Eastern Green Link 3

Marine Environmental Appraisal

Appendix 11A: Scottish Navigational Risk Assessment

Prepared for:
Scottish Hydro Electric Transmission plc (SHE-T)

Scottish & Southern Electricity Networks
TRANSMISSION

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Abbreviations/Glossary

AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
CBRA	Cable Burial Risk Assessment
CLV	Cable Lay Vessel
COLREGS	Regulations for Preventing Collisions at Sea, 1972
EEA	European Economic Area
EMODnet	European Marine Observation Data Network
EMF	Electromagnetic Field
ESCA	European Subsea Cables Association
FLO	Fisheries Liaison Officer
FoS	Factor of Safety
FSA	Formal Safey Assessment
HAZID	Hazard Identification
HVDC	High Voltage Direct Current
IMO	International Maritime Organisation
INS	International Navigation System
IS	In Service
KIS-ORCA	Kingfisher Information Service - Offshore Renewable & Cable Awareness
km	Kilometre
m	Metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MEAp	MEAp - Marine Environmental Appraisal
MHWS	Mean High Water Springs
MMO	Maine and Maritime Organisation
NAVAREA	Navigational Areas
NAVTEX	Navigational Telex
NM	Nautical Mile
NRA	Navigational Risk Assessment
NTM	Notice to Mariners
OREI	Offshore Renewable Energy Installations
OOS	Out of Service
RIFG	Regional Inshore Fisheries Groups

ROV	Remotely Operated Vehicle
RYA	Royal Yachting Association
SIMOPs	Simultaneous operations
SFF	Scottish Fishermen's Federation
SOPEP	Shipboard Oil Pollution Emergency Plan
The Project	Eastern Green Link 3
UK	United Kingdom
UKC	Under Keel Clearance
UKHO	United Kingdom Hydrographic Office
VMS	Vessel Monitoring System
WMS	Web Mapping Service
ZOI	Zone of Influence

1. Introduction

1.1. Overview

This technical appendix sets out the approach to the Navigational Risk Assessment (NRA) for the Scottish offshore elements of Eastern Green Link 3 (EGL 3), hereafter referred to as the 'Proposed Development'. This document is an appendix to the EGL 3 Marine Environmental Appraisal (MEAp) **Chapter 11: Shipping and Navigation** and considers the marine Scottish elements of the project, known as the Scottish Offshore Scheme.

The Proposed Development is being developed by Scottish Hydro Electric – Transmission plc (SHE-T) (hereafter referred to as 'the Applicant') and includes approximately 145 km of subsea High Voltage Direct Current (HVDC) cables from mean high water springs (MHWS) at the landfall at Sandford Bay, Scotland, to the boundary with adjacent English waters.

The purpose of this NRA is to identify and assess the potential impacts arising from the construction, operation (including maintenance and repair during the operational life) of the Proposed Development in relation to shipping activity and key navigation features. The Proposed Development is expected to have a life span of approximately 40 years.

There are currently no specific plans to decommission the Proposed Development. It is expected that the transmission of electricity would continue for as long as there is a business case for doing so and that any decommissioning activity would occur decades into the future. It is expected that an assessment in accordance with the legislation and guidance at the time of decommissioning would be undertaken. However, no impacts greater than those assessed in this NRA for the construction or operational phase are anticipated. Once decommissioned, the Proposed Development is not expected to have ongoing shipping and navigation impacts.

This NRA is a working document that will be updated as the Proposed Development develops and through consultation with stakeholders.

1.2. Shipping and Navigation Study Area

The study area for shipping and navigation in this NRA and **Chapter 11: Shipping and Navigation** includes the Red Line Boundary (RLB) (**Figure 2-1**) plus an additional 5 Nautical Miles (NM) buffer either side to ensure that all shipping patterns and navigational features are captured (hereafter referred to in this technical appendix as the 'Shipping and Navigation Study Area'). This Shipping and Navigation Study Area captures the potential for direct and indirect effects associated with the activities during construction, operation (including maintenance and repair) and decommissioning.

In this NRA for the Proposed Development the extent of the Shipping and Navigation Study Area is from the Scottish border up to Mean High Water Springs (MHWS) in Sandford Bay.

1.3. Guidance and Best Practice

This NRA and risk matrix **(Appendix A: Risk Matrix)** has been prepared in accordance with the guidance below:

- International Maritime Organisation (IMO) Guidelines for Formal Safety Assessment (FSA) – MSC-MEPC.2/Circ.12/Rev.2 (IMO, 2018).
- Consideration to linear structures such as marine cables in relation to offshore renewable structures has been given using:
  Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 654 (Merchant and Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) - Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response. (MCA, 2021).
  MCA MGN 372 Amendment 1 "Offshore Renewable Energy Installations (OREIs) - Guidance to Mariners operating in the vicinity of UK OREIs" (MCA, 2022).
  MCA Methodology for Assessing the Marine Navigational Safety Risks & Emergency Response of OREIs Version 3.1 (MCA, 2023).

The assessment has been informed by the above guidance which states that the assessment stage should follow a clear progression from the characterisation of the hazard, the risk that hazard has on, in the case of this assessment, the existing shipping baseline in addition to the steps and risk controls that are in place to reduce the overall impact of the hazard to As Low As Reasonably Practicable (ALARP).

1.4. Data Sources

The NRA involved an information gathering exercise in order to determine the baseline shipping and navigation conditions.

A summary of the organisations that have supplied data, together with the nature of that data is outlined in **Table 1-1** and **Table 1-2**.

Primary sources of background information used in this NRA are as follows:

- Ossian Array Site NRA (https://marine.gov.scot/sites/default/files/volume_3_-_technical_reports_-_appendix_13.1_-_navigation_risk_assessment.pdf, Anatec, 2024).
- EGL 3 Project and EGL 4 Project Electromagnetic Field (EMF) Study (EEN/637/NOTE2025 v1). (**Appendix 3A: Electric and Magnetic Field Assessment**).
- Commercial Fisheries Report for EGL 3 and EGL 4 (Brown & May Marine, 2023).

As part of the cable route selection process in the feasibility stage, the Proposed Development has been routed away from areas with high vessel densities and anchorages where possible.

To assess commercial fishing activity, a desk-based study using publicly available data was undertaken by Brown and May Marine Ltd. in March 2023 to understand the spatial and temporal distribution of fishing activity within the Shipping and Navigation Study Area. Automatic Identification System (AIS) data from UK and European vessels over 15 metres (m) in length was also obtained and interrogated to assess the distribution of fishing effort in this study. For Vessel Monitoring Systems (VMS) data, it should be noted that vessels under 12 m are not presently captured within the study; the majority of these vessels under 12 m tend to be inshore creel/potting vessels, which is recognised as important fisheries within the Shipping and Navigation Study Area. Information and consultation have been sought from the Scottish Fishermen's Federation (SFF) and Regional Inshore Fisheries Groups (RIFG). For further details on fishing activity, please refer to **Chapter 12: Commercial Fisheries**.

The Ossian array site NRA has been referenced particularly for cumulative effects due to close proximity to the Ossian array site in Scottish waters. In the NRA, a cumulative vessel routeing assessment was undertaken to estimate deviations around proposed OREI developments (Anatec, 2024).

An EMF study **(Appendix 3A: Electric and Magnetic Field Assessment)** has been completed by the Applicant which informs further assessment about the risk to marine navigational equipment due to potential compass deviations and any mitigation measures if required.

Table 1-1: Site-specific data sources used in the EGL 3 NRA

Data Source	Description	Reference
MariTrace	5-minute time series AIS data of shipping activities from 1st December 2023 to 30th November 2024 (12 months of data).	MariTrace, 2025
Marine Themes Vector Data	Marine Themes Vector data tiles including anchorage areas, marine use areas, aquaculture, navigational lines, navigational routes, beacons and buoys.	FIND Mapping, 2024
Admiralty Charts	Admiralty charts covering the Shipping and Navigation Study Area.	Admiralty, 2025

Table 1-2: Publicly available data sources used in the EGL 3 NRA

Data Source	Description	Reference
Royal Yachting Association (RYA)	UK Coastal Atlas of Recreational Boating 2.1AIS dataset of recreational vessel activity.	RYA, 2019
European Marine Observation and Data Network (EMODnet)	Coarse-grained vessel density maps.	EMODnet, 2024
Royal National Lifeboat Institution (RNLI)	RNLI 2019-2023 datasets including Returns of Service, lifeboat stations and support centres.	RNLI, 2024
Marine Accident Investigation Branch (MAIB)	MAIB incident data portal	MAIB, 2025
VMS data	VMS data for the period 2019 - 2023	Defra, 2024

1.5. Vessel Data Used

As per Regulation 19 of Chapter V, Safety of Navigation, of the Annex to the International Convention for the Safety of Life at Sea (SOLAS V), 1 July 2002, an AIS transponder must be installed and operated on:

- All ships of 300 gross tonnage and upwards engaged on international voyages,
- Cargo ships of greater than 500 gross tonnage not engaged on international voyages, and
- All passenger vessels irrespective of size.

AIS has increasingly been installed on vessels by other maritime users on smaller craft including yachts, fishing vessels and pleasure craft. AIS can therefore be considered as the most reliable indicator of marine traffic, with data gaps for smaller vessels being supplemented by additional data on recreational vessels. EMODnet vessel density maps (EMODnet, 2025) are created from publicly shared AIS data, which is an automatic tracking system used to identify and locate vessels by electronically exchanging data with other nearby ships, AIS coastal stations and satellites. They provide the total ship presence time for ship categories for every month (vessel hours per month) on a 1 kilometre (km) grid that follows the European Economic Area (EEA)/Inspire standards. The regulation for AIS transponders covers almost all commercial vessels and most private vessels; however, some smaller fishing and recreational vessels could be missing from the AIS dataset.

To supplement this, AIS data from recreational vessels sourced from the Royal Yachting Association (RYA) have been used to give a picture of the most utilised routes and areas by leisure boaters which may not have an AIS transponder fitted.

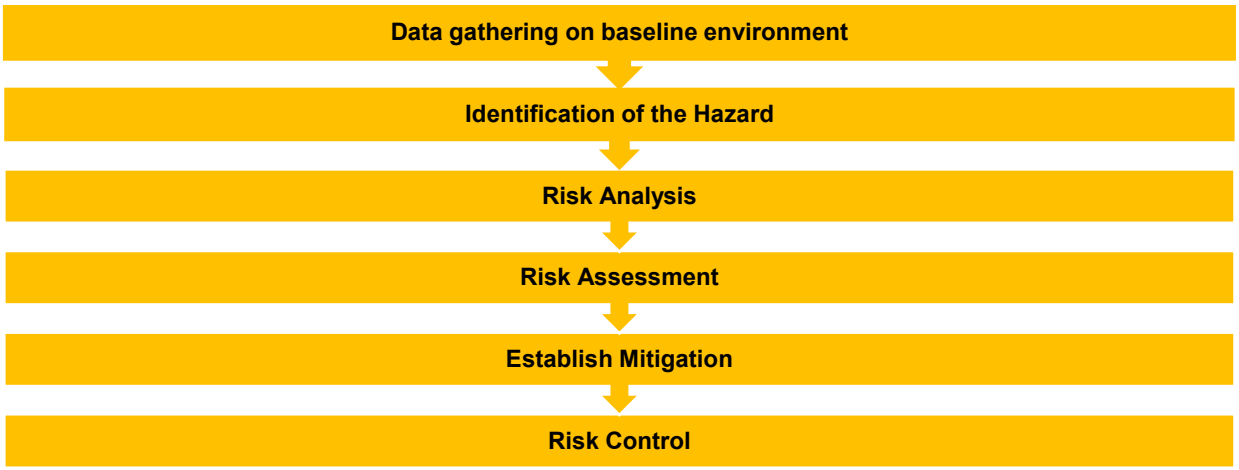
Publicly available vessel data has been cross-referenced with the live traffic maps on the Marine Traffic website (Marine Traffic, accessed 2025; not available to purchase or download) to ensure that shipping patterns, usage of anchorages and usage of ports remain unchanged. Furthermore, the vessel density for purchased data is in a finer resolution (0.08 km grid) than the publicly available data, therefore, smaller shipping patterns in vessels can be identified.

The Applicant holds AIS data purchased from MariTrace for the entire area (1st December 2023 to 30th November 2024, 12 months of data). This 5-minute time series data has been used to create vessel density maps. The AIS data extends outside the 5 NM Shipping and Navigation Study Area to cover previously identified potential routes for the Proposed Development and provide a characterisation of general vessel behaviour in the area. The AIS data has been processed to provide outputs of vessel hours per year in 500 x 500 m grids. Where relevant, commercial fishing vessel activity has been assessed, as presented in **Chapter 10: Commercial Fisheries**.

1.6. Methodology

The assessment process involves the following main steps presented in **Figure 1-1**. The NRA is undertaken based on IMO standards (IMO, 2018) and using MGNs (MCA, 2021; MCA, 2022; MCA, 2023). In carrying out these assessments, as far as reasonably possible, all phases of the Proposed Development's life are addressed, i.e., construction, operation and maintenance, and decommissioning. The NRA approach has also been informed by the scoping opinion alongside consultation with specific shipping and navigation stakeholders (please refer to **Chapter 11: Shipping and Navigation** for further information).

Figure 1-1: Assessment steps for the NRA



The definition of "hazard" and "risk" for the NRA are:

- Hazard - A potential source of marine incidences, collisions and disruptions to the existing baseline of other marine users; and
- Risk - The probability of suffering harm, loss or displacement and is a measure of the probability (frequency) and consequence of a hazard.

Below, **Table 1-3** illustrates a high-level summary of each step of the NRA.

Table 1-3: NRA Methodology Steps Overview

Data Requirement	Method	Data Source
Baseline Assessment	Establish current shipping conditions and features that exist within the Shipping and Navigation Study Area. A specialist study to provide data on maritime activity, shipping intensity and density in the Shipping and Navigation Study Area and a risk assessment of potential shipping hazards such as collision risk and anchoring risks. A 5 NM buffer is applied around the Proposed Development to ensure that all shipping patterns and navigational features are captured.	EMODnet vessel density maps of European waters AIS datasets (1st December 2023 to 30th November 2024) Admiralty charts RYA UK Coastal Atlas of Recreational Boating Royal National Lifeboat Institution (RNLI) Incidents Data (2025) Marine Accident Investigation Branch (MAIB) data portal (MAIB, 2025)
Consultation	Proactive consultation with key ports authorities (e.g. Peterhead Port Authority) and the Maritime and Coastguard Agency (MCA), alongside other maritime stakeholders (e.g. local sailing clubs, RYA Scotland, Northern Lighthouse Board, Chamber of Shipping, SFF).	Stakeholder consultation meetings Non-statutory scoping opinion responses Please refer to the **Chapter 11: Shipping and Navigation** for further information
Hazard Identification	Identify known hazards expected to be encountered as a result of the offshore operations and presence of vessels associated with the Proposed Development.	Identify known hazards expected to be encountered as a result of the offshore operations and presence of vessels associated with the Proposed Development.
Risk Analysis	Determine the impact of hazards on navigational safety, displacement of vessels, and human safety in terms of frequency and consequence, developed using IMO guidelines. Cumulative effects have been evaluated at a high-level by considering other existing and planned projects and the cumulative impact pathways as a result.	Hazard identification phase IMO Guidelines (IMO, 2018)
Risk Assessment	Risks are examined using a risk matrix, which illustrates the combination of the frequency and the consequence of the hazard to establish the potential impact.	Frequency and consequences from the risk analysis phase
Mitigation	Embedded measures for each hazard are established to (in preferential order): prevent/avoid, reduce, or offset the potential risk. Gaps in existing procedures and areas in which mitigation may need to be enhanced would also be considered. Care to be taken to ensure that any new hazards created as a result are themselves identified and managed.	International Regulations for Preventing Collisions at Sea (COLREGs) IMO Guidelines UK Standards European Subsea Cable Association Guidance Shipping and navigation Hazard Identification (HAZID) workshops
Risk Control	Reduce risks on the existing shipping baseline to ALARP using embedded measures. Additional analysis, consultation and enhanced embedded measures are normally needed for risks that are assessed as Major after reducing risks to ALARP. Where further mitigation is not possible, a residual hazard may remain.	Stakeholder consultation where required

1.6.1. Risk Analysis Methodology

The risk analysis introduces the concept of risk in a qualitative way in order to prioritise the hazards identified during the hazard identification process and assess their impact on navigational safety.

The definitions of hazards utilised in the NRA have been developed using the IMO guidelines and stakeholder consultation, which includes the following possible consequences of hazards:

- Effect on human safety;
- Effect on vessel(s) / property;
- Displacement of vessel(s);
- Business / reputational effects; and
- Environmental effects.

Risk is the combination of frequency and consequence which are defined in **Table 1-4** and **Table 1-5** respectively below, which are used to determine the inherent and residual risk ratings.

Table 1-4: Definitions and categories of frequency

Frequency Value	Description	Definition
1	Extremely Remote	Likely to occur once in the lifetime of the Proposed Development (assumed as 40 years) or less
2	Remote	Likely to occur once a decade
3	Probable	Likely to occur once per year
4	Very Probable	Likely to occur once per month
5	Frequent	Likely to occur once per week or more

Please refer to the consultation and stakeholder engagement section (**Section 3.1**) for further information on how the frequency categories have been updated as per MCA feedback on the risk matrix.

Risk prioritisation is an important part of the NRA process; the greater the potential of a hazard, the greater the need to ensure that there are embedded measures in place to control the risk.

Table 1-5: Definitions and categories of consequence

Consequence Value	Description	Definition				
		Effects on Human Safety	Effect on Ship(s)	Displacement of Vessel(s)	Business/ Reputational Effects	Environmental Effects
1	Minor	Single or minor injuries	Single local equipment damage	Temporal displacement of vessel (hours)	No negative publicity. No perceptible impact.	No response needed. However, minor emissions as a result.
2	Significant	Multiple minor injuries	Multiple local equipment damage	Temporal displacement of vessel (days)	Minor reputational risks. Local negative publicity.	Tier 1 response - local assistance needed.
3	Severe	Multiple or severe injuries	Non-severe ship and equipment damage	Temporal displacement of vessel (weeks)	Moderate reputational risks. Regional negative publicity.	Tier 2 response - may not require external assistance
4	Serious	Single fatality or multiple severe injuries	Severe damage to ship and equipment	Temporal displacement of vessel (months)	National reputational risks and negative publicity.	Tier 2 response - would require external assistance.
5	Catastrophic	Multiple fatalities	Total loss of ship and equipment	Permanent displacement of vessels	International reputational risks and negative publicity.	Tier 3 response - national assistance needed.

1.6.2. Risk Assessment

The realisation of hazards can result in potential accidents and consequences. The potential for a hazard to be realised can be combined with an estimated (or known) consequence of the outcome. This combination is termed "risk". Risk is therefore a measure of the frequency and consequence of a hazard. One way to compare risk levels is to use a matrix approach.

To undertake the risk assessment, a risk matrix approach has been utilised, which examines the frequency and consequence of a hazard to determine the combined risk. Risk ratings are calculated **Table 1-6**, which can be interpreted using the definitions of the risk level and tolerability in **Table 1-7**. For example, where the frequency of a hazard has been assessed as extremely remote and the consequence assessed as minor, the risk can be said to be negligible. On the other end of the scale, where hazards are assessed as frequent and the consequence catastrophic, then risk is intolerable.

The risk matrix identifies areas where the level of risk to the baseline shipping and navigation environment would need to be reduced to ALARP. Risk control (see **Section 1.6.4**), in the form of mitigation (i.e. embedded measures), is required to reduce the risk ratings (and therefore the effects on the baseline shipping and navigation environment) to ALARP, to ensure an acceptable or tolerable level of risk. Where risks are not able to be mitigated further in accordance with ALARP, these are deemed intolerable.

Table 1-6: Risk rating matrix based on consequence and frequency

		Consequence				
		Minor	Significant	Severe	Serious	Catastrophic
Frequency	Extremely Remote	1	2	3	4	5
	Remote	2	4	6	8	10
	Probable	3	6	9	12	15
	Very Probable	4	8	12	16	20
	Frequent	5	10	15	20	25

Table 1-7: Definition of risk levels and tolerance

Score	Risk level	Definition	Tolerability
1-2	Negligible	A hazard which causes noticeable changes in the navigation environment but without effecting its sensitivities. Generally considered as insignificant.	Acceptable
3-4	Minor	A hazard that alters the character of the navigation environment in a manner that is consistent with existing baseline. Hazards are generally considered as minor and adequately controlled by best practice and legal controls. Opportunities to reduce hazards further through mitigation may be limited and are unlikely to be cost effective.	Tolerable with embedded controls
5-9	Moderate	A hazard which, by its frequency and consequence alters the aspect of the navigation environment. Generally considered as Moderate but effects are those, considered to be tolerable. However, it is expected that the hazard has been subject to feasible and cost-effective mitigation and has been reduced to ALARP and that no further measures are feasible.	Tolerable with additional controls
10-14	Major	An effect which, by its frequency and consequence alters most of the aspects of the navigation environment. Generally regarded as unacceptable prior to any mitigation measures being considered.	Unacceptable

Score	Risk level	Definition	Tolerability
15-25	Intolerable	Regarded as intolerable prior to any mitigation measures being considered.	Intolerable

After determining the risk ratings for each hazard before and after mitigation measures, the resultant risk matrix is split into two halves – the first describes the frequency and consequences before mitigation (inherent risk) and the second half describes the frequency and consequences after mitigation measures have been applied (residual risk).

1.6.3. Establish Mitigation

Mitigation measures are the actions or systems proposed to manage or reduce the potential adverse effects identified. These have been termed 'Embedded Measures'.

A standard hierarchical approach to identifying mitigation requirements has been used to inform the NRA:

- **Avoidance**: Where viable, the Proposed Development will be redesigned to avoid impacts. Avoidance will also be considered during the assessment of alternative routes.
- **Reduction**: Reduction (through the use of mitigation or different techniques) will be considered when all options for the avoidance of impacts have been exhausted or deemed to be impractical. For example, alternative technologies could be considered to reduce impact.
- **Offset**: Where the potential for avoiding and reducing impacts has been exhausted, consideration will be given to providing compensation for residual impacts or undertaking remedial works to make the proposal more environmentally acceptable.

The risk assessment includes a review of existing hazards and their associated mitigation. As a result, new mitigation (or changes to existing mitigation) may be identified for consideration, both where there are gaps in existing procedures and where mitigation need to be enhanced.

Care should be taken to ensure that any new hazards created as a result are themselves identified and managed. The overall risk to the existing baseline during this stage would allow recommendations to be made to enhance safety. Mitigation measures are sometimes confused with measures taken to ensure legal compliance, which can be similar. Legislation is often designed to ensure effects to the environment are minimised.

1.6.4. Risk Control

The aim of assessing the Proposed Development operations on the existing shipping baseline is to reduce risk to ALARP.

The risk assessment is repeated taking into consideration the application of Embedded Measures. This determines the risk level of the hazard with mitigation applied. When the risk assessment is carried out after mitigation is applied, the resulting risk level is referred to as ALARP.

Residual risks that have been assessed as Major or above after considering mitigation would normally require additional analysis and consultation to discuss and possibly further mitigate hazards, where possible. Where further mitigation is not possible, a residual risk may remain.

