

# Morecambe Offshore Windfarm: Generation Assets Environmental Statement

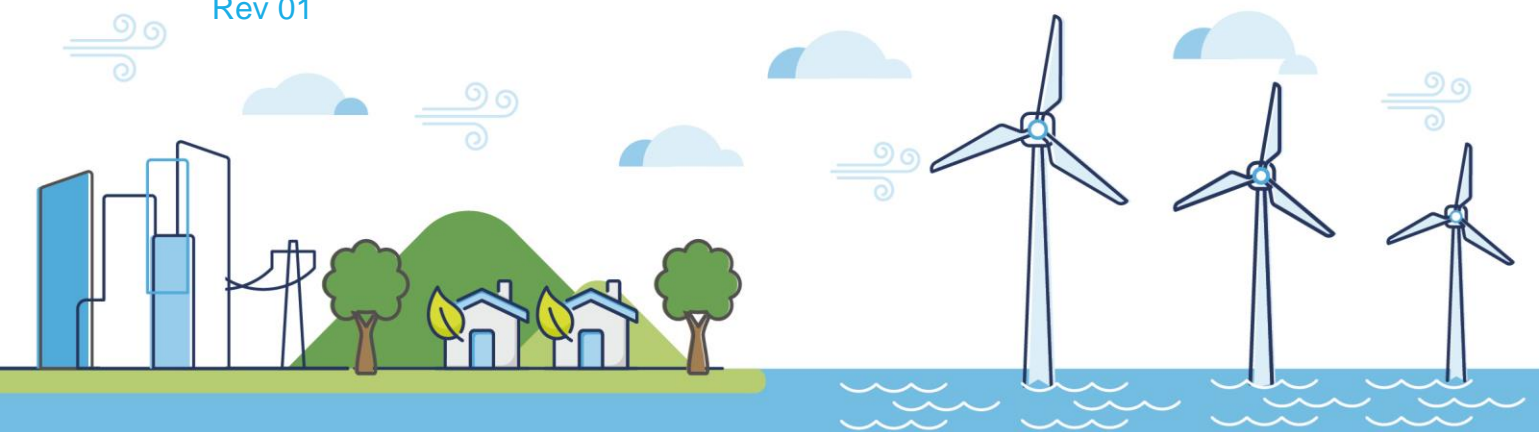
## Volume 5

### Chapter 10 Fish and Shellfish Ecology Figures

PINS Document Reference: 5.3.10

APFP Regulation: 5(2)(a)

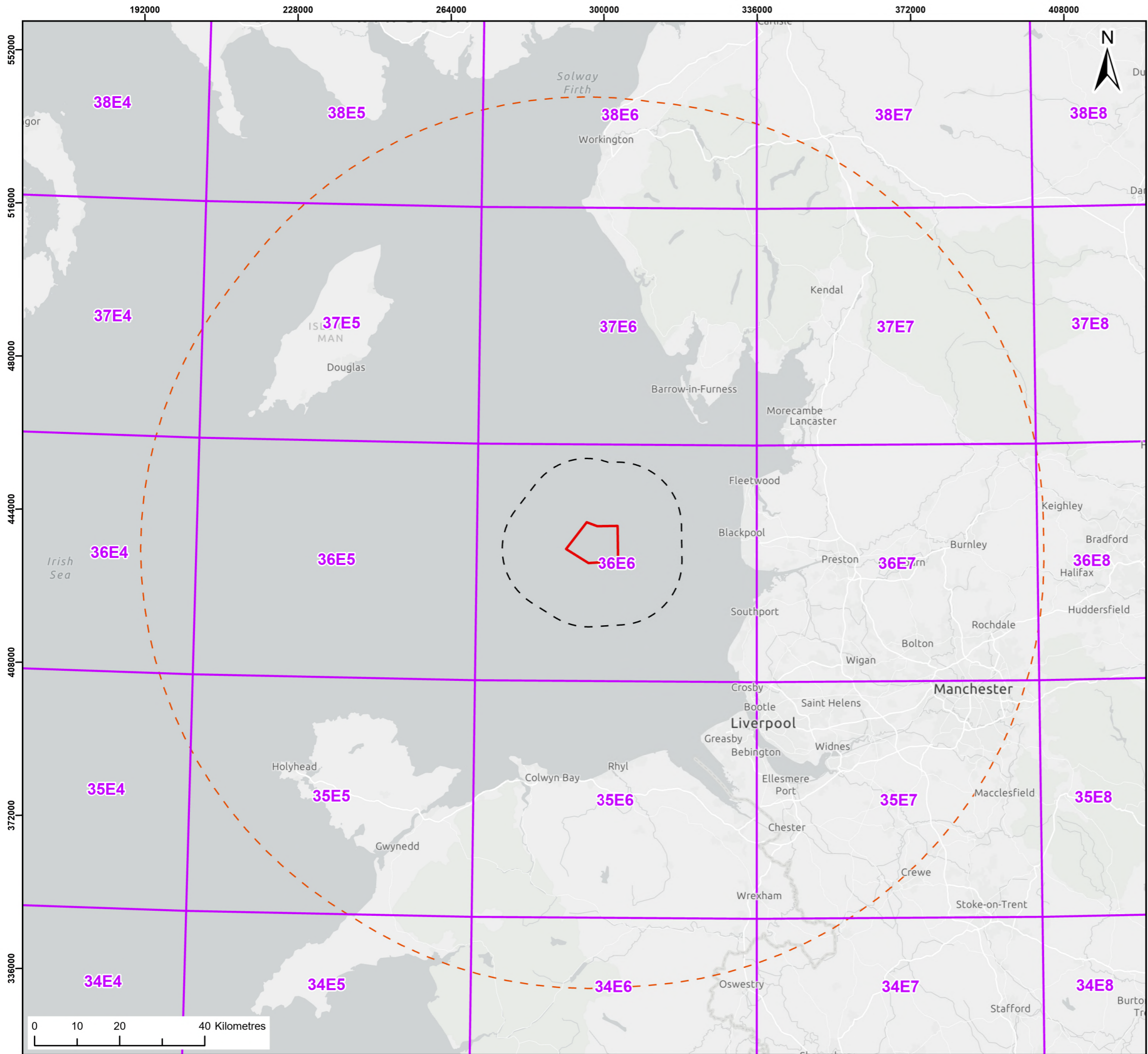
Rev 01



## Document History

<b>Doc No</b>	MOR001-FLO-CON-ENV-FIG-1100	<b>Rev</b>	01
<b>Alt Doc No</b>	PC1165-RHD-ES-XX-DG-Z-0010		
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<b>Rev</b>	<b>Date</b>	<b>Doc Status</b>	<b>Originator</b>	<b>Reviewer</b>	<b>Approver</b>	<b>Modifications</b>
01	May 2024	Approved for Use	Royal HaskoningDHV	Morecambe Offshore Windfarm Ltd	Morecambe Offshore Windfarm Ltd	n/a



**Legend:**

- Morecambe Offshore Windfarm Site
- ICES Rectangles
- 15km Potential Zone of Influence (Zol)
- 100km Potential Zone of Influence (Zol)

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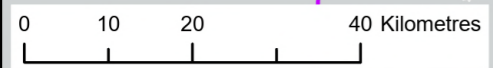
**Report:**  
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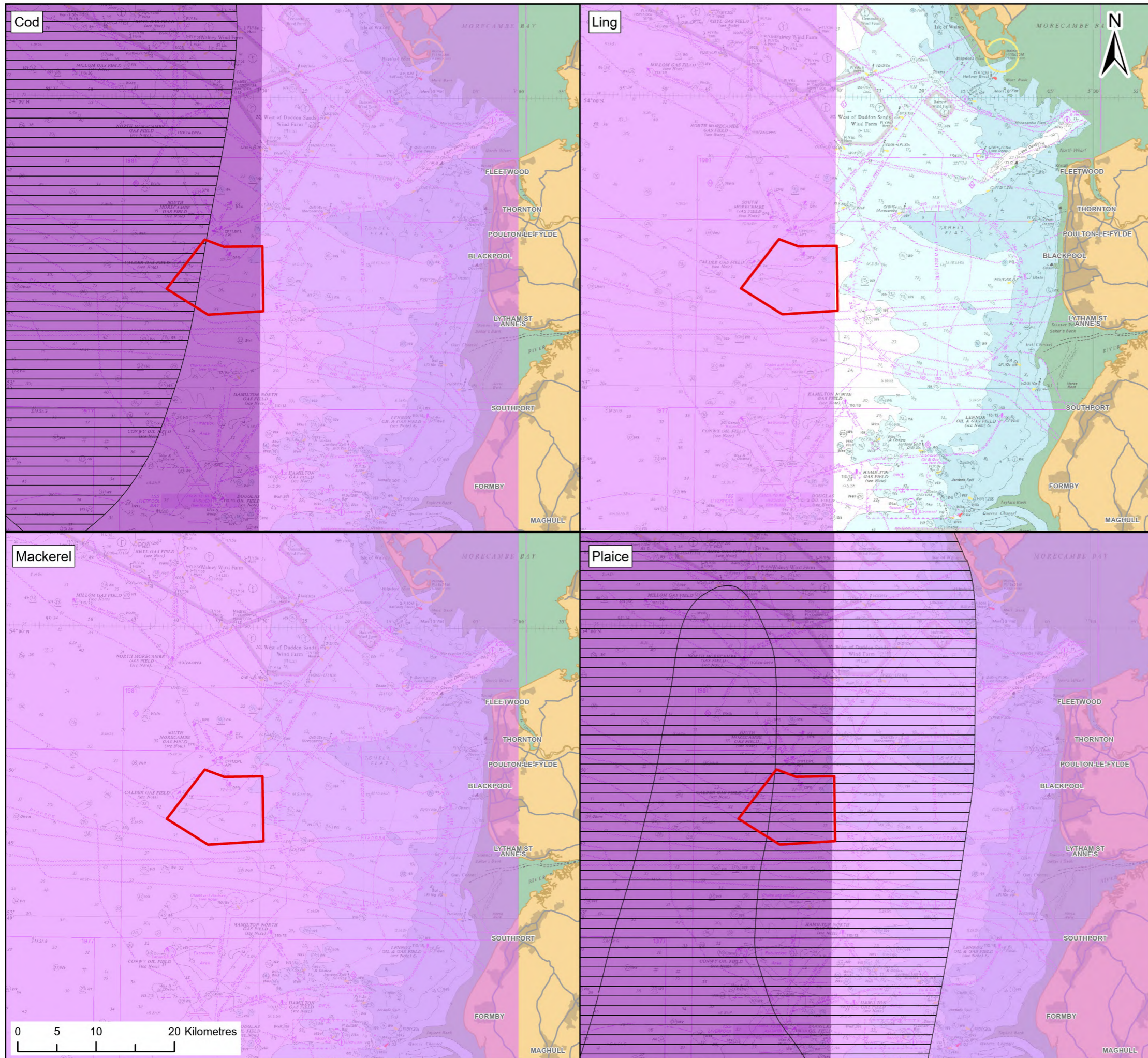
**Title:**  
**Morecambe Offshore Windfarm Site location and ICES Rectangles**

**Figure:** 10.1      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0034

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	12/07/2023	JT	GC	A3	1:900,000
P02	27/03/2024	JH	SB	A3	1:900,000

**Co-ordinate system:** WGS 1984 UTM Zone 30N





**Legend:**

- Morecambe Offshore Windfarm Site
- Spawning grounds (Coul et al, 1998)

