impact on the population and its health and wellbeing.

895 The Study Area covers part of the Irish Sea, which is a busy shipping area, used by commercial shipping vessels, fishing vessels and oil and gas operators. Impacts to shipping and navigation are considered in Section 8.8 impacts to commercial fishing is considered in Section 8.7, and impacts to other users is considered in Section 8.11.

896 A desk-based study will be undertaken to identify tourism and recreation features which may be affected by the Project, using sources of information online and through continued consultation with statutory stakeholders. The tourism baseline will be described on the basis of trends for visitor numbers, visitor origin, expenditure, secondary benefits from tourism, and the timing of visitor periods.

897 The socio-economics assessment will be informed by a desk-based assessment of socio-economic baseline conditions, including collecting data on:

- Regional and local labour market and trends (considering commercial fisheries as discussed in Section 8.8)

- High level indication of temporary and rented accommodation supply and trends
- Current workforce
- Local and regional population and trends
- Local and regional employment and trends
- Education
- Skills

898 Any additional primary or secondary datasets will be identified through ongoing consultation with stakeholders through the Evidence Plan Process (EPP), as described in Section 3.4.

8.16.2 Approach to impact assessment

899 The Overarching National Policy Statement (NPS) for Energy (EN-1) states that where a project is likely to have an impact on socio-economics at a local or national scale the assessment should consider all relevant impacts.

900 There is no set of industry standard guidance for the assessment of socio-economic impacts. In light of this, the socio-economic assessment will present a qualitative assessment of the anticipated impacts and benefits, their extent and when they are expected to occur. A methodology will be developed using the following guidance:

- Good practice from the International Association for Impact Assessment (IAIA)'s Social Impact Assessment: Guidance for assessing and managing the social impacts of projects (Vanclay 2015)
- Emerging best practice published by the IEMA in line with the 'Health in Environmental Impact Assessment: A Primer for a Proportionate Approach' (Cave et al. 2017)
- Published guidance from Glasson and Chadwick in Methods of Environmental and Social Impact Assessment (Natural and Built Environment Series) Fourth Edition (Therivel and Wood 2017):
    - Chapter 13 Socio-economic impacts 1: overview and economic impacts and Socio-economic impacts
    - Chapter 14 Socio-economic impacts 2: Social impacts
- The methodology used to estimate the economic impacts follows the guidance set out in the HM Treasury's Green Book (HM Treasury 2020) and Homes and Communities Agency Additionality Guide (2014)
- Guidance notes from the Office for National Statistics have been used to ensure appropriate use of national statistics

901 Economic impacts will be dependent on a range of factors which will be considered in the EIA where possible, such as:

- The technologies and infrastructure to be deployed during construction, operation and maintenance and decommissioning methodologies
- Procurement/contracting strategy
- Availability and capacity of the supply chain
- Number of workers
- Where the workers come from
- The duration of employment

902 The absolute scale of economic impacts, both beneficial (e.g. the number of jobs which construction, operation and maintenance, and decommissioning activity is expected to support) and adverse (e.g. disruption to other activities) would be calculated based on a worst case scenario, using an approach consistent with methods for economic impact assessment set out in HM Treasury Green Book (2020). The socio-economic impact magnitude will be determined by consideration of the predicted deviation from baseline conditions.

903 With regards to tourism, are no specific statutory guidelines which inform the assessment of impacts upon tourism and recreation receptors. The assessment will focus on factors that have the potential to reduce the number of tourists visiting or returning to an area and will be developed with other inter-related assessments such as the offshore seascape landscape and visual impact assessment and the socio-economics assessment to ensure that inter-relationships are captured and relevant receptors are considered. The tourism and recreation assessment will cross reference these assessments as appropriate.

904 As there is no statutory guidance on assessing tourism, or recreation impacts, a methodology will be developed using guidance notes from the Office for National Statistics.

8.16.3 Potential impacts

905 A range of potential impacts on socio-economic, tourism and recreation receptors have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. These impacts include those issues identified as requiring consideration in the National Policy Statement for Renewable Energy Infrastructure (EN-3) (DECC, July 2011) and in the guidance documents listed above.

8.16.3.1 Potential impacts during construction

906 There is potential for impacts on socio-economic, tourism and recreation receptors during construction which may include:

- Direct economic benefit (supply chain)
- Increased employment
- Change in demographics due to in-migration
- Loss of, disruption to or pressure on existing offshore activities (including disruption to recreational activities)
- Changes in visitor behaviour as a result of visual, noise, transport or other environmental impacts Reduction in available accommodation due to construction personnel

907 The construction of offshore windfarms can have beneficial socio-economic effects in terms of providing employment and continuing to develop the wind energy market at a national level, i.e. encouraging wind energy manufacturers to be based in the UK. However, there is a small potential for adverse impacts on social infrastructure where the project components and activities to construct them impact on specific receptors, unless they are identified and avoided through micro-siting and mitigation measures.

908 The EIA will consider direct economic benefit through the supply chain required for the Project, including spending on local goods and services supplied by local businesses. Increased employment, as well as potential changes to demographics due to national and international immigration will be assessed, considering likely recruitment strategies.

909 There is a small potential for in-migrant workers to affect the local tourism economy by using accommodation that might otherwise be used by tourists. There is also the beneficial effect of in-migrant workers in the offseason utilising hotel beds that would otherwise be empty.

910 The potential visibility of the offshore construction activities may also affect the amenity value of tourist features, particularly those areas most valued for their landscape setting.

911 Offshore construction activities would require the introduction of navigation safety zones, which may affect marine and coastal recreation activities.

8.16.3.2 Potential impacts during operation and maintenance

912 There is potential for impacts on socio-economic, tourism and recreation receptors during the operation and maintenance (O&M) phase which may include:

- Direct economic benefit (supply chain)
- Increased employment
- Change in demographics due to immigration
- Loss of, disruption to or pressure on offshore activities
- Visual impacts
- Disruption to marine recreational activities

913 The impacts assessed for the O&M phase of the Project will be as described above for construction. As has been seen from the other offshore windfarms in the Irish Sea, the O&M activities associated with maintaining a windfarm is considerable and will create opportunities for training and long-term employment across a number of sectors. Adding to the existing Irish Sea windfarms will help develop O&M bases and supporting business with the associated socio-economic benefits.

914 The visibility of the wind turbine generators to onshore tourist and recreation receptors has the potential to affect the amenity of the area. Tourism perception research in rural Wales (NFO, 2003), North Devon (Aitchison, 2004), Scotland (Glasgow Caledonian University, 2008), and Northumberland (Northumbria University, 2014) show that the majority of people do not perceive windfarms negatively. Furthermore, economic studies of Wales (Regeneris and The Tourism Company, 2014) and Scotland (Biggar Economics, 2017) demonstrate that windfarms have no measurable effect on the tourism economy.

915 Offshore, some navigational restrictions for leisure craft are likely to continue in the immediate vicinity of the wind turbine generators. This is likely to be applied in the form of safety zones around each fixed structure. Recreational sailing is considered separately in Section 8.8.