2. Existing Shipping and Navigation Baseline

2.1.1. Navigational Features

Navigational features are areas that are marked on nautical charts for mariner's information, either as aids to navigation or areas to be aware of or avoided. These include ports and port areas, anchorage areas, extraction areas, military practice or firing areas, wind farms, spoil grounds, cables, pipelines, traffic separate schemes, anchorages, aids to navigation, pilot boarding stations, oil and gas infrastructure and charted wrecks or obstructions.

The key navigational features found in the Shipping and Navigation Study Area are:

- Peterhead Port Authority
- Port Erroll (Cruden Bay)
- Boddam Harbour
- Buchan Ness Lighthouse

- Pilotage station (2.5 km to the east of Boddam)
- Offshore Wind Farms (OWFs) - notably Morven, Ossian, Bowdun and associated cabling infrastructure within the Shipping and Navigation Study Area
- Military Practice Area - Areas of Intense Aerial Activity
- Open spoil deposit sites - North Buchan Ness and Peterhead
- Closed spoil deposit sites – four closed sites near Peterhead - notably South Buchan Ness B in Sandford Bay, which is situated within the RLB
- Peterhead lifeboat station

These features are all detailed in **Figure 2-1 (Drawing reference P2675-NAV-EGL3-001-B)** in relation to the Proposed Development. There are also four lighthouses in proximity to the Scottish landfall, namely Peterhead South Breakwater, Peterhead Harbour North, Peterhead Harbour South, and Bucan Ness (near Boddam).

Peterhead Port offers a deep-water berth (<14 m) and is therefore able to facilitate large vessels, in particular deep sea fishing vessels. Its 11 quay areas provide for a diverse number of sectors including fishing, oil and gas, cargo and renewable energy. The Proposed Development enters Peterhead Port Authority area for approximately 3.7 km.

Bowdun, Morven and Ossian wind farm array sites are located within the 5 NM Shipping and Navigation Study Area, with the Proposed Development being routed in the gap between Morven and Ossian. At its narrowest point, the Red Line Boundary is approximately 2 km away from Morven's array limits. Morven and Bowdun are at pre-planning stage; Ossian submitted its offshore consents application in June 2024 (Anatec, 2024).

2.1.2. AIS Overview

AIS data has been used to determine the size and quantity of vessels which operate in the vicinity of the Proposed Development. AIS provides information on the type of vessel and vessel density. The coverage of AIS data used extends past the 5 NM of the Shipping and Navigation Study Area to provide a characterisation of general vessel behaviour in the area.

It should be noted that in the UK, vessels under 12 m are not required to carry AIS equipment, and therefore vessels may be operational in the Shipping and Navigation Study Area but not captured in the AIS data.

A series of charts for AIS data by vessel type and for AIS data by month are displayed in the appendices **(Appendix B: AIS Vessel Hours Split By Month** and **Appendix C: AIS Vessel Hours Split By Vessel Type** respectively), which are referred to in the interpretation of the AIS data below. **Figure 2-2 (Drawing reference P2675-AIS-EGL3-001-A)** displays all vessels present for the years' worth of data.

550000 600000 650000

6400000 6350000 6300000 6250000

Moray East OFTO

IN Salamander

Buchan Deep Demo

IN Nora

Muir Mhor

Campion

NORTH SEA
OFFSHORE CHARTS
SHEET 5
DEPTHS IN METRES

Aberdeen Offshore W/F

Kincardine

Bowdun Offshore Wind Farm

Bellrock

Ossian Offshore Wind Farm

Morven

Seagreen Phase 1 Windfarm

Seagreen Phase 1 OFTO

Berwick Bank Wind Farm

Berwick Bank OFTO

0 10 20 30 KM

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Navigational Features

P2675-NAV-EGL3-001-B

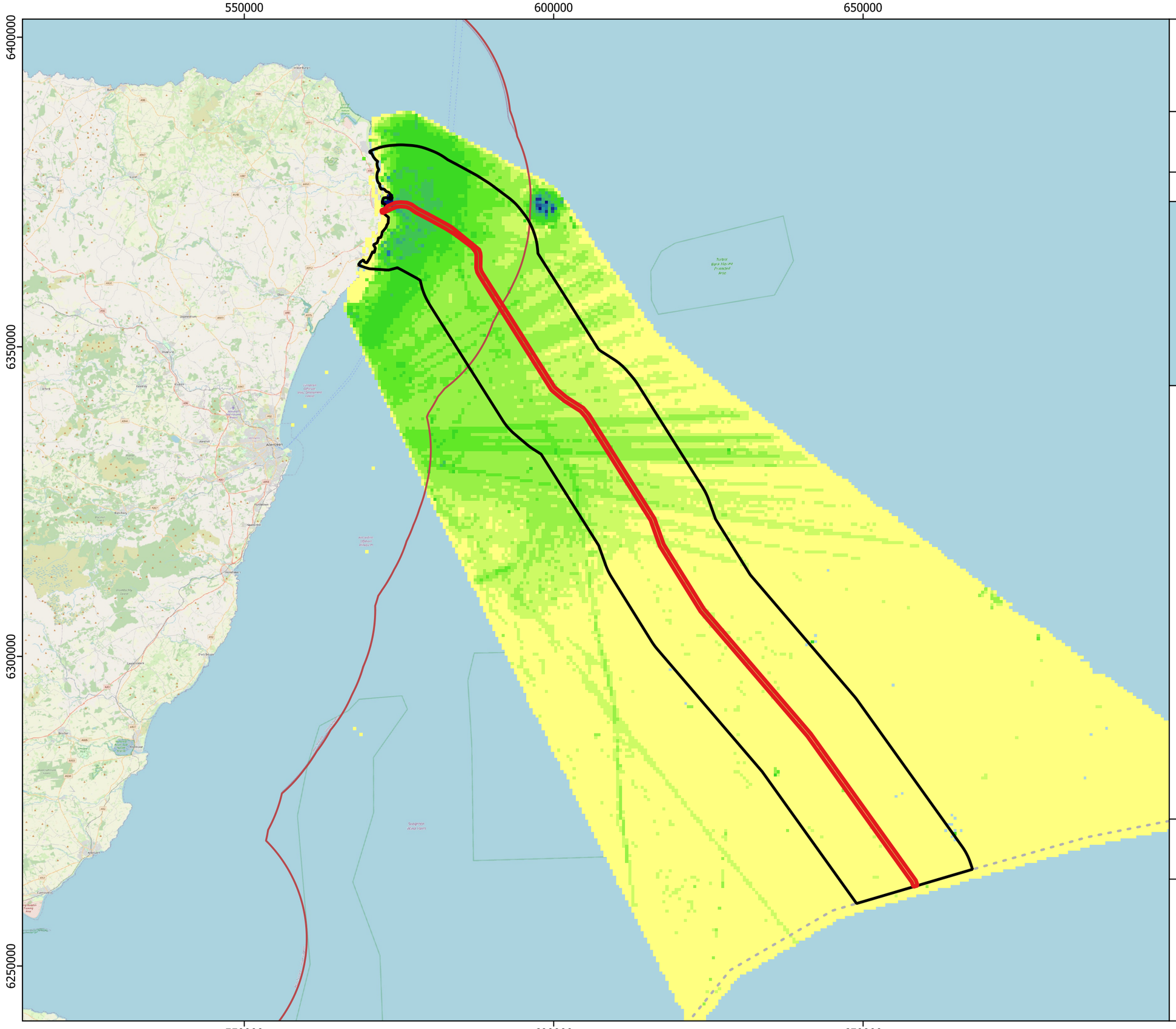
Legend

- Red Line Boundary
- Shipping and Navigation Study Area
- Anchorage Area
- Buoy
- Navigation Line
- Anchorage Area
- Caution Area
- Dumping Ground
- Harbour Area
- Military Practice Area
- Restricted Area
- Wind Cable Agreements
- Wind Site (All Status)
- 12NM Limit
- Scottish Adjacent Waters

0 10 20 30 KM
0 5 10 15 NM
N

Date	23/07/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:600,000
Created	AJ
Reviewed	VF
Authorised	JH

J:\P2675\Mxd_QGZ\00_WORKING\EGL3 Shipping_CEA_Maps.qgz



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Average Vessel Hours (2023-2024) All Vessels

P2675-AIS-EGL3-001-A

Legend

- Red Line Boundary
- Shipping and Navigation Study Area
- 12NM Limit
- Scottish Adjacent Waters

Vessel Density 2023 - 2024 (Hours per Year)

- <1
- 1 -2
- 2 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 75
- 75 - 100
- 100 - 150
- 150 - 200
- 200 - 500
- > 500

0 10 20 30 KM

0 5 10 15 NM

N

Date	22/05/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:600,000
Created	EL
Reviewed	VF
Authorised	JH

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2.1.3. AIS Vessel Activity

There is higher vessel activity nearshore the Scottish landfall, which is related to vessels transiting to/from Aberdeen Port and Peterhead Port. The greatest risk of the Proposed Development interacting with shipping is to the north of Sandford Bay, where densities of 239 and 154 vessel hours per year are found to intersect with the Red Line Boundary within Peterhead Port Authority limits. Northwards, within Peterhead Bay itself, holds the highest vessel density due to large volumes of vessel traffic and numerous anchored vessels in the northern section of the port.

Many vessels service oil and gas infrastructure in the North Sea, which leads to hotspots of vessel activity. Although these hotspots are outside the Shipping and Navigation Study Area, vessel track lines can be seen on **Figure 2-2 (Drawing reference P2675-AIS-EGL3-001-A)**, which are orientated west-east and southwest-northeast in the direction of the oil fields.

There is a hotspot of vessel activity during Spring and Summer months (see **Appendix B: AIS Vessel Hours Split By Month)** at the Buchan Deep Demo site (Hywind Scotland), which is 24 km east of Sandford Bay and 0.5 km east of the Shipping and Navigation Study Area. At Buchan Deep Demo, the greatest vessel density recorded within the AIS data period was 571 vessel hours per year, which is primarily made up of cargo vessels, high-speed craft and tug vessels. This higher level of vessel activity associated with this floating wind demonstration site is expected to be transient.

The lowest vessel activity within the Shipping and Navigation Study Area is found southwards, where there is typically less than 1 vessel hour per year. In this area, the Ossian and Morven wind farms will be situated up to the marine border between Scotland and England. The array sites will be lit up and marked as one block, which is likely to deter most future marine users from transiting the middle channel between the two wind farms. Ossian consultation and cumulative routeing assessment resulted in viable commercial route deviation options being determined to both the east and west of the sites (Anatec, 2024).

There is a band of higher passenger vessel density which follows the coast approximately 6 km offshore due to regular roll on – roll off ferries (NorthLink) between Aberdeen and either the Shetland or Orkney Islands. However, these ferry routes result in relatively low vessel densities (maximum of 3.5 vessel hours per year) which are less likely to interact with nearshore operations.

Greater shipping activity has been recorded in this data period within the Shipping and Navigation Study Area compared to the MEAp Scoping Report (The Applicant, 2024), with many more unique vessels recorded in the AIS datasets (147 vessels in 2022/2023; 2,015 vessels in 2023/2024). Commercial shipping has increased in particular with greater numbers of cargo and tanker vessels. Further information on the proportion of vessel types can be found in .

In total, 2,015 unique vessels were recorded within the Shipping and Navigation Study Area between 1st December 2023 and 30th November 2024. Cargo vessels make up the largest component of this (34.0%), followed by fishing vessels (13.6%) and vessels classified as 'other' (12.0%). **Appendix C: AIS Vessel Hours Split By Vessel Type** presents charts of AIS vessel hours per year split by vessel types.

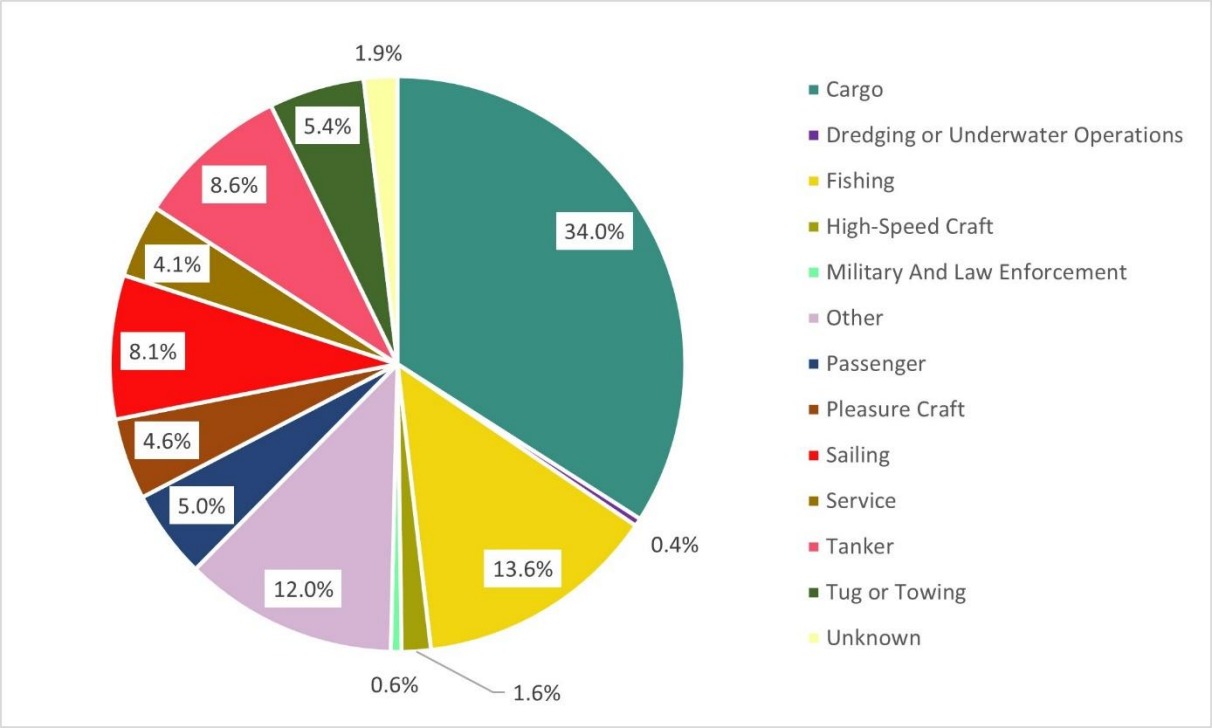

Figure 2-3: Vessel type distribution in the Proposed Development Shipping and Navigation Study Area within Scottish waters

2.1.4. Recreational Vessel Activity

RYA Scotland AIS data is displayed in **Figure 2-4 (Drawing reference P2675-RYA-EGL3-002-A)** northwards of the Scottish Adjacent Waters Boundary.

Inside the Shipping and Navigation Study Area at Peterhead, there are four RYA affiliated clubs and training centres, including Relyon Nutec, Peterhead Sailing Club, North East Scotland College (Scottish Maritime Academy), and Peterhead Sea Cadets Club. These clubs are based around the Peterhead Marina. Correspondingly, there is moderately intense recreational vessel activity around Peterhead and the nearshore area, but most activity is limited to approximately 8 km from the coastline. Sandford Bay itself has low recreational vessel activity.

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600000
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Royal Yatching Association UK - Coastal Atlas of Recreational Boating

P2675-RYA-EGL3-002-A

Legend

- Red Line Boundary
- Shipping and Navigation Study Area
- 12NM Limit
- Scottish Adjacent Waters

AIS Intensity (Recreational Yachting)

- High
- Low

0 10 20 30 KM

0 5 10 15 NM

N

Date	22/05/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:600,000
Created	EL
Reviewed	VF
Authorised	JH

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2.2. Marine Incidents

This section reviews maritime incidents that have occurred within the Shipping and Navigation Study Area. The analysis is intended to provide a general indication as to whether the Shipping and Navigation Study Area is currently a low or high-risk area in terms of maritime incidents. If it were found that the Proposed Development resided in a high-risk area for incidents, this may indicate that the Proposed Development could add to the existing maritime safety risks in the area.

The most recently available 5 years of data from RNLI and the last 5 years of MAIB incidents have been analysed. It is noted that the same incident data could have been recorded by both sources.

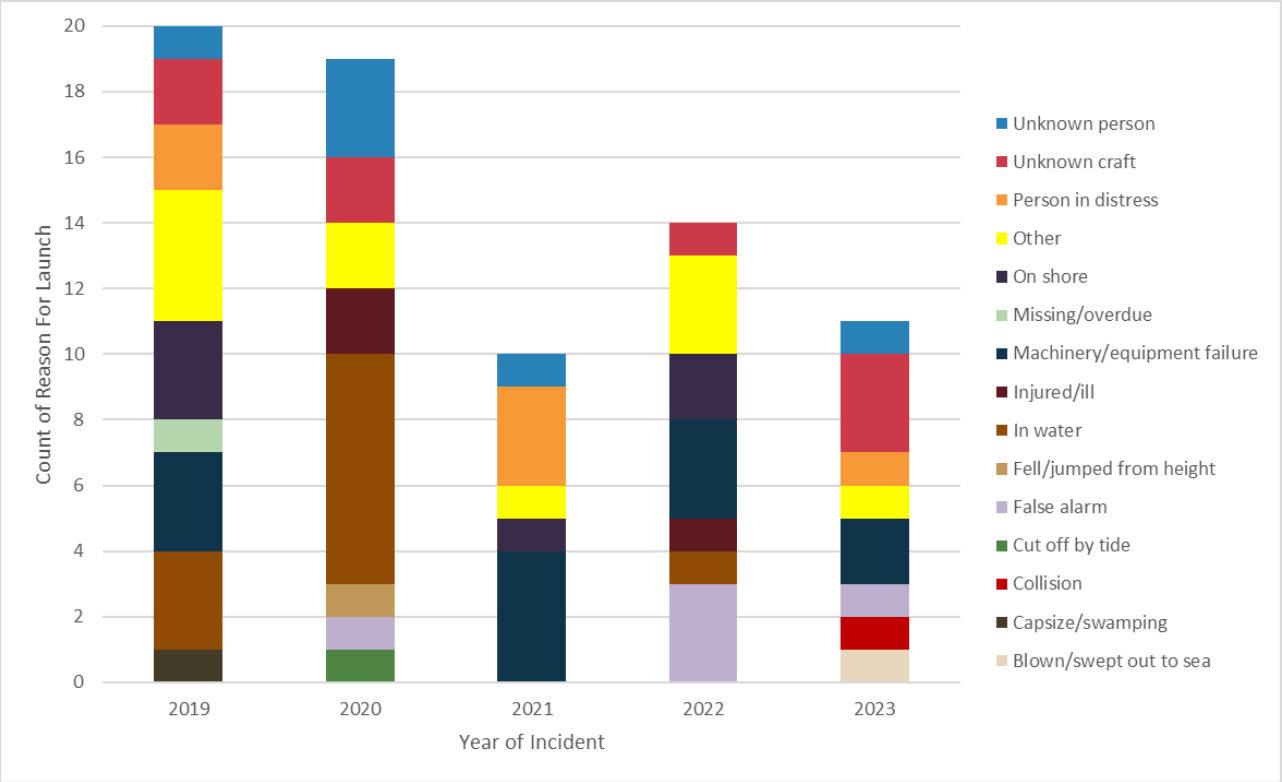
2.2.1. RNLI

As shown in **Figure 2-5** the reasons for launching RNLI assistance are spread across multiple associated causes, which indicates there are warning signs for specific issues within this Shipping and Navigation Study Area. Machinery/equipment failure comprises the highest proportion of RNLI incidents at 16.2%, and 'in water' and 'other' both make up a 14.9% proportion of incidents.

There is a single incident related to a collision involving a commercial fishing vessel within the Shipping and Navigation Study Area during this time period. It took place in July 2023 1 km southeast of the Red Line Boundary near Boddam. RNLI incident data for Scottish waters is illustrated in **Figure 2-6 (Drawing reference P2675-RNLI-EGL3-001-A)** .

Return of Service incidents are concentrated around Sandford Bay. A total of 74 incidents occurred from 2019 to 2023, with only a single incident in the offshore area which is related to commercial fishing. 64 launches were from the Peterhead lifeboat station, with two from Aberdeen and eight from Fraserburgh. RNLI data prior to 2019 has not been considered as it is no longer made publicly available.

Figure 2-5: RNLI reasons for launch per year within the Shipping and Navigation Study Area



550000 600000 650000 700000

6400000 6350000 6300000 6250000

0 1 2 3 4 5 KM

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RNLI Return of Service Incidents

P2675-RNLI-EGL3-001-A

Legend

- Red Line Boundary
- Shipping and Navigation Study Area
- 12NM Limit
- Scottish Adjacent Waters

RNLI Return of Service

- Blown/swept out to sea
- Capsize/swamping
- Collision
- Cut off by tide
- False alarm
- Fell/jumped from height
- Fire/explosion
- In water
- Injured/ill
- Machinery/equipment fail
- Machinery/ equipment failure
- Missing/overdue
- On shore
- Other
- Person in distress
- Stranding/grounding
- Trapped/stuck
- Unknown craft
- Unknown person

0 10 20 30 KM

0 5 10 15 NM

N

Date	22/05/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:600,000
Created	EL
Reviewed	VF
Authorised	JH

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2.2.2. MAIB

All UK-flagged commercial vessels are required by law to report accidents to MAIB. Non-UK flagged vessels do not have to report unless they are within a UK port/harbour or are within UK territorial waters (i.e. 12 NM from the coastline) and carrying passengers to or from a UK port. However, the MAIB would always record details of significant accidents of which they are notified by bodies such as the Coastguard. The MCA, harbour authorities and inland waterway authorities also have a duty to report accidents to the MAIB.

MAIB have released a data portal where marine incident data is updated bi-annually. The data portal covers occurrences from 1 January 2022 to 31 December 2024. The findings from the MAIB portal has been summarised below in **Table 2-1**.

A total of 10 MAIB incidents occurred between 2022 and 2024, of which 30% of these had a weather component as part of the cause and 40% of the total incidents occurred within Peterhead Port. 20% of the incidents were reported as collisions; one collision took place in the port itself.

Table 2-1: Overview of MAIB data portal occurrences (2022 – 2024)

Date Occurred	Year Reported	Severity	Main Incident	Description	Occurrence Location	Latitude	Longitude
01/05/2024	2024	Marine Incident	Fire / Explosion	A supply vessel experienced a fire in the engine room	Internal waters -> Port area	57.495	-1.78833
01/05/2024	2024	Marine Incident	Contact	A search and rescue vessel made contact with a pontoon; wind pushed the vessel.	Internal waters -> Port area	57.5025	-1.7738
01/04/2024	2024	Marine Incident	Loss Of Control	Crew transfer vessel transferred passengers at wind farm when port and starboard generators failed	Coastal waters <= 12 nm	57.49067	-1.5075
01/01/2024	2024	Less Serious	Accident to person(s)	Ro-Ro passenger ship rolled due to weather resulting in a serious passenger injury.	Coastal waters <= 12 nm	57.445	-1.71
01/11/2023	2023	Marine Incident	Contact	A research vessel made contact with the jetty whilst performing compass adjustments.	Coastal waters <= 12 nm	57.4905	-1.77283
01/09/2023	2023	Less Serious	Collision	Fishing vessel was being towed by other vessel when they made contact after getting caught up in breakwaters one crew member bashed his head on the side of vessel resulting in concussion and spinal injury	Internal waters -> Port area	57.5035	-1.7733

Date Occurred	Year Reported	Severity	Main Incident	Description	Occurrence Location	Latitude	Longitude
01/08/2023	2023	Marine Incident	Capsizing / Listing	Unmanned survey vessel capsized by strong wave and was later recovered with superficial damage.	Coastal waters <= 12 nm	57.42317	-1.42633
01/12/2022	2023	Less Serious	Accident to person(s)	Fishing vessel's crew member was loading the catch when a number of boxes fell on their head.	Internal waters -> Port area	57.5	-1.7667
01/11/2022	2022	Less Serious	Accident to person(s)	Fishing vessel crew member sustained a leg injury whilst carrying out duties as part of normal fishing operations	Open sea -> Within EEZ	57.38333	-1.38333
01/01/2022	2022	Marine Incident	Collision	An offshore supply vessel had to reduce speed to avoid a collision with a fishing vessel.	Coastal waters <= 12 nm	57.5303	-1.69

Looking at both the RNLI and MAIB incidents in combination, there are three separate collisions that took place within the Shipping and Navigation Study Area. Each of these collisions took place in the nearshore area and involved a commercial fishing vessel.