**Spawning grounds (Ellis et al, 2010)**

**Intensity**

- High
- Low

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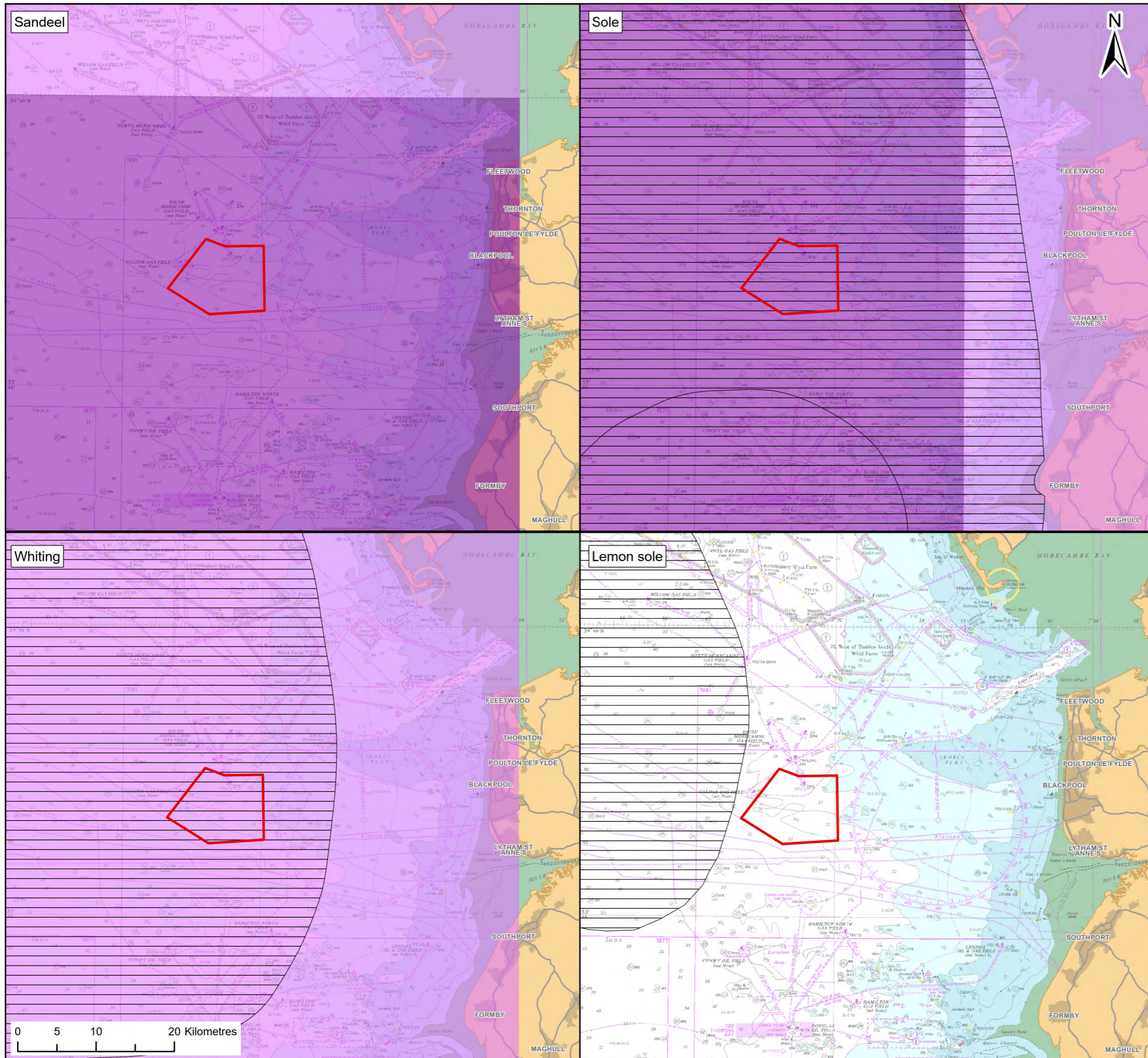
**Title:**  
Spawning grounds overlapping  
the Fish and Shellfish Ecology Study Area

**Figure:** 10.2a      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0035

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	12/07/2023	JT	GC	A3	1:500,000
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Co-ordinate system: WGS 1984 UTM Zone 30N





**Legend:**

- Morecambe Offshore Windfarm Site
- Spawning grounds (Coul et al, 1998)

**Spawning grounds (Ellis et al, 2010)**

**Intensity**

- High
- Low

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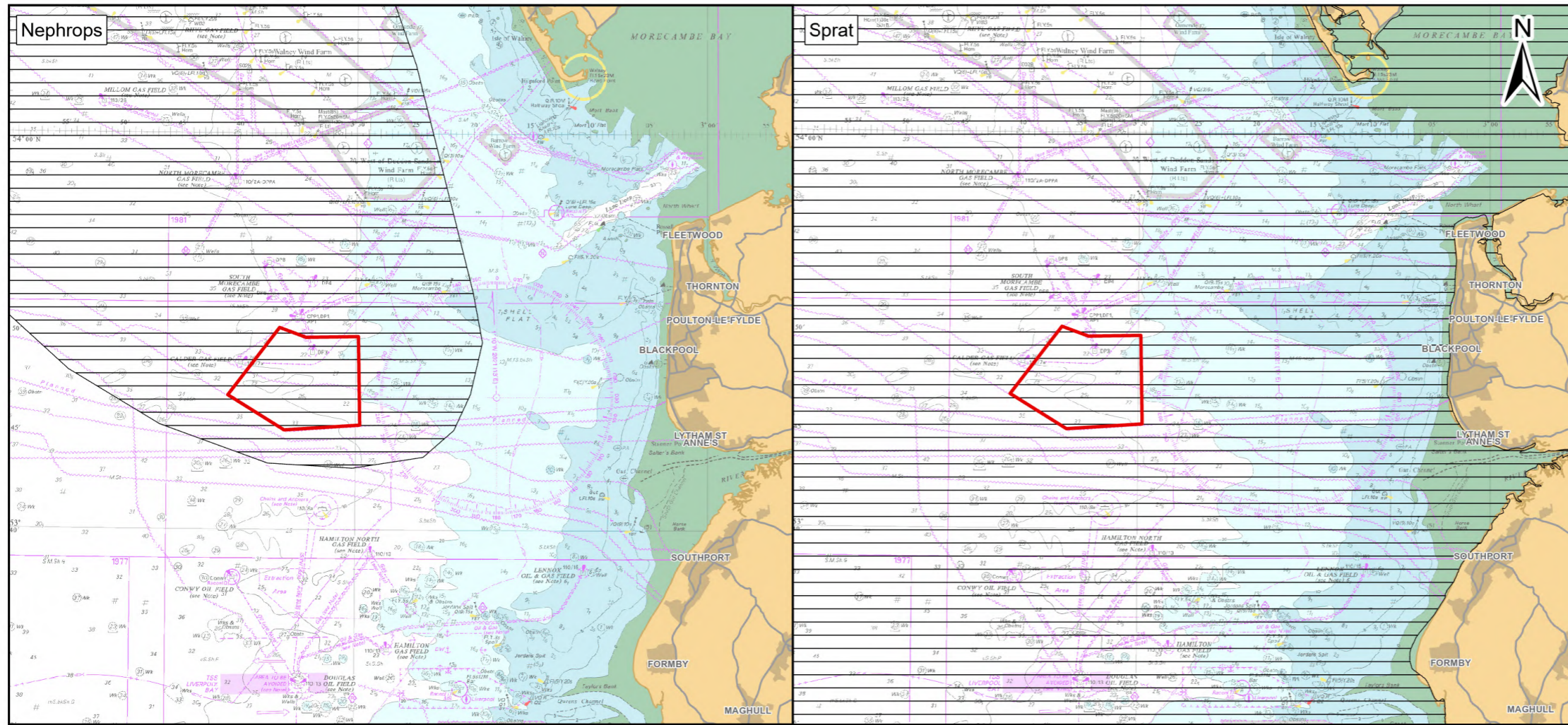
**Title:**  
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**Figure:** 10.2b      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0035

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P02	27/03/2024	JH	SB	A3	1:500,000

Co-ordinate system: WGS 1984 UTM Zone 30N





Legend:

- Morecambe Offshore Windfarm Site
- Spawning grounds (Coul et al, 1998)

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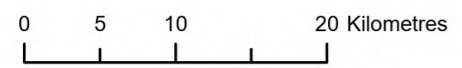
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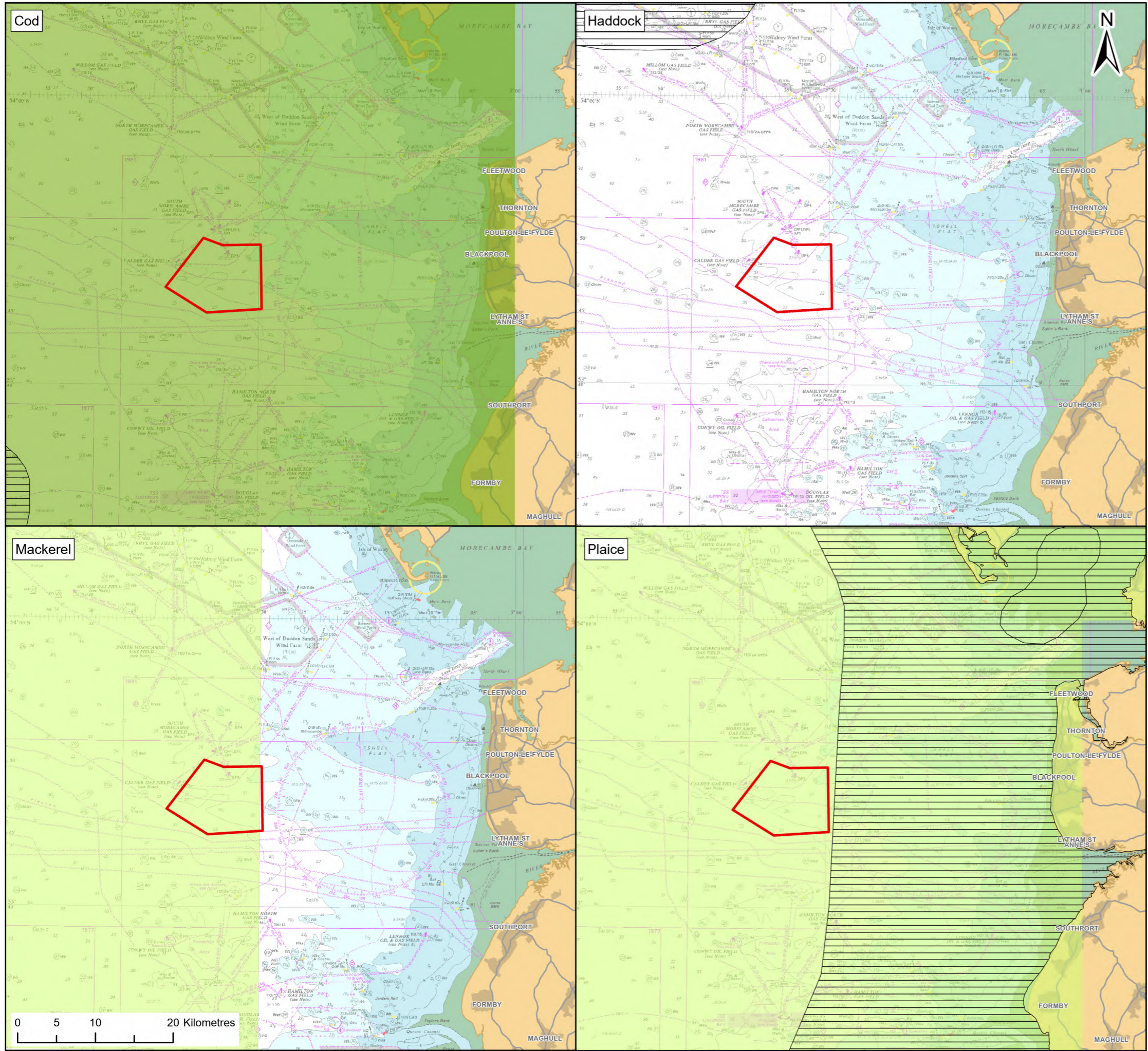
Title:  
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the Fish and Shellfish Ecology Study Area