8.16.3.3 Potential impacts during decommissioning

916 Potential impacts during decommissioning impacts will be assessed as outlined in Section 7.2. It is anticipated that the decommissioning impacts would be similar in nature to those of construction.

8.16.3.4 Potential cumulative impacts

917 There may be potential for cumulative impacts to occur on socio-economic, tourism and recreation receptors as a result of other activities.

918 Projects and activities relevant to the assessment of cumulative impacts on socio-economic, tourism and recreation receptors will be identified through a screening exercise. The potential impacts considered in the cumulative assessment as part of EIA will be in line with those described for the project-

alone assessment, though it is possible that some will be screened out on the basis that the impacts are highly localised or where management measures in place for the Project and other projects will reduce the risk of impacts occurring.

919 There is potential for the Project to bring socio-economic benefits, for example by providing opportunities for business, jobs and training. The clustering of offshore windfarm developments in the Irish Sea, including other Round 4 windfarms, will provide longer term opportunities for the supply chain and skills sectors than a single development. Conversely, there is also potential to cumulatively impact upon other industries negatively as a result of displacement of workers currently employed in other industries. This will be considered further in the EIA.

8.16.3.5 Potential transboundary impacts

920 Transboundary effects in relation to socio-economics, tourism and recreation are not expected and are therefore scoped out for further assessment. Any potential transboundary impacts on recreational fishing, sailing and other users are considered separately in Sections 8.7, 8.8 and 8.11 respectively.

8.16.3.6 Summary of potential impacts

921 Table 8.39 outlines the socio-economic, tourism and recreation impacts which are proposed to be scoped into and/or out of the EIA. This may be refined as additional information and data become available.

Table 8.39 Summary of impacts relating to tourism and recreation

Potential impact	Construction	Operation and maintenance	Decommissioning
Direct economic benefit (supply chain)	✓	✓	✓
Increased employment	✓	✓	✓
Change in demographics due to immigration	✓	✓	✓
Loss of, disruption to or pressure on offshore activities	✓	✓	✓
Visual impacts	✓	✓	✓
Disruption to recreational activities	✓	✓	✓

Potential impact	Construction	Operation and maintenance	Decommissioning
Reduction in available accommodation due to construction personnel	✓	x	x
Cumulative impacts	✓	✓	✓
Transboundary impacts	x	x	x

8.17 Climate change

923 The Project EIA will consider the potential effects of the Project and potential effects on the Project in relation to climate change.

924 Climate change was included as a required topic as part of the EIA Directive 2014/52/EU, which was implemented into UK regulations in May 2017. The climate change chapter will include consideration of the effect of the Project to climate change (net change in greenhouse gas (GHG) emissions), and the impact of climate change to the Project (vulnerability of infrastructure and assets)

925 The climate change assessment will therefore comprise two separate assessments, an assessment which quantifies the GHG emissions released from activities associated with the Project. This will also determine the 'net' effect of the provision of renewable energy to the UK grid. In addition, a climate resilience assessment will be carried out to understand how the Project infrastructure may be potentially impacted by the projected effects of climate change. The approach to the assessment will follow the updated Environmental Impact Assessment Guidance on Assessing Green House Gas Emissions by the Institute of Environmental Management and Assessment.

8.18 Major accidents and disasters

926 The Environmental Impact Assessment (EIA) will consider the potential effects of the Project in relation to major accidents and disasters.

927 Following guidance published by Institute of Environmental Management and Assessment (IEMA) on Major Accidents and Disasters in EIA (IEMA, 2020), it is proposed that consideration of major accidents and disasters within the EIA process for the Project will be based on assessments conducted within individual technical chapters, where this can be adequately covered by the scope of these chapters.

928 Following a review of the potential major accidents and disasters which may interact with, or arise from the Project, the following have been identified:

- Accidental spills of hazardous material (considered within the 'Marine Water and Sediment Quality', 'Benthic Ecology', Fish and Shellfish Ecology', 'Marine Mammal Ecology' and 'Human Health' EIA chapters)
- Vessel collision (considered within the 'Shipping and Navigation' EIA chapter)
- Exposed cables leading to vessel snagging (considered within the 'Shipping and Navigation', 'Commercial Fisheries' and 'Infrastructure and Other Users' EIA chapters)

929 As the impacts of these accidents/disasters are being considered individually within the above technical EIA chapters, a separate Major Accidents and Disasters chapter is not considered within the EIA or its ES, and the topic is therefore proposed to be scoped out of further assessment.

8.19 Onshore topics

930 As discussed previously, this Scoping Report considers the Generation assets only. As these Generation assets are located approximately 30km from shore, for some topics which are usually included in an EIA for Generation and Transmission assets associated with an offshore windfarm, there is no pathway for effect as potential receptors are located onshore outside an potential zone of influence. Therefore, the following topics are proposed to be scoped out of the EIA.

- Ground conditions and contamination
- Land use
- Onshore ecology
- Onshore ornithology
- Onshore archaeology and cultural heritage

- Water resources and flood risk (any potential impacts on water resources is considered in the Marine Water and Sediment Quality chapter)
- Onshore traffic and transport (any potential impacts on traffic and transport and associated air and noise impacts will be considered separately in a Port Access and Transport Plan which will be submitted with the Development Consent Order application).

9. Part 3: Inter-relationships

931 The EIA will identify and assess inter-relationships which are likely to result from the construction, operation and decommissioning of the Project. The inter-relationships relevant to the Project are outlined in Table 9.1. Each inter-relationship identified in the table below will be considered in the relevant EIA topic chapter as the assessment is undertaken.

Table 9.1 Inter-relationships

Topic	Inter-relationships
Marine geology, oceanography and physical processes	Will have effects on: ▪ Marine archaeology and cultural heritage ▪ Benthic ecology ▪ Marine water and sediment quality ▪ Fish and shellfish ecology
Marine water and sediment quality	Is affected by: ▪ Marine geology, oceanography and physical processes Will have effects on: ▪ Benthic ecology ▪ Fish and shellfish ecology ▪ Marine mammals ▪ Human health
Benthic ecology	Is affected by: ▪ Marine geology, oceanography and physical processes ▪ Marine water and sediment quality Will have effects on: ▪ Fish and shellfish ecology
Fish and shellfish ecology	Is affected by: ▪ Marine geology, oceanography and physical processes ▪ Marine water and sediment quality ▪ Benthic ecology Will have effects on: ▪ Commercial fisheries ▪ Marine mammals ▪ Offshore ornithology ▪ Socio-economics, tourism and recreation
Marine mammals	Is affected by: ▪ Marine water and sediment quality ▪ Fish and shellfish ecology ▪ Shipping and navigation