3. Assessment

3.1. Consultation and Stakeholder Engagement

A summary of the relevant responses received in the Non-Statutory Scoping Opinion in relation to shipping and navigation, including confirmation of how these have been considered (for example as mitigation) within the assessment, can be found in **Chapter 11: Shipping and Navigation.** Key extracts related to shipping and navigation have been summarised below:

- Clear, effective and frequent Proposed Development communication;
- Use of RYA coastal atlas to supplement assessments for recreational vessels; and
- Safety advisory zones to include sufficient turning space for vessels.

Shipping and navigation hazard identification (HAZID) workshops took place on 13 November 2024, where focus groups for English waters and Scottish waters were formed. In these workshops, the NRA methodology was presented, and the risk matrix was introduced to the shipping and navigation stakeholders.

The shipping and navigation risk matrix was sent for comment to stakeholders. The risk matrix underwent development based on the feedback received. Key changes as a result are as follows:

- Updated the frequency categorisations to have 'once a week or more' as the most frequent definition instead of 'likely to occur once per day', which brings the frequency ratings more in line with the definition of frequency in standard guidelines and NRA methodologies. The frequency categories are based on the FSA guidelines (IMO, 2018) and are determined as a suitable resolution for the durations of the marine campaigns.
- Added environmental impact definition and risk ratings.
- Added Business/Reputational Impacts definition and risk ratings.
- New hazard definition of: 'Reduced visibility / adverse weather conditions' as a more appropriate hazard.

- Added snagging of static fishing gear by seabed preparation and route clearance activities as a risk.

Further comments and recommendations have been considered and have been either incorporated into wordings of the NRA or mitigation measures or reserved to reduce over-complexity.

This NRA is a working document that will be updated as the Proposed Development develops and through consultation with stakeholders.

3.2. Cumulative Effects

Cumulative effects have been evaluated at a high-level in this NRA as a qualitative assessment and considered in the risk ratings in the shipping and navigation risk matrix. As outlined by **Chapter 4: Marine Environmental Appraisal Scope and Methodology**, a four-stage approach has been undertaken to assess the cumulative adverse effects from other plans and projects in-combination with the construction of the Proposed Development.

With the North Sea seabed becoming increasingly congested, the cumulative presence of multiple OREIs within the area can lead to the restriction of shipping and navigation users. The area around the Morven, Ossian and Bellrock offshore wind array sites are a particular focus area for potential cumulative effects. Current levels of vessel traffic are low in this area (typically 1 vessel hour per year), however deviations around the array sites once constructed could lead to slightly higher concentrations of vessels. The array sites will be lit up and marked as one block, which is likely to deter most future marine users from funnelling through the middle channel between the two wind farms. Ossian consultation and cumulative routeing assessment resulted in viable commercial route deviation options being determined to both the east and west of the sites, with inshore of Morven being preferred (Anatec, 2024). Due to the water depths in this area, there is a potential for larger vessels to drop anchor in emergency situations; it is likely that vessels will preferentially drift away from the turbines to avert allision, which (dependent on vessel heading) could lead to a greater probability of anchor drag in proximity to the Proposed Development.

In addition, sufficient sea room to accommodate vessel manoeuvres may become spatially restricted by multiple offshore activities occurring at the same time. This will lead to an increased risk of vessel collisions, disturbance to existing shipping and fishing patterns and potential of vessels associated with the Proposed Development blocking navigational features. This would particularly affect the construction phase where the promulgation of notices, effective communication and simultaneous operations (SIMOPs) between different parties would be essential for efficient and safe vessel movements.

Multiple developments (array sites, export cables, reinforcement links) being constructed at the same time has the potential to increase risks. The Applicant would seek to co-ordinate with other developers as appropriate to manage risks and reduce impacts.

The ports used for the construction phase of the development are to be confirmed at a later stage in the Proposed Development. However, it is noted that the vessel movements for various offshore activities must be co-ordinated to lower the risk of possible vessel incidents.

3.3. Anticipated Marine Activities

Chapter 3: Project Description provides details of the Proposed Development and operational aspects of the marine campaign works such as cable installation, site preparation and cable protection methods; a schedule is also included to estimate the timeframe for the various marine activities. Anticipated marine campaign works have been based on the **Chapter 3: Project Description** activities.

Flexibility would be required in the construction programme in order to accommodate a range of uncertainties. This would include the time taken to undertake procurement activities, variable lead times for components and equipment, and variable task durations dependent on the suppliers, technologies and methodologies selected. This may be affected by factors such as supply chain bottlenecks as well as implementation of any required mitigation measures for environmental sensitivities or sensitive receptors.

Furthermore, realistic but worse-case assumptions have been utilised in **Chapter 3: Project Description** and determination of the risk ratings in this NRA, such as using the lower end of progress rates. A factor of safety (FoS) has also been added to the zones of influences (ZOIs) in order to add contingency. This approach has added a layer of conservatism to account for uncertainties.

Pertinent information based on the activities described in **Chapter 3: Project Description** is outlined below in **Table 3-1** in order to identify the ZoIs for shipping and navigation. The following assumptions have been made to guide the ZoI:

- Existing vessels would be requested to remain at least 500 m from vessels associated with the Proposed Development whilst they are engaged in cable construction activities. This is due to limited ability for construction vessels to manoeuvre whilst undertaking operations.
- Unless otherwise specifically directed by Notice to Mariners (NtMs), sections of the Proposed Development would require to be kept clear of all fishing gear (mobile and static) until the end of the works, including the post-lay survey period.

- The operation is assumed to be performed on a 24-hour basis unless otherwise described. Durations presented are exclusive of any third-party influences that may increase the duration or interrupt operations.
- The number of days have been rounded up to the nearest whole number.

Further information regarding the marine campaign activities is available in the following sections as indicative estimations.

Table 3-1: Worse-case progress rate estimations for the Proposed Development

Marine Campaign	Rate of progress (m/hr unless otherwise stated)	Operational quantaties	Operational length - EGL 3 (m)	Duration hours	Factor of Safety	Duration (days) without FoS	Duration (days) with FoS	Zone of Influence (km) in 24 hour period	Assumptions/Comments
Unexploded Ordnance (UXO) survey	2000	8 lines	145000	580	1.5	25	38	72.0	Assuming entire route of UXO survey 100m corridor. *UXO ID and Disposal not assessed - Optional dependent on UXO survey campaign. Assumes lower end of progress rate
Pre and Post Lay Survey	3000	2 lines	145000	97	1.2	5	6	86.4	Assuming single line x2 pre and post lay with Remotely Operated Vehicle (ROV).
PLGR	1500	1 line	145000	97	1.2	5	6	43.2	Assume 100% route length to require PLGR.
Boulder clearance	200	1 line	50000	250	1.2	11	14	5.8	
Sandwave pre-sweeping	200	1 line	2000	10	1.2	1	2	5.8	
Out of Service (OOS) cable removal	1 asset per day	1 OOS cable	100 m of OOS cable removed	24	1.2	1	2	0.5	These will be de-buried with ROV manipulator arm
Cable Lay	200	1 line	145000	725	1.2	31	38	5.8	Assumes lower end of progress rates to account for weather
Cable Burial	150	1 line	145000	967	1.2	41	50	4.3	Assumes lower end of progress rates to account for potential challenging geology
Cable Jointing	14 days per joint	2 joints expected	N/A	480	1	20	20	0.2	FoS not required either as operations are robust enough to not be affected by weather or a weather window would be targeted for operations
HDD punch out and Cable Pull in	6 days per pull in	1 pull in	N/A	6 days per landing	1.5	6	9	0.5	4 days, with an added 2 days for potential prep works for the pull-in itself; a jack-up barge/spud barge/multi-cat is likely to also be on site for 2-4 months.

Marine Campaign	Rate of progress (m/hr unless otherwise stated)	Operational quantaties	Operational length - EGL 3 (m)	Duration hours	Factor of Safety	Duration (days) without FoS	Duration (days) with FoS	Zone of Influence (km) in 24 hour period	Assumptions/Comments
External Protection for In Service (IS) cables and pipeline crossings	1 crossing per day	5 crossings	400	120	1.2	5	6	0.5	From active, IS and proposed assets in the third-party crossings list. Includes pre-lay mattressing. No external protection due to shallow burial has been accounted for in this operation (see remedial rock protection below).
Remedial Rock Placement	200	Please refer to **Chapter 3: Project Description**	10500	53	1.5	3	5	7.2	Due to shallow bedrock preventing burial being achieved and remedial rock required at the HDD punch-out. Assumes lower end of progress rates. Factor of safety increased to account for contractor's tools to potentially not be able to reach lowering depth due to poor tool performance
Operation and Maintenance Survey	1000	1 line	145000	145	1.5	7	11	36.0	Assuming single line with ROV. Assumes lower end of progress rate

3.3.1. Pre-construction Works

3.3.1.1. UXO Survey

There is a risk that UXO may be encountered during cable construction and cable repair activities. UXO can present a high risk to vessels and personnel if encountered and specifically within the footprint of the construction equipment.

An offshore geophysical, geotechnical and environmental survey has been completed across a 500 m survey corridor for the Proposed Development. The survey was designed to detect any significant seabed features and obstacles. A more detailed UXO end-to-end target investigation and archaeological survey using a magnetometer array would be undertaken prior to construction along a detailed route position engineered within the Proposed Development.

The extent of the UXO survey would be nominally 50 m either side of the detailed route position. With a reasonable FoS added onto this for safety of marine users, a 500 m width for the ZoI has been assigned.

3.3.2. Route Preparation

It is essential to ensure the Proposed Development is clear of obstructions that may hinder construction works. Types of seabed preparation that may be required in certain areas are boulder clearance, sandwave pre-sweeping and a pre-lay grapnel run (PLGR).

3.3.2.1. Boulder Clearance

A review of the geophysical survey data indicates that 50 km (32%) of the Proposed Development requires boulder clearance in Scottish waters **(Chapter 3: Project Description)**.

3.3.2.2. Sandwave Pre-sweeping

Sandwave clearance may be necessitated where mega ripples (wave heights <1.5 m) and sand waves (wave heights > 1.5 m) are present as they present technical challenges for burial equipment. These sandwaves would be cleared to ensure sufficient tool reach and safe operation by removing steep slopes.

Approximately 3.5 km of the Proposed Development will require pre-sweeping in Scottish waters **(Chapter 3: Project Description)**.

The methodology for pre-sweeping on the Proposed Development is yet to be determined. It is noted that the construction contractor may prepare individual method statements and specific risk assessments for the different methodologies, which must be read in conjunction with this NRA if available.

3.3.2.3. Pre-Lay Grapnel Run

A PLGR would involve towing a grapnel along the route position engineered to clear any seabed debris (e.g. ghost fishing gear) that may present snagging risks and to prepare the route position for cable construction. This is usually undertaken a few days before cable construction. A large vessel is required for this due to the tension generated by the pre-lay grapnel as it is towed along the seabed.

3.3.2.4. Pre-lay geophysical survey

The installation contractor may conduct further surveys prior to the commencement of cable construction.

The objectives of these surveys would be to:

- Confirm that no new obstructions have appeared on the seabed since the original marine surveys were undertaken;
- Confirm the seabed level pre- and post-construction to demonstrate that the required burial depth for the cables has been reached; and
- Micro-route the engineered route position around any mobile bedforms or sensitive habitats within the proposed development.

The geophysical survey is typically split into two elements: nearshore (<10 m of water) and offshore (>10 m of water). Each element requires a survey vessel that is appropriate for the water depths. The offshore vessel is generally much larger and can conduct 24-hour operations. The nearshore vessel is generally smaller, but can operate in shallower water depths. Operations are usually kept to 12 hours (or daylight hours) for nearshore operations.

The survey would involve a range of standard geophysical survey techniques such as multi-beam echosounder, side scan sonar, sub-bottom profiler and magnetometer. Visual inspection of seabed features may be carried out with a ROV. This may require the survey vessel to hold position at a specific location.

3.3.3. Cable Construction

3.3.3.1. Construction Vessels

The cable lay operation would be performed on a 24-hour basis. It is anticipated that the following vessel types would be required for cable construction:

- Cable-lay vessel would undertake cable lay and burial in water depths greater than 10 m.
- HDD would require a jack-up barge, spud barge or multi-cat.
- Post-lay burial vessel would undertake cable lowering below seabed to a required depth.
- Guard vessel(s) would be used to protect areas of exposed cable prior to external protection being applied and would be used in support of the cable-lay vessel which would have limited manoeuvrability. Guard vessels are small to increase manoeuvrability around the larger vessels during sensitive operations. Suitably experienced fishing vessels (locally based or sourced through the SFF) can be used in this role.
- Construction support vessels would likely include crew transfer vessels, dive support vessels (DSV), general construction support vessels and rock placement vessels. DSVs and construction support vessels come in a variety of sizes to fit the working conditions and activity and can be adapted to undertake several different roles - e.g. archaeological or UXO inspections, PLGR, and deposition of concrete mattresses at crossing locations. Rock-placement vessels are specialised vessels that feature a large hopper to transport the rock, and a mechanism for deployment of the rock on site. It is likely that a fall pipe vessel would be used for rock placement.

It is noted that survey/installation contractors may prepare individual method statements and specific risk assessments for each of the operations.

3.3.3.2. Cable Laying

Cable Lay Techniques

Post-lay burial is being considered for the Proposed Development. In this operation, the Cable Lay Vessel (CLV) would lay the cables on the seabed and a post-lay burial vessel would follow to bury the cables. The post-lay burial vessel may be some distance, or some days, behind the lay vessel so there are two discrete operations separated physically and in time. Both vessels utilise high redundancy dynamic positioning (DP2) which would enable cable laying at a reasonable speed without reducing laying accuracy.

The sea surface footprint of a cable construction spread would depend on the technique that is used. It would incorporate that of the vessel, or vessels if working together, and the surrounding area commensurate with being a "vessel restricted in its ability to manoeuvre". Typically, a large CLV would be up to 150 m in length and other vessels would be requested to remain a safe distance from the operation. This is typically a 500 m radius or potentially up to 1200 m radius if the CLV has anchors.

Cable lay operations would be performed on a 24-hour basis to maximise suitable weather conditions, vessel and equipment time and to minimise the presence of the cable lay spread in navigation channels or other sensitive areas such as harbour authorities.

Cable Lay Progress Rates

The effect of the cable lay operations would depend on the slowest moving element which is usually the cable lay burial spread. Indicative progress rates for a laying of a straight-line bundled cable with no allowances for operational delays or stoppages are expected to be:

- Surface cable lay between 130 – 320 m/hr [assuming 200 m/hr].
- Cable burial first pass between 110 – 260 m/hr [assuming 150 m/hr].

These progress rates may be reduced in practice once operational constraints are factored in for lay initiation, cable end lay down, weather delays, tidal current delays, alter courses, cable crossings, micro-routeing around obstructions and unplanned maintenance.

The vessel speed of a DP2 vessel would remain constant throughout operations including when in proximity to physical obstructions such as navigation marks. Manoeuvring on anchors however would result in significantly reduced vessel speeds and therefore progress rates.

3.3.3.3. Burial Depths

The recommended and target burial depths along the cable length have been determined using a cable burial risk assessment (CBRA) to be between 0.6 m to 2.5 m typically. The burial depths consider cable design, seabed geology and morphodynamics, sediment mobility, and potential for damage from external sources, e.g. fishing gear and vessel anchors.

3.3.3.4. Infrastructure Crossings

A number of third-party crossings have been identified across the Proposed Development consisting of active and inactive pipeline and cables and proposed infrastructure (assumed to be installed before the Proposed Development). It is estimated that seven third-party crossings would be constructed for the Proposed Development in Scottish waters; where third-party assets are in proximity to one another, a longer rock berm would be considered which covers multiple crossings.

During typical infrastructure crossing operations, support vessel would place pre-lay mattresses on the crossed infrastructure to prepare for the cable to be laid across it. The cable would then be laid across the mattresses and trenched into the seabed on either side of the crossing up to an agreed exclusion zone between the two crossing parties, leaving up to 100 m of exposed cable on the seabed. Post-lay rock is then placed onto the exposed cable to protect the asset against external aggressors.

OOS cables would be removed during the route clearance campaign.

3.3.3.5. Cable Jointing

In Scottish waters, the Proposed Development is expected to require two cable joints. The lay down area and jointing operations would be designed to minimise existing shipping and target areas of lower AIS traffic.

At the cable joint position, the end of the installed cable would be temporarily left on the seabed whilst the CLV returns to port to pick up a new cable length. The cable end may be temporarily buried into the seabed, marked with a buoy and/or guarded by a guard vessel whilst the CLV is offsite.

3.3.3.6. HDD Punch Out and Cable Pull-in

During the cable pull-in operations in Sandford Bay, the CLV would be stationed around the 10 m water depth contour. A jack-up barge, spud barge or multi-cat would be on site at the HDD exit for a period of 2-4 months.

If the water is too shallow for CLV to carry out operations, then a shallow water anchored barge would likely be used until water depths are great enough for the CLV to continue laying the cable.

The cable would then float off the vessel to shore to complete the cable pull-in operation.

As the construction vessels are likely to be situated 1.6 km from MHWS at the Sandford Bay landfall, with a safety advisory zone, it is likely that there will be moderate disruption to other marine users who are travelling to/from the south and southeast of Peterhead Port.

3.3.3.7. Remedial Rock

Remedial rock across the Proposed Development may be required where the cable cannot reach the target depth of lowering. If burying the cable to sufficient depths is not viable due to challenging geology, then other means of protection with equivalent safety should be applied. Approximately 10 km (7%) of the Proposed Development is likely to require remedial rock placement due to hard layers which are likely to impede burial.

In addition to areas of challenging geology, technical memorandums have been undertaken for Proposed Development to provide preliminary estimations of rock volumes using a 1.2 multiplier as the factor of safety.

Within Scottish waters, there are five crossings in total which are assumed to require rock berms. In addition, external protection has been considered by the HDD punch-out which has the potential to encroach to the east of Sandford Bay where the Proposed Development meets the traffic from Peterhead Port.

3.3.3.8. Post-lay Inspection Survey

A post-lay geophysical inspection survey would be undertaken once the construction of the cable has been completed. This survey would be completed using standard geophysical survey equipment and survey techniques used would be similar to the pre-construction surveys. This would include visual inspection by ROV, multi-beam echosounder, side scan sonar and magnetometer. In addition, shallow sub-bottom profiling and cable tracking may be used.

3.3.4. In-Service Cable Operation

3.3.4.1. Electromagnetic Fields (EMFs)

Submarine HVDC cables generate magnetic fields due to the current flowing along the cables. The magnitude of the magnetic fields produced is directly dependent upon the amount of current flowing through the cables. The cable sheathing is used to prevent the propagation of electric fields into the surrounding environment. The movement of sea water or marine organisms through the static magnetic fields would create small, localised induced electric fields.

The Proposed Development will be formed of a pair of bundled HVDC armoured cables, and as such, would operate at zero Hertz. Bundled and armoured cable design reduces the EMF generated during operation. In addition, cable burial also increases the distance between the EMF source and potential receptors.

An EMF assessment (**Appendix 3A: Electric and Magnetic Field Assessment)** indicates that over 99.6% of the Proposed Development resulted in compass deviations of less than 3 degrees; small sections exceeding this are located in shallow waters, where water depth is below 3 m. 99.7% of the Proposed Development is within the threshold for less than 5 degree compass deviation. Subsequently, low compass deviation occurs over the cables other than at Sandford Bay.

Based on Marine Management Organisation (MMO) recommendations (from previous projects with a similar design) for compass deviation, there must be no more than a 3 degree electromagnetic variation for 95% of the cable route and for the remaining 5% of the cable route there must be no more than a 5 degree electromagnetic variation in water depths of 5 m and deeper. The calculations provided indicate that this guidance is met.

Post-construction compass deviation surveys would be undertaken if required to confirm compass deviation levels and the results forwarded to the United Kingdom Hydrographic Office (UKHO) and MCA.

3.3.4.2. Maintenance and Repair

Routine maintenance work to the cable is not anticipated. Some work may be required to maintain the burial of the cable to protect it from adverse interactions with other sea users and marine processes which might damage it. The cable and its construction would be designed to minimise any maintenance requirements.

The requirement for repair operations during the lifetime of the cable would depend on the number of faults, location of the faults, and the burial or protection methods used for the original construction.

The estimate of the number of repair operations is:

- One operational cable fault over the operational lifetime of the cable (40 years);
- Two third party interactions with the cable over the operational lifetime of the cable (40 years), based on calculation formulas provided by Ofgem, ENTSO-E and CIGRE 3791. All repair activities would be undertaken within the Proposed Development; the effects of each cable repair are assumed to be the following:
  - Repair to 500 m length of each cable (i.e. two power cables and the fibre optic cable);
  - Cables would be re-buried; and
  - Cable removal and re-burial footprints would not overlap (as a worst case, as in reality they may occur within overlapping areas).

3.4. Risk Assessment

A risk matrix approach has been used to undertake the risk assessment. This has been adapted from the guidance, which examined the frequency and consequence of a hazard to determine the combined inherent risk. Risk ratings have been calculated using **Table 1-6**, which can be interpreted using **Table 1-7**.

Below, **Section 3.4** summarises the key results of the inherent risk ratings for each hazard pre-mitigation with a focus on the typical risk levels and details where there may be deviations for specific operations. This should be read in conjunction with the left-hand side of **Appendix A: Risk Matrix**, which contains ratings for all considered operations, hazards and consequences to determine the inherent risk.

In **Section 3.5**, the risk rating exercise has been repeated with compliance mitigation, industry best practice measures and mitigation measures, which result in a residual risk enabling the hazards to be reduced to ALARP. No hazards more than a Major risk are present as identified in the risk assessment post-mitigation.

3.4.1. Vessel Collisions

Transiting vessels may have to re-route around vessels associated with the Proposed Development which may create pinch points and alter the rate of encounters. Therefore, there is the potential for vessel-to-vessel collisions to occur as a result from existing shipping avoiding the marine operations, particularly across channels of higher vessel density, near fishing grounds and where port traffic from Peterhead intersects the Proposed Development to the east of Sandford Bay.

Vessels would be operating in compliance with international shipping standards; therefore, vessel masters are assumed to be competent and adept at navigating in unfamiliar waters.

