Scottish Hydro Electric Power Distribution plc

Eriskay - Barra Submarine Cable

Navigation Risk Assessment

ASSIGNMENT A101090-S00
DOCUMENT A-101090-S00-A-REPT-002

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REVISIONS & APPROVALS

[Redacted]

REV	DATE	DESCRIPTION	ISSUED	CHECKED	APPROVED	CLIENT
A01	12/02/2026	Issued for Use	AM	AF	AM	SHEPD
R02	13/01/2026	Issued for Review	JJM	AM	AM	SHEPD
R01	18/12/2025	Issued for Review	JJM/MP	KM	AM	SHEPD

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ACRONYMS AND ABBREVIATIONS

ABBREVIATION	DEFINITION
AC	Alternating Current
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AtoN	Aid to Navigation
BT	British Telecoms
CalMac	Caledonian MacBrayne
CEMP	Construction Environmental Management Plan
CSV	Comma-Separated Values
DC	Direct Current
DWT	Deadweight Tonnage
EMF	Electromagnetic Fields
EU	European Union
FIR	Fishing Industry Representative
FLMAP	Fisheries Liaison Mitigation Action Plan
FLO	Fisheries Liaison Officer
FSA	Formal Safety Assessment
HES	Historic Environment Scotland
Hz	Hertz
IMO	International Maritime Organisation
IRPCS	International Regulations for the Prevention of Collision at Sea
KIS - ORCA	Kingfisher Information Service – Offshore Renewable and Cable Awareness
km	Kilometres
km^2	Square kilometres
KP	Kilometre Point
kV	kilovolt
m	Metres
MCA	Maritime and Coastguard Agency

ABBREVIATION	DEFINITION
MEA	Marine Environmental Appraisal
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMSI	Maritime Mobile Service Identity
MTS	Marine Traffic Survey
NM	Nautical Mile
NRA	Navigational Risk Assessment
NtMs	Notice to Mariners
OIMD	Operation, Inspection, Maintenance and Decommissioning Strategy
OoS	Out of Service
OREI	Offshore Renewable Energy Installation
RCZ	Recommended Clearance Zone
RP	Reference Point
Ro-Ro	Roll-on/Roll-off
SAR	Search and Rescue
SHEPD	Scottish Hydro Electric Power Distribution
SOLAS	Safety of Life at Sea
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UTC	Universal Time Coordinated
VTS	Vessel Traffic Service
µT	microtesla

1 INTRODUCTION

This high-level Navigational Risk Assessment (NRA) provides an appraisal of navigational risk associated with the proposed Eriskay to Barra cable (EB-3) installation ("the Project"). The cable will be constructed between the landfalls at Eriskay (South Uist) and Barra in the Scottish Outer Hebrides. The cable will be approximately 10 kilometres (km) in length. A "high-level" NRA approach has been utilised as being suitable to assess the navigation and shipping risk posed by this Project due to the short length of the proposed cable and therefore limited Zone of Influence of this Project.

A targeted Marine Traffic Survey (MTS) has been undertaken to describe the relevant shipping and navigation and marine traffic baseline, as understood through desk-based review, and is presented in Section 3. The high-level Navigation Risk Assessment (NRA) uses a Formal Safety Assessment (FSA) approach to identify and assess the risks to shipping and navigation presented by the project activities. This NRA should be read in conjunction with the following documents that together comprise the submission to the regulator:

- Eriskay - Barra Subsea Cable Replacement Project Description (Briggs, 2025);
- Marine Environmental Appraisal (MEA) (Xodus Document No. A-101090-S00-A-REPT-001);
- Marine Licence Application Form;
- European Protected Species Inshore Licence Application Form;
- Basking Shark Derogation Licence Application Form;
- Marine Construction Environmental Management Plan (CEMP, Xodus Document No. A-101090-S00-A-PLAN-001);
- Outer Hebrides Fisheries Liaison Mitigation Action Plan (FLMAP)
- How SHEPD co-exists with other marine users document[1];
- Operation, Inspection, Maintenance and Decommissioning Strategy (OIMD); and
- Cost Benefit Analysis Summary Report.

1.1 Project Overview

Scottish Hydro Electric Power Distribution plc (SHEPD) holds a licence under the Electricity Act 1989 for the distribution of electricity in Scotland. It has a statutory duty to provide an economic and efficient system for the distribution of electricity and to ensure that its assets are maintained to provide a safe, secure and reliable supply to customers.