Topic	Inter-relationships
	Will have effects on: ▪ Socio-economics, tourism and recreation
Offshore ornithology	Is affected by: ▪ Fish and shellfish ecology
Commercial fisheries	Is affected by: ▪ Fish and shellfish ecology ▪ Shipping and navigation Will have effects on: ▪ Socio-economics, tourism and recreation ▪ Human health
Shipping and navigation	Will have effects on: ▪ Marine mammals ▪ Commercial fisheries Will have effects on: ▪ Socio-economics, tourism and recreation ▪ Human health
Marine archaeology and cultural heritage	Is affected by: ▪ Marine geology, oceanography and physical processes ▪ Seascape, landscape and visual amenity
Civil and military aviation	N/A
Infrastructure and other users	Will have effects on: ▪ Socio-economics, tourism and recreation
Offshore seascape, landscape and visual impact assessment	Will have effects on: ▪ Marine archaeology and cultural heritage ▪ Socio-economics, tourism and recreation
Offshore air quality	N/A
Offshore airborne noise	N/A
Human health	Is affected by ▪ Water and sediment quality ▪ Commercial fisheries ▪ Shipping and navigation ▪ Offshore seascape, landscape and visual amenity ▪ Socio-economics, tourism and recreation
Socio-economics, tourism and recreation	Is affected by: ▪ Fish and shellfish ecology ▪ Marine mammal ecology ▪ Shipping and navigation ▪ Commercial fisheries ▪ Infrastructure and other users

Topic	Inter-relationships
	▪ Offshore seascape, landscape and visual amenity Will have effects on: ▪ Human health
Climate change	The need to need to reduce greenhouse gas emissions is a key driver for the Project. Inter-relationships with climate change will be considered within each relevant EIA topic.
Major accidents and disasters	N/A

10. References

ABPmer (2018). SeaState. Available at: https://www.seastates.net/explore-data/

ASCOBANS (2015). Recommendations of ASCOBANS on the Requirements of Legislation to Address Monitoring and Mitigation of Small Cetacean Bycatch. October 2015.

Aitchison (2004). Evidence Gathering of the impact of wind farms on visitor numbers and tourist experience.

Bailey, G., Galandiou, N., Peeters, H., Jons, H., and Mennenga, M. (2020). *The Archaeology of Europe's Drowned Landscapes.* Coastal Research Library 35: 95–123.

Baines, M. E., and P. G. H. Evans. (2012). Atlas of the Marine Mammals of Wales. Countryside Council for Wales Monitoring Report No. 68. 2nd edition. 139pp.

Band, W., 2012. SOSS-02: Using a Collision Risk Model to Assess Bird Collision Risks For Offshore Wind Farms (No. SOSS-02).

Barker, J., Seymour, A., Mowat, S. and Debney, A. (2014). Thames harbour seal conservation project. Report for the UK & Europe Conservation Programme, Zoological Society of London.

Biggar Economics (2017) Wind Farms and Tourism Trends in Scotland. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fbiggareconomics.co.uk%2Fwp-content%2Fuploads%2F2020%2F01%2FWind-farms-and-tourism-trends-in-Scotland.pdf&clen=1258166&chunk=true

British Geological Survey (BGS) (2015). Geology of the seabed and shallow subsurface: The Irish Sea. Available at: http://nora.nerc.ac.uk/id/eprint/512352/1/BGS_Report_Irish_Sea_Geology_CR-15-057N.pdf

Carter, M.I., Boehme, L., Duck, C.D., Grecian, J., Hastie, G.D., McConnell, B.J., Miller, D.L., Morris, C., Moss, S., Thompson, D. and Thompson, P. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles: Report to BEIS, OESEA-16-76, OESEA-17-78.

Cave, B., Fothergill, J., Pyper, R., Gibson, G., Saunders, P. (2017) Health in Environmental Impact Assessment: a primer for a proportionate approach. DOI 10.13140/RG.2.2.22254.20801

Cave, B., Claßen, T., Fischer-Bonde, B., Humboldt-Dachroeden, S., Martín-Olmedo, P., Mekel, O., Pyper, R., Silva, F., Viliani, F., Xiao, Y. 2020. Human health: Ensuring a high level of protection. A reference paper on addressing Human Health in Environmental Impact Assessment. As per EU Directive 2011/92/EU amended by

2014/52/EU. International Association for Impact Assessment and European Public Health Association.

Cefas (2004). Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements: Version 2.

Cefas (2013). Survey: CEND 18/13 (part of North West Groundfish Survey, Qtr 3 (FSS: NWGFS)).

Cefas (2019). Young Fish Survey Data 1981 to 2010.

Cefas (2011). Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects.

Cefas (2020) Review of Action Levels used for assessing dredging and disposal marine licences.

Cefas (2005). Assessment of the significant of changes to the inshore wave regime as a consequence of an Offshore Wind Array. Cefas report AE1227. September 2005.

Cefas. (2012). Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy projects. Contract report: ME5403.

Chartered Institute for Archaeologists' (2014a). *Standard and Guidance for Historic Environment Desk-Based Assessments*. [Online] Available at: https://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf.

Chartered Institute for Archaeologists' (2014b). *Code of Conduct*. [Online] Available at: https://www.archaeologists.net/sites/default/files/CodesofConduct.pdf.

CIEEM, 2018. Guidelines for Ecological Impact Assessment in the UK and Ireland. CIEEM, Winchester.

Clean Seas Environment Monitoring Programme (CSEMP), (2018). Available at: http://marine.gov.scot/information/clean-seas-environment-monitoring-programme-csemp

Cleasby, I.R., Owen, E., Wilson, L., Wakefield, E.D., O'Connell, P., Bolton, M., 2020. Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping. Biological Conservation 241. https://doi.org/10.1016/j.biocon.2019.108375

Cleasby, I.R., Owen, E., Wilson, L.J., Bolton, M., 2018. Combining habitat modelling and hotspot analysis to reveal the location of high density seabird areas across the UK (Research Report No. 63). RSPB Centre for Conservation Science.

Clewley, G.D., Scragg, E.S., Thaxter, C.B., Burton, N.H.K., 2017. Assessing the habitat use of Lesser Black-backed Gulls (Larus fuscus) from the Bowland Fells SPA ANNEX 1 – 2017 update (BTO Research Report No. 694a). BTO, Thetford.

Clewley, G.D., Thaxter, C.B., Humphreys, E.M., Scragg, E.S., Bowgen, K.M., Bouten, W., Masden, E.A., Burton, N.H.K., 2021. Assessing movements of Lesser Black-backed Gulls using GPS tracking devices in relation to the Walney Extension and Burbo Bank Extension Offshore Wind Farms (BTO Research Report No.738). BTO, Thetford.

Climate Change Committee (2020). Sixth Carbon Budget. Available at: https://www.theccc.org.uk/publication/sixth-carbon-budget/

Clwydian Range and Dee Valley AONB Management Plan 2014-2019.

Cook, A., Johnston, A., Wright, L., Burton, N., 2012. SOSS-02: A review of flight heights and avoidance rates of birds in relation to offshore wind farms (BTO Research Report No. 618). British Trust for Ornithology.

Cook, A.S.C.P., Humphreys, E.M., Masden, E.A., Burton, N.H.K., 2014. The Avoidance Rates of Collision Between Birds and Offshore Turbines (No. Volume 5 Number 16), Scottish Marine and Freshwater Science.

Coull, K.A. Johnstone, R. and Rogers, S.I. (1998) Fisheries Sensitivity Maps in British Waters Published and distributed by UKOOA Ltd. Aberdeen, 63 pp. Dana Petroleum (2018). Platypus Development Environmental Statement (D/4229/2018).