Figure: 10.2c      Drawing No: PC1165-RHD-ES-OF-DR-Z-0035

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Co-ordinate system: WGS 1984 UTM Zone 30N





**Legend:**

- Morecambe Offshore Windfarm Site
- Nursery grounds (*Coul et al, 1998*)

**Nursery grounds (*Ellis et al, 2010*)**

**Intensity**

- High
- Low

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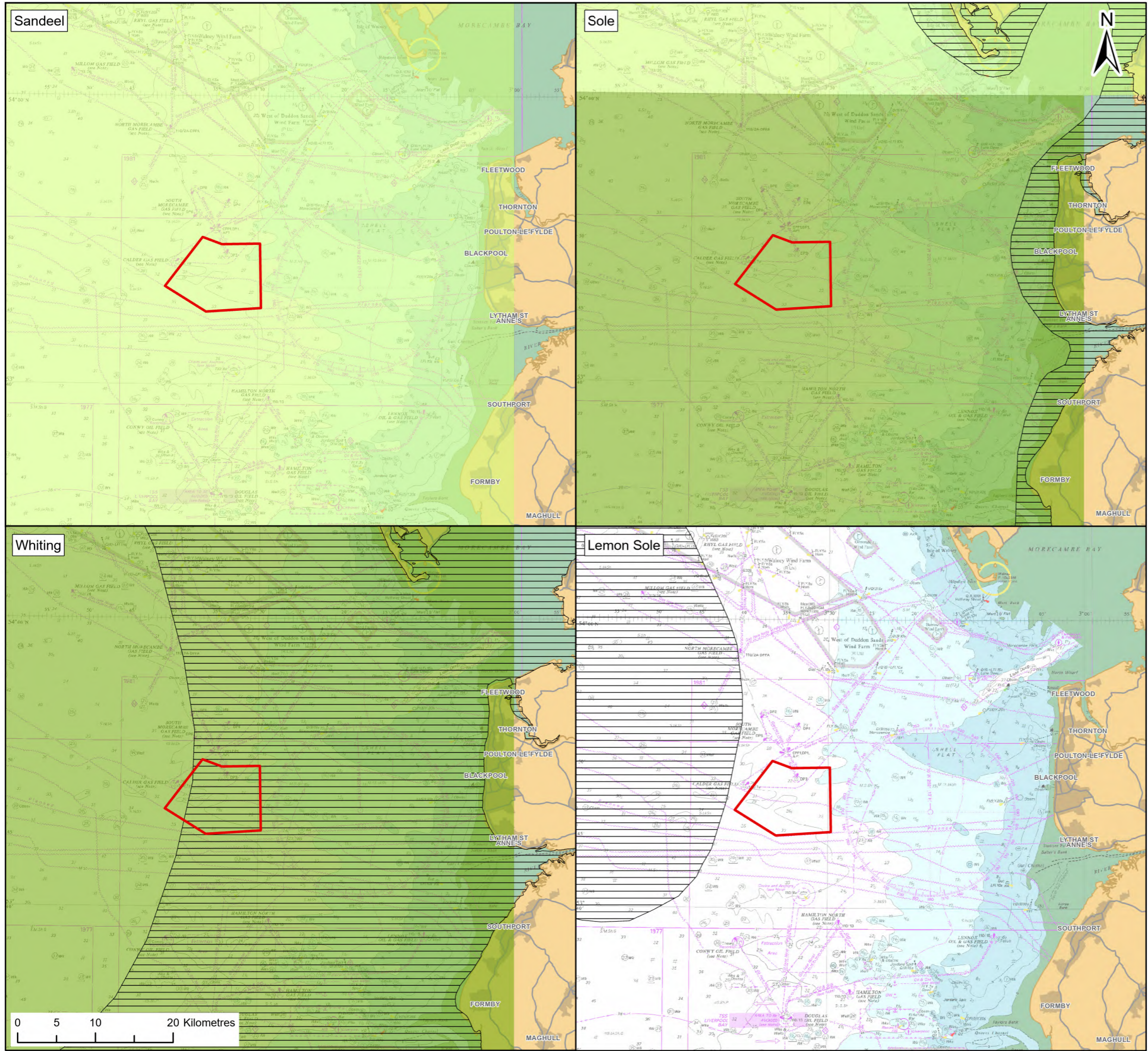
**Title:**  
Nursery grounds overlapping  
the Fish and Shellfish Ecology Study Area

**Figure:** 10.3a     **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0036

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P02	28/03/2024	JH	SB	A3	1:500,000

Co-ordinate system: WGS 1984 UTM Zone 30N





**Legend:**

- Morecambe Offshore Windfarm Site
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**Nursery grounds (*Ellis et al, 2010*)**

**Intensity**

- High
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**Title:**  
Nursery grounds overlapping the Fish and Shellfish Ecology Study Area