The likelihood of a vessel to vessel collision is Remote, but the consequence could be Catastrophic, with a resultant Major risk level.

The likely frequency of vessel collisions increases to Probable for jointing operations due to higher likelihood of vessels being stationary in one location for several days at a time, leading to an Intolerable inherent risk rating prior to mitigation.

3.4.2. Reduced Visibility / Adverse Weather Conditions

A long-range weather forecast is usually monitored hourly when conducting marine operations which mitigates the risk of encountering any adverse or extreme weather conditions. However, reduced visibility may occur in the event of extreme weather conditions, which can be unpredictable in the North Sea. This could mean that vessels associated with the Proposed Development may need to shelter in port or in designated adverse weather shelters if weather exceeds working limitations. However, during the cable lay process, this could mean cutting and buoying the cable in a situation that is too dangerous to continue working.

The probability of vessels encountering extreme weather is Very Probable, but the consequence is likely to be Significant, with a resultant Moderate risk level.

3.4.3. Vessels Associated with the Proposed Development Blocking Navigational Features

The probability of vessels associated with the Proposed Development blocking navigational features, such as anchorages or approaches to ports, is expected to be Probable to Very Probable, and the consequence could be Severe for vessel displacement and business (reputational effects), for most operations, with a resultant Moderate risk level typically. Exceptions to this are described below.

For HDD operations, due to the possibility of a jack-up barge, spud barge or multi-cat being situated in close proximity of port traffic from Peterhead, the probability of the displacement of vessels has been considered as Very Probable and the consequence is Severe, leading to a Major risk level.

There is a higher likelihood of vessels associated with the Proposed Development blocking navigational features during slower paced operations nearshore Peterhead Port to the east of Sandford Bay, causing the potential interaction with vessels to be increased. As a result, the frequency has been determined as Very Probable during cable lay and burial, HDD punch out, cable pull, UXO survey and the external protection operations on the approach to Peterhead. With business and reputational effects having a consequence of Severe, the risk ratings for these operations have been considered as Major.

It has been considered that joints and sandwaves would be located offshore and therefore are less likely to block navigational features. This has led to a frequency of Probable being determined for jointing and route clearance, and a consequence of Significant to Severe, resulting in a Moderate risk level.

3.4.4. Disturbance to Existing Shipping and Fishing Patterns

During construction, the risk of disturbance to existing shipping and fishing patterns is greater due to slower moving vessels (Table 3-1) being situated near Peterhead Port. As a result of the presence of vessels associated with the Proposed Development, other vessels may have to re-route around or reduce speed on approach to the vessels associated with the Proposed Development, having the potential for temporary disturbance. However, alternative routes to access the port are available and it is therefore not anticipated that smaller craft will be squeezed into areas utilised by larger vessels. Considering this, the probability is typically expected to be Very Probable.

HDD punch out and cable pull in operations are anticipated to have a Frequent level of disturbance to shipping and fishing patterns during the operation due to the HDD exit being located in a higher intensity shipping channel from Peterhead to the south east of the port.

The consequence could be Severe for cable lay and burial, HDD operations and external protection due to proximity to shipping lanes from Aberdeen and Peterhead, with a resultant Intolerable inherent risk level.

3.4.5. Accidental Anchor Strike or Drag

Risk of anchor strike is lowest in the construction phase of the Proposed Development, however, there is a small probability of emergency anchoring of vessels associated with the Proposed Development, which has been determined to be Extremely Remote for cable lay and burial.

The probability of accidental anchor strike or drag over surface-laid/exposed cable is highest in the operational phase, as cable exposures may have occurred due to mobile sediment/scour. In addition, vessel anchors would have the potential to interact with the Proposed Development if deployed where the cable is surface laid. However, it is very unlikely that an anchor would be deployed offshore in deeper waters and away from designated anchorage areas. The probability of an anchor deployment on a surface laid cable has been determined to be Probable but remains remote in the event of an emergency or accidental deployment of an anchor.

Furthermore, the probability of anchor strike/drag on the cable is relatively low throughout the majority of the Proposed Development, considering that the Proposed Development would enter into crossing agreements and/or proximity agreements with third-party asset owners. As a result, the probability of a ships anchor interacting with the operational cables are Probable, but the consequence could be Catastrophic for business and reputation, with a resultant Intolerable risk level.

3.4.6. Accidental Fishing Gear Snagging

Fishing vessel gear would have the potential to interact with the Proposed Development for brief periods during construction before protection is installed or when the cable is surface laid prior to burial. Once established, appropriate mitigation is needed to ensure the cable is suitably protected against fishing and anchoring in the area. While it is advised as per European Subsea Cables Association (ESCA) standard industry guidelines that fishing should be avoided across subsea cables (ESCA, 2022; UK Hydrographic Office, 2024), it is assumed that fishing may occur across the cable once installed.

During construction, there would be a designated Fisheries Liaison Officer (FLO). With these services in place, there would be a FLO monitoring body present during the construction process. The Proposed Development FLO can disseminate information to the guard vessels (if employed) regarding seasonal variations in fishing patterns. This leads to a frequency of Remote for cable lay and burial. With a consequence ratings ranging from Minor to Serious, the resultant risk ratings have a maximum of Moderate for cable lay and burial activities.

The probability of a fishing gear interacting with the in-service cable is Probable, but the consequence could be Serious particularly for effects on human safety and vessels, with a resultant Moderate risk level. The consequence of business and reputational impacts has been considered as potentially Catastrophic, leading to an Intolerant risk level for the in-service cable before mitigation.

3.4.7. Reduction in Under-Keel Clearance

The risk of reduction in under-keel clearance (UKC) is present during the operational phase due to the presence of cable protection measures that reduce the navigable water depth for vessels. However, the operational cables are located in waters deep enough for this not to be in effect. A rock berm will be installed at the HDD exit location, which will end approximately 150m away from the navigational line into Peterhead Port. The rock berm height will be a maximum of 1.5m and will be located in an area of water depth of approximately 20.4 m to 24.5 m which will result in a depth reduction between 7.4% and 6.1%. Based on vessel traffic, it is expected that this rock berm will be located outside of the area of highest potential vessel traffic entering the port.

The probability of a reduction in UKC affecting shipping and navigation over the operational cable is Probable, and the consequence could be Severe for displacement of vessels with a resultant Moderate risk.

3.4.8. Interference with Marine Navigation Equipment

Emissions of EMF have the potential to cause deviations of magnetic compasses and interference with inertial navigation. Considering inertial navigation, craft using international navigations systems (INS) and global positioning systems (GPS) are not expected to be greatly affected by EMF emanating from the operational cable, since these systems have negligible sensitivity to EMF. This is owing to marine gyrocompasses (used in INS) remaining unaffected by external magnetic fields as modern INS equipment generally uses laser technology and resonating quartz devices which are self-contained. Affected INS equipment is more likely to be present on older recreational and leisure vessels.

However, the EMFs that would be generated from the Proposed Development may have a small, localised effect that could cause compass deviations in vessels using magnetic compasses. The degree of deviation can depend on multiple factors, such as the proximity of marine cables to each other, and water depth. However, any compass deviation as a result of EMF emanation from the Proposed Development is expected to have minor consequences.

Appendix 3A: Electric and Magnetic Field Assessment indicates that over 99.6% of the Proposed Development resulted in compass deviations of less than 3 degrees; small sections exceeding this are located in shallow waters, where water depth is below 3 m. 99.7% of the Proposed Development is within the threshold for less than 5 degree compass deviation. Subsequently, very low compass deviation is expected to occur over the cables. 0.4% of the route outside the deviation threshold has been used as the basis of the frequency of the compass deviation risk rating. This leads to a Negligible risk classification for compass deviation.

MCA guidance for compass deviation is that there must be no more than a 3 degree electromagnetic variation for 95% of the cable route and for the remaining 5% of the cable route there must be no more than a 5 degree electromagnetic variation in water depths of 5 m and deeper. The calculations provided indicate that this guidance is met.

3.5. Risk Control to ALARP

Risks that have been assessed as Major or above after considering mitigation would normally require additional analysis and consultation to discuss and possibly further mitigate hazards where possible. Where further mitigation is not possible a residual hazard may remain.

Short-hand identifiers have been assigned to each mitigation and referred to in the shipping and navigation risk matrix.

3.5.1. Embedded measures

Table 3-2 contains a list of the identified embedded mitigations relating to shipping and navigation, which have been established to improve identified impacts in the MEAp. Environmental mitigations have been applied to reduce the risks to ALARP to determine residual risk ratings post-mitigation.

Several management plans would be provided to support the Marine Licence Application. These would include an Outline Construction Fisheries Liaison and Coexistence Plan (FLCP), an Outline Construction Environmental Management Plan (CEMP) and Outline Marine Pollution Contingency Plan (MPCP). These documents would outline measures to be implemented to comply with legislation (e.g., in relation to the prevention of oil and chemical spills) during all phases of the Proposed Development. These management plans would also include details of notices to be sent to other marine users (including fishers) prior to activities being undertaken. Final management plans would be submitted for approval in accordance with the Marine Licence conditions to discharge the licence conditions. The embedded measures listed below would be secured and circulated to the contractors through these management plans.

Table 3-2: Embedded measures list

ID	Embedded Measures (EM)
CF01	A Fisheries Liaison Officer (FLO) and fisheries working group(s) would be maintained throughout construction to ensure Proposed Development information is effectively disseminated, dialogue is maintained with the commercial fishing industry and access to home ports is maintained during the main fishing season. Details of the FLO would the included in the Construction Fisheries Liaison and Coexistence Plan.
OMT03	The intention is to bury the cables in the seabed, except in areas where trenching is not possible e.g. where ground conditions do not allow burial or at infrastructure crossings.
OMT04	Cable protection features would only be installed where considered necessary for the safe operation of the Proposed Development. This includes the repair of cables due to accidental damage, where depth of lowering is not achieved and at infrastructure crossings.
OMT06	HVDC poles would be bundled to minimise the effects of EMF for electrosensitive receptors.
OMT07	As-built locations of cable and external protection would be supplied to UKHO (Admiralty), The Crown Estate Scotland and Kingfisher (KIS-ORCA).
OMT08	Several management plans would be provided to discharge Marine Licence conditions prior to the start of construction. These would include a Construction Environmental Management Plan (CEMP), Marine Pollution Contingency Plan (MPCP), Marine Mammal Mitigation Plan (MMMP) and a Fisheries Management and Mitigation Plan (FMMP). These documents will outline measure to be implemented to comply with legislation, such as the International Convention for the Prevention of Pollution from Ships (MARPOL) and the Safety of Life at Sea (SOLAS) convention, and the mitigation commitments proposed within this MEAp.
OMT09	All vessels associated with the Proposed Development must comply with the International Regulations for Preventing Collisions at Sea (1972), regulations relating to International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) with the aim of preventing and minimising pollution from ships and the International Convention for the Safety of Life at Sea (SOLAS, 1974).
OMT10	Designated (and as minimal as possible) anchoring areas and protocols shall be employed during marine operations to minimise physical disturbance of the seabed.
OSU03	Procedures will be in place to minimise disruption near high density shipping areas. e.g. avoidance of anchoring near busy areas, passage planning of installation vessels, emergency response plan etc.
OSU04	Channels of communication would be established and maintained between the Applicant, commercial fishing interests and relevant port authorities.
OSU06	Coordination of SIMOPs with other developers and marine activities to be undertaken prior to commencement of operations.
OSU07	All vessels associated with the Proposed Development would comply with the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) as amended, particularly with respect to the display of lights, shapes and signals. The masters of other vessels are expected to be familiar with and comply with the COLREGs.
OSU08	Pilotage within Port Authority Limits as required by the Port Authority.

ID	Embedded Measures (EM)
OSU11	Cable jointing operations to be planned away from high shipping activity where possible.
OSU15	Cables would be marked on Admiralty Charts and fisherman's awareness charts (paper and electronic format).
OSU02	Timely and efficient communication would be given to sea users in the area via Notices to Mariners (NtM), Kingfisher Bulletins, Radio Navigation Warnings Navigational Telex (NAVTEX and Navigational Areas (NAVAREA) warnings and /or broadcast warnings.
OSU14	All vessels associated with the Proposed Development would display appropriate marks and lights and would always broadcast their status on AIS if appropriate.
OSU10	Guard vessel(s), using RADAR with Automatic RADAR Plotting Aid (ARPA) to monitor vessel activity and predict possible interactions, would be employed to work alongside the construction vessel(s) during cable construction works and to protect any temporary cable exposures during construction.
OSU12	Cable Burial Risk Assessment (CBRA) to be undertaken to identify appropriate target depth of burial based on geology, water depths and AIS data. This will reduce the chance of interaction with other marine users, and as per the CBRA recommendations deeper burial or cover will be implemented in areas of high shipping activity to further reduce this risk.
OSU01	For safety purposes, all vessels would be requested to maintain a minimum distance from construction vessels to prevent interactions.
OSU16	Crossing and/or proximity agreements would be agreed with aggregate extraction, cable and pipeline owners. The crossing agreement would describe the rights and responsibilities of the parties and also the design of the crossing. Crossing design would be in line with industry standards, using procedures and techniques agreed with the cable and pipeline owners.
OSU17	Client Representation from, or on behalf of the Applicant, onboard Project vessels ensuring compliance with crossing design and communications with Asset Owners.
OSU13	Designated adverse weather shelter areas (would recommend to be further than 500 m from construction) to be determined with the contractor.

3.5.2. Residual risk

Where further mitigation is not possible, a residual hazard may remain. However, all impacts were assessed to be no more than a Moderate risk post-mitigation. Following the implementation of embedded measures, any residual impacts can be considered as ALARP. Therefore, no intolerable residual risks for navigation and shipping remain.

As the Proposed Development is still in development, it is necessary that flexibility in the NRA is retained and that this would be developed as the Proposed Development progresses. Updates based on further stakeholder consultation and the latest reports and technical memos (e.g. rock protection, EMF effects) would be reflected in the NRA where appropriate. The risk ratings and mitigation measures would be re-assessed upon availability of this information.

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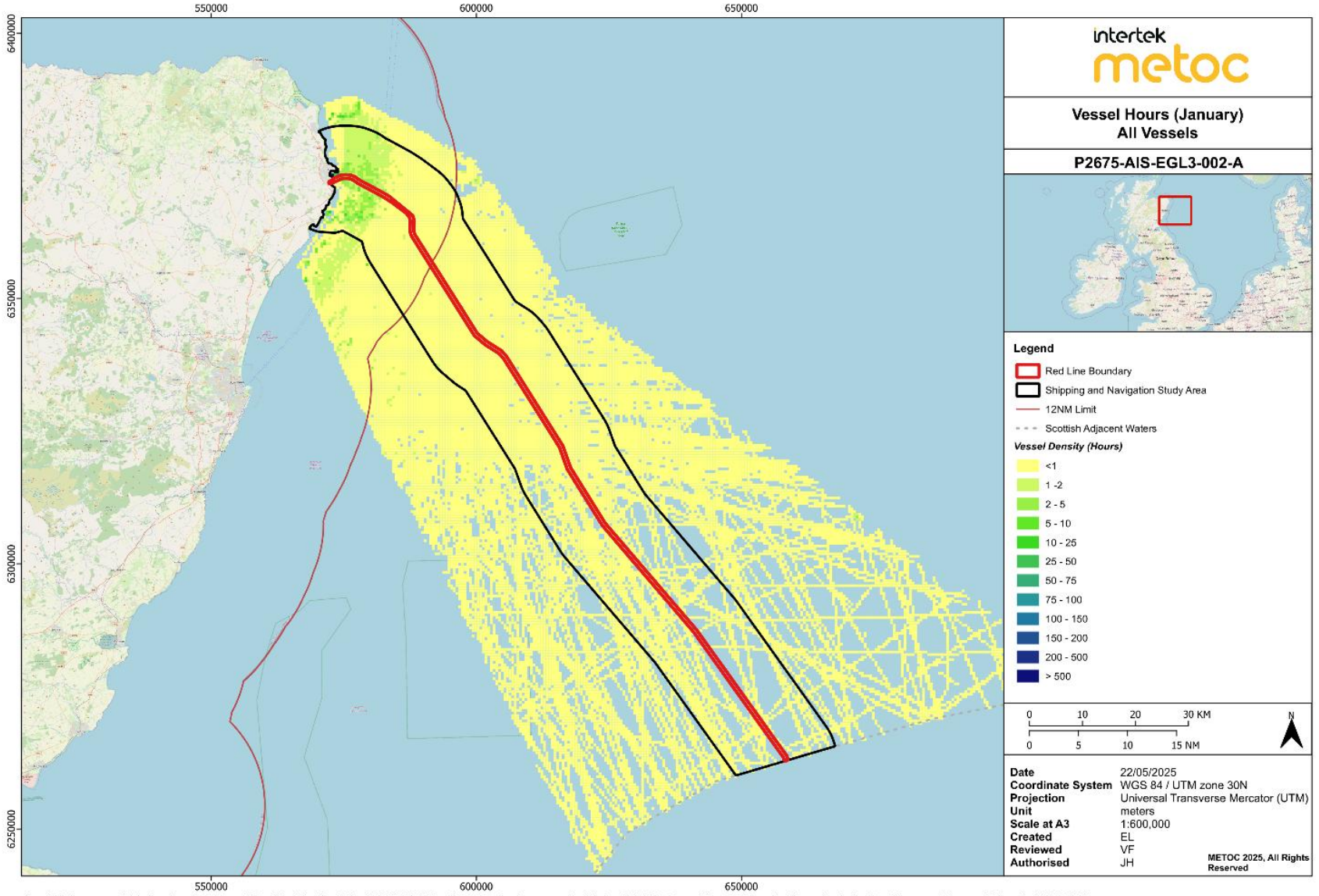
Appendix A – Risk Matrix

Risk Assessment: Operation	Hazard	Inherent Risk											Mitigation	Residual Risk											Comments
		Frequency	Consequence					Risk Rating						Frequency	Consequence					Risk Rating					
			Effect on Human Safety	Effect on Vessel(s) / Property	Displacement of Vessel(s)	Business/ Reputational Effects	Environmental Effects	Effect on Human Safety	Effect on Vessel(s)	Displacement of Vessel(s)	Business/ Reputational Impacts	Environmental Impacts			Effect on Human Safety	Effect on Vessel(s)	Displacement of Vessel(s)	Business/ Reputational Effects	Environmental Effects	Effect on Human Safety	Effect on Vessel(s)	Displacement of Vessel(s)	Business/ Reputational Effects	Environmental Effects	
UXO Survey (Target Investigation)	Disturbance to existing shipping patterns & fishing	4	1	1	2	3	1	4	4	8	12	4	CF01, OMT07, OMT08, OMT09, OMT10, OSU03,OSU04, OSU06, OSU07, OSU08, OSU02, OSU14, OSU01, OSU13	3	1	1	2	3	1	3	3	6	9	3	
	Vessel collision	2	5	5	N/A	5	5	10	10	N/A	10	10		1	5	5	N/A	5	5	5	5	N/A	5	5	Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	4	1	1	2	3	1	4	4	8	12	4		3	1	1	2	3	1	3	3	6	9	3	
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	
Pre- and Post-Lay Survey	Disturbance to existing shipping patterns & fishing	4	1	1	2	3	1	4	4	8	12	4	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OSU04, OSU06, OSU07, OSU08,OSU02, OSU14, OSU01, OSU13	3	1	1	2	3	1	3	3	6	9	3	
	Vessel collision	2	5	5	N/A	5	5	10	10	N/A	10	10		1	5	5	N/A	5	5	5	5	N/A	5	5	Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	3	1	1	2	3	1	3	3	6	9	3		2	1	1	2	3	1	2	2	4	6	2	
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	
Route Clearance & Preparation of third-party asset crossings (PLGR, Boulder Clearance, Sandwave Pre-Sweeping, OOS removal)	Disturbance to existing shipping patterns & fishing	4	1	1	2	3	1	4	4	8	12	4	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OSU04, OSU06, OSU07, OSU08, OSU02, OSU14, OSU01, OSU13, OMT03, OMT04	3	1	1	2	3	1	3	3	6	9	3	
	Vessel collision	2	5	5	N/A	5	5	10	10	N/A	10	10		1	5	5	N/A	5	5	5	5	N/A	5	5	Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	3	1	1	2	3	1	3	3	6	9	3		2	1	1	2	3	1	2	2	4	6	2	
	Snagging of static fishing gear on seabed	3	2	2	4	3	2	6	6	12	9	6		2	2	2	4	2	2	4	4	8	4	4	
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	
Cable Lay and Burial	Disturbance to existing shipping patterns & fishing	4	1	1	3	3	1	4	4	12	12	4	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OSU04, OSU06, OSU07, OSU08, OSU02, OSU14, OSU01, OSU13	3	1	1	3	3	1	3	3	9	9	3	
	Vessel collision	2	5	5	N/A	5	5	10	10	N/A	10	10		1	5	5	N/A	5	5	5	5	N/A	5	5	Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	4	1	1	2	3	1	4	4	8	12	4		3	1	1	2	3	1	3	3	6	9	3	
	Accidental anchor strike or drag on cable	1	3	3	2	4	1	3	3	2	4	1		1	3	3	2	4	1	3	3	2	4	1	Small risk of emergency anchoring of project vessels
	Accidental snagging of fishing gear on cable	2	4	4	2	4	1	8	8	4	8	2		1	4	4	2	4	1	4	4	2	4	1	Maintain fishing clearance until after post-lay surveys (co-ordinated via FLO). Guard vessels assumed to be present
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	
HDD punch out and Cable Pull (Trenchless Construction)	Disturbance to existing shipping patterns & fishing	5	1	1	3	3	1	5	5	15	15	5	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OSU04, OSU06, OSU07, OSU08, OSU02, OSU14, OSU01, OSU13	3	1	1	3	3	1	3	3	9	9	3	
	Vessel collision	2	5	5	N/A	5	5	10	10	N/A	10	10		1	5	5	N/A	5	5	5	5	N/A	5	5	Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	4	1	1	3	3	1	4	4	12	12	4		3	1	1	2	3	1	3	3	6	9	3	Location of jack-up barge/spud barge/multi-cat likely to cause interaction with advisory safety zone buffer
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	

Risk Assessment: Operation	Hazard	Inherent Risk											Mitigation	Residual Risk											Comments
		Frequency	Consequence					Risk Rating						Frequency	Consequence					Risk Rating					
			Effect on Human Safety	Effect on Vessel(s) / Property	Displacement of Vessel(s)	Business/ Reputational Effects	Environmental Effects	Effect on Human Safety	Effect on Vessel(s)	Displacement of Vessel(s)	Business/ Reputational Impacts	Environmental Impacts			Effect on Human Safety	Effect on Vessel(s)	Displacement of Vessel(s)	Business/ Reputational Effects	Environmental Effects	Effect on Human Safety	Effect on Vessel(s)	Displacement of Vessel(s)	Business/ Reputational Effects	Environmental Effects	
Jointing Operations	Disturbance to existing shipping patterns & fishing	3	1	1	2	3	1	3	3	6	9	3	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OU04, OSU06, OSU07, OSU08, OSU02, OSU14, OSU01, OSU13, OSU11, OSU10	2	1	1	2	3	1	2	2	4	6	2	Joints will be located away from high shipping traffic, which decreases the likelihood.
	Vessel collision	3	5	5	N/A	5	5	15	15	N/A	15	15		1	5	5	N/A	5	5	5	5	N/A	5	5	Vessel collision could be higher as stationary in one location for several days but with the correct mitigation has been assessed as low. Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	3	1	1	2	3	1	3	3	6	9	3		2	1	1	3	3	1	2	2	6	6	2	Vessels will be mainly offshore and therefore not blocking navigation features.
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	
External Protection (third-party crossings & remedial rock) Operations	Disturbance to existing shipping patterns & fishing	4	1	1	3	3	1	4	4	12	12	4	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OSU04, OSU06, OSU07, OSU08, OSU02, OSU14, OSU01, OSU13, OMT03, OMT04, OSU16, OSU17, OSU10	3	1	1	3	3	1	3	3	9	9	3	
	Vessel collision	2	5	5	N/A	5	5	10	10	N/A	10	10		1	5	5	N/A	5	5	5	5	N/A	5	5	Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	4	1	1	2	3	1	4	4	8	12	4		3	1	1	3	3	1	3	3	9	9	3	External rock protection assumed to be required at Sandford Bay HDD punch-out, located approximately 150m away from the navigation line intothe Port
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	
Operation & Maintenance Surveys	Disturbance to existing shipping patterns & fishing	4	1	1	2	3	1	4	4	8	12	4	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OSU04, OSU06, OSU07, OSU08, OSU02, OSU14, OSU01, OSU13	3	1	1	2	3	1	3	3	6	9	3	Periodic inspections every 5-8 years.
	Vessel collision	2	5	5	N/A	5	5	10	10	N/A	10	10		1	5	5	N/A	5	5	5	5	N/A	5	5	Cannot assess vessel displacement if collision has occurred. Cannot quantify costs of vessel collisions for each vessel type.
	Project vessels blocking navigational features	3	1	1	2	3	1	3	3	6	9	3		2	1	1	2	3	1	2	2	4	6	2	
	Reduced visibility / Adverse weather conditions	4	2	2	2	2	1	8	8	8	8	4		3	2	2	2	2	1	6	6	6	6	3	
In-Service Cable	Accidental snagging of fishing gear on cable	3	4	4	2	5	1	12	12	6	15	3	CF01, OMT07, OMT08, OMT09, OMT10, OSU03, OSU04, OSU06, OSU07, OSU08, OSU15, OSU02, OSU14, OSU01, OSU13, OMT03, OMT04, OSU16, OSU17, OSU12, OMT06,	1	4	4	2	5	1	4	4	2	5	1	Maintain fishing clearance until after post-lay surveys (co-ordinated via FLO). Guard vessels assumed to be present
	Accidental anchor strike or drag on cable	3	3	3	2	5	1	9	9	6	15	3		1	3	3	2	5	1	3	3	2	5	1	
	Reduction in under-keel clearance	3	1	1	3	2	1	3	3	9	6	3		2	1	1	2	2	1	2	2	4	4	2	Water depth assessed as navigable at all crossings. External rock protection assumed to be required at Sandford Bay HDD punch-out, located approximately 150m away from the navigation line intothe Port
	Interference with Marine Navigational Equipment	2	1	1	1	1	1	2	2	2	2	2		2	1	1	1	1	1	2	2	2	2	2	Frequency based on 0.5% of the routes being affected by <3º compass deviation and recreational & leisure vessel tracklines in nearshore area. No additional mitigation measures suggested.