As part of a routine inspection campaign, SHEPD have identified that the current lice subsea cable between Eriskay (South Uist) and Barra in the Scottish Outer Hebrides is in poor condition and requires replacement to safeguard the supply of power to local communities. Currently, there are two subsea power cables between the Eriskay and Barra landfalls which require augmentation to ensure security of supply, these are:

- The Eriskay-Barra 1 (EB-1) which was installed in 1979 and is out of service (OoS); and
- The Eriskay-Barra 2 (EB-2) an 11 kilovolt (kV) cable which was installed in 2013, which has been found to be in poor external condition.

[1] *https://www.ssen.co.uk/globalassets/about-us/projects-and-live-works/subsea-cables/how-shepd-co-exists-with-other-marine-users.pdf.*

SHEPD intends to augment the existing EB-2 cable through the installation of a new 33 kV subsea cable (EB-3) which will initially operate at 11 kV. This will improve the resilience of the network and deliver network security, as replacement of cables before they fail is essential to ensure a continued electricity supply to customers connected to these circuits. The proposed subsea cable will be installed within the proposed cable corridor, as illustrated in Figure 1-1. Full project description can be found in the Eriskay - Barra Subsea Cable Replacement Project Description (Briggs, 2025).

The proposed EB-3 cable will be constructed between the landfalls at Eriskay and Barra to tie into existing distribution networks (Figure 1-2). The final cable route has not yet been determined. As such, to provide flexibility for final route engineering, this NRA considers an approximately 5.1 km^2 proposed cable corridor, within which the Eriskay to Barra cable will be located. The final route selection will be based on further detailed route engineering and design parameters, while taking environmental and other constraints into account.