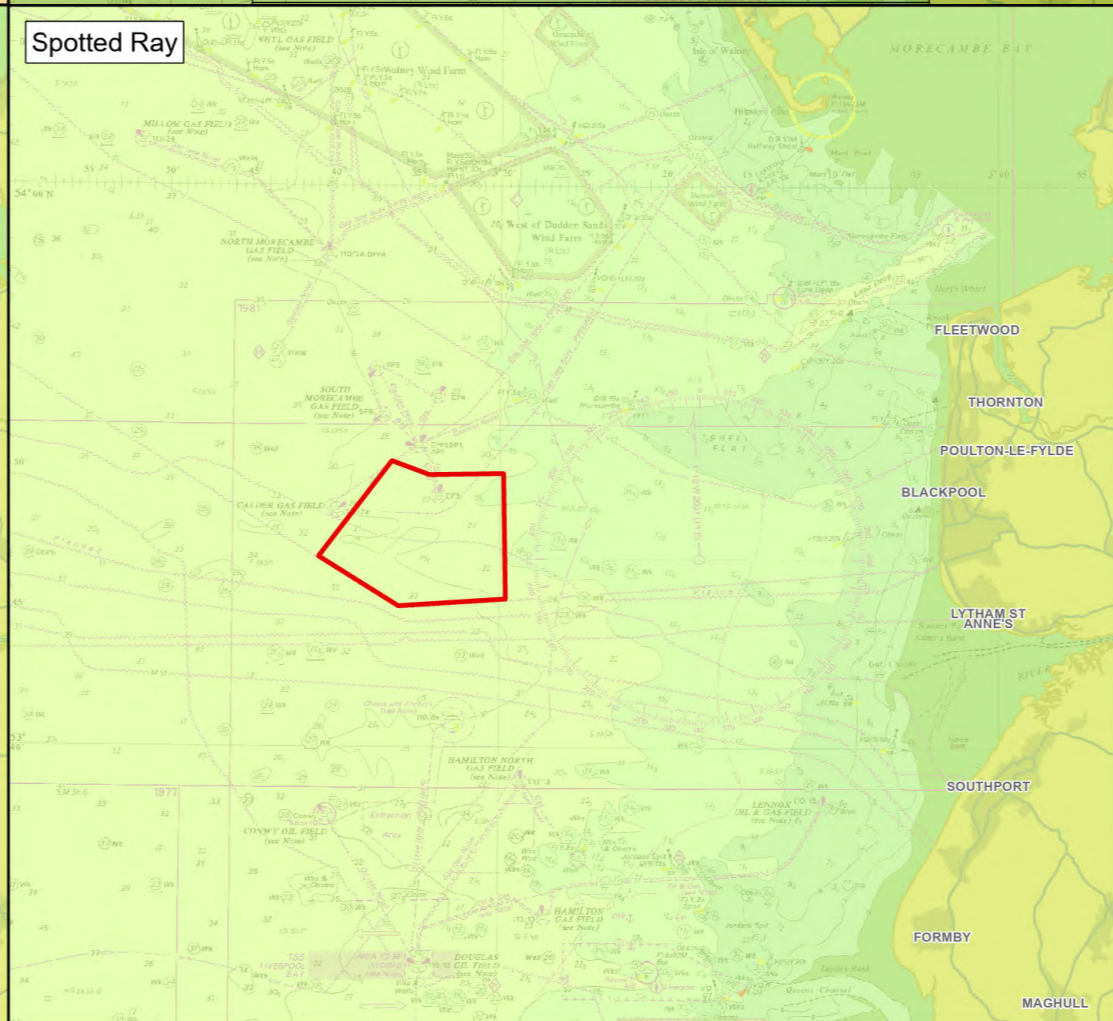
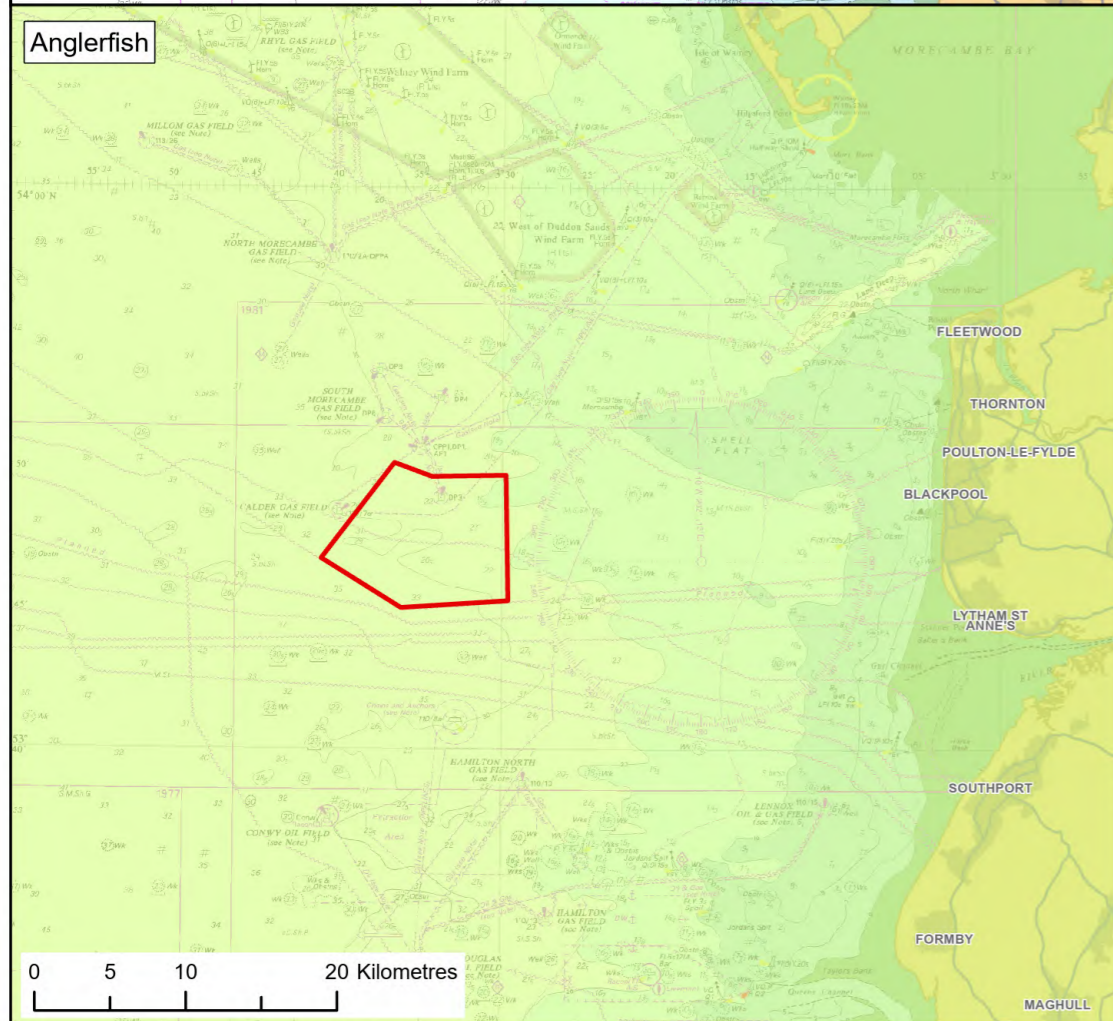
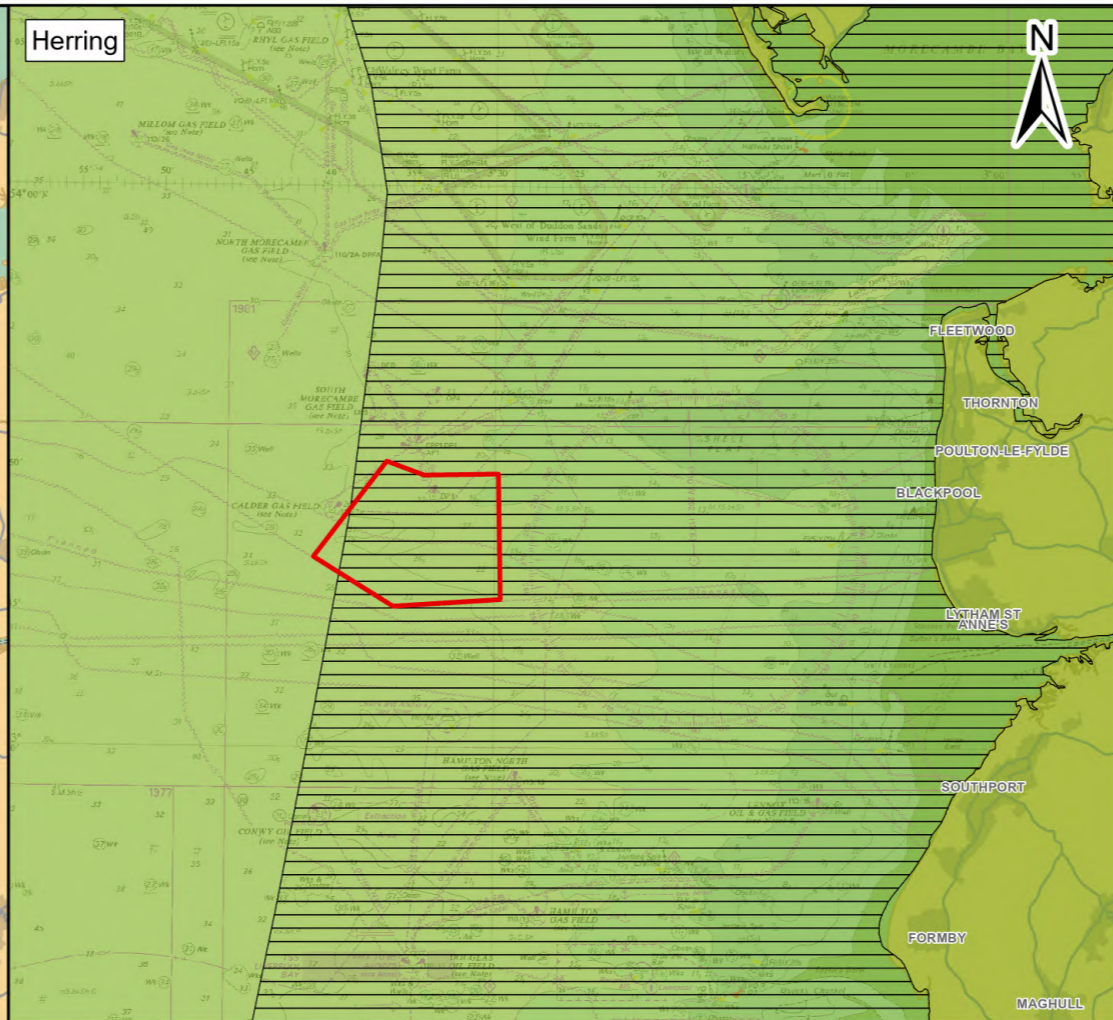
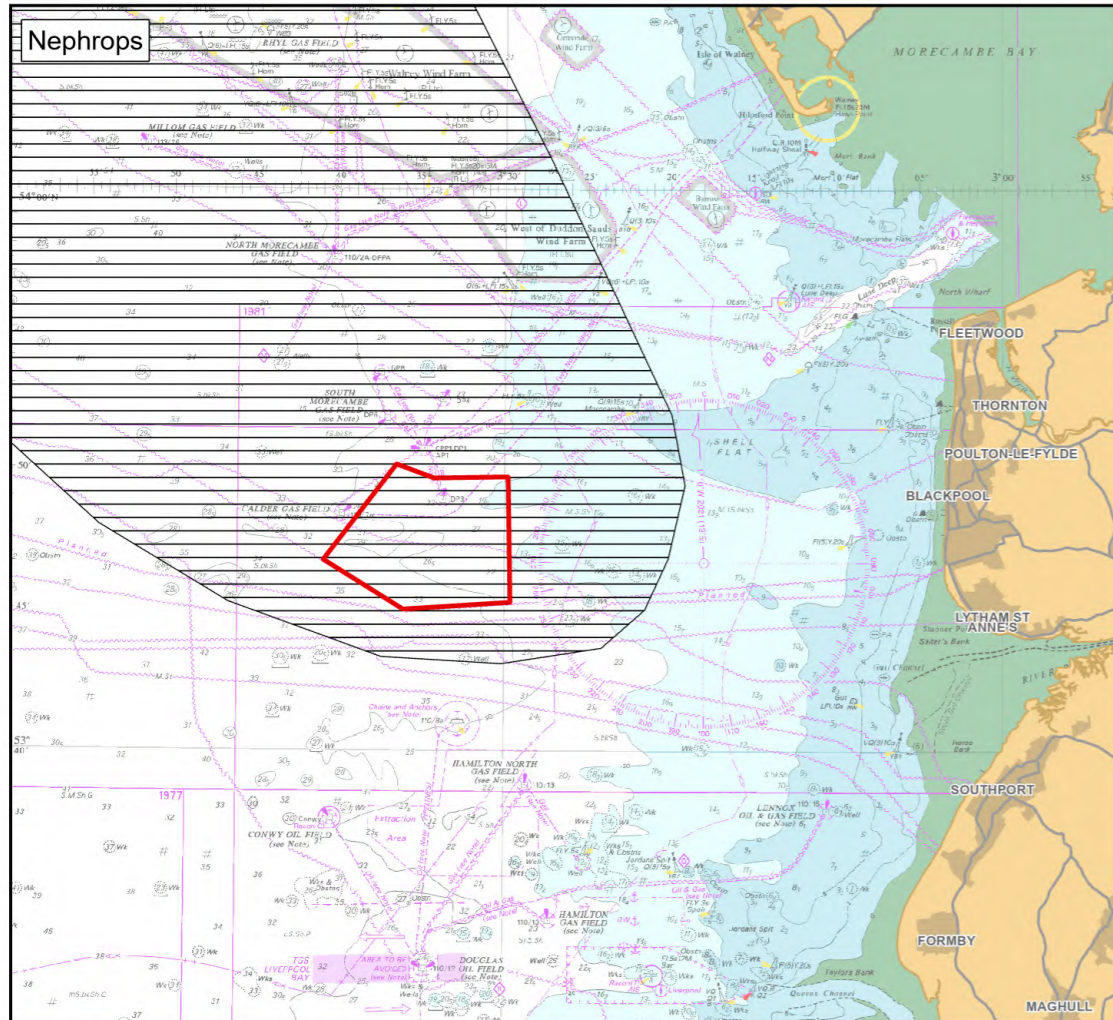
**Figure:** 10.3b      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0036

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Co-ordinate system: WGS 1984 UTM Zone 30N







Legend:

- Morecambe Offshore Windfarm Site
- Nursery grounds (Coul et al, 1998)