COWRIE (2009). Coastal Process Modelling for Offshore Windfarm Environmental Impact Assessment: best practice guide. COWRIE Limited, London.

Crown Estate (2019) Review of cable installation, protection mitigation and habitat recoverability. Available at: https://www.rpsgroup.com/media/4295/review-of-cable-installation-protection-mitigation-and-habitat-recoverability.pdf

Cumbria County Council (2011). Cumbria Landscape Character Guidance and Toolkit, Part One – Landscape Character Guidance and Part Two – Landscape Character Toolkit.

Dean, B., Freeman, R., Kirk, H., Leonard, K., Phillips, R., M Perrins, C., Guilford, T., 2013. Behavioural mapping of a pelagic seabird: Combining multiple sensors and a hidden Markov model reveals the distribution of at-sea behaviour. Journal of the Royal Society Interface 10. https://doi.org/10.1098/rsif.2012.0570

Dean, B., Kirk, H., Fayet, A., Shoji, A., Freeman, R., Leonard, K., Perrins, C., Guilford, T., 2015. Simultaneous multi-colony tracking of a pelagic seabird reveals cross-colony utilization of a shared foraging area. Marine Ecology Progress Series 538, 239–248. https://doi.org/10.3354/meps11443

DECC (2011a). Overarching National Policy Statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

DECC (2011b). National Policy Statement for Renewable Energy Infrastructure (EN-3) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37048/1940-nps-renewable-energy-en3.pdf

DECC (2011c). National Policy Statement for Electricity Networks Infrastructure (EN-5) Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/37050/1942-national-policy-statement-electricity-networks.pdf

DECC (now Department for Business, Energy and Industrial Strategy (BEIS)) (2016), UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3)

DECC (2021a). Draft Overarching National Policy Statement for Energy (EN-1). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015233/en-1-draft-for-consultation.pdf [Accessed: 20/01/2022].

DECC (2021b). Draft National Policy Statement for Renewable Energy Infrastructure (EN-3). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1015236/en-3-draft-for-consultation.pdf [Accessed: 20/01/2022].

Department of Energy and Climate Change. 2012. Power Lines: Demonstrating compliance with EMF public exposure guidelines - A voluntary Code of Practice. London, England. www.gov.uk/government/publications/demonstrating-compliance-with-emf-public-exposure-guidelinesvoluntary-code-of-practice

Den Boon, H., Sutherland, J., Whitehouse, R., Soulsby, R., Stam, C-J., Verhoeven, K., Høgedal, M. and Hald, T. (2004). Scour Behaviour and scour protection for monopile foundations of offshore wind turbines. Proceedings of the European Wind Energy Conference [CD-ROM].

Department for Business, Enterprise and Regulatory Reform (BERR). (2008). Fisheries Liaison with Offshore Wind and Wet Renewables Group (FLOWW) Recommendations For Fisheries Liaison: Best Practice guidance for offshore renewable developers.

Department for Environment, Food and Rural Affairs (Defra) (2003). UK small cetacean bycatch response strategy. Department for Environment, Food and Rural Affairs. March 2003.

Det Norske Veritas (DNV) (2004). Design of Offshore Wind Turbine Structures. Offshore Standard DNV-OS-J101, 138pp

Diederichs, A., Nehls, G., Dähne, M., Adler, S., Koschinski, S. and Verfuß, U. (2008). Methodologies for measuring and assessing potential changes in marine mammal behaviour, abundance or distribution arising from the construction, operation and decommissioning of offshore windfarms. Commissioned by COWRIE Ltd, 231.

Dierschke, V., Furness, R.W., Garthe, S., 2016. Seabirds and offshore wind farms in European waters: Avoidance and attraction. Biological Conservation 202, 59–68. https://doi.org/10.1016/j.biocon.2016.08.016

Dolphin, T., Silva, T and Rees, J. (2011) Natural Variability of Turbidity in the Regional Environmental Assessment (REA) Areas. Marine Aggregate Levy Sustainability Fund MEPF 09/114

Dong Walney (UK) Ltd (2006) Walney Offshore Windfarm Environmental Statement

Drewitt, A.L., Langston, R.H.W., 2006. Assessing the impacts of wind farms on birds. Ibis 148, 29–42. https://doi.org/10.1111/j.1474-919X.2006.00516.x

Dyfed Archaeological Trust. (2018). Submerged Landscaped - Liverpool Bay - Results and Submergence Sequences. [Online] Available at: https://www.dyfedarchaeology.org.uk/lostlandscapes/liverpoolbay.html.

East Anglia THREE Limited (2013) JNCC and Natural England Suggested Tiers for Cumulative Impact Assessment. Available at: https://infrastructure.planninginspectorate.gov.uk/wpcontent/ipc/uploads/projects/EN010056/EN010056-001638-EA3%20-%20JNCC%20and%20NE%20suggested%20tiers%20for%20CIA.pdf

Environment Agency (2017) Clearing the waters for all. Available at Water Framework Directive assessment: estuarine and coastal waters - GOV.UK (www.gov.uk)

EU Data Collection Framework (EU DCF) database. (2021). Data by quarter-rectangle: Tables and maps of effort and landings by ICES statistical rectangles for 2012 to 2016.

European Subsea Cable Association (ESCA). (2018). European Subsea Cable Association Statement on vessels operating in the vicinity of subsea cables.Fisheries Liaison with Offshore Wind and Wet Renewables group FLOWW (2015) FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Disruption Settlements and Community Funds (FLOWW, 2015).

Fitch, S and Gaffney, V. (2011). *West Coast Palaeolandscapes Survey.* University of Birmingham. [Online] Available at: https://www.dyfedarchaeology.org.uk/lostlandscapes/WCPStechnical.pdf.

Fliessbach, K.L., Borkenhagen, K., Guse, N., Markones, N.,Schwemmer, P., and Garthe, S. (2019) A Ship Traffic Disturbance Vulnerability Index for Northwest

European Seabirds as a Tool for Marine Spatial Planning. Mar. Sci., 11 April 2019 | https://doi.org/10.3389/fmars.2019.00192

Fleming, N. C. (2005). *The Scope of Strategic Environmental Assessment of Irish Sea Area SEA6 in regard to prehistoric archaeological remains*. London, Department of Trade and Industry. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/197300/SEA6_Archaeology_NCF.pdf.

FLOWW (2014) FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison. January 2014.

Furness, R., (2015) Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS). Natural England Commissioned Report 164.

Furness, R.W., Wade, H.M., Masden, E.A., (2013). Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management 119, 56–66. https://doi.org/10.1016/j.jenvman.2013.01.025

Furness, R.W., and Wade, H.M., (2012). Vulnerability of Scottish seabirds to offshore wind turbines. Marine Scotland Science.

Garthe, S., Huppop, O., 2004. Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index. Journal of Applied Ecology 41, 724–734. https://doi.org/10.1111/j.0021-8901.2004.00918.x

Gill, A.B., Gloyne-Phillips, I., Neal, K.J. and Kimber, J.A. (2005). The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm developments on electrically and magnetically sensitive marine organisms – a review. COWRIE 1.5 Electromagnetic Fields.