Appendix B - AIS Vessel Hours Split By Month



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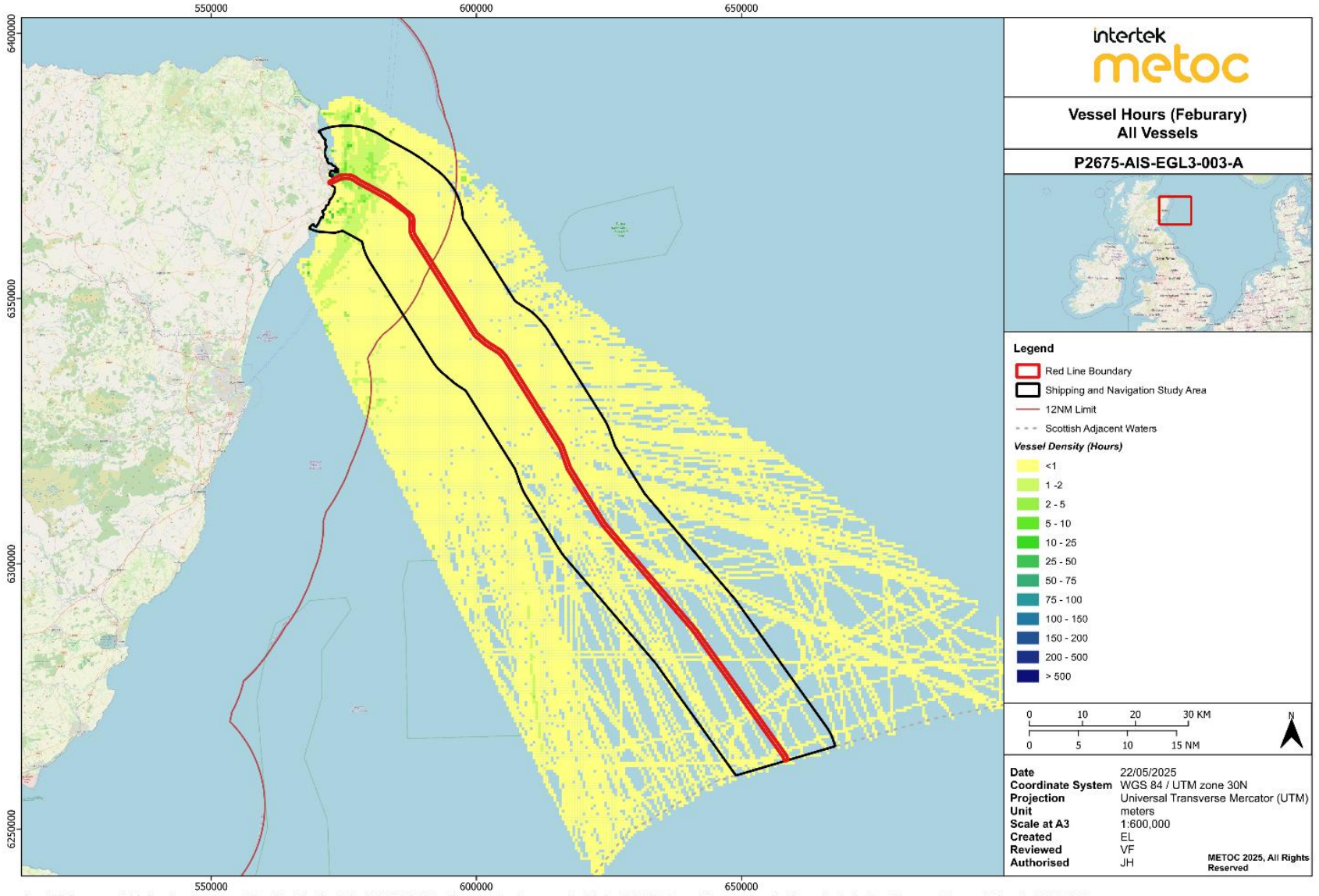

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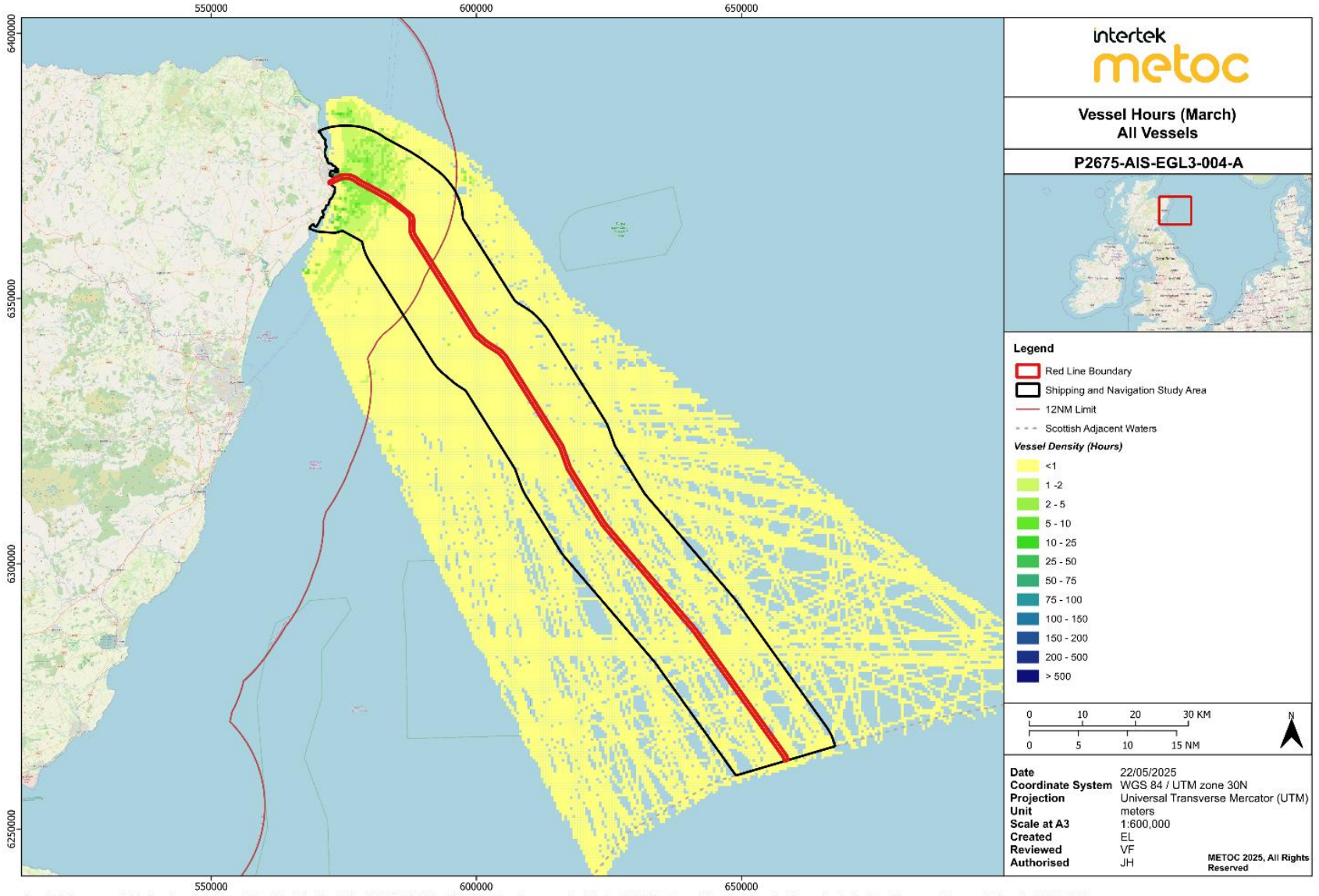

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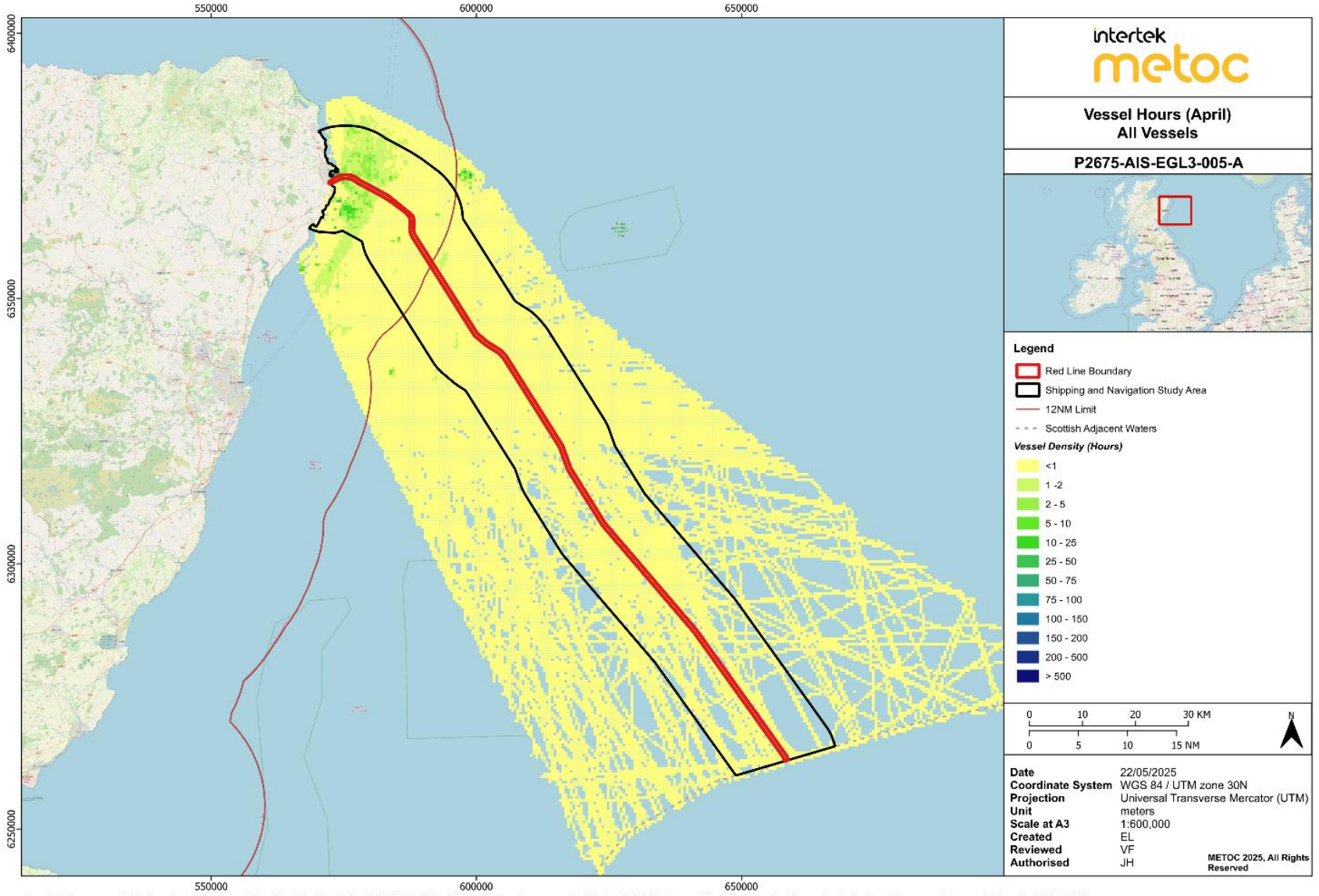

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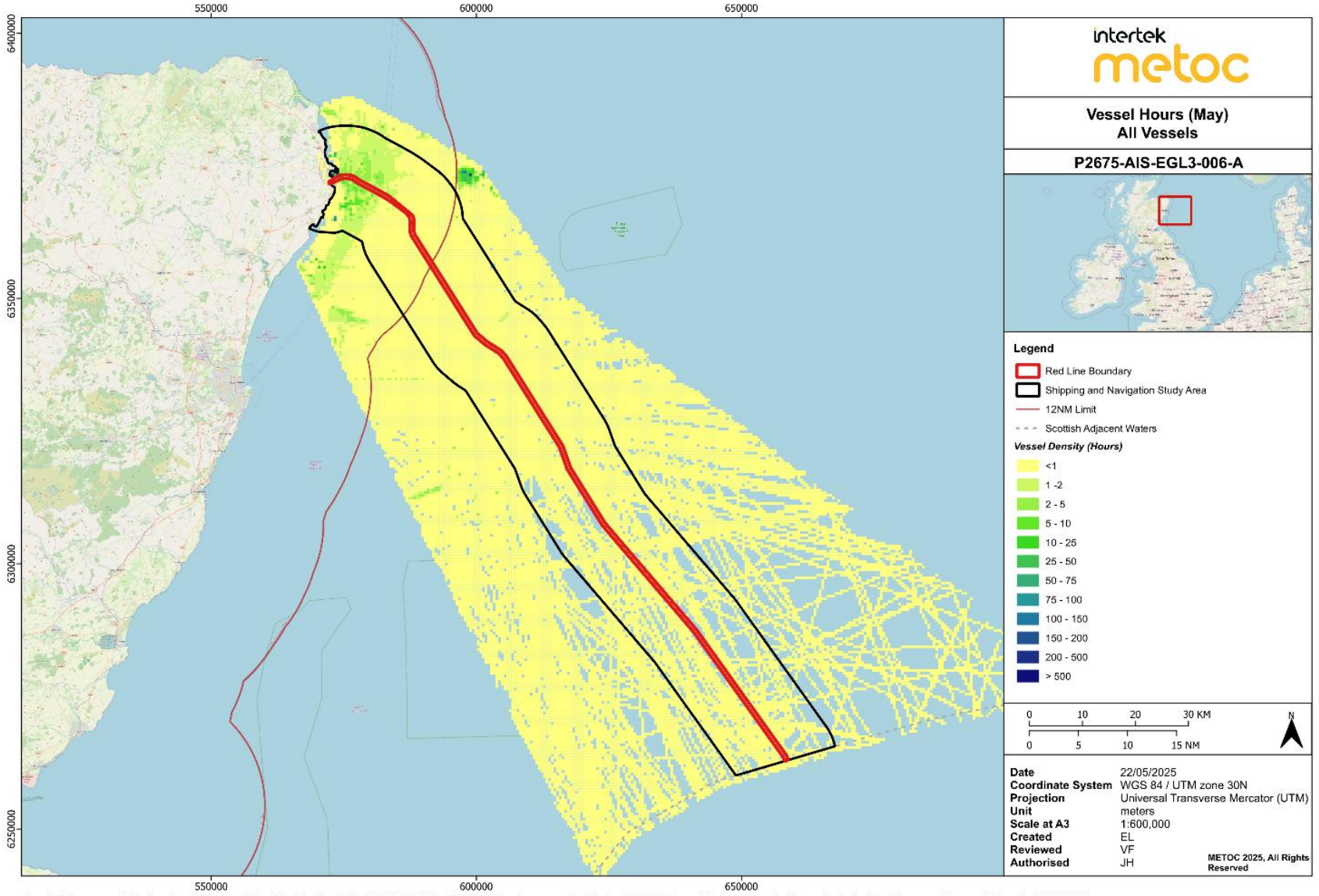

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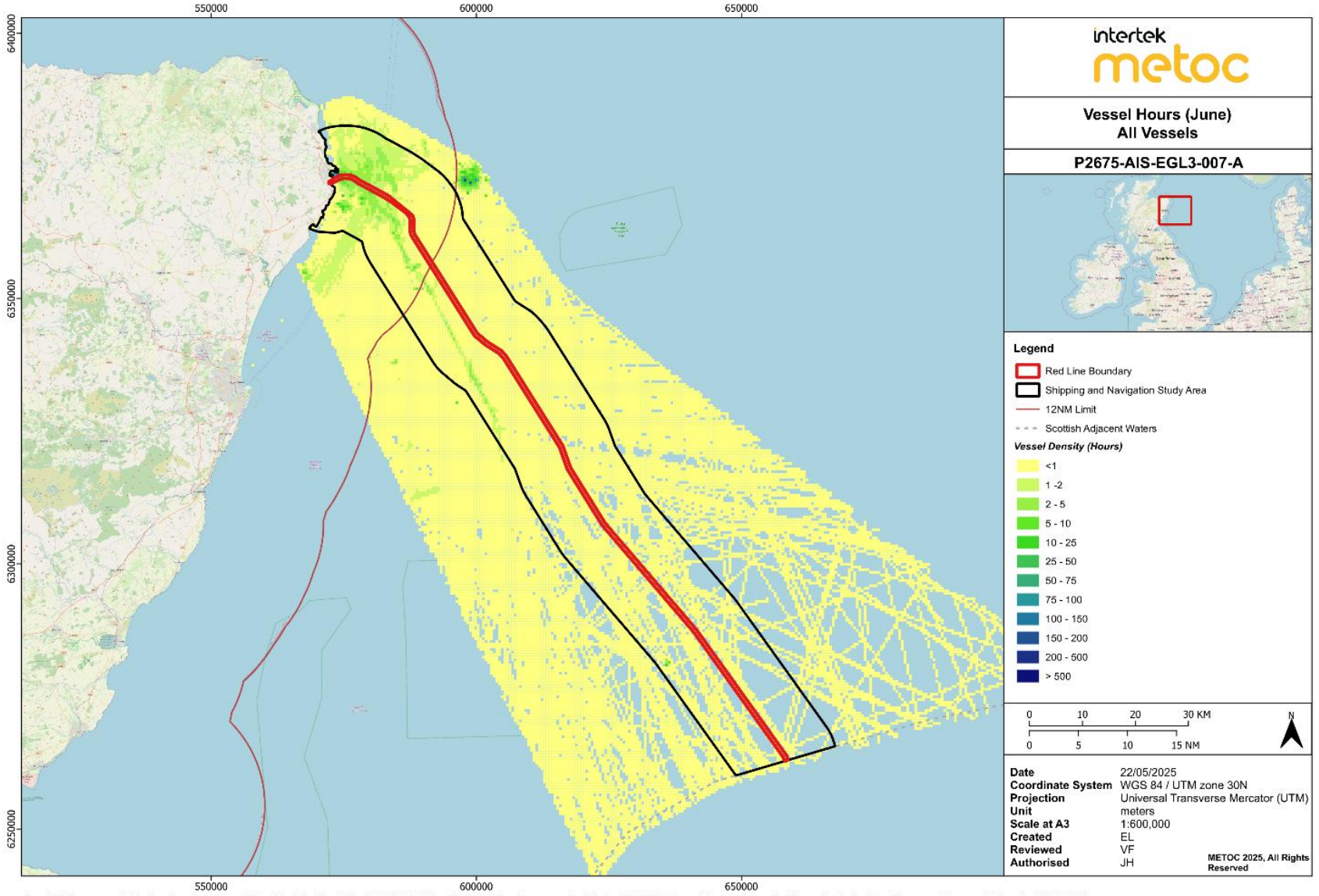