**Nursery grounds (Ellis et al, 2010)**

**Intensity**

- High
- Low

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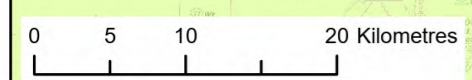
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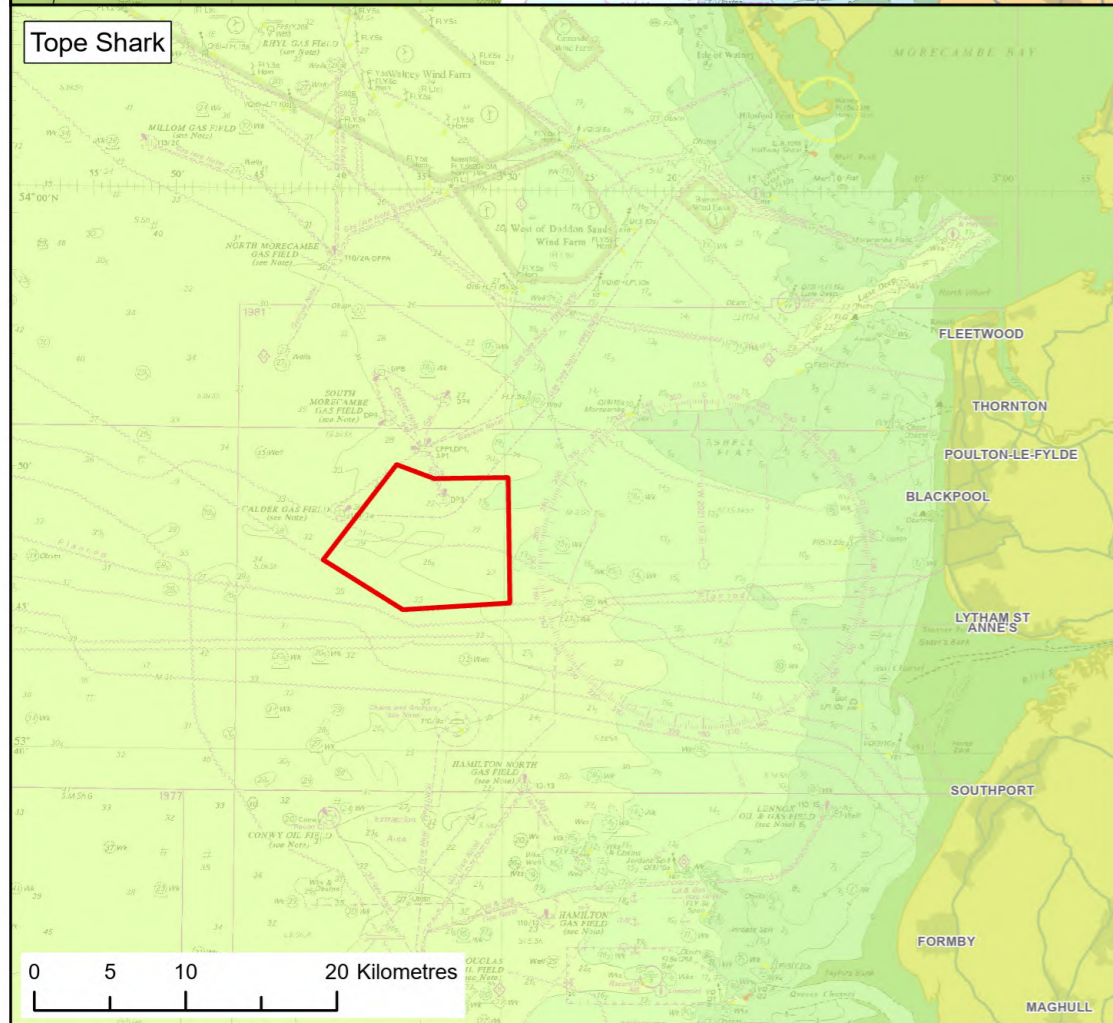
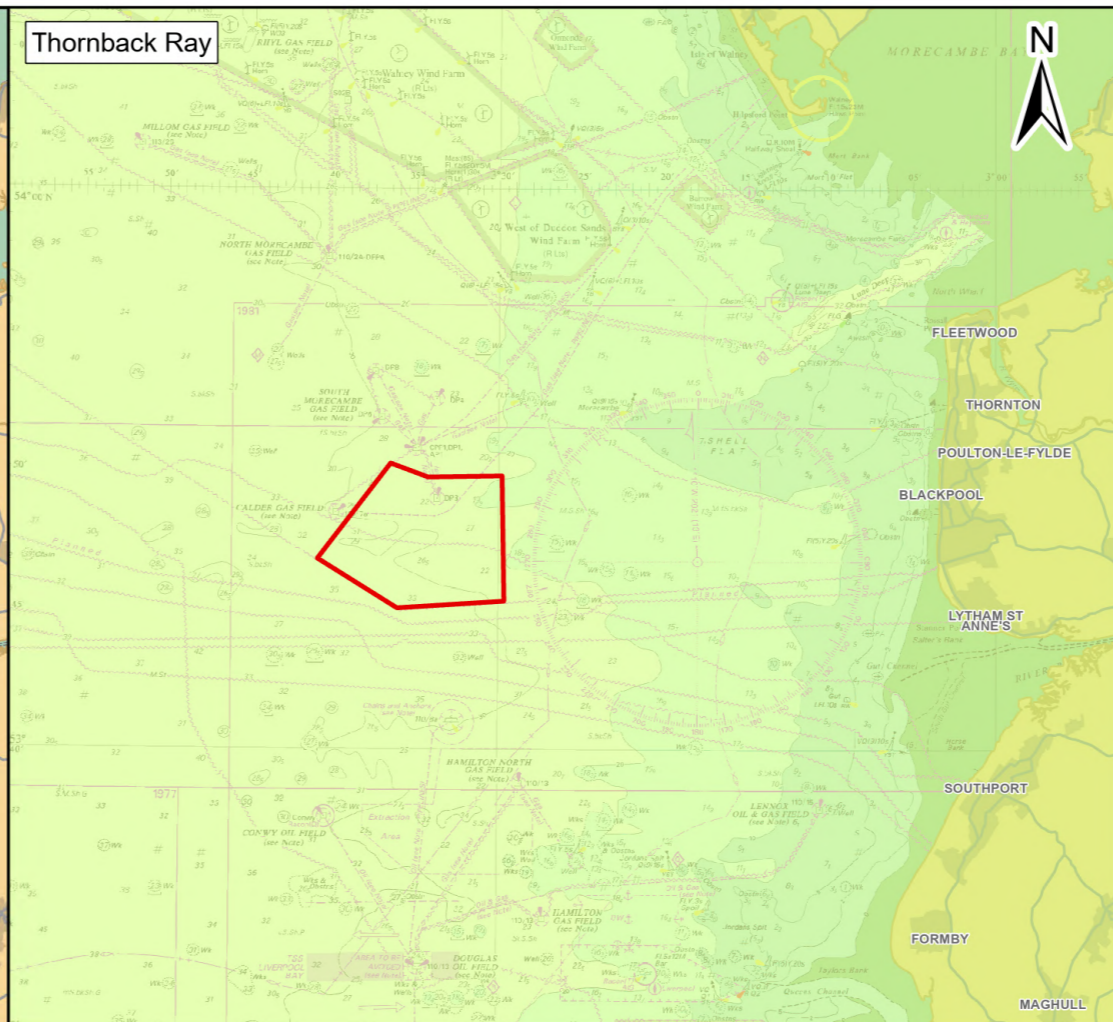
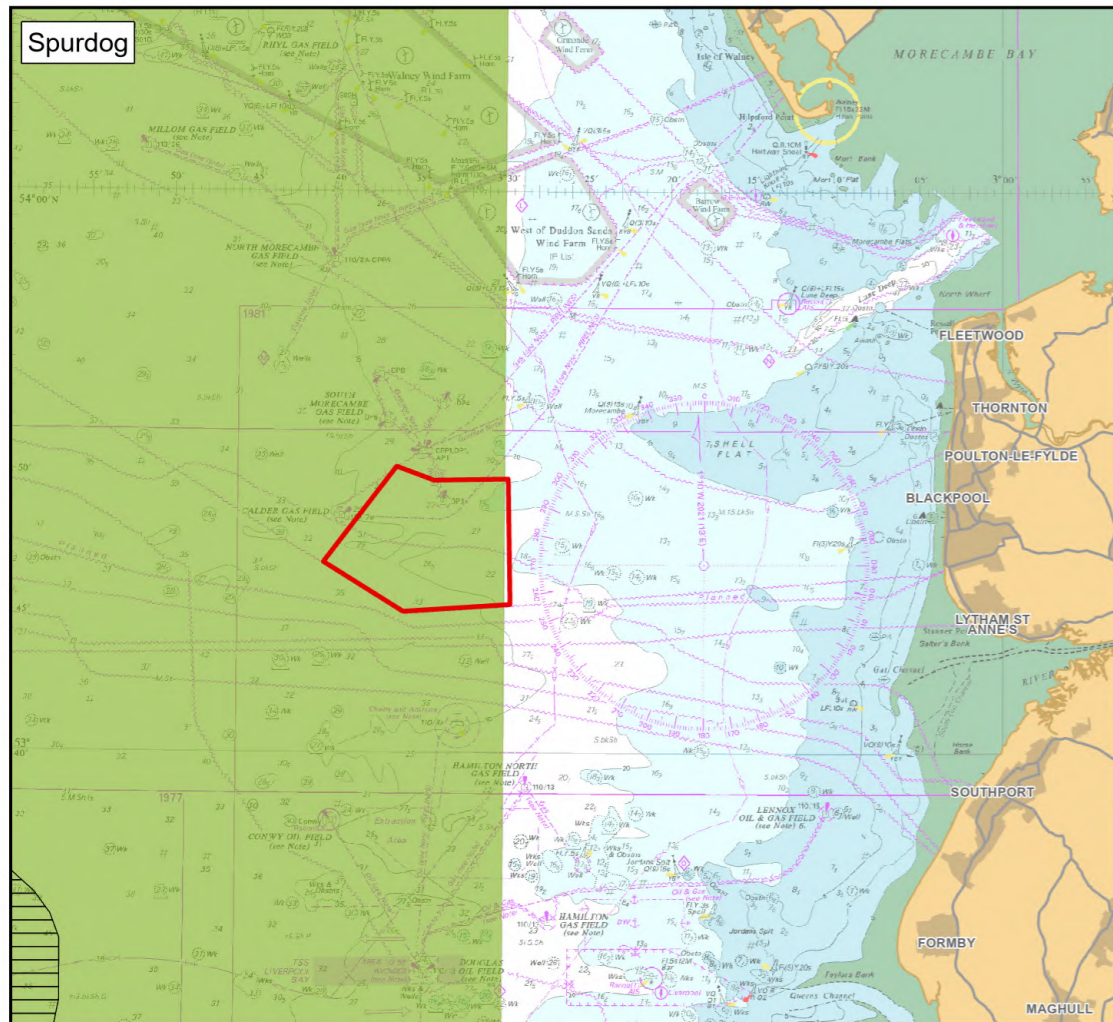
Title:  
Nursery grounds overlapping  
the Fish and Shellfish Ecology Study Area

Figure: 10.3c Drawing No: PC1165-RHD-ES-OF-DR-Z-0036

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P01	12/07/2023	JT	GC	A3	1:500,000
P02	28/03/2024	JH	SB	A3	1:500,000

Co-ordinate system: WGS 1984 UTM Zone 30N





**Legend:**

- Morecambe Offshore Windfarm Site
- Nursery grounds (Coul et al, 1998)

**Nursery grounds (Ellis et al, 2010)**

**Intensity**

- High
- Low

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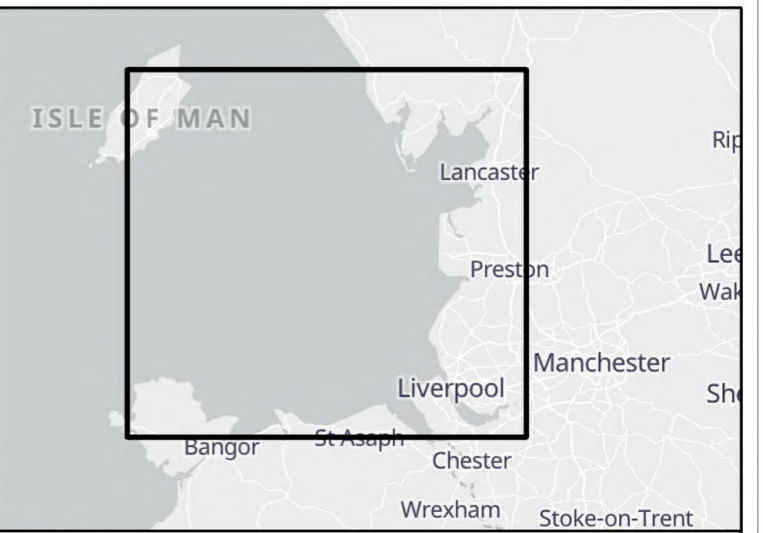
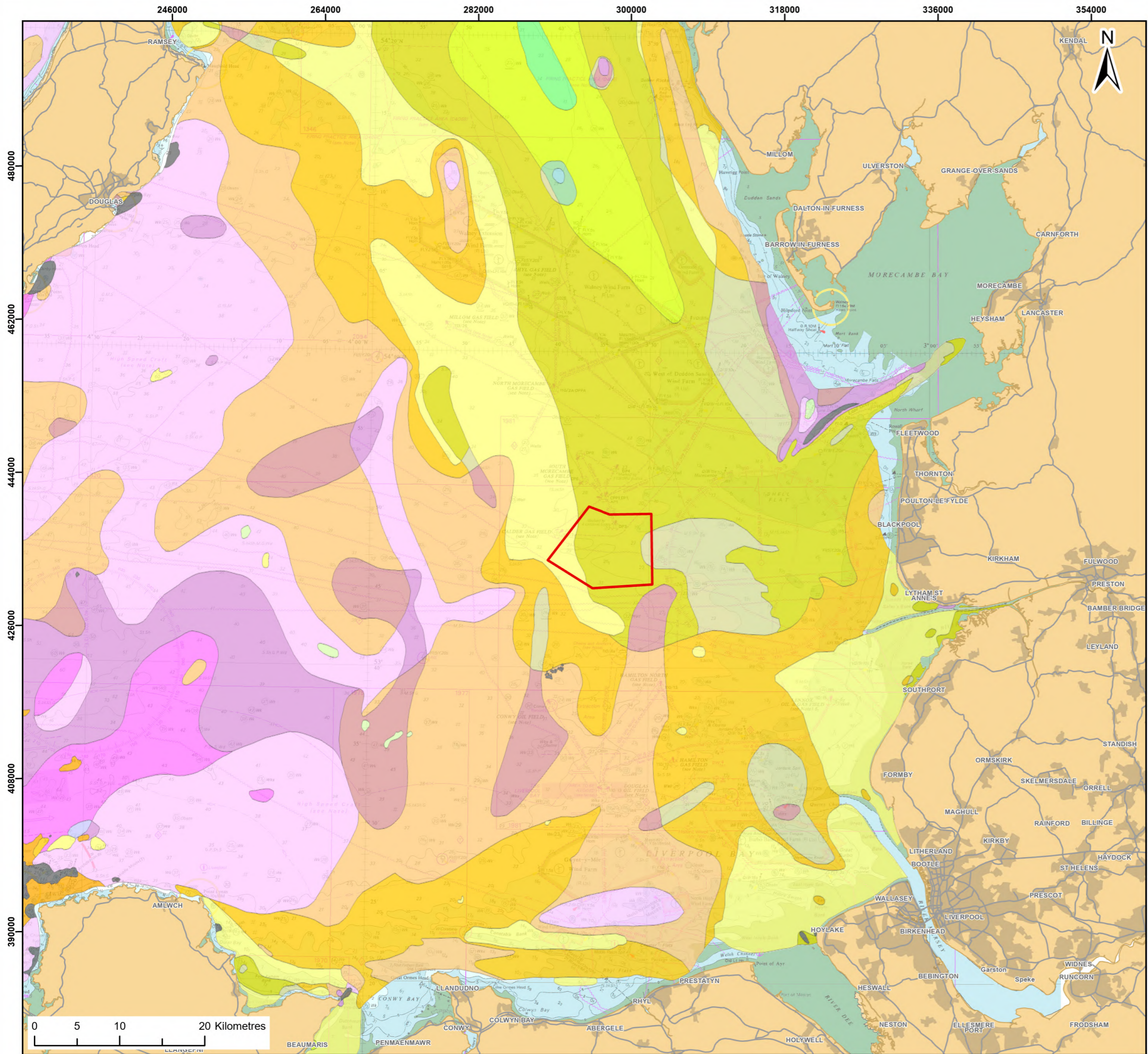
**Title:**  
Nursery grounds overlapping the Fish and Shellfish Ecology Study Area