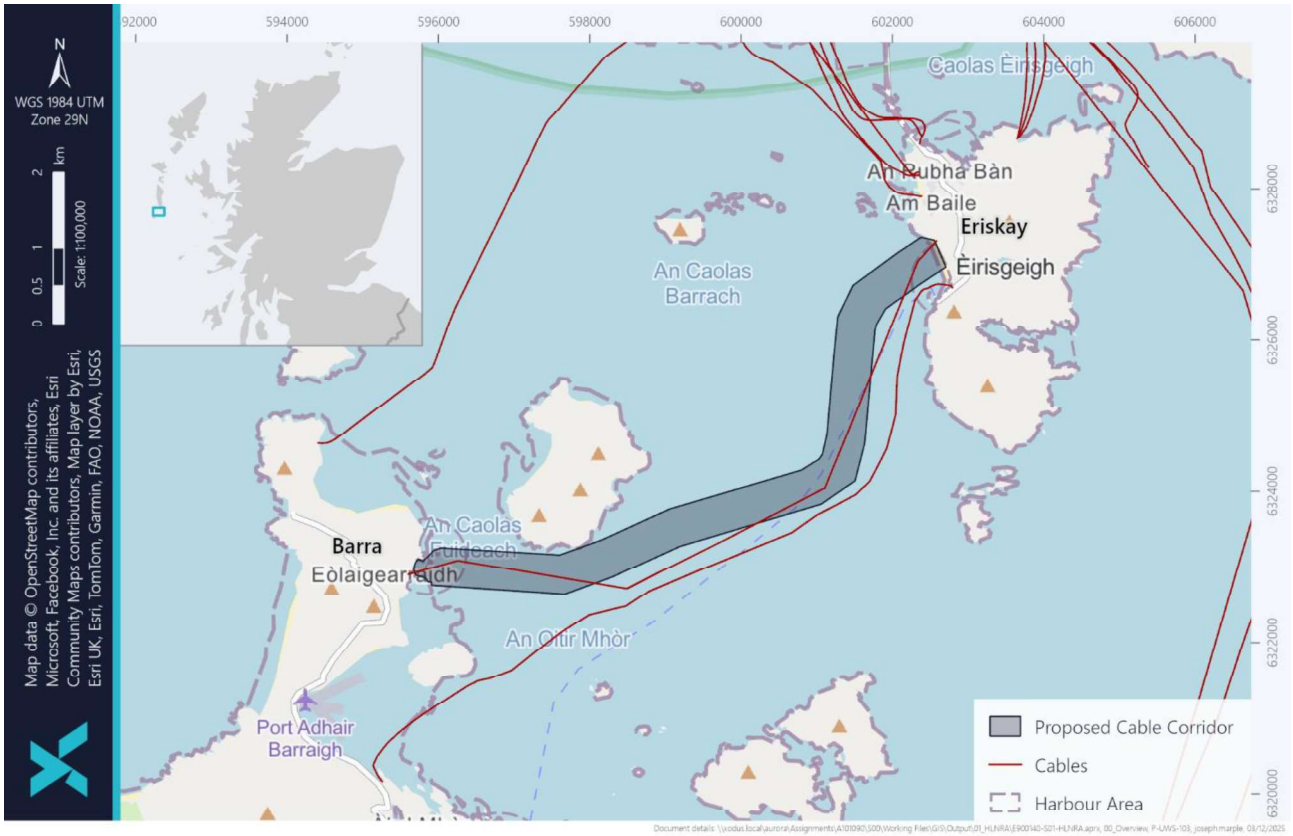


Figure 1-1 Eriskay to Barra Proposed Cable Corridor

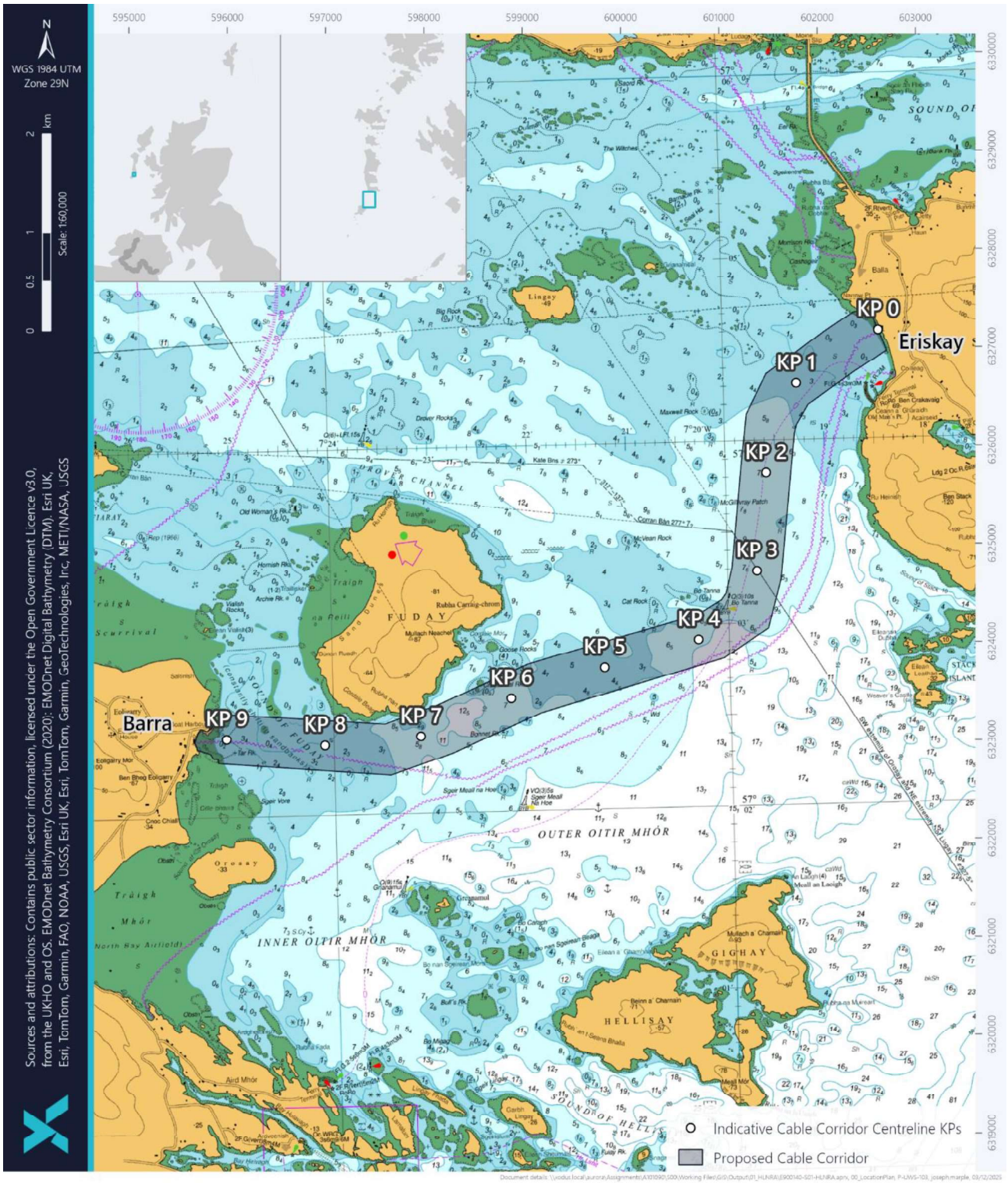


Figure 1-2 Eriskay to Barra Proposed Cable Corridor with Admiralty Chart 2770 and Indicative Cable Centreline KPs