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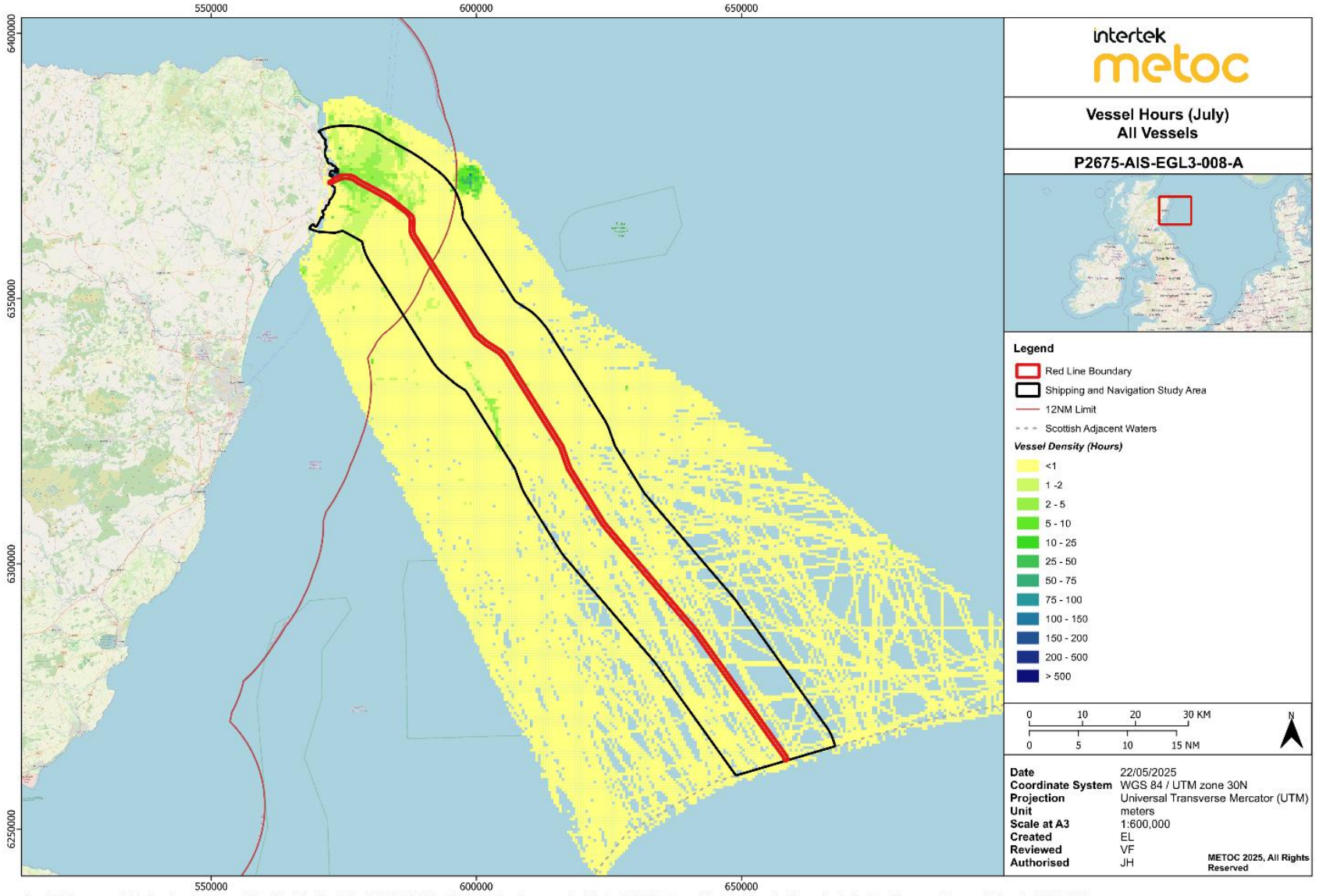

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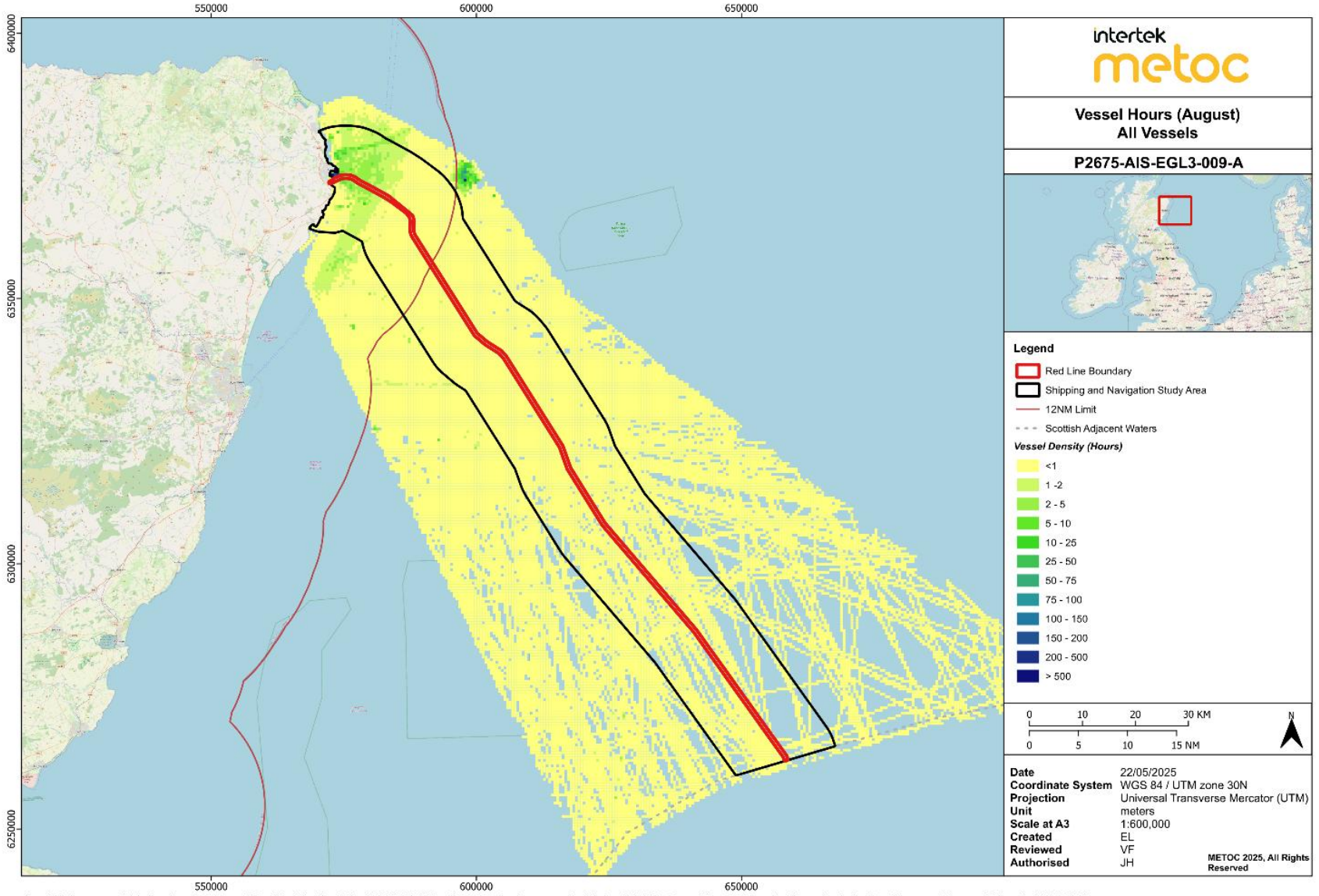

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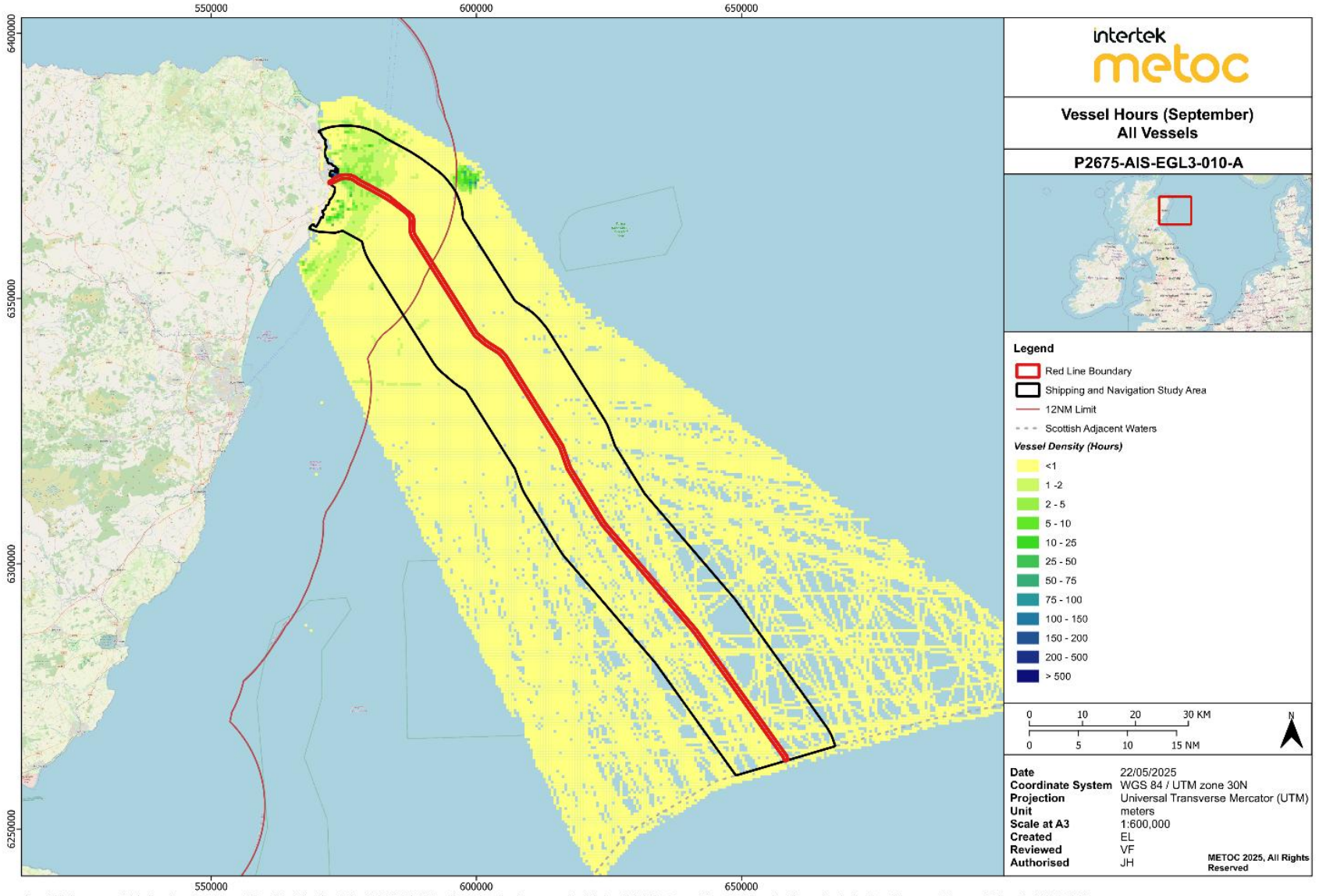

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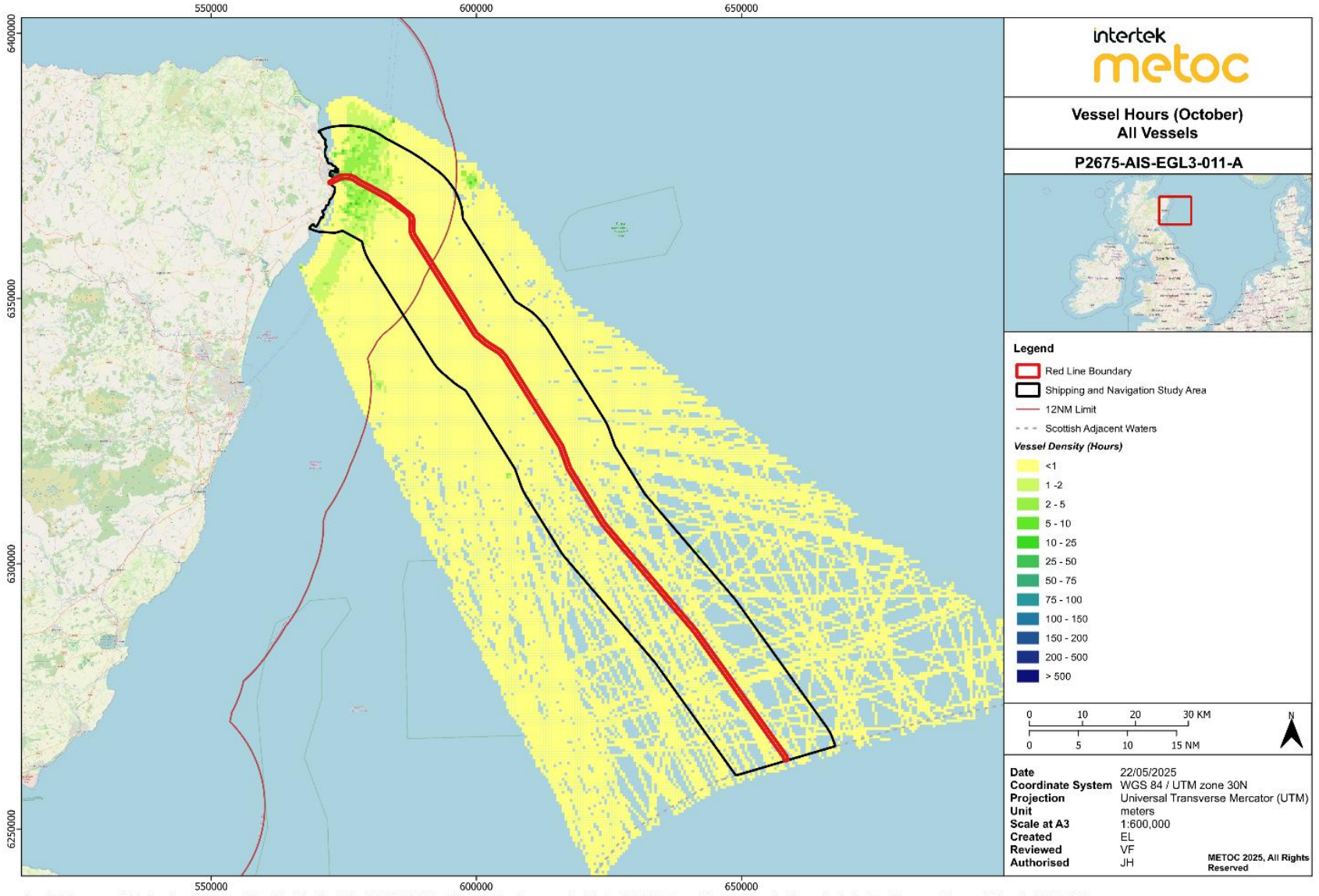

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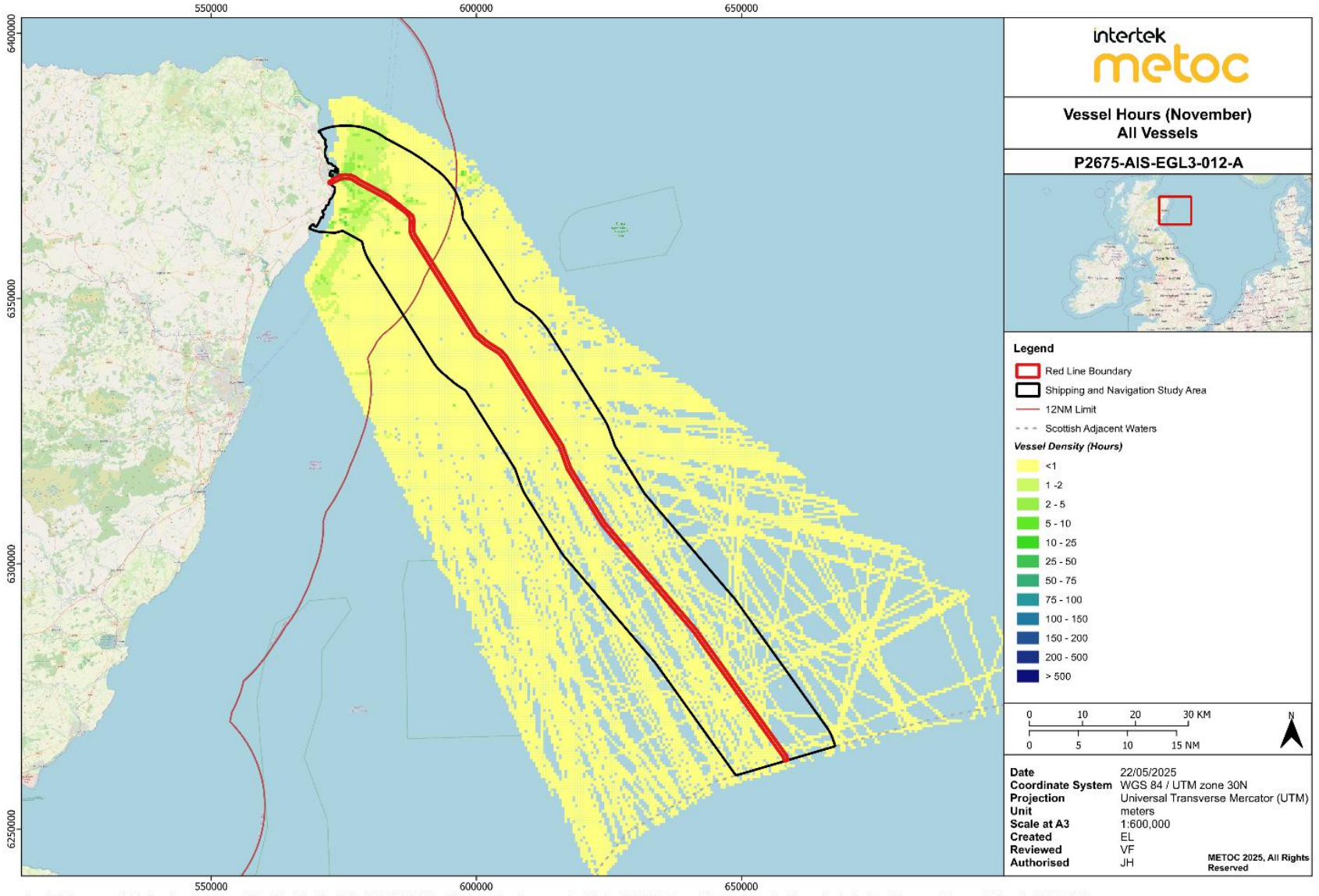

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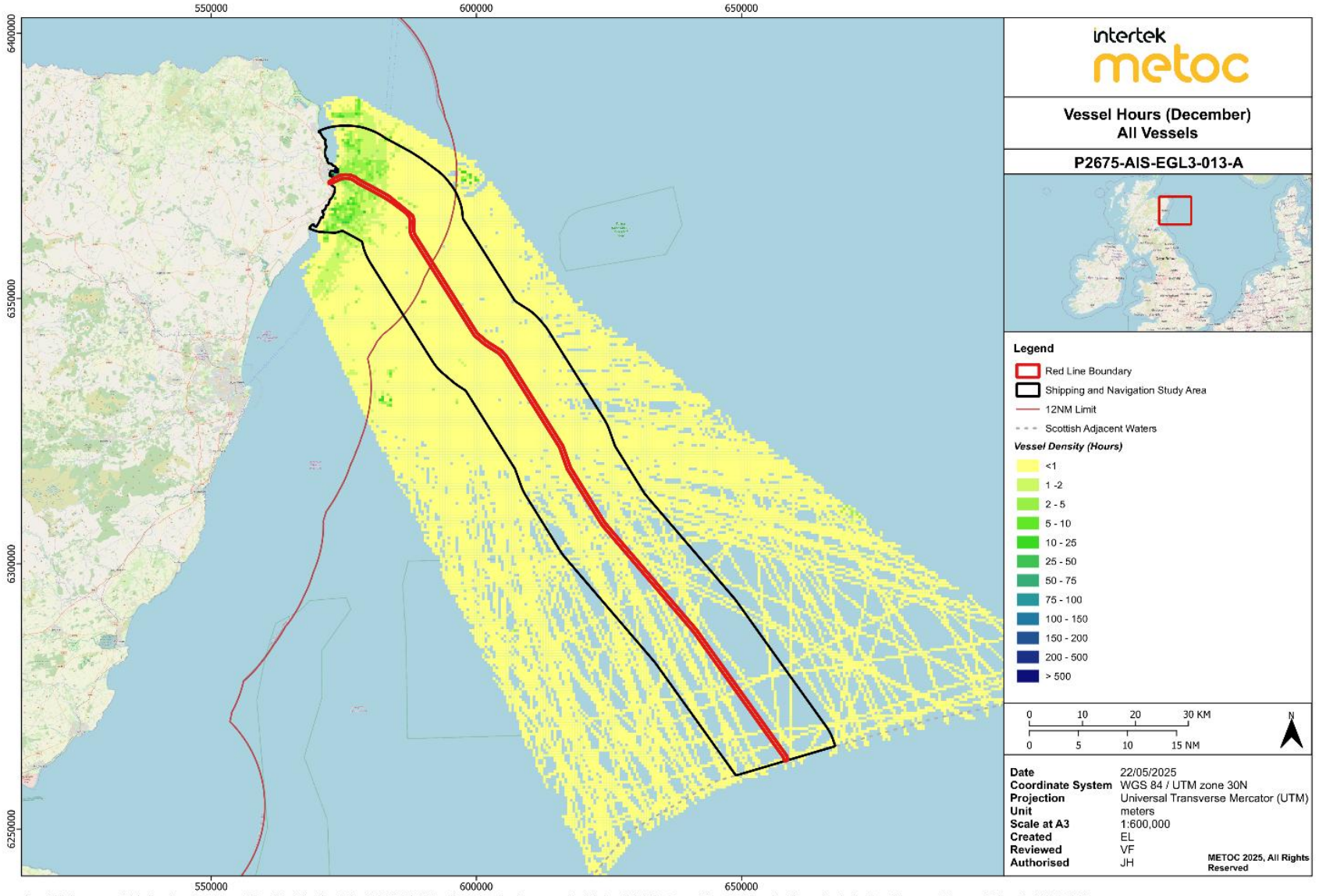

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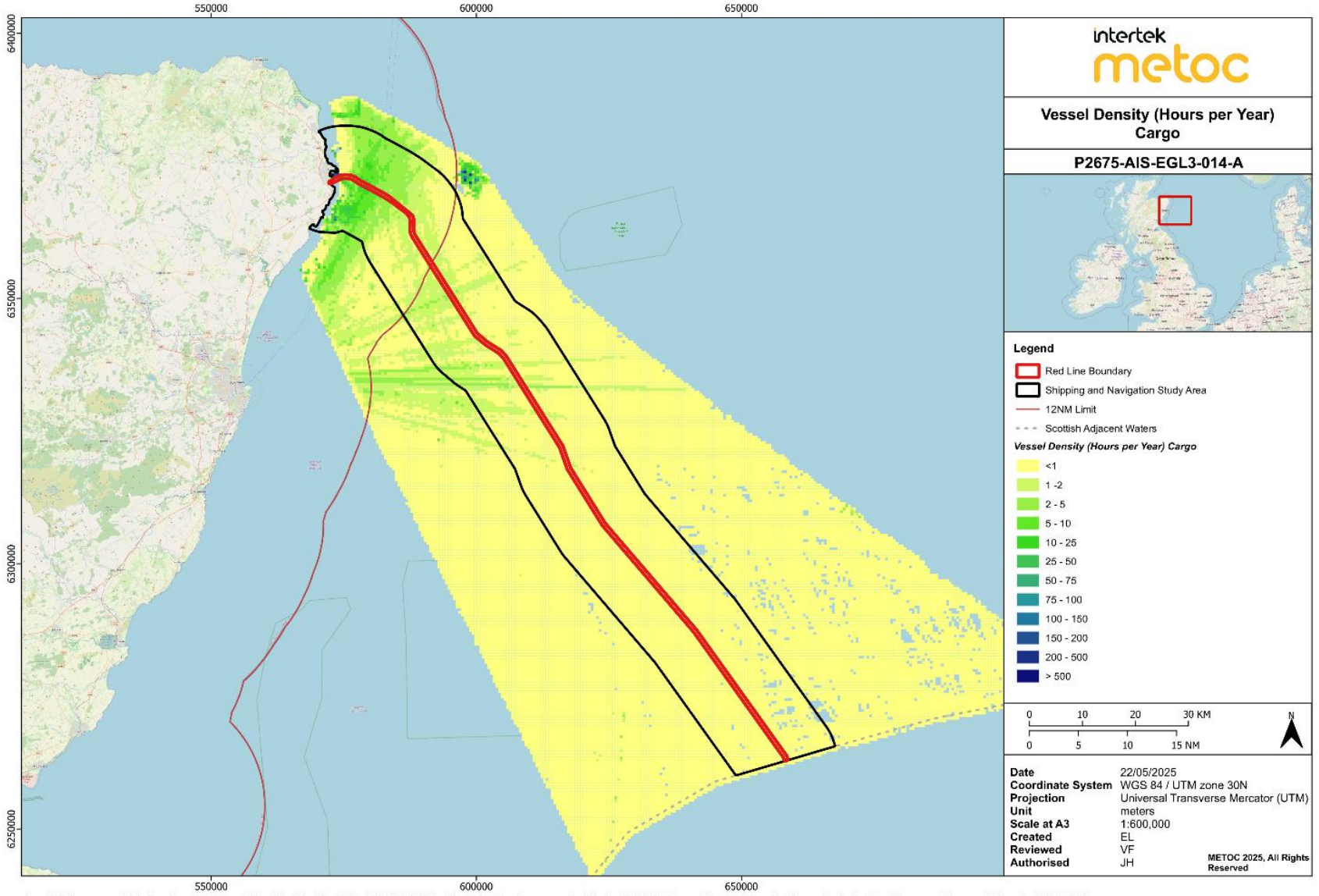
Appendix C - AIS Vessel Hours Split By Vessel Type