**Figure:** 10.3d **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0036

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P01	12/07/2023	JT	GC	A3	1:500,000
P02	28/03/2024	JH	SB	A3	1:500,000

Co-ordinate system: WGS 1984 UTM Zone 30N





**Legend:**

Morecambe Offshore Windfarm Site	MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - GRVELLY MUDDY SAND (SEA BED SEDIMENT, BASED ON FOLK)
<b>Seabed Sediments</b>	MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - SAND (SEA BED SEDIMENT, BASED ON FOLK)
MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - MUDDY SANDY GRAVEL (SEA BED SEDIMENT, BASED ON FOLK)	MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - GRAVELLY SAND (SEA BED SEDIMENT, BASED ON FOLK)
MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - GRAVEL (SEA BED SEDIMENT, BASED ON FOLK)	MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - SLIGHTLY GRAVELLY MUDDY SAND (SEA BED SEDIMENT, BASED ON FOLK)
MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - MUD (SEA BED SEDIMENT, BASED ON FOLK)	MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - MUDDY SAND (SEA BED SEDIMENT, BASED ON FOLK)
MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - SANDY MUD (SEA BED SEDIMENT, BASED ON FOLK)	MARINE SEDIMENTS, PLEISTOCENE (UNDIFFERENTIATED) - DIAMICTON
MARINE SEDIMENTS, HOLOCENE (UNDIFFERENTIATED) - SLIGHTLY GRAVELLY MUD (SEA BED SEDIMENT, BASED ON FOLK)	PALAEOZOIC OR QUATERNARY ROCK AND SEDIMENT (UNDIFFERENTIATED) [OFFSHORE ONLY] - ROCK AND SEDIMENT
	PRE-QUATERNARY ROCKS (UNDIFFERENTIATED) - ROCK

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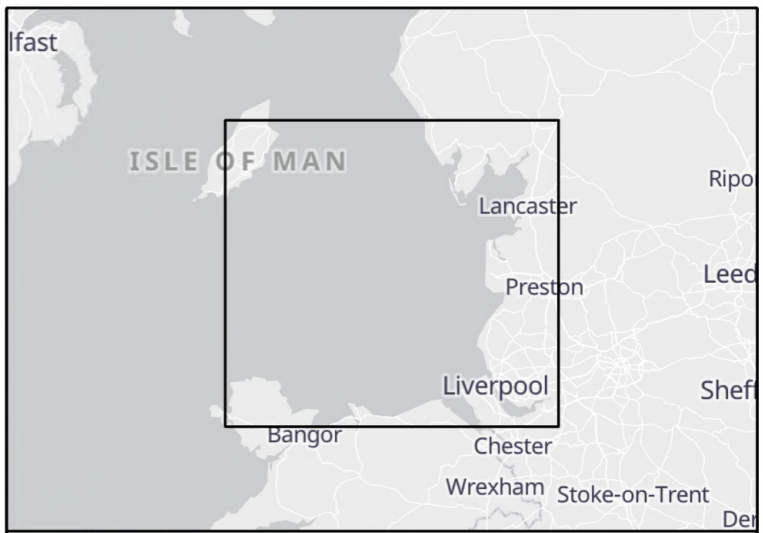
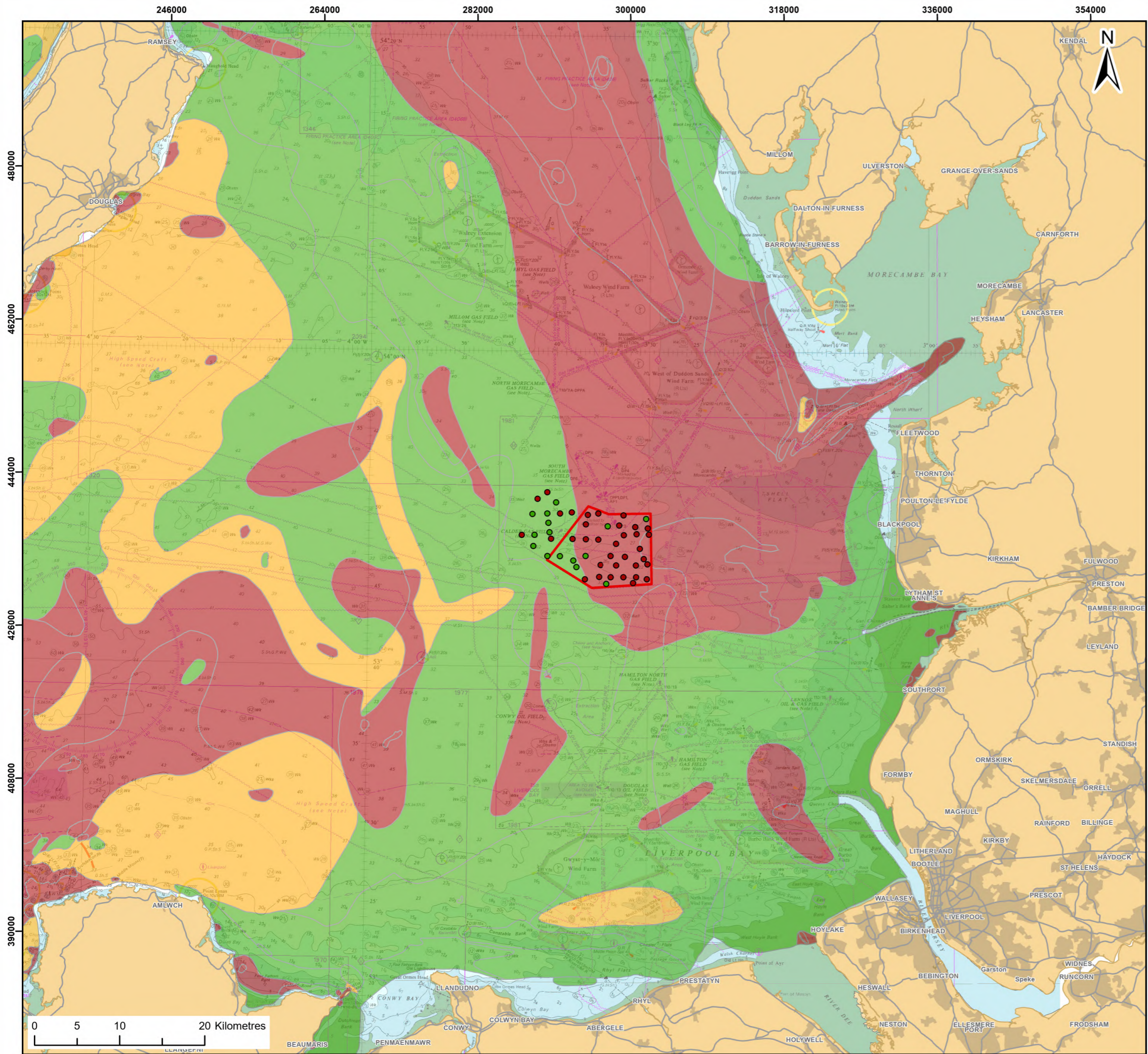
**Title:**  
Seabed sediment types in the Irish Sea (Folk, 1954)

**Figure:** 10.4      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0037

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P02	28/03/2024	JH	SB	A3	1:450,000

Co-ordinate system: WGS 1984 UTM Zone 30N





**Legend:**

Morecambe Offshore Windfarm Site

**Sandeel habitat preference (Particle Size Analysis data)**

- Preferred
- Marginal
- Unsuitable

**Sandeel habitat preference (EMODnet data)**

- Preferred
- Marginal
- Unsuitable

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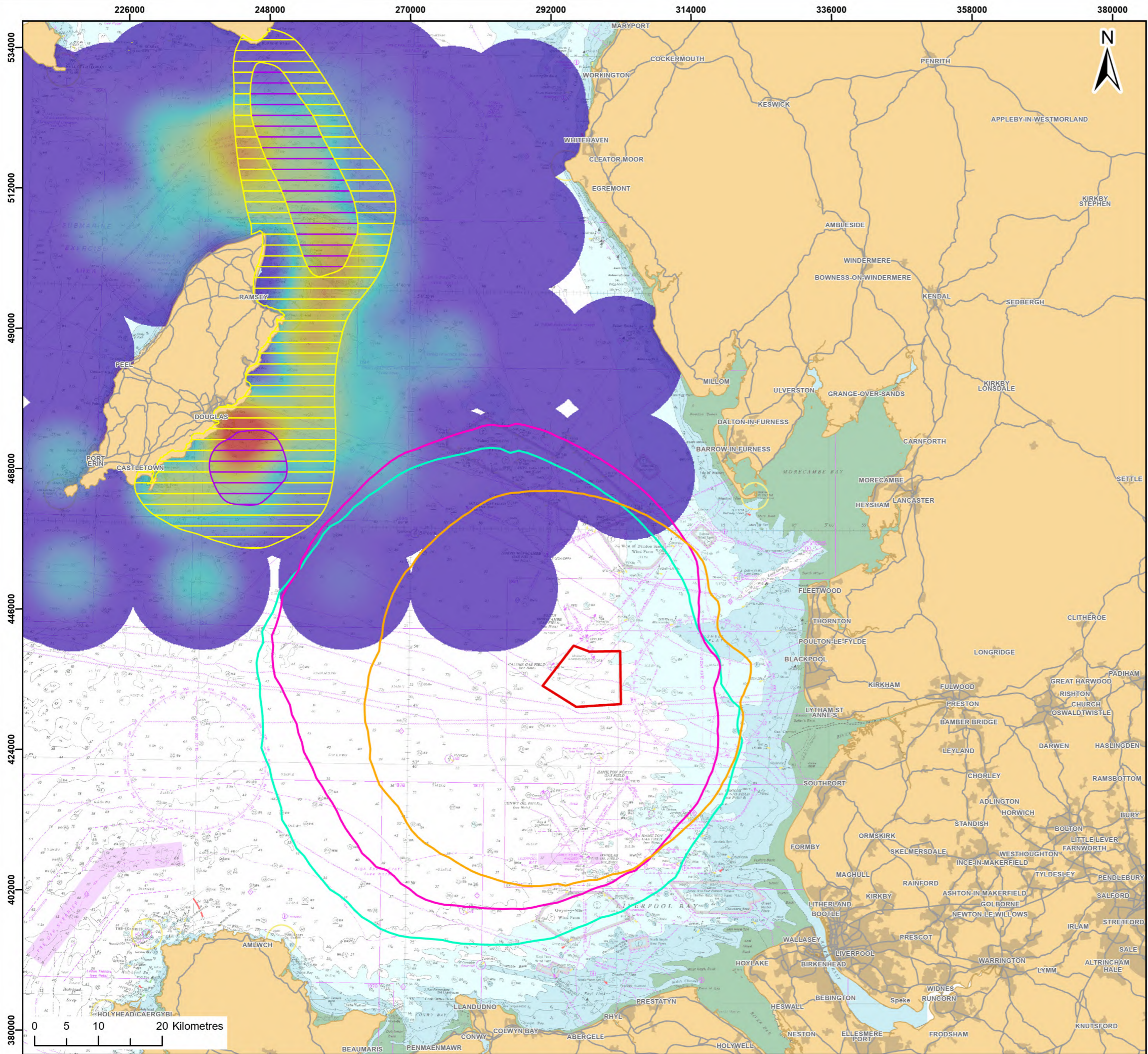
**Title:**  
Sandeel habitat and spawning ground suitability based on site specific PSA data, broadscale sediment data, and Ellis et al. (2012)