1.2 Embedded Mitigation

Certain risk control or mitigation measures are embedded in the Project design as adherence from all operators to standard industry best practices, which is fundamental to how the Project will be executed. Details of the embedded mitigation which SHEPD are committed to implementing, and hence has been considered by this NRA, are presented in Table 1-1. All embedded mitigation will be included within the marine CEMP (Xodus Document No. A-101090-S00-A-PLAN-001).

During the high-level NRA, all proposed mitigation is considered when assessing the significance of risks.

Table 1-1 Embedded Mitigation and Principal Industry Best Practices Relevant to the Proposed Activities.

MEASURE	DETAILS
Avoidance of Trawling and Anchoring	In line with guidance provided by the United Kingdom Hydrographic Office (UKHO), the International Maritime Organisation (IMO) and the Maritime and Coastguard Agency (MCA) within the Mariner's Handbook (NP100), and Marine Guidance Note (MGN) 661, SHEPD recommend that vessels should avoid demersal fishing and anchoring in proximity to subsea cables.
Production of a Marine CEMP	The Marine CEMP is designed to provide a consolidated point of reference for SHEPD and their marine contractors. It ensures all embedded and additional mitigation measures identified by the MEA and supporting documents are effectively disseminated to and implemented by the Project team during Project activities, thus ensuring that any potential environmental impacts are minimised.
All Project personnel will be trained and informed of their responsibility to implement the environmental and ecological mitigation outlined in the Marine CEMP	Toolbox talks, inductions, and awareness notices will be used to disseminate this information among all relevant personnel.
A Fisheries Liaison Officer (FLO) will be employed to manage interactions between cable installation vessels, personnel, equipment and fishing activity. This will be managed through the Outer Hebrides FLMAP	Employment of a FLO will ensure all commercial fisheries operators in the vicinity of the Project will be proactively and appropriately communicated with in terms of the proposed cable installation activities.
Consultation with commercial fishing stakeholders to identify acceptable and feasible mitigation options with the aim of	SHEPD will, in consultation with commercial fishing stakeholders, work towards identifying acceptable and feasible mitigation options with the aim of minimising any potential effects on commercial fishing associated with the

MEASURE	DETAILS
minimising potential effects on commercial fishing	replacement of submarine electricity cable. There are various options available to mitigate the risks, including: • Continuing effective positive liaison with commercial fishing stakeholders through the pre-installation, installation and operational phases of any cable replacement; • Continued employment of FLO/Fishing Industry Representative (FIR) services until the completion of the replacement works; • Ensuring contractors comply with the contractor's obligations outlined above so as to minimise any interference to commercial fishing activities; • Managing the cable replacement works so as to minimise any potential effects on the marine environment, habitats and commercial fishing; • Raising awareness of the danger of fishing in the vicinity of submarine cable; • Adopting a hierarchical approach to submarine cable protection, taking account of sea users concerns; • Organising an installation phasing workshop (if new cable is required) to inform commercial fishermen of planned activities; • Organising installation schedules (if new cable is required) as far as is practicably possible in order to reduce the combined loss of fishing area associated with safety zones; • Distributing weekly notice of operations; • Providing information in plotter format to enable fishermen to easily interpret the information; and/or • Scouting surveys to identify potting areas and any other relevant static gear areas.
Notice to Mariners (NtMs), local notifications to marine users, Kingfisher bulletins, Radio Navigational Warnings, and/or broadcast warnings will be promulgated in advance of any proposed works. The notices will include the time and location of any work being carried out, and emergency event procedures.	Ensure navigational safety and minimise the risk and equipment snagging. Notices will also be issued if any OoS cables are removed or moved and chart updates will be provided.
Compliance with International Regulations for the Prevention of Collision at Sea (IRPCS) (IMO, 1972) and the International Regulations for the Safety of Life at Sea (SOLAS)	IRPCS are the international standards designed to ensure safe navigation of vessels at sea. All installation vessels will adhere to these rules, including displaying appropriate lights and shapes. SOLAS is an international maritime treaty which sets