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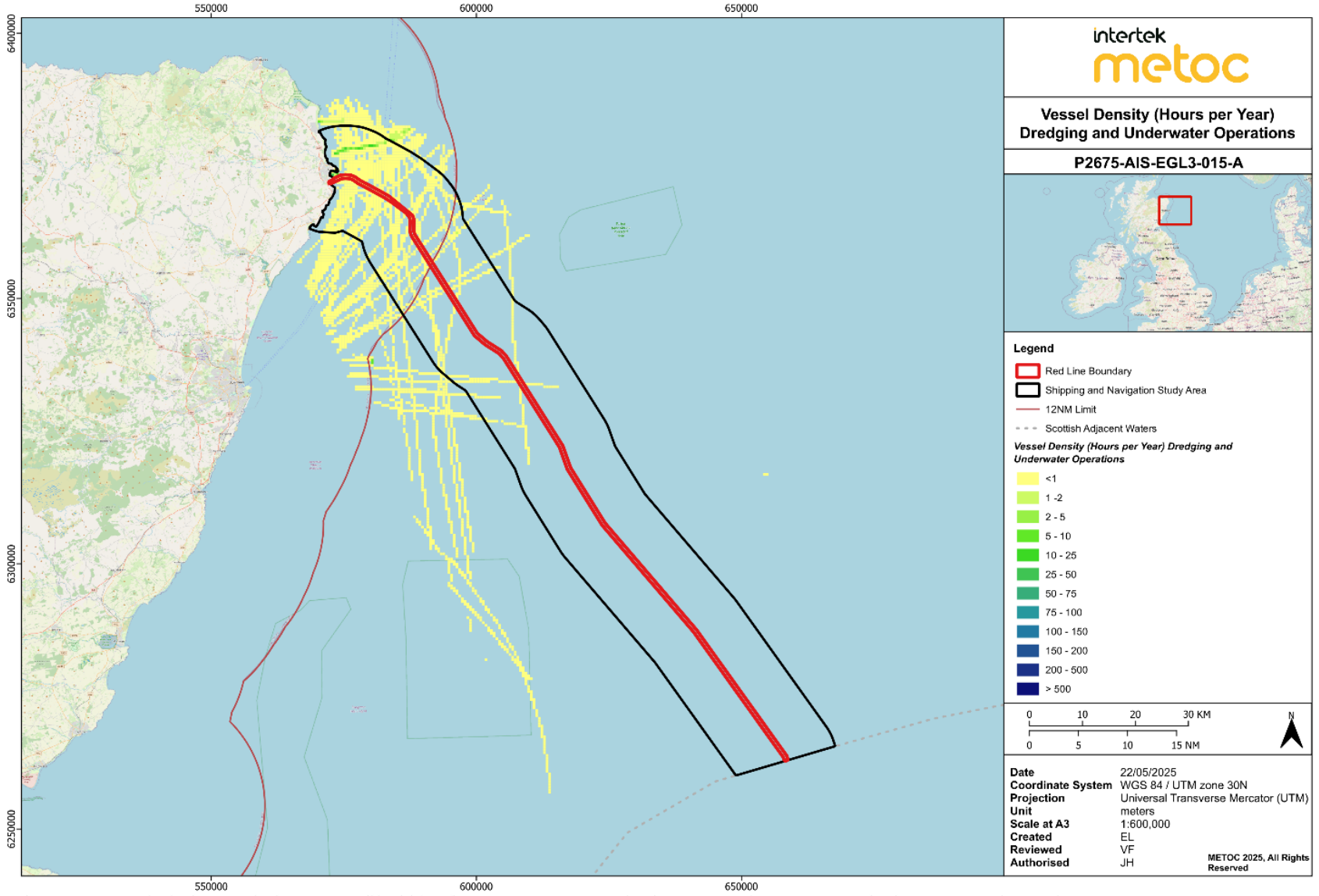

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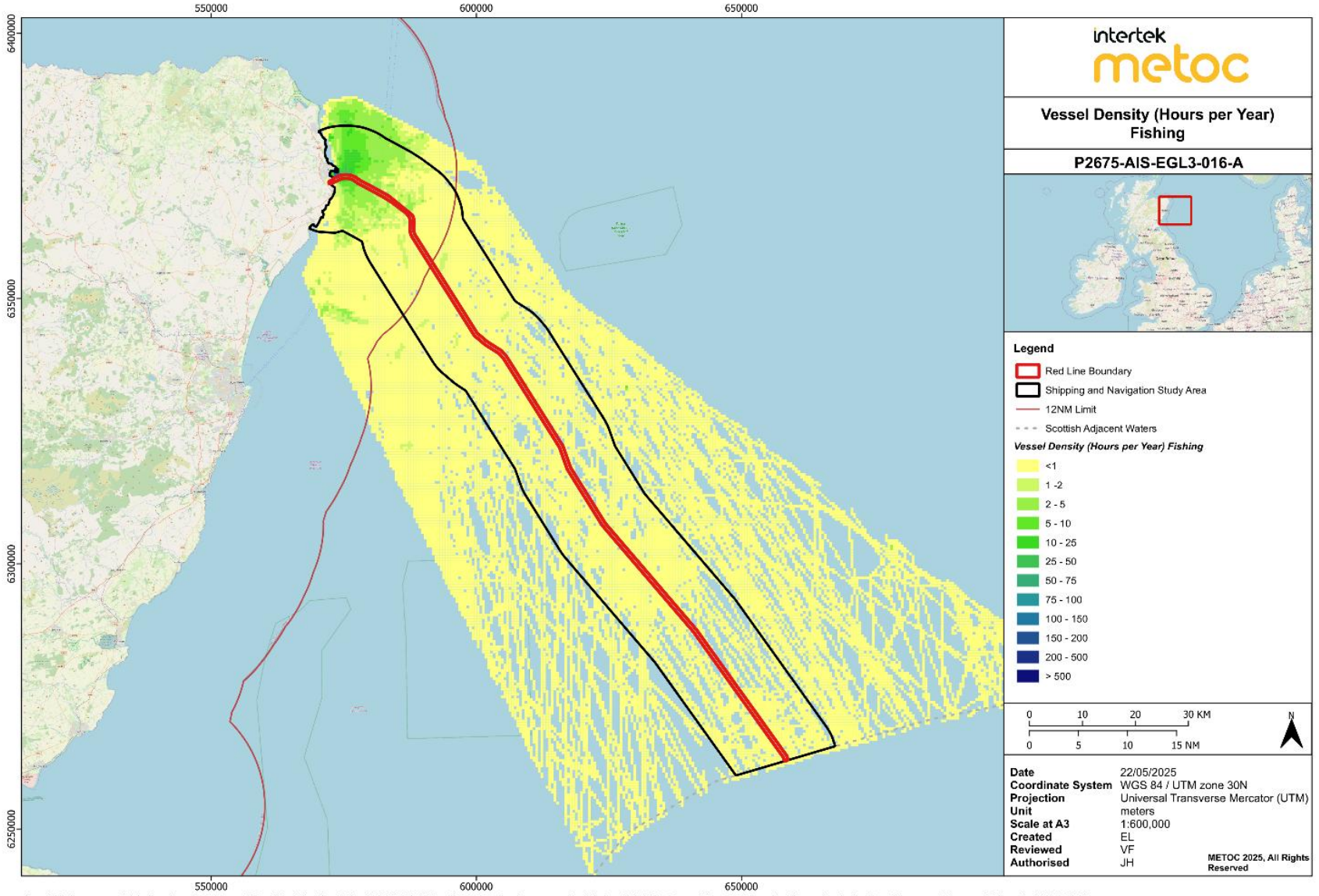

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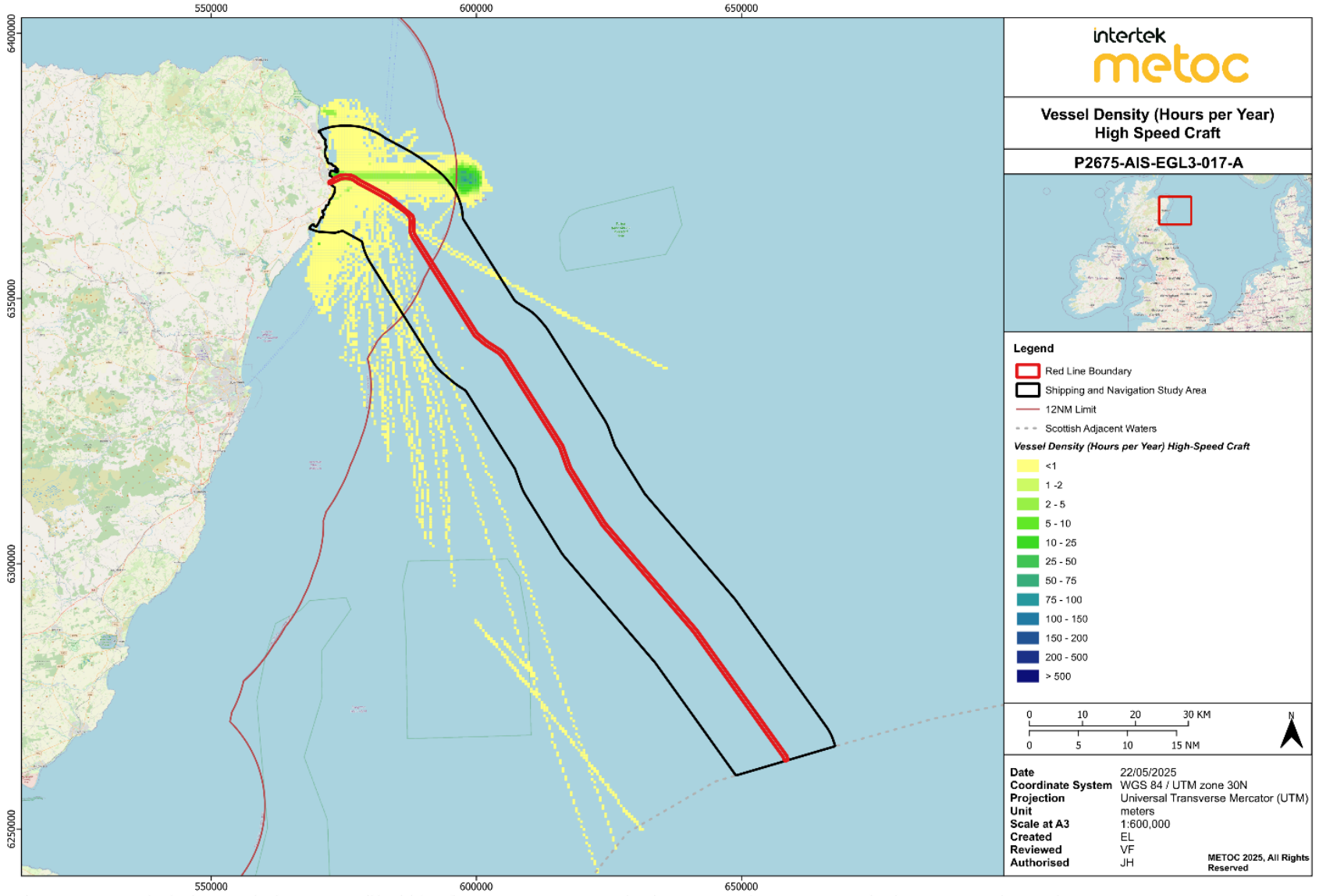

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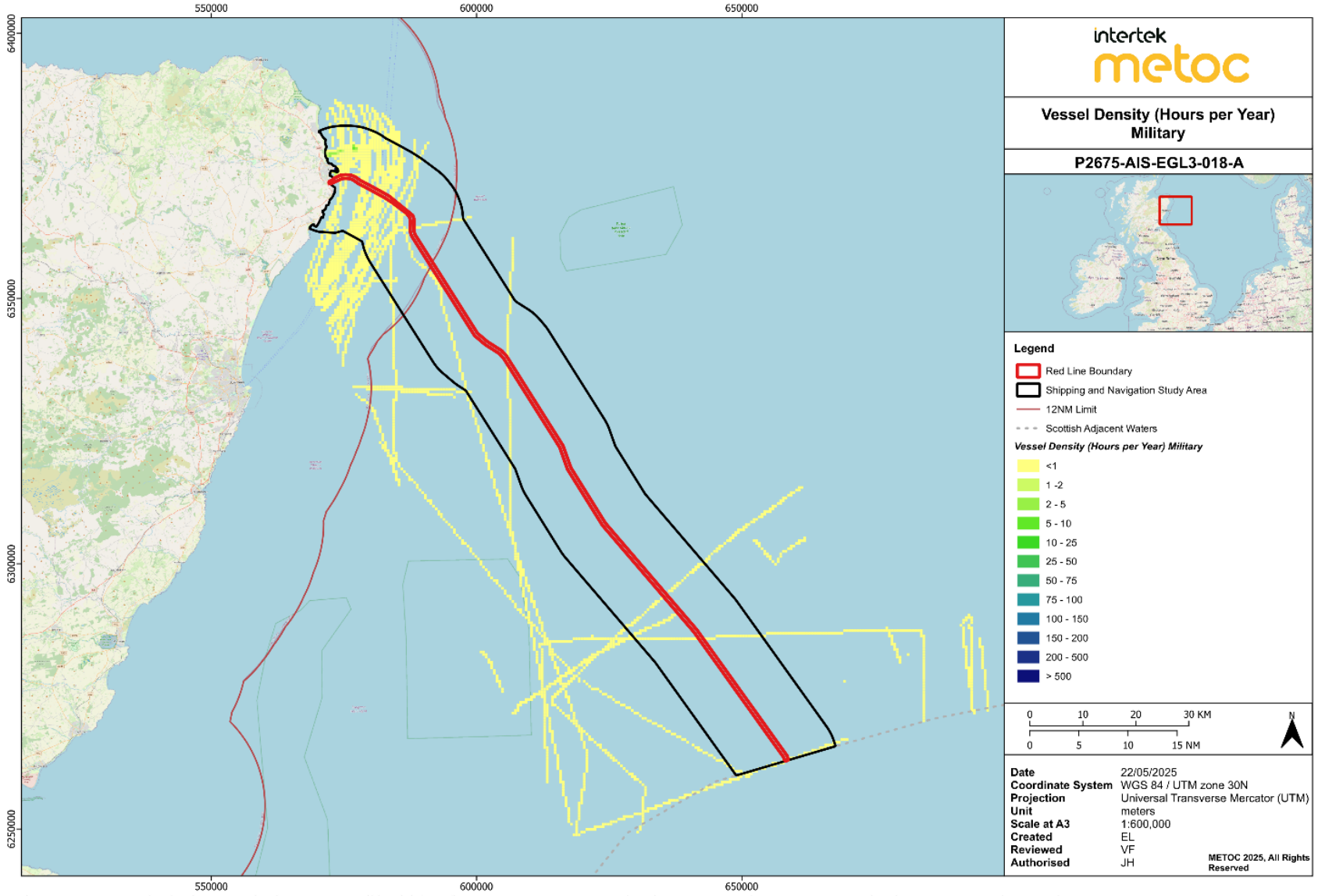

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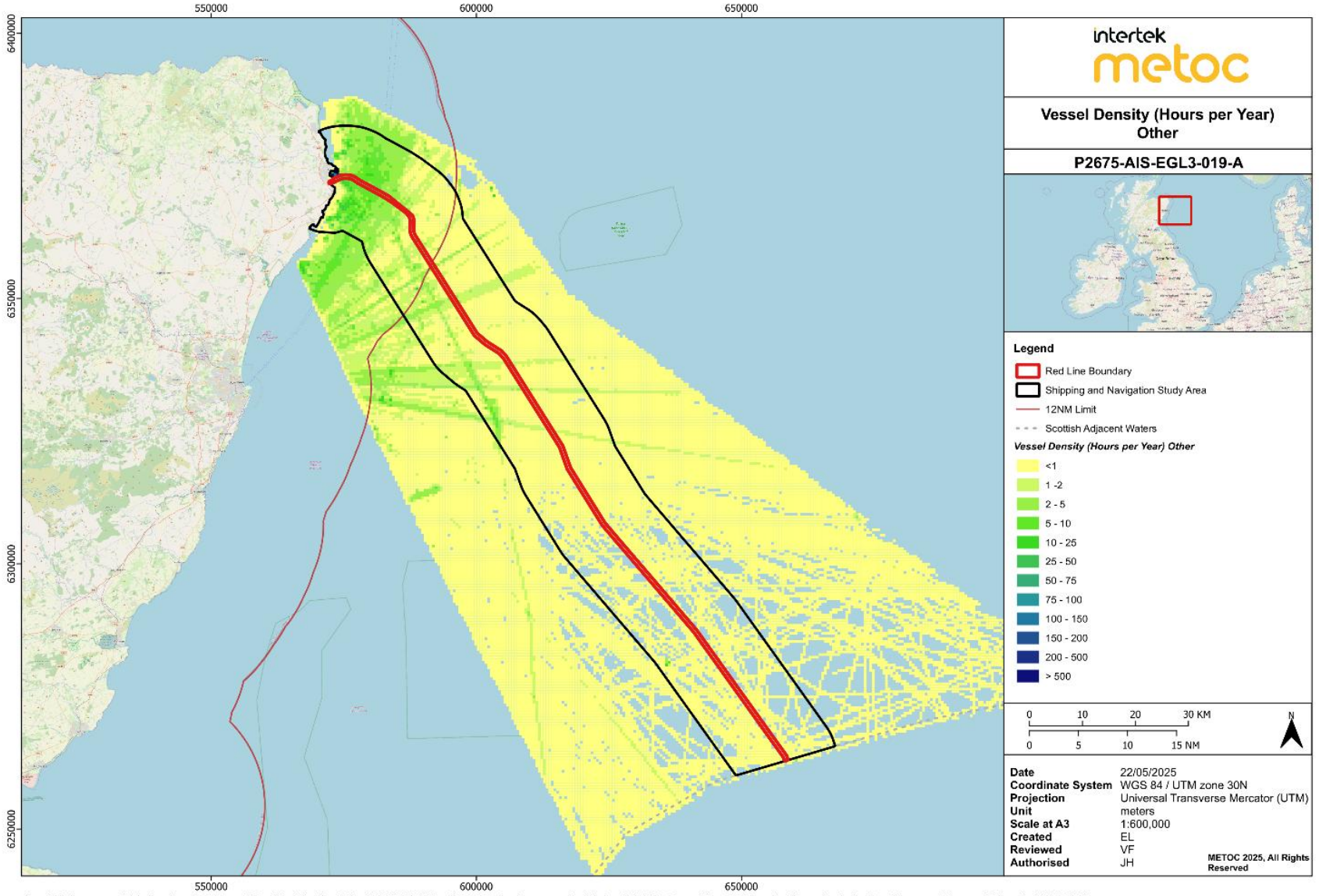

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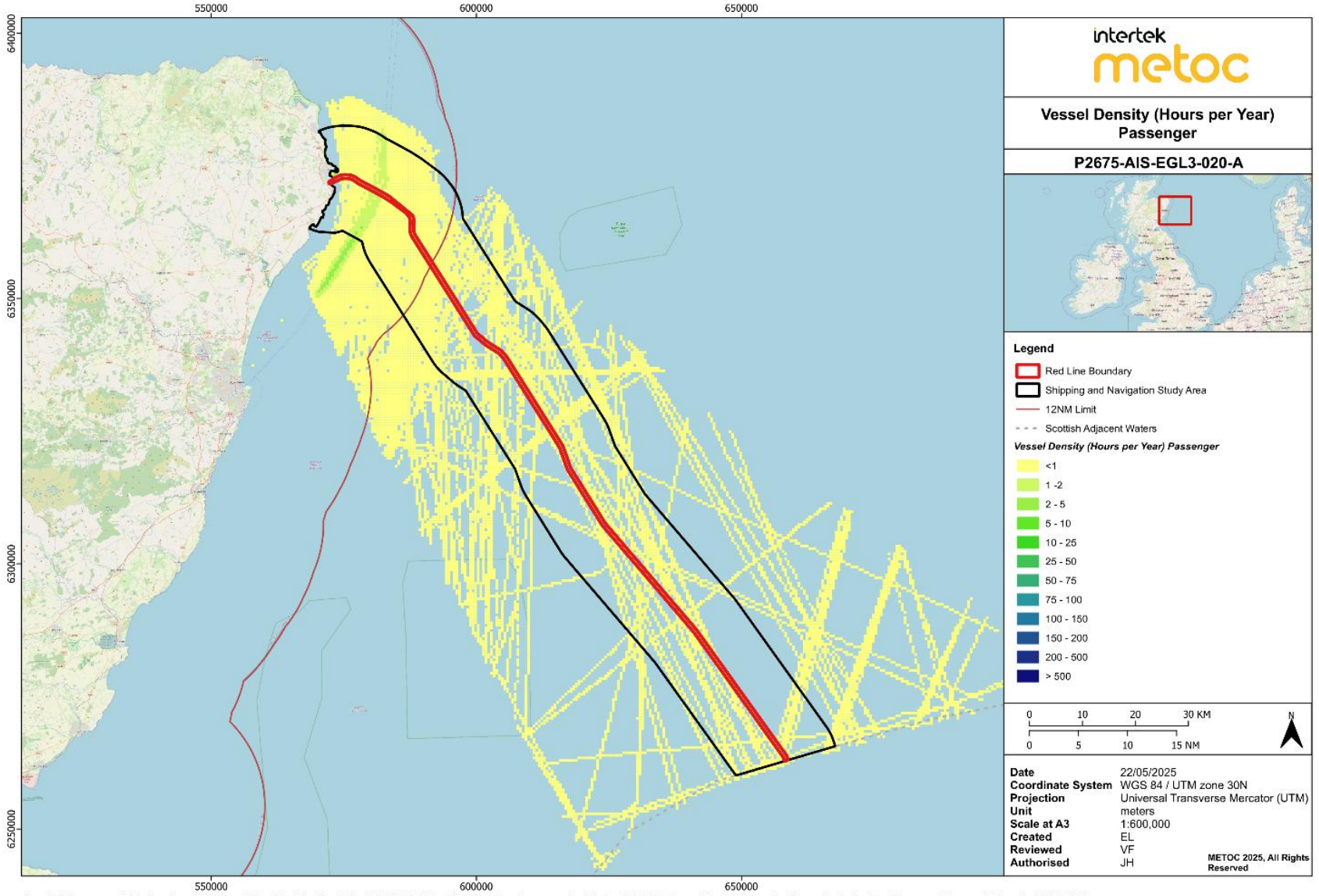