Gill, A.B. and Bartlett, M.D. (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Scottish Natural Heritage Commissioned Report.

Glasgow Caledonian University. (2008) The economic impact of wind farms on Scottish tourism.

Great Orme Country Park and Local Nature Reserve Management Plan 2011-2016.

Green, H. S., (1984). *Pontnewydd Cave. A Lower Palaeolithic Hominid Site in Wales*. The First Report. Amgueddfa Genedlaethol Cymru. Cardiff.

Halcrow (2010a). Cell Eleven Tidal and Sediment Study Phase 2 (ii). Commissioned by the North West & North Wales Coastal Group. Available online: http://mycoastline.org [Accessed 30/09/21]

Halcrow (2011b). Joint Probability Study Extreme wave heights and JOIN-SEA results September 2011. 42pp

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Boerjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M., Scheidat, M. and Teilmann, J. (2021). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Wageningen Marine Research.

Hawkins A. D., Popper A. (2014) Assessing the impacts of underwater sounds on fishes and other forms of marine life. Acoustics Today, 10: 30–41

Heinänen, S. and Skov, H. (2015). The identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, JNCC Report No.544 JNCC, Peterborough.

Historic England (2013) *Marine Geophysics Data Acquisition, Processing and Interpretation*. Guidance prepared for Historic England. [Online] Available at URL: https://historicengland.org.uk/images-books/publications/marine-geophysics-data-acquisition-processing-interpretation/mgdapai-guidance-notes/.

Historic England (2015). *Managing Significance in Decision-Taking in the Historic Environment* Historic Environment Good Practice Advice in Planning: 2. [Online] Available at: https://historicengland.org.uk/images-books/publications/gpa2-managing-significance-in-decision-taking/gpa2/.

Historic England (2021) National Heritage List for England (NHLE)*. Available at:* Search the List - Find listed buildings, monuments, battlefields and more | Historic England *(accessed 19/10/21)*

HM Government (2009) The UK Low Carbon Transition Plan. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/228752/9780108508394.pdf

HM Government (2020a). United Kingdom of Great Britain and Northern Ireland's Nationally Determined Contribution. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/943618/uk-2030-ndc.pdf

HM Government (2020b) The Energy White Paper. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/945899/201216_BEIS_EWP_Command_Paper_Accessible.pdf

HM Government (2021) Build Back Better – Our Plan for Growth. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/969275/PfG_Final_print_Plan_for_Growth_Print.pdf

HM Government (2021) North West Marine Plans .Available at: https://www.gov.uk/government/publications/the-north-west-marine-plans-documents

HM Treasury (2020) The Green Book Central Government Guidance on Appraisal and Evaluation

Hodgson, J. and Brennand, M. (eds), (2006). The Prehistoric Period. In: *The Archaeology of North West England. An Archaeological Research Framework for North West England*. Volume 1, Resource Assessment. M. Brennand (ed.), pp. 23-58. ALGAO and CBA North West, Archaeology North West 8.

Howe, V.L. (2018). Marine Mammals-Cetaceans. In: Manx Marine Environmental Assessment (1.1 Edition - partial update). Isle of Man Government. pp. 51. Available at: https://www.gov.im/about-the-government/departments/infrastructure/harbours-information/territorial-seas/manx-marine-environmental-assessment/

IAMMWG (2021). Updated abundance estimates for cetacean Management Units in UK waters. JNCC Report No. 680, JNCC Peterborough, ISSN 0963-8091.

International Cable Protection Committee. (2009). Fishing and Submarine Cables - Working Together.

International Maritime Organisation (1972). Convention on the International Regulations for Preventing Collisions at Sea (COLREGs). Available at: https://www.imo.org/en/About/Conventions/Pages/COLREG.aspx. [Accessed: 20/01/2022].

International Maritime Organisation (1974). International Convention for the Safety of Life at Sea (SOLAS). Available at: https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx [Accessed: 20/01/2022].

International Maritime Organisation (2018) Revised Guidelines for Formal Safety Assessment (FSA) for use I the IMO rule making process.

Jacobi, R.M., Gowlett, J.A., Hedges, R.E.M. and Gillespie, R. (1986). Accelerator Mass Spectrometry dating of the Upper Palaeolithic finds with the Poulton Elk as an example. In *Studies of the Upper Palaeolithic of Britain and North West Europe*, D.A. Roe (ed.), pp. 121-128. Oxford: British Archaeological Reports (International Series) 296.

JNAPC (2006) *Code for Practice for Seabed Development*. [Online] Available at URL: http://www.jnapc.org.uk/jnapc_brochure_may_2006.pdf.

JNCC, Natural England and CCW (2010). Draft EPS Guidance - The protection of marine European Protected Species from injury and disturbance. Guidance for the marine area in England and Wales and the UK offshore marine area. Joint Nature

Conservation Committee, Natural England and Countryside Council for Wales. October 2010.

JNCC and Natural England (2011). General advice on assessing potential impacts of and mitigation for human activities on MCZ features, using existing regulation and legislation. Advice from the Joint Nature Conservation Committee and Natural England to the Regional MCZ Projects: June 2011. Available at: https://data.jncc.gov.uk/data/6aff8099-10e1-4323-a4d5-b8539b8013b0/MCZs-and-human-activities-2011.pdf

Johnston, A, Cook, A.S.C.P., Wright, L.J., Humphreys, E.M., Burton, N.H.K., 2014a. Modelling flight heights of marine birds to more accurately assess collision risk with offshore wind turbines. Journal of Applied Ecology 51, 31–41. https://doi.org/10.1111/1365-2664.12191

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L.J., Reid, J.B., 2010. An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs (JNCC Report No. 431). JNCC, Peterborough.

Lake District National Park Partnership (2021). Lake District National Park Landscape Character Assessment and Guidelines.

Lake District National Park Partnership Management Plan 2020-2025.

Lancashire County Council (2000) A Landscape Strategy for Lancashire, Landscape Character Assessment. *Available at:* https://www.lancashire.gov.uk/media/152746/characterassesment.pdf *(accessed 19/10/21)*

LANDMAP Wales visual and sensory data via https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/evidence-to-inform-development-planning/landmap-the-welsh-landscape-baseline/?lang=en

Landscape Institute (2019). Visual Representation of Development Proposals Technical Guidance Note 06/19;

Lawson, J., Kober, K., Win, I., Allcock, Z., Black, J., Reid, J.B., Way, L., O'Brien, S.H., 2016. An assessment of the numbers and distributions of wintering waterbirds and seabirds in Liverpool Bay/Bae Lerpwl area of search (JNCC Report No: 576). JNCC, Peterborough.

Lindeboom, H., Kouwenhoven, H., Bergman, M., Bouma, S., Brasseur, S., Daan, R., Fijn, R., de Haan, D., Dirksen, S., van Hal, R., Hille Ris Lambers, R., ter Hofstede, R., Krijgsveld, K., Leopold, M. and Scheidat, M. (2011) Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. Environmental Research Letters, 6(3).