MEASURE	DETAILS
	minimum safety standards in the installation, equipment and operation of merchant ships. The convention requires signatory flag states to ensure that ships flagged by them comply with at least these standards. In relation to the Project its compliance will ensure navigational safety.
As built survey data will be provided to the UKHO and Kingfisher for inclusion on Admiralty Charts and the Kingfisher Information Service – Offshore Renewable and Cable Awareness (KIS-ORCA) charts	Ensure navigational safety and minimise the risk of equipment snagging.
Engagement with Shipping and Navigation Consultees	Ongoing consultations with ports and harbour authority (Comhairle nan Eilean Siar) ensure continued awareness and communication of installation and harbour specific details relevant to minimising disruption. Ongoing consultation with fisheries as detailed within the Outer Hebrides FLMAP to discuss the potential impacts as a result of the installation activities. Engagement with ferry operator Caledonian MacBrayne (CalMac) and regular runners ensures awareness of the installation details which minimises disruption. Installation maintenance and decommissioning schedules arranged to minimise impact on ferry schedules. This may extend to working in night-time hours where practicable.
Guard Vessels and Recommended Clearance Zone (RCZ)	A guard vessel or small support vessel, marshalling a 500 m RCZ may be used during the installation campaign where a potential risk to the asset or danger to navigation has been identified. The requirement for a guard vessel will be considered through consultation with the Comhairle nan Eilean Siar Harbour Authority, ferry operator CalMac and Installation Contractor. The RCZ may be reduced to 250 m (or other agreed distance) for the CalMac Ferries and vessels carrying Comhairle nan Eilean Siar Harbour Authority pilots. This will be implemented through ongoing communications and agreements between the Comhairle nan Eilean Siar Harbour Master, the CalMac ferry operator, SHEPD and the cable installation contractor.

2 METHODOLOGY

2.1 Introduction

This high-level NRA uses the baseline shipping data from the MTS to inform a high-level desk-top FSA process which identifies and assesses hazards to all relevant navigation or shipping activities, from the Project. The process provides a hazard log which ultimately demonstrates that suitable risk management measures have been applied to the development and that risks are both reduced to as low as reasonably practicable (ALARP) and trackable.

2.2 Baseline Conditions

2.2.1 Marine Traffic Study

Relevant baseline marine traffic conditions have been established by undertaking a review of historic Automatic Identification System (AIS) data for a 10 nautical mile (NM) wide corridor around the proposed cable corridor (the study area). The IMO requires that all ships of ≥ 300 gross tonnage engaged on international voyages, cargo vessels of ≥ 500 gross tonnage not engaged on international voyages, and all passenger ships regardless of size built on or after 1st July 2002, are fitted with an AIS. All European Union (EU) registered fishing vessels of length 15 m and above are required to carry AIS equipment by EU directive. Smaller fishing vessels (below 15 m) as well as recreational craft are not required to carry AIS, although a proportion does so voluntarily. As such smaller vessels are likely to be underrepresented in the AIS data.

AIS data was used to assess the patterns and intensity of shipping activity in the vicinity of the marine installation corridor. AIS records were acquired for a full year between the dates 1st November 2024 and 31st October 2025 23:59 Universal Time Coordinated (UTC), and supplied by Kpler (industry standard commercial AIS data supplier) with all standard parameters (longitude, latitude, vessel Maritime Mobile Service Identity (MMSI) number, status, speed, course, heading and timestamp) and the following additional parameters:

- Deadweight tonnage (DWT);
- Vessel length;
- Vessel draught;
- Vessel type;
- Vessel name;
- Previous port; and
- Next port.

AIS data was received in a raw, point-based table format in multiple comma-separated values (CSV) files and quality checked. The entire point-based dataset was subsequently converted to vessel tracks using in-house developed Python tools that use the unique MMSI, journey information (previous port and next port) and the timestamp associated with each individual AIS record. Vessel tracks were created where each AIS record was 'connected' by a line to another that shares the same MMSI and vessel type and that falls under a specified time and distance threshold. In this case, sequential AIS point records were connected where the intervening time or distance did not exceed 120