**Figure:** 10.5      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0102

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	21/11/2023	JH	SB	A3	1:450,000
P02	28/03/2024	JH	SB	A3	1:450,000

**Co-ordinate system:** WGS 1984 UTM Zone 30N





**Legend:**

- Morecambe Offshore Windfarm Site
- Spawning Grounds (Coul et al, 1998)**
- Intensity**
- Higher
- Lower
- Average Herring Larvae Density (2012 - 2021)**
- High
- Low
- East Modelling Location
- North-West Modelling Location
- South-West Modelling Location

**135dB SEL<sub>ss</sub> Herring Behavioural Response Thresholds at Maximum Monopile Hammer Energy (6,600kJ)**

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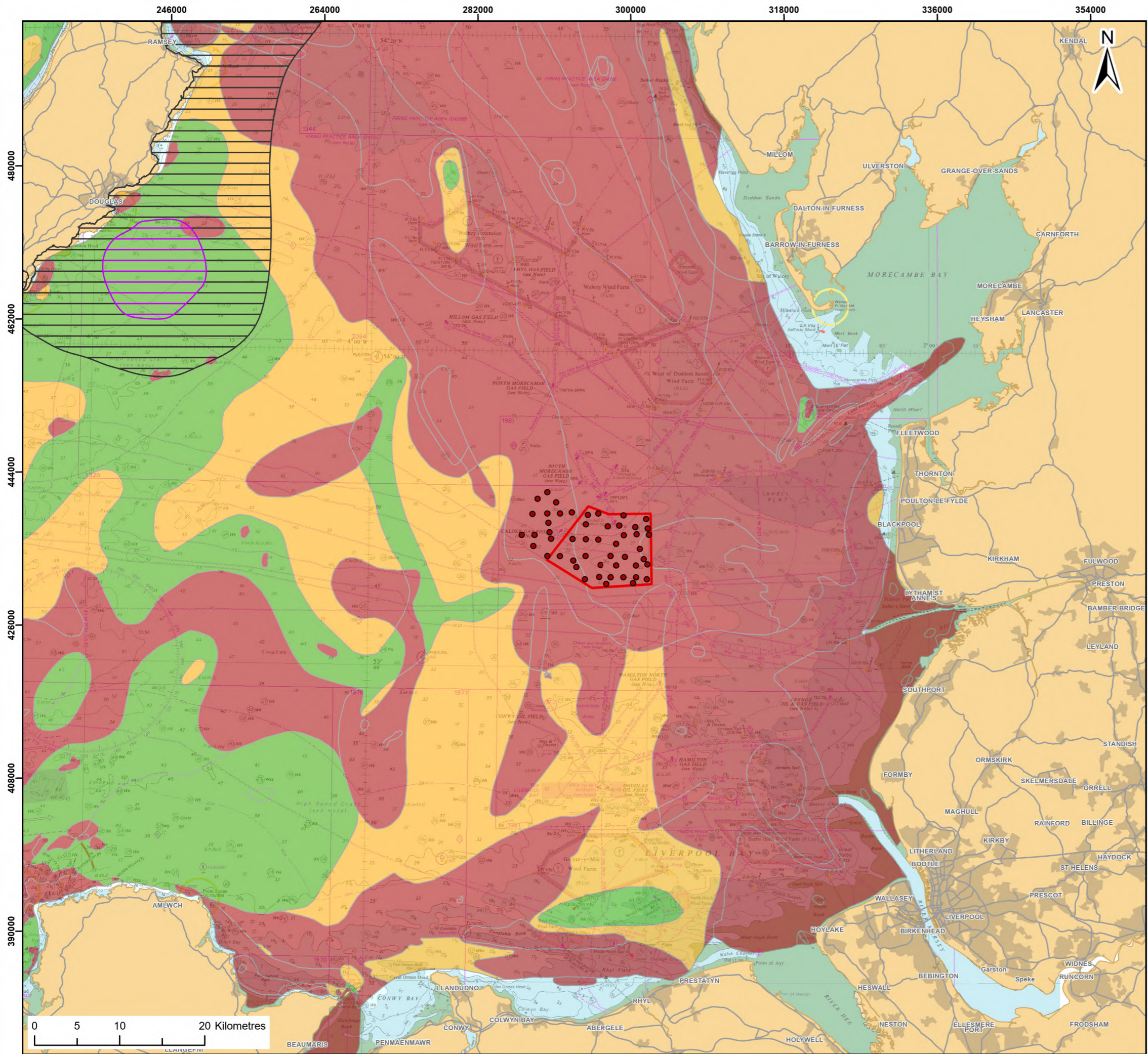
**Title:**  
Herring spawning grounds and noise contours

**Figure:** 10.6      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0038

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P02	27/10/2023	FC	EB	A3	1:600,000
P03	16/04/2024	JH	SB	A3	1:600,000

**Co-ordinate system:** WGS 1984 UTM Zone 30N





**Legend:**

- Morecambe Offshore Windfarm Site

**Herring habitat preference (Particle Size Analysis data)**

- Preferred
- Marginal
- Unsuitable

**Herring habitat preference (EMODnet data)**

- Preferred
- Marginal
- Unsuitable

**Spawning Grounds (Coull *et al.*, 1998)**

**Intensity**

- Higher
- Lower

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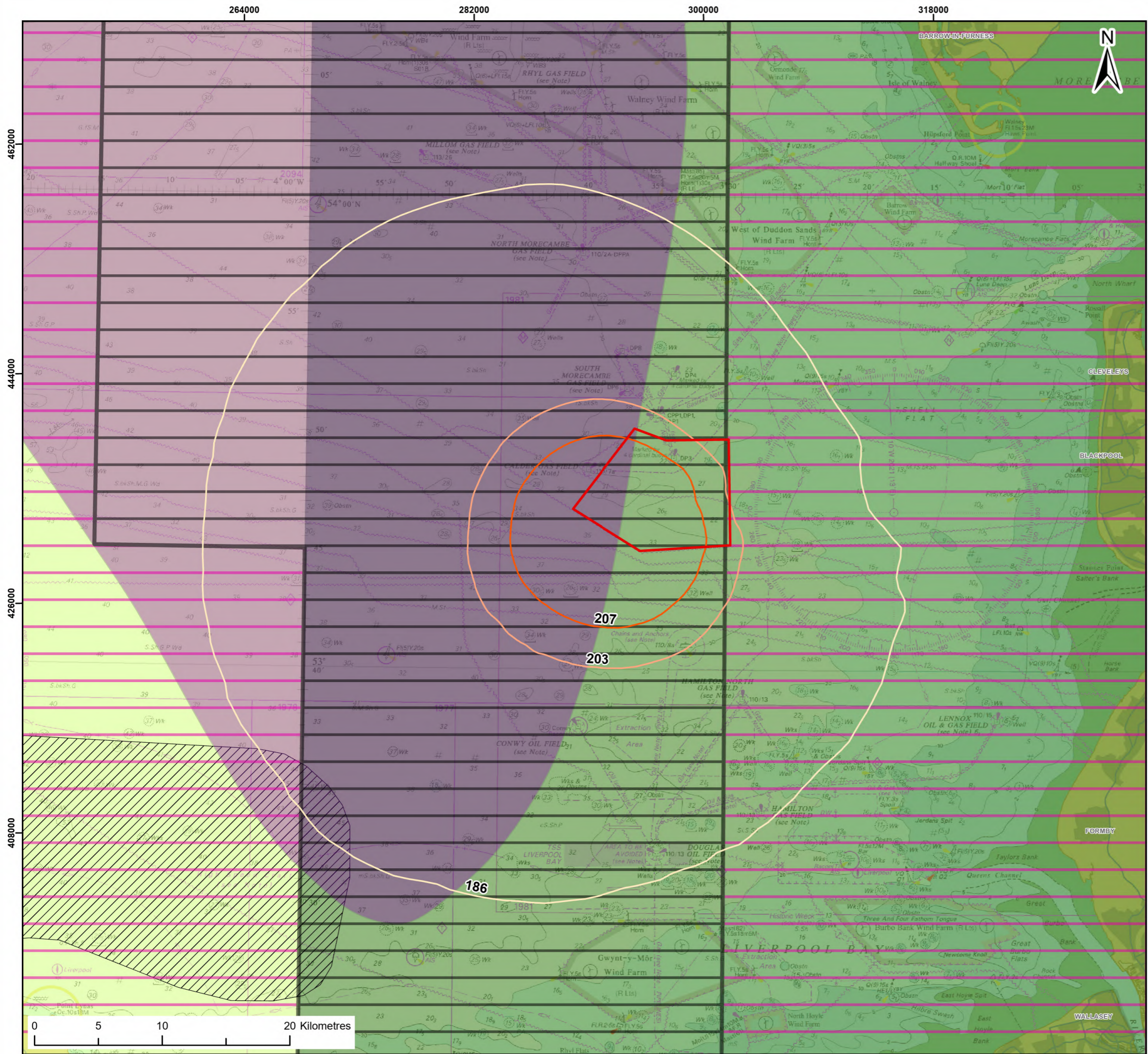
**Report:**  
 Morecambe Offshore Windfarm: Generation Assets  
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**Title:**  
 Herring spawning ground suitability based on site  
 specific PSA data, broadscale EMODnet sediment  
 data, and Coull *et al.* (1998)

**Figure:** 10.7      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0103

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	21/11/2023	JH	SB	A3	1:450,000
P02	28/03/2024	JH	SB	A3	1:450,000

**Co-ordinate system:** WGS 1984 UTM Zone 30N



**Legend:**

- Morecambe Offshore Windfarm Site

**Spawning and nursery grounds**

- Spawning grounds (Coul et al, 1998)
- Nursery grounds (Coul et al, 1998)

**Spawning grounds (Ellis et al, 2012)**

- High
- Low

**Nursery grounds (Ellis et al, 2012)**

- High
- Low

**Piling noise impact ranges (Popper et al, 2014)**

- 207dB - Mortality and potential mortal injury
- 203dB - Recoverable injury
- 186dB - Temporary Threshold Shift