Lockwood, S. (2005). 'A Strategic Environmental Assessment of the Fish & Shellfish Resources with Respect to Proposed Offshore Wind Farms in the Eastern Irish Sea'. Report RWE Innogy. pp 105.

Mackey, M., Giménez, D.P., n.d. SEA678 Data Report for Offshore Seabird Populations. Coastal & Marine Resources Centre, Environmental Research Institute, University College, Cork.

Marine Management Organisation (2018) Marine Licensing: sediment analysis and sample plans. Available at Marine Licensing: sediment analysis and sample plans - GOV.UK (www.gov.uk)

Marine Management Organisation (MMO) (2021). IFISH database with landing statistics data for UK registered vessels for 2016 to 2020 with attributes for: landing year; landing month; vessel length category; country code; ICES rectangle; vessel/gear type; species; live weight (tonnes); and value; and landing year; landing month; vessel length category; country code; vessel/gear type; port of landing; species; live weight (tonnes); and value.

Marine Scotland (2012). MS Offshore Renewables Research: Work Package A3: Request for advice about the displacement of marine mammals around operational offshore windfarms. Available at: http://www.gov.scot/Resource/0040/00404921.pdf.

MARINElife (2021) surveys from ferry routes across the southern North Sea area. Available at: https://www.marine-life.org.uk/survey-reports

Maritime and Coastguard Agency (2021) Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREI)

Maritime and Coastguard Agency (2021) MGN 654 Safety of navigation: OREIs - Guidance on UK navigational practice, safety and emergency response

Masden, E.A., Haydon, D.T., Fox, A.D., Furness, R.W., 2010. Barriers to movement: Modelling energetic costs of avoiding marine wind farms amongst breeding seabirds. Marine Pollution Bulletin 60, 1085–1091. https://doi.org/10.1016/j.marpolbul.2010.01.016

MarLIN. (2021). Available at: https://www.marlin.ac.uk/species

Masden, E.A., Reeve, R., Desholm, M., Fox, A.D., Furness, R.W., Haydon, D.T., 2012. Assessing the impact of marine wind farms on birds through movement modelling. Journal of the Royal Society, Interface 9, 2120–2130. https://doi.org/10.1098/rsif.2012.0121

McConnell, B., Lonergan, M. and Dietz, R. (2012). Interactions between seals and offshore wind farms. The Crown Estate. ISBN: 978-1-906410-34-5.

McGrail, S. (2001). *Boats of the World*. Oxford: Oxford University Press.

McGregor, R.M., King, S., Donovan, C.R., Caneco, B., Webb, A., 2018. A Stochastic Collision Risk Model for Seabirds in Flight. Marine Scotland.

Met Office. https://www.metoffice.gov.uk/guide/weather/symbols#visibility (accessed 29/10/21)

Middleton, R., Wells, C. E. and Huckerby, E., (1995). *The Wetlands of North Lancashire. North West Wetlands Survey*, *Lancaster Imprints* 4. Lancaster: Lancaster University Archaeological Unit.

Mitchell, P.I., Newton, S.F., Ratcliffe, N., Dunn, T.E., 2004. Seabird Populations of Britain and Ireland. T. and A.D. Poyser, London.

MMO (2014). Review of post-consent offshore wind farm monitoring data associated with licence conditions. A report produced for the Marine Management Organisation, pp 194. MMO Project No: 1031. ISBN: 978-1-909452-24-4.

MMO (2018) Seascape Character Assessment for the North West Inshore and Offshore marine plan areas. A report produced for the Marine Management Organisation, MMO Project No: MMO1134, September 2018, 63pp. Available at: https://www.msp-platform.eu/sites/default/files/north_west_-_seascape_character_assessment_report.pdf

MMO (2018) Displacement and habituation of seabirds in response to marine activities. A report produced for the Marine Management Organisation. MMO Project No: 1139, May 2018.

Natural England (2012). An Approach to Seascape Character Assessment;

Natural England (2012). Shell Flat & Lune Deep candidate Special Area of Conservation Formal advice under Regulation 35(3) of The Conservation of Habitats and Species Regulations 2010. Available online: file:///C:/Users/305087/Downloads/SFLD-consobj_tcm6-21670.pdf [Accessed 01/10/2021]

Natural England (2014). An Approach to Landscape Character Assessment;

Natural England (2021) The Multi-Agency Geographical Information for the Countryside (MAGIC). *Available at: https://magic.defra.gov.uk/home.htm (accessed 19/10/21)*

Natural England (2022) Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards Phase III: Expectations for data analysis and presentation at examination for offshore wind applications. Version 1 March 2022.

Natural England, Countryside Council for Wales, 2010. Departmental Brief: Liverpool Bay / Bae Lerpwl Special Protection Area.

(NE) Natural England, (NRW) Natural Resources Wales, (JNCC) Joint Nature Conservation Committee, 2016. Departmental brief: Liverpool Bay / Bae Lerpwl potential Spacial Protection Area (pSAP). Proposal for extension to existing site and adding new features. (Advice to the Welsh Government and UK Government).

NIRAS, 2013. Walney Extension Offshore Wind Farm. Environmental Statement Chapter 13 - Offshore Ornithology (No. 10.1.13). DONG Energy Walney Extension (UK) Ltd.

Natural Resources Wales (2021). Guidance Note 046 Using LANDMAP in Landscape and Visual Impact Assessments (LVIA)

Navitus Bay (2014) Navitus Bay Wind Farm - Response to Environment Agency Written Representation on Fisheries

Nedwell J R, Turnpenny A W H, Lovell J, Parvin S J, Workman R, Spinks J A L, Howell D (2007a). A validation of the dBht as a measure of the behavioural and auditory effects of underwater noise. Subacoustech Report Reference: 34R1231, Published by Department for Business, Enterprise and Regulatory Reform.

Nedwell, J.R, Parvin, S.J, Edwards, B, Workman, R, Brooker, A.G. and Kynoch, J.E. (2007b). Measurements and interpretation of underwater noise during construction and operation of offshore wind farms in UK waters.

NFO. (2003). Investigation into the potential impact of wind farms on tourism in Wales.

Normandeau, Exponent, T. Tricas, and A. Gill. (2011). Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.

ORE Catapult (2017) The Economic Value of Offshore Wind. Available at https://ore.catapult.org.uk/app/uploads/2017/12/SP-0012-The-Economic-Value-of-Offshore-Wind-1.pdf

OSPAR (2020) Levels and trends in marine contaminants and their biological effects – CEMP Assessment report 2019 – 2020. Found at p00774_cemp_2019-2020.pdf (ospar.org)

OSPAR Commission (2008). Assessment of the environmental impact of offshore windfarms

Oxford Archaeology (2008). *Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy*. [Online] Available at: https://www.biofund.org.mz/wp-content/uploads/2018/11/F1349.Cowrie-Ciarch-Web.pdf.

Paxton, C.G.M., Scott-Hayward, L., Mackenzie, M., Rexstad, E. and Thomas, L. (2016). Revised Phase III Data Analysis of Joint Cetacean Protocol Data Resources with Advisory Note, JNCC Report 517, ISSN 0963-8091: http://jncc.defra.gov.uk/page-7201.