minutes or 20 miles, respectively. These thresholds were set to strike a balance between ensuring the connectivity of valid points across the assessment area so that a singular journey is not broken into multiple lines and therefore misrepresenting the volume of transits or trajectories, and accurately reflecting the direction or route of a transect. Vessel density grids for the wider area were produced by overlaying a 0.5 square kilometres (km^2) hexagonal grid and determining the density of tracks within each cell. The tracks are subsequently 'reattached' to the ship-specific attribute data base to enable further analysis. Each track line or trajectory will have a start and end time and date taken from the minimum and maximum timestamp value for the range of AIS points associated with that track line, allowing for temporal analysis of vessel distributions. Vessels were determined to be transiting during the day where the journey end time was between 06:30 (06:30 AM) and 18:30 (06:30 PM) and during the night where the journey end time was between 18:30 (06:30 PM) and 06:30 (06:30 AM).

2.3 Consultation

Stakeholder meetings have been held with local ferry operators (CalMac) and fishing organisations (Western Isles Fisheries Association and Scottish Fishermen's Federation) over the course of 2025, to discuss the Project and inform of future works. Follow-on meetings were held with 29th January 2026 with representatives from the Western Isles Fisherman Association and CalMac and on 10th February 2026 with the harbour masters from the Comhairle nan Eilean Siar Harbour Authority to understand key concerns to navigation from the Project, which has supported the assessment of impacts. The outputs from the consultation meetings have been considered in preparation of this NRA, but overall the stakeholders were content with the assessment carried out and the conclusions reached. Consideration of the feedback received on potential future dredging required for Eriskay ferry pier development, which is outwith the scope of the NRA, is discussed in Section 12.1.1 of the MEA (Xodus Document No. A-101090-S00-A-REPT-001).

2.4 Formal Safety Assessment

2.4.1 Introduction

The FSA process provides a structured and systematic method for evaluating and controlling risk within a defined framework. The process is implemented using a classic risk matrix approach broadly in line with the IMO FSA Guidelines (IMO, 2018) and the MCA Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI).

This approach is qualitative and comprises the following principal elements:

- Hazard / impact identification;
- Identification of existing risk control measures;
- Risk assessment;
- Identification of additional risk control measures; and
- Cost benefit considerations.

The outcome of these elements is the formulation of recommendations to inform decision-making for all relevant parties. Further detail on each element is provided below.

2.4.2 Hazard/Impact Identification

Considering the Project components and activities, baseline information provided in the MTS, expert judgement/industry experience, a list of all relevant hazards, as well as their worst potential outcomes is compiled. The hazards are categorised according to Project phase with the operational phase referring to the condition where the cable is installed, and sea surface activities have ceased. Installation, maintenance, and decommissioning phases translate to the presence of vessels limited in their manoeuvrability across the installation corridor for the duration of the operations.

2.4.3 Identification of Existing Risk Control Measures

All existing risk control measures are identified such that they can be incorporated into the risk assessment process. These include mandatory requirements and good industry practice as well as Project specific measures that are prescribed / predefined as forming part of the Project design.

2.4.4 Risk Assessment

Each impact is individually evaluated against specific criteria and assigned categories for severity of the hazardous outcome consequences and likelihood or frequency of the occurrence. The definitions used in the FSA to evaluate the consequence and frequency of impacts are shown below in Table 2-1 and Table 2-2. Note that there is no established consensus for risk matrix category definitions within the IMO, MCA or across wider industry. The categories applied here are considered appropriate for this NRA.

Table 2-1 Severity of Consequence of Hazard/Impact Criteria.

SEVERITY / MAGNITUDE	CRITERIA DESCRIPTION
High	Loss of a crew member, or multiple serious injuries / Major/Severe damage to infrastructure or vessel / Operations / activities halted indefinitely
Medium	Serious injury to person / Notable damage to infrastructure or vessel / Protracted operational delays
Low	Minor injury(s) to person / Minor/Local damage to equipment or vessel / Minor operational delays
Negligible	No significant operational impacts

Table 2-2 Likelihood Criteria.

LIKELIHOOD	CRITERIA DESCRIPTION
Remote	Never occurred during SHEPD's activities but has been known to occur in the wider industry.
Unlikely	Has occurred in SHEPD's activities in the past but as an isolated incident under exceptional circumstance.
Occasional	Has occurred on more than one occasion during SHEPD's activities in the past.
Likely	Occurs regularly during SHEPD's activities.