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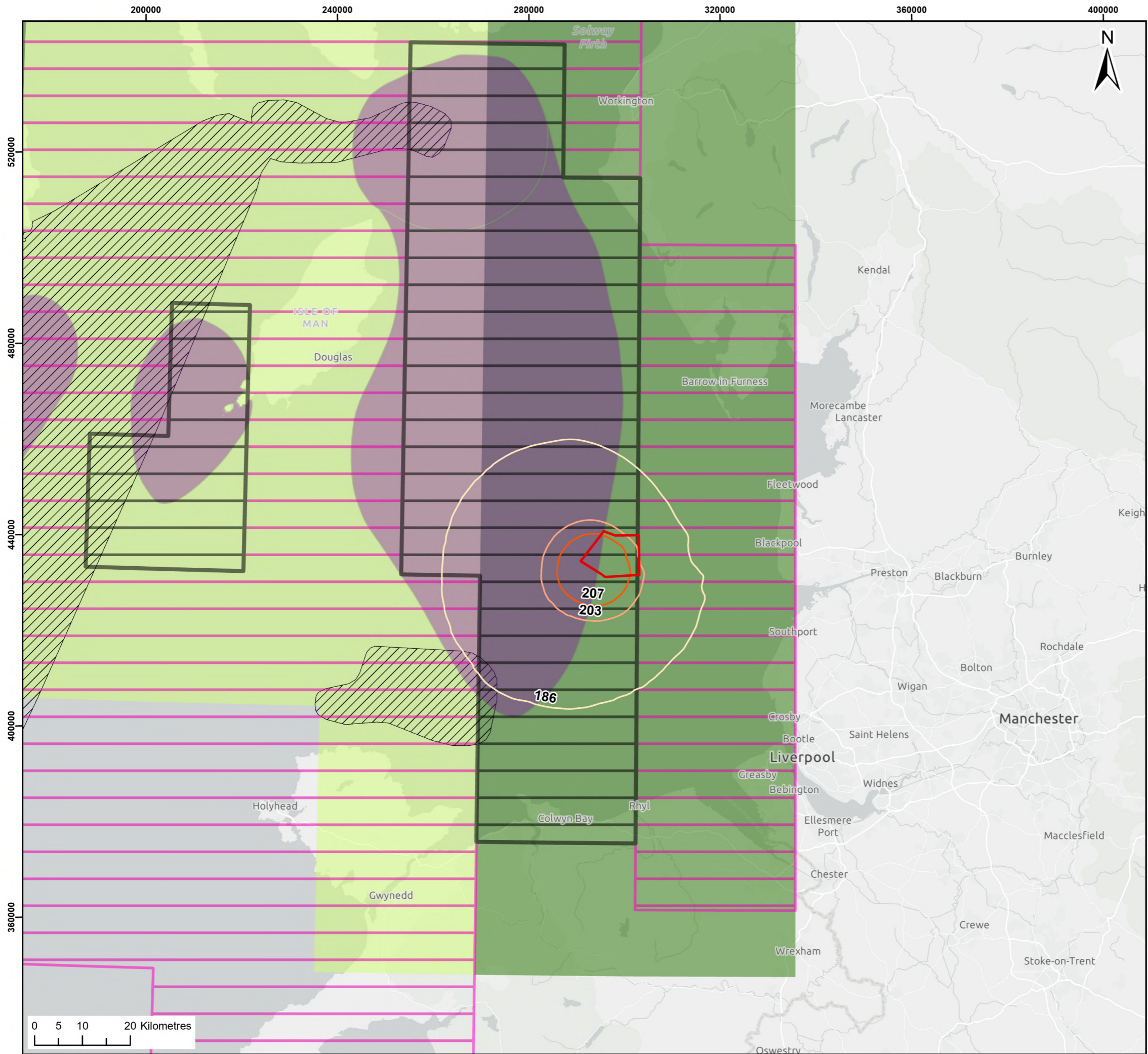
**Title:**  
Worst-case piling noise impact ranges (based on Popper et al. (2014)) and Atlantic cod spawning and nursery grounds for three sequentially piled monopiles within 24 hours

**Figure:** 10.8a **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0119

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	23/02/2024	JH	SB	A3	1:300,000
P02	17/05/2024	JH	SB	A3	1:300,000

**Co-ordinate system:** WGS 1984 UTM Zone 30N





- Legend:**
- Morecambe Offshore Windfarm Site
  - Spawning and nursery grounds**
  - Spawning grounds (*Coul et al, 1998*)
  - Nursery grounds (*Coul et al, 1998*)
  - Spawning grounds (*Ellis et al, 2012*)**
  - High
  - Low
  - Nursery grounds (*Ellis et al, 2012*)**
  - High
  - Low
  - Piling noise impact ranges (*Popper et al, 2014*)**
  - 207dB - Mortality and potential mortal injury
  - 203dB - Recoverable injury
  - 186dB - Temporary Threshold Shift

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**Title:**  
Worst-case piling noise impact ranges (based on *Popper et al. (2014)*) and Atlantic cod spawning and nursery grounds for three sequentially piled monopiles within 24 hours

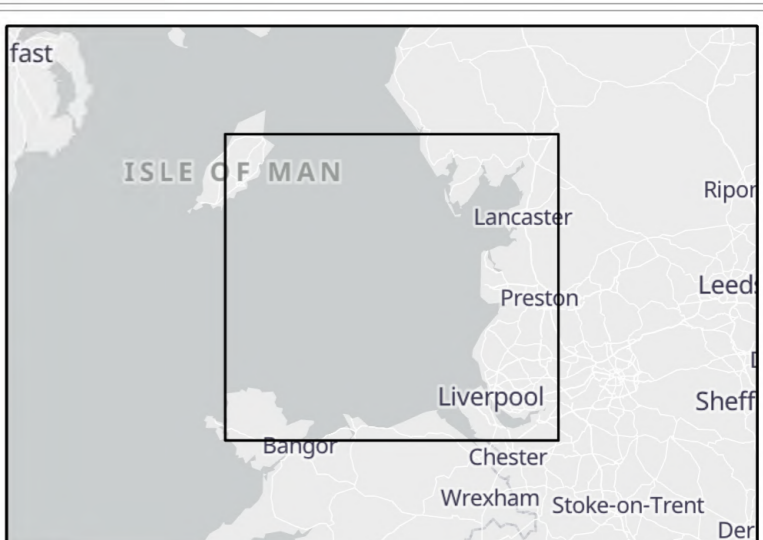
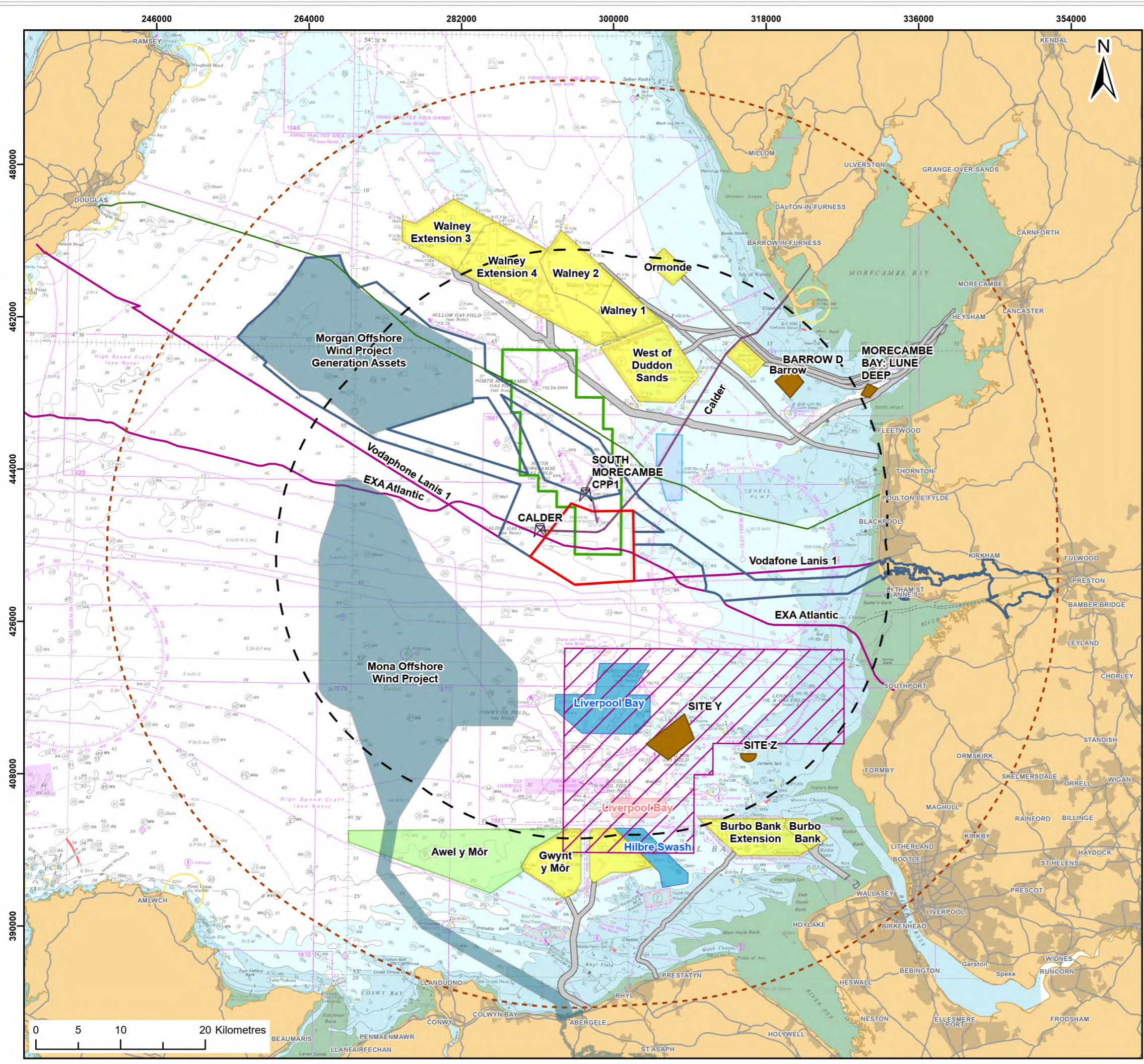
Figure: 10.8b Drawing No: PC1165-RHD-ES-OF-DG-Z-0152

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Co-ordinate system: WGS 1984 UTM Zone 30N







**Legend:**

- Morecambe Offshore Windfarm Site
- Morgan and Morecambe Offshore Wind Farms: Transmission Assets (In Planning)
- Morecambe Offshore Windfarm Site - 30km buffer
- Morecambe Offshore Windfarm Site - 50km buffer
- Offshore platform
- Oil & Gas Pipeline
- Telecom cables
- Isle of Man Interconnector
- Disposal Sites
- Gateway Gas Storage Project
- Carbon Capture Storage License (CS004)
- Carbon Capture Storage Area (EIS Area 1)
- Offshore Wind Cable Agreements
- Minerals & Aggregates Site Agreements
- Exploration and Option Area
- Production Agreement Area

**Windfarm status**

- Fully commissioned
- Consented
- In Planning

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**Report:**  
Morecambe Offshore Windfarm: Generation Assets Environmental Statement

**Title:**  
Other plans, projects and activities included in the Cumulative Effects Assessment for fish and shellfish ecology

**Figure:** 10.9      **Drawing No:** PC1165-RHD-ES-OF-DR-Z-0105

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
P01	21/11/2023	JH	SB	A3	1:450,000
P02	05/04/2024	JH	SB	A3	1:450,000

**Co-ordinate system:** WGS 1984 UTM Zone 30N