Planning Inspectorate (2016) Scoping Opinion: Proposed Norfolk Vanguard Offshore Wind Farm

Planning Inspectorate (2019). Advice Note Seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf

Planning Inspectorate (2020) Scoping Opinion: Awel Y Mor Offshore Wind Farm

Popper AN, Hawkins AD, Fay RR, Mann D, Bartol S, Carlson T, Coombs S, Ellison WT, Gentry R, Halvorsen MB, Løkkeborg S, Rogers P, Southall BL, Zeddies D and Tavolga WN (2014). Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report, ASA S3/SC1.4 TR-2014 prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Springer and ASA Press, Cham, Switzerland.

Public Health England (2020) Health Impact Assessment in spatial planning A guide for local authority public health and planning teams. Available at: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F929230%2FHIA_in_Planning_Guide_Sept2020.pdf&clen=1145770&chunk=true

Public health Engand (2021) Advice on the content of Environmental Statements accompanying an application under the Nationally Significant Infrastructure Planning Regime.

Pyper, R., Cave, B., Purdy, J. and McAvoy, H. (2021). Health Impact Assessment Guidance: Technical Guidance. Standalone Health Impact Assessment and health in environmental assessment. Institute of Public Health. Dublin and Belfast.

Regeneris Consulting and The Tourism Company (2014) Study into the Potential Economic Impact of Wind Farms and Associated Grid Infrastructure on the Welsh Tourism Sector.

RenewableUK. (2013). Cumulative impact assessment guidelines, guiding principles for cumulative impacts assessments in offshore wind farms.

RPG in England from the National Heritage List for England (NHLE) at https://historicengland.org.uk/listing/the-list/.

RSK (2000) Barrow Offshore Wind Farm Environmental Impact Assessment RSK/H/P/P4186/04/03

Russell, D.J.F. and McConnell, B.J. (2014). Seal at-sea distribution, movements and behaviour. Report to DECC. URN: 14D/085. March 2014 (final revision).

Scheidat, M., Tougaard, J., Brasseur, S., Carstensen, J., van Polanen Petel, T., Teilmann, J. and Reijnders, P. (2011). Harbour porpoise (*Phocoena phocoena*) and wind farms: a case study in the Dutch North Sea. Environ. Res. Lett. 6 (April-June 2011) 025102.

SCOS (2020). Scientific Advice on Matters Related to the Management of Seal Populations: 2020. Available at: http://www.smru.st-andrews.ac.uk/research-policy/scos/

Scottish Natural Heritage (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments; and

Scottish Natural Heritage (2017). Visual Representation of Windfarms: Version 2.2.

Sea Watch Foundation (2021). Reports of cetacean sightings eastern England: Available at: http://www.seawatchfoundation.org.uk/recentsightings/

Seafish (2012). Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments. Available online: http://www.seafish.org/media/634910/ukfen%20ia%20best%20practice%20guidance.pdf [Accessed November 2019]

Searle, K., Mobbs, D., Daunt, F., Butler, A., 2019. A Population Viability Analysis Modelling Tool for Seabird Species (Natural England Commissioned Report No. ITT_4555).

Sefton Council (2003). Supplementary Planning Guidance in Sefton, Landscape Character of Sefton.

Sharples R.J., Matthiopoulos, J. and Hammond, P.S. (2008). Distribution and movements of harbour seals around the coast of Britain: Outer Hebrides, Shetland, Orkney, the Moray Firth, St Andrews Bay, The Wash and the Thames, Report to DTI July 2008.

Sinclair, RR; Darias-O'hara, AK, Ryder, M & Stevens, A (2021). Awel Y Môr Marine Mammal Baseline Characterisation. SMRU Consulting Report Number Smruc-Gob-2021-003, Submitted To Gobe And RWE, July 2021.

SNCBs (2022). Joint SNCB1 Interim Advice On The Treatment Of Displacement For Red-Throated Diver (2022)

SNH (2017) - Siting and Designing Windfarms in the Landscape, Guidance (Version 3)

Southall, B.L., Finneran, J.J., Reichmuth, C., Nachtigall, P.E., Ketten, D.R., Bowles, A.E., Ellison, W.T., Nowacek, D.P. and Tyack, P.L. (2019). Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. Aquatic Mammals, 45(2), pp.125-232.

Speakman, J., Gray, H., Furness, L., 2009. University of Aberdeen report on effects of offshore wind farms on the energy demands of seabirds. (Report to the Department of Energy and Climate Change).

Stienen, E., Waeyenberge, V., Kuijken, E., Seys, J., 2007. Trapped within the corridor of the Southern North Sea: the potential impact of offshore wind farms on seabirds, in: De Lucas, M., Janss, G., Ferrer, M. (Eds.), Birds and Wind Farms. Quercus, Madrid.

Stober, U., and Thomsen, F. (2021) How could operational underwater sound from future offshore wind turbines impact marine life? The Journal of the Acoustical Society of America 149, 1791 (2021) https://doi.org/10.1121/10.0003760

Stone, C.J., Webb, A., Barton, C., Ratcliffe, N., Reed, T.C., Tasker, M.L., Camphuysen, C.J., Pienkowski, M.W., 1995. An atlas of seabird distribution in north-west European waters. JNCC, Peterborough.

Teilmann, J., Carstensen, J., Dietz, R., Edrén, S. and Andersen, S. (2006). Final report on aerial monitoring of seals near Nysted Offshore Wind Farm Technical report to Energi E2 A/S. Ministry of the Environment Denmark.

The Crown Estate (2021). Offshore Wind Leasing Round 4. Available at: https://www.thecrownestate.co.uk/en-gb/what-we-do/on-the-seabed/offshore-wind-leasing-round-4/

The Landscape Institute with the Institute of Environmental Management and Assessment (2013) Guidelines for the Assessment of Landscape and Visual Impacts. Third Edition.

The Planning Inspectorate (2016) Application by Vattenfall Wind Power Ltd for an Order Granting Development Consent for the Norfolk Vanguard Offshore Wind Farm Issue of Scoping Opinion. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010079/EN010079-001922-6.04%20Scoping%20Opinion.pdf

The Planning Inspectorate (2017a). Advice Note Three: EIA consultation and notification. Available at https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-three-eia-notification-and-consultation-2/

The Planning Inspectorate (2017b) SCOPING OPINION; Proposed Norfolk Boreas Offshore Wind Farm. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010087/EN010087-000860-6.5%20Scoping%20Opinion.pdf

The Planning Inspectorate (2017b). Advice Note Ten: Habitats Regulations Assessment. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/06/Advice-note-10v4.pdf

The Planning Inspectorate (2017c) SCOPING OPINION: Proposed East Anglia ONE North Offshore Windfarm. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010077/EN010077-001006-6.5%20EA1N%20Scoping%20Opinion.pdf

The Planning Inspectorate (2017d) SCOPING OPINION: Proposed East Anglia TWO Offshore Windfarm. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010078/EN010078-001616-6.5%20EA2%20Scoping%20Opinion.pdf

The Planning Inspectorate (2018) Advice Note Nine: Rochdale Envelope. *Available at:* https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-nine-rochdale-envelope/ *(accessed 19/10/21)*

The Planning Inspectorate (2018) Advice Note Nine: Using the Rochdale Envelope. Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf

The Planning Inspectorate (2019) Advice Note Seventeen: Cumulative Effects Assessment. Available at https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf

The Planning Inspectorate (2019) Advice Note Nine: Using the Rochdale Envelope (version 3). Available at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf

The Planning Inspectorate (2020a) Advice Note Seven: Environmental Impact Assessment, Preliminary Environmental Information, Screening and Scoping. Available at

The Planning Inspectorate (2020b) Advice Note Twelve: Transboundary Impacts and Processes. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-twelve-transboundary-impacts-and-process/

Therivel and Wood (2017). Methods of Environmental and Social Impact Assessment (Natural and Built Environment Series) Fourth Edition. Taylor and Francis.