The likelihood and consequence categories are combined for each hazard/impact using the risk matrix shown in Table 2-3, which is used to derive a risk tolerability level of either Unacceptable, Tolerable or Broadly Acceptable, with unacceptable or tolerable risks being considered to be significant in Environmental Appraisal terms. Definitions of each risk tolerability level are provided in Table 2-4.

Table 2-3 Risk Matrix.

FREQUENCY/ LIKELIHOOD					
	Likely	Broadly Acceptable	Tolerable	Unacceptable	Unacceptable
	Occasional	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
	Unlikely	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
	Remote	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable
	-	Negligible	Low	Medium	High
SEVERITY OF CONSEQUENCE / MAGNITUDE					

Table 2-4 Tolerability Definitions.

TOLERABILITY	DEFINITION
Broadly Acceptable (Low Risk - not significant)	Generally regarded as acceptable and adequately controlled. At these risk levels the opportunity for further reduction is limited.
Tolerable if ALARP (Moderate Risk - significant)	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate mitigation measures are in place, residual risks are ALARP and that risks are periodically reviewed to monitor if further controls are appropriate.
Unacceptable (High Risk - significant)	Generally regarded as unacceptable whatever the level of benefit associated with the activity. Significant risk mitigation or design modification required to reduce to tolerable (ALARP).

2.4.5 Identification of Additional Mitigation Measures

Where risks are assessed as being unacceptable or tolerable after factoring in the embedded mitigation measures already identified, further additional risk mitigation measures are considered and identified where necessary and practicable.

2.4.6 Cost-benefit Considerations

To formulate recommendations for decision-making, any additional risk mitigation measures identified are subjected to a qualitative cost-benefit comparison in order to justify the measure and establish a residual risk categorisation and basic ALARP position.

2.4.7 Risk Assessment Table/Hazard Log

The NRA output has been presented in a table, such that the hazards for each of the development scheme phases and their associated mitigation measures (embedded and additional) are captured to provide a single auditable hazards and effects log. The output of the assessment can be seen in Table 4-1.

3 MARINE TRAFFIC STUDY

This section covers the relevant shipping and navigation baseline within the study area, providing a summary of key navigational features and shipping activity as determined from analysis of AIS data. Analysis of shipping and navigation is important, due to potential interactions between existing vessel traffic and the proposed cable, particularly during the installation phase.

3.1 Key Navigational Features

An overview of all relevant key navigational features is provided in the following sections and presented on Figure 3-1.

3.1.1 Ports and Ferry Routes

Aird Mhòr is the terminal for the Sound of Barra ferry, across to Eriskay in the Western Isles of Scotland. The service commenced in March 2004, enabling cars to be driven, for the first time, all the way from Vatersay in the south, to Port of Ness at the northern tip of Lewis[2].

The terminal for the Sound of Barra ferry is situated at Ceann a' Ghàraidh on Eriskay. To accompany the building of the Eriskay Causeway, new harbours and slipways were built at Aird Mhòr on the north east of Barra, and at Ceann a' Ghàraidh on Eriskay's east coast. Both ferry ports are operated by Caledonian MackBrayne (CalMac), and are located in the Comhairle nan Eilean Siar Statutory Harbour Authority area.

The direct ferry service across the Sound of Barra has been operated by CalMac since 2007 using the MV Loch Alainn (MMSI: 232003073). The Loch Alainn has the capacity for 150 passengers and 24 cars. The MV Loch Bhrusda is the temporary replacement vessel when the Loch Alainn is being maintained.

The proposed cable replacement corridor start and endpoints intersect the harbour areas of Ceann a' Ghàraidh, Eriskay, and Eoligarry, Barra, respectively. The Barra (Aird Mhòr) to Eriskay (Ceann a' Ghàraidh) ferry route intersects the northern half of the proposed cable corridor Figure 3-1. As a result, vessel traffic within the study area primarily consists of passenger vessels operating this service. It comprises 58.5% of the track lines in the AIS data (see Section 3.2).

3.1.2 Cables and Navigational Aids

As shown in Figure 1-1, multiple submarine cables run within and near the proposed cable corridor. Among them is the SHEPD live cable EB-2 and the OoS EB-1 cable (ESCA), the subject of these replacement works. Additionally, there is also the active British Telecoms (BT) HIE S 1.18B telecommunications cable which is approximately 80 m from the proposed cable corridor near the Eriskay landfall.

[2] https://www.ports.org.uk/port.asp?id=756

The Bo Tanna East Cardinal Buoy intersects the mid-point of the proposed cable corridor as an aid for navigation.