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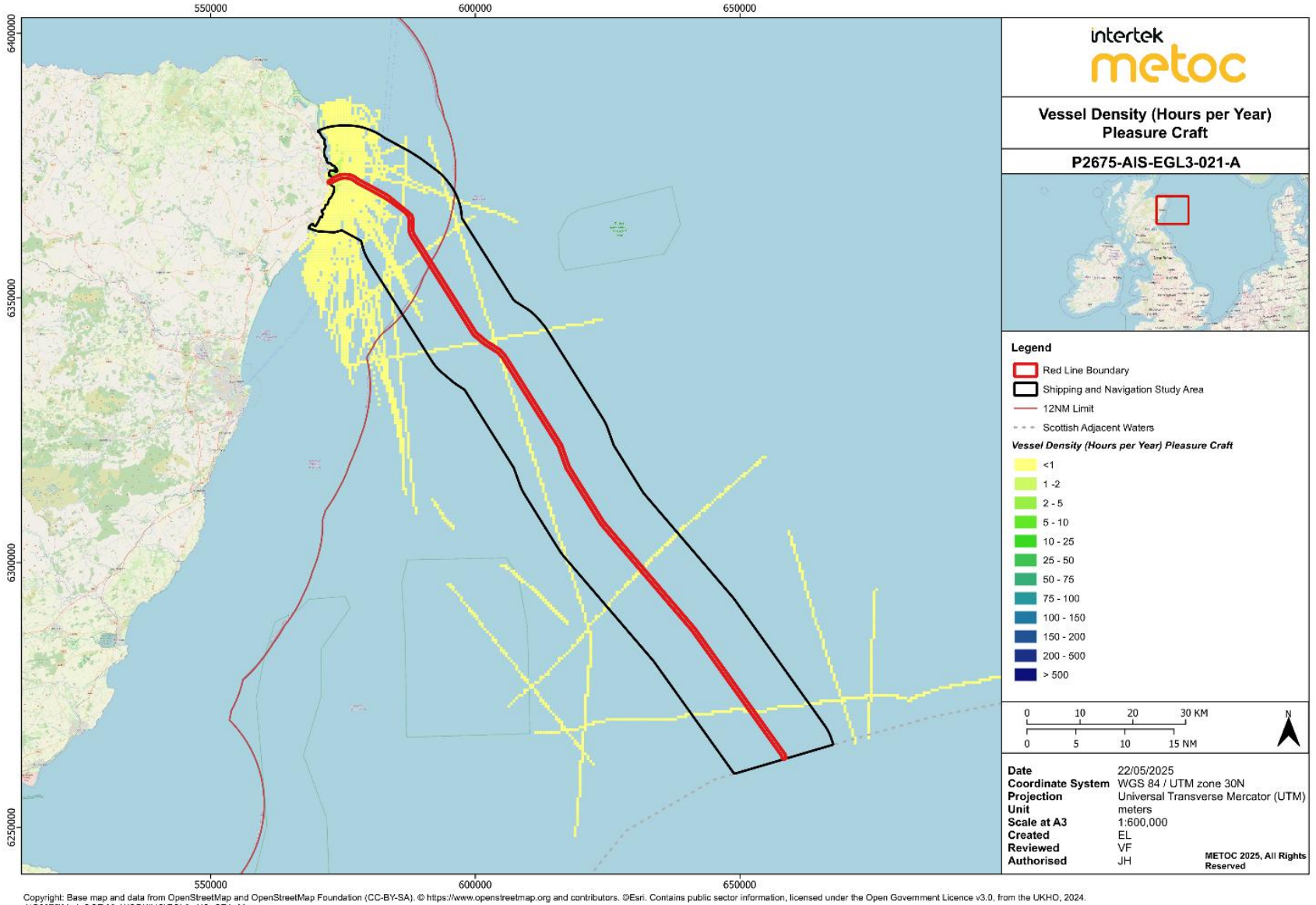

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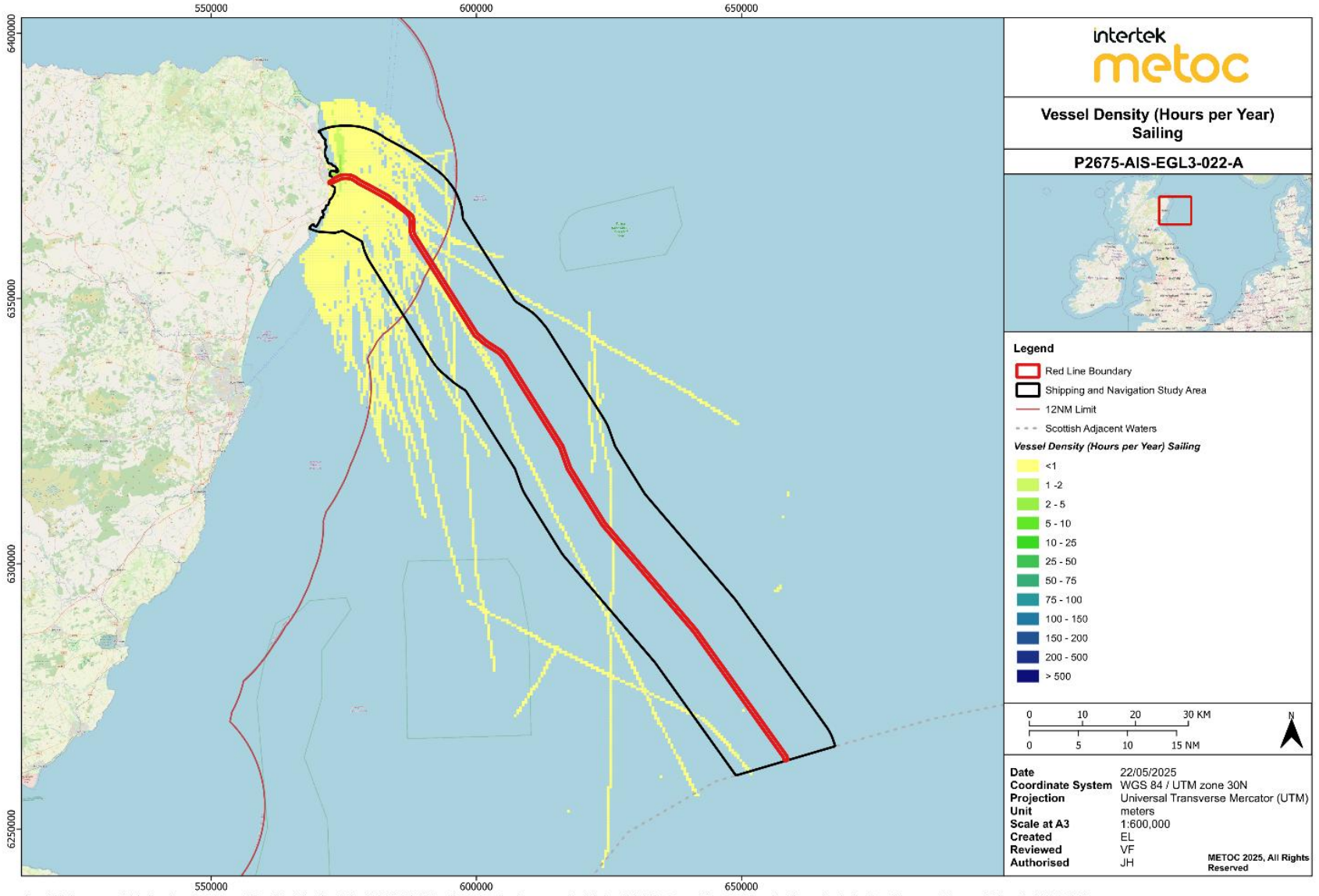

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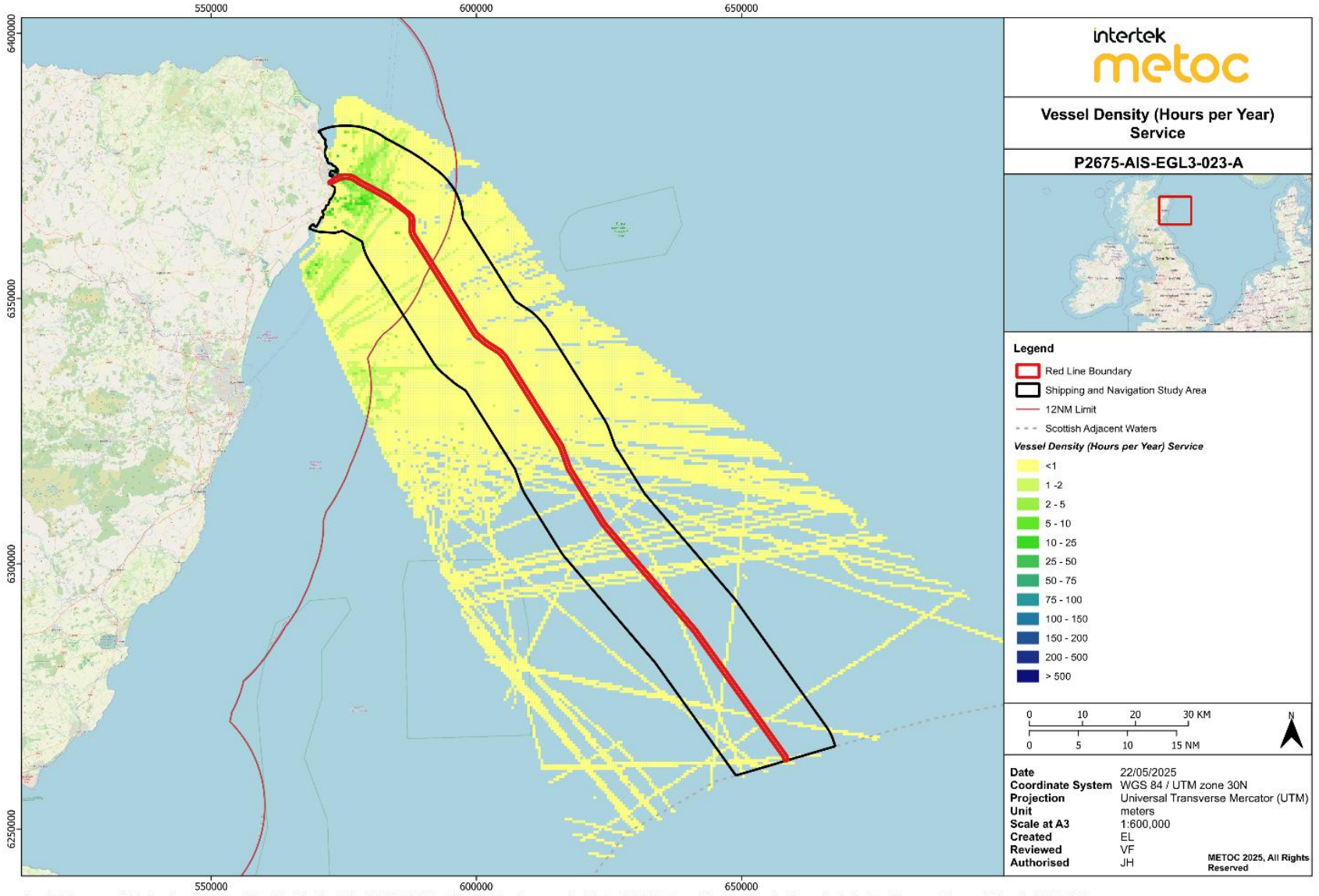

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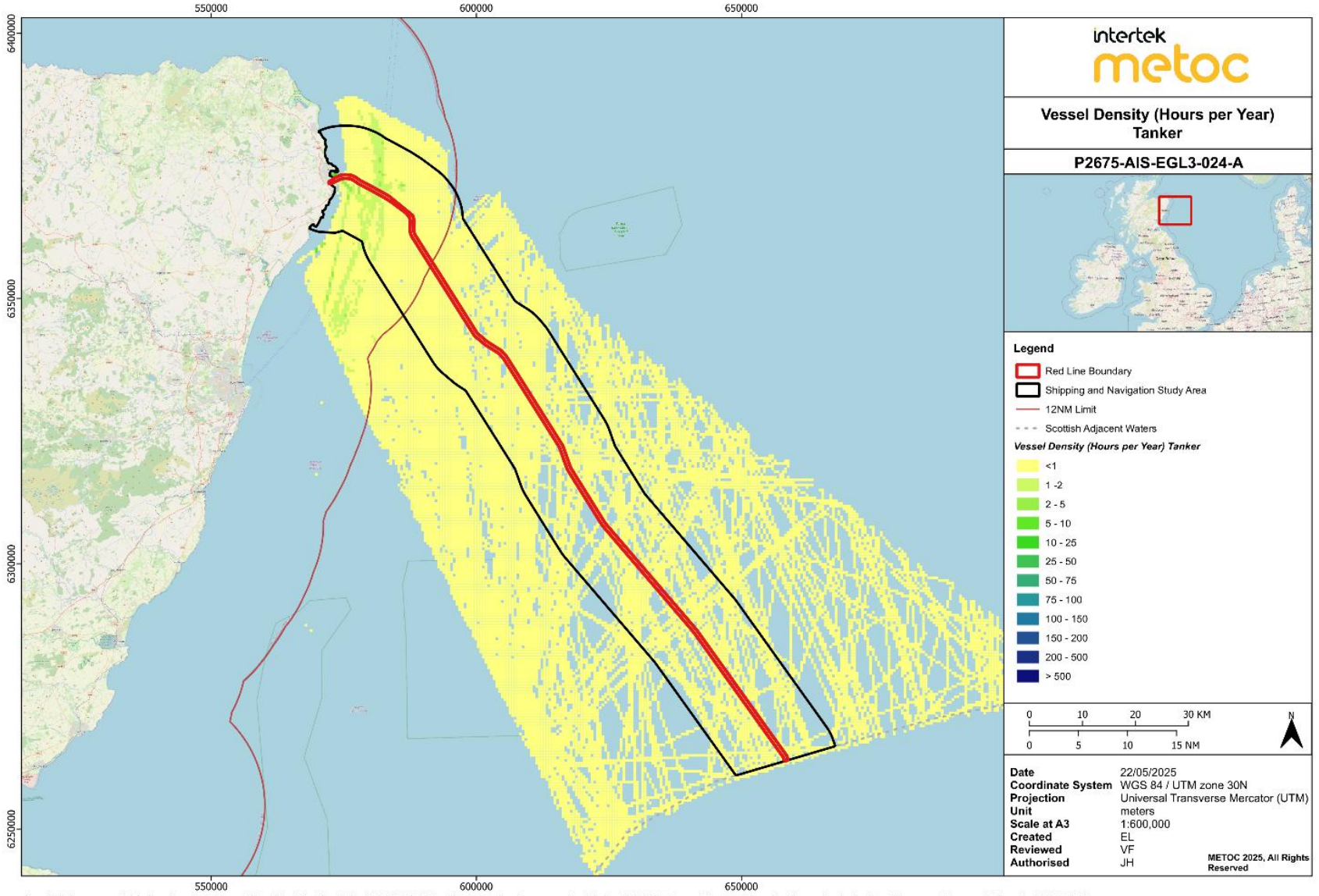

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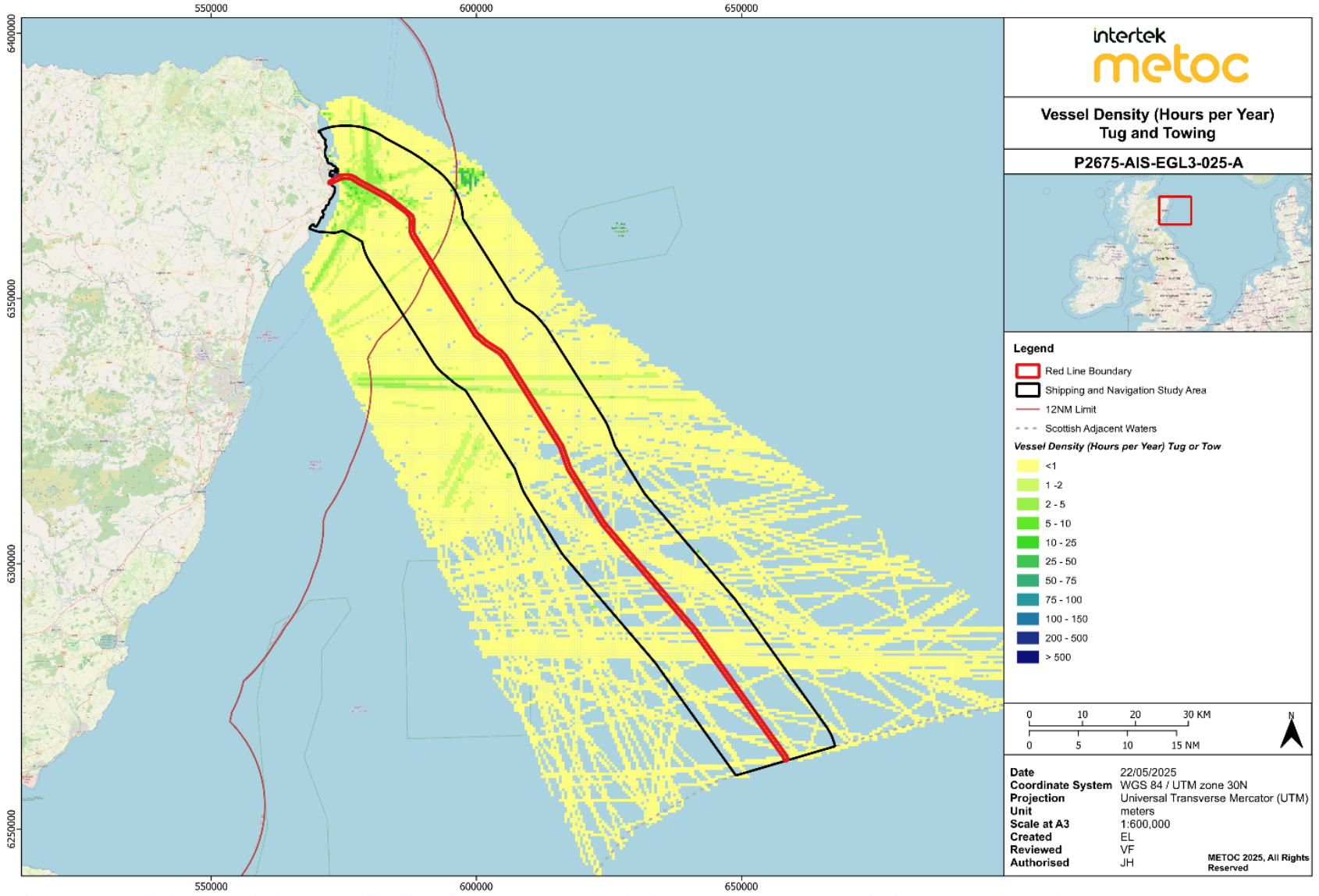

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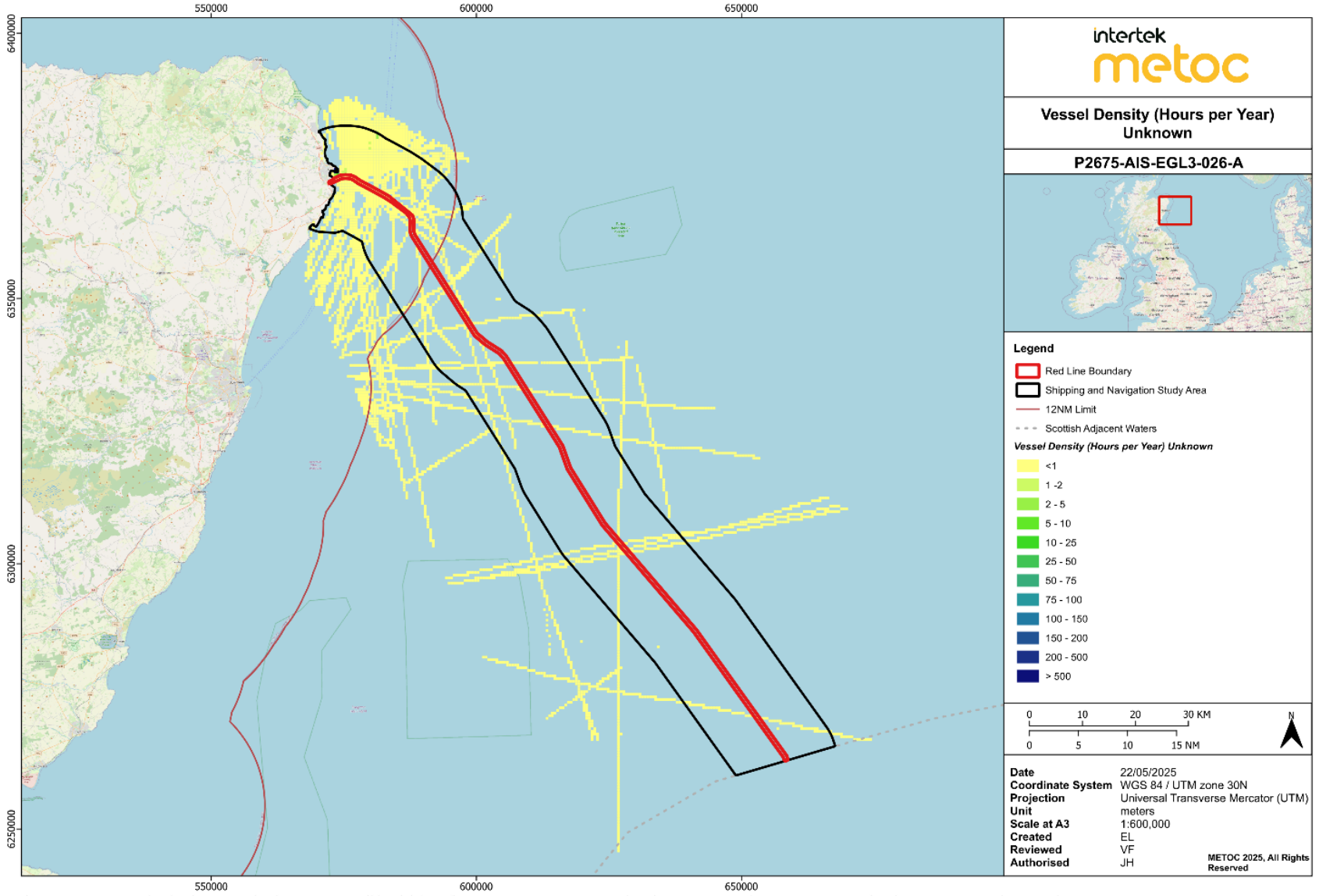

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