Tougaard, J., Carstensen, J. and Teilmann, J. (2009a). Pile driving zone of responsiveness extends beyond 20km for harbour porpoises (*Phocoena phocoena* (L.)) (L). J. Acoust. Soc. Am., 126, pp. 11-14.

Tougaard, J., Carstensen, J., Wisch, M.S., Teilmann, J., Bech, N., Skov, H. and Henriksen, O.D. (2005). Harbour porpoises on Horns reef—effects of the Horns Reef Wind farm. Annual Status Report 2004 to Elsam. NERI, Roskilde (Also available at: www.hornsrev.dk).

Tougaard, J., Henriksen, O.D. and Miller. L.A. (2009b). Underwater noise from three types of offshore wind turbines: estimation of impact zones for harbour porpoise and harbour seals. Journal of the Acoustic Society of America 125(6): 3766.

TURTLE Database, (2011), the database can be viewed via the UK Cetacean Strandings Investigation Programme, http://ukstrandings.org/.

UK Oil and Gas (2015). Fisheries Liaison Guidelines - Issue 6.

UKSeaMap. (2018). Available at: https://hub.jncc.gov.uk/assets/202874e5-0446-4ba7-8323-24462077561e

UK SNCBs, (2017). Joint SNCB Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from Offshore Wind Farm (OWF) developments.

Van de Noort, R. (2003). An ancient seascape: the social context of seafaring in the early Bronze Age. *World Archaeology*, *35*(3), 404-415.

Vanclay, F., Esteves, A.M., Aucamp, I. & Franks, D. (2015) Social Impact Assessment: Guidance for assessing and managing the social impacts of projects. Fargo ND: International Association for Impact Assessment. [Online]. Available at: https://www.iaia.org/uploads/pdf/SIA_Guidance_Document_IAIA.pdf

Wade, H.M., Masden, E.A., Jackson, A.C., Furness, R.W., (2016). Incorporating data uncertainty when estimating potential vulnerability of Scottish seabirds to marine renewable energy developments. Marine Policy 70, 108–113. https://doi.org/10.1016/j.marpol.2016.04.045

Waggitt, J.J., Evans, P.G., Andrade, J., Banks, A.N., Boisseau, O., Bolton, M., Bradbury, G., Brereton, T., Camphuysen, C.J., Durinck, J. and Felce, T. (2019). Distribution maps of cetacean and seabird populations in the North-East Atlantic.

Journal of Applied Ecology, 57(2), pp.253-269. https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2664.13525.

Wakefield, E.D., Bodey, T.W., Bearhop, S., Blackburn, J., Colhoun, K., Davies, R., Dwyer, R.G., Green, J.A., Grémillet, D., Jackson, A.L., Jessopp, M.J., Kane, A., Langston, R.H.W., Lescroël, A., Murray, S., Le Nuz, M., Patrick, S.C., Péron, C., Soanes, L.M., Wanless, S., Votier, S.C., Hamer, K.C., 2013. Space Partitioning Without Territoriality in Gannets. Science 341, 68. https://doi.org/10.1126/science.1236077

Wakefield, E.D., Owen, E., Baer, J., Carroll, M.J., Daunt, F., Dodd, S.G., Green, J.A., Guilford, T., Mavor, R.A., Miller, P.I., Newell, M.A., Newton, S.F., Robertson, G.S., Shoji, A., Soanes, L.M., Votier, S.C., Wanless, S., Bolton, M., 2017. Breeding density, fine-scale tracking, and large-scale modeling reveal the regional distribution of four seabird species. Ecological Applications 27, 2074–2091. https://doi.org/10.1002/eap.1591

Ware, S.J. and Kenny, A.J., (2011). Guidelines for the conduct of benthic studies at marine aggregate extraction sites. Cefas, Lowestoft (UK). Project Code: MEPF, 8, p.P75.

Wessex Archaeology (2007) *Historic Environment Guidance for the Offshore Renewable Energy Sector*. Guidance prepared by Wessex Archaeology and issued by COWRIE. [Online} Available at URL: https://www.wessexarch.co.uk/sites/default/files/field_file/COWRIE_2007_Wessex_%20-%20archaeo_%20guidance_Final_1-2-07.pdf.

Wessex Archaeology. (2011). Round 3 Irish Sea Zone (Met Mast Geotechnical), Stage 2 Geoarchaeological Recording and Subsampling. Unpublished Report, Ref: 73751.005.

White, S. Michaels, S. King, H (2019). Seascape and visual sensitivity to offshore wind farms in Wales: Strategic assessment and guidance Parts 1-3.

Whitehouse, R. (1998). Scour at marine structures: A manual for practical applications. Thomas Telford.

Whitehouse, R.J.S. (2004). Marine scour at large foundations. In: Proceedings of the Second International Conference on Scour and Erosion, Singapore, November 2004, eds. Chiew Y-M., Lim, S-Y. and Cheng, N-S. Pages 455-463. Stallion Press.

Wirral Metropolitan Borough Council (2019). Wirral Landscape Character Assessment.

Woodward, I., Thaxter, C.B., Owen, E., Cook, A.S.C.P., 2019. Desk-based revision of seabird foraging ranges used for HRA screening (BTO Research Report No.724).

Wright, L.J., Ross-Smith, V.H., Austin, G.E., Massimino, D., Dadam, D., Cook, A.S.C.P., Calbrade, N.A., Burton, N.H.K., (2012). SOSS-05: Assessing the risk of offshore wind farm development to migratory birds designated as features of UK Special Protection Areas (and other Annex 1 species) (BTO Research Report No. 590), SOSS05. British Trust for Ornithology.

Wyn, G. and Brazier, P. (2001). Procedural Guideline No. 3-1 - In situ intertidal biotope recording. In Davies J., Baxter J., Bradley M., Connor D., Khan J., Murray E., Sanderson W., Turnbull C. & Vincent M. 2001. Marine Monitoring Handbook, 405 pp.

Zaaijer MB (2003) Comparison of monopile, tripod, suction bucket and gravity base design for a 6 MW turbine. In Proceedings of the OWEMES 2003 European Seminar. Energy Research Centre of the Netherlands, Petten, the Netherlands. Available at: http://www.ecn.nl/fileadmin/ecn/units/wind/docs/dowec/2003-OWEMES-Support-structures.pdf