No charted anchorage areas are located within, or in the immediate vicinity of the proposed cable corridor.

3.1.3 Wrecks and Obstructions

Wreck locations were identified using Marine Themes Vector data layers from Emapsite and the National Record of the Historic Environment (Canmore) – Maritime records of wrecks, losses, and obstructions. The unverified Canmore wreck 'Unknown 1876', National Record of the Historic Environment (NRHE) ID 326110, is the closest at approximately 550 m north-west of the northern section of the proposed cable corridor (Figure 3-1, MEA: Xodus doc ref: A-101090-S00-A-REPT-001). It is worth mentioning that the Canmore dataset has a relatively low threshold for what is included and can often overestimate. Additionally, the provided locations do not resemble legal extents of wrecks.

The closest UKHO dataset wreck is unnamed and categorised as a "wreck showing any portion of hull or superstructure". This wreck is located approximately 4,000 m north-west of the northern section of the proposed cable corridor (Figure 3-1). The accuracy of the UKHO dataset is considered greater than that of the Canmore dataset.

Neither the UKHO nor the Canmore dataset display any wreck or obstruction which intersects the proposed cable corridor (Figure 3-1). Geophysical survey data has confirmed no wrecks have been recorded within the cable corridor (Aspect, 2025).

Figure 3-1 Key Navigational Features.

3.2 Baseline Shipping Activity

3.2.1 Overview and Temporal Changes

A total of 6,475 and 1,737 vessel tracks were recorded within the study area and the proposed cable corridor between the dates 1st November 2024 and 31st October 2025, respectively (Table 3-1). These tracks were associated to 590 unique vessels, and 501 unique routes, based on previous and next port information captured in the AIS data. The busiest routes were associated with the ferry service operated by the passenger vessels Loch Alainn and Loch Brushda with 1,531 and 93 tracks respectively intersecting the proposed cable corridor, clearly visible in Figure 3-5.

Some seasonal variation is observed, with autumn and winter recording higher track line counts within both the study area and the proposed cable corridor, when compared to spring and summer. Within the study area, vessel activity recorded an average of 539 tracks per month, with November and December being the quietest months (Figure 3-3). In the proposed cable corridor, vessel activity averaged 145 tracks per month, with November and December again being the quietest months (Figure 3-4).

2,363 tracks within the study area were observed during summer months, accounting for 36.5% of total track line counts across the study year. Within the proposed cable corridor specifically, 508 tracks were recorded during the same period accounting for 29.2% of total track line counts across the study year. Autumn and winter observed a slight decrease in the number of vessel tracks, with both seasons accounting for 35.2% (2,279 tracks) and 41.0% (712 tracks) of the total number of tracks within the study area and the proposed cable corridor, respectively. The difference in track count between day (06:30 – 18:30) and night (18:30 – 06:30) is illustrated in Figure 3-2 and Table 3-1. Track counts recorded during the day are consistently higher across all seasons, most notably for summer with 86.2% (2,036 tracks) of activity during the day compared to 13.8 % (327 tracks) at night-time within the study area. Within the proposed cable corridor, the summer season saw a majority of 95.3% (484 tracks) activity during the day compared to 4.7% (24 tracks) at night-time.

In terms of vessel types, passenger vessels were the most frequent within both the study area and the proposed cable corridor. Passenger vessels were the most dominant vessel type during autumn, winter and spring whilst the summer season displays an increase in recreational vessels, particularly from May to August for both the study area and the proposed cable corridor. Particularly within the proposed cable corridor, passenger vessels represent an average of 93.9% of total track lines across all months (Figure 3-4).

July was the busiest month for the study area (952 tracks) whilst May was the busiest month for the proposed cable corridor (196 tracks). The day with the highest vessel activity within the study area was March 25, 2025, when 54 vessel tracks were recorded. While the busiest day for the proposed cable corridor was on 19th May 2025 and 7th June 2025 which both recorded 10 tracks.

Table 3-1 Vessel Tracks Per Season and Day/Night.

SEASON	TRACK LINE COUNTS					
	Study Area			Proposed Cable Corridor		
	Day	Night	Total	Day	Night	Total
Autumn	904	237	1,141	316	31	347
Winter	806	332	1,138	281	84	365
Spring	1,281	552	1,833	377	140	517
Summer	2,036	327	2,363	484	24	508
Grand Total	5,027	1,448	6,475	1,458	279	1,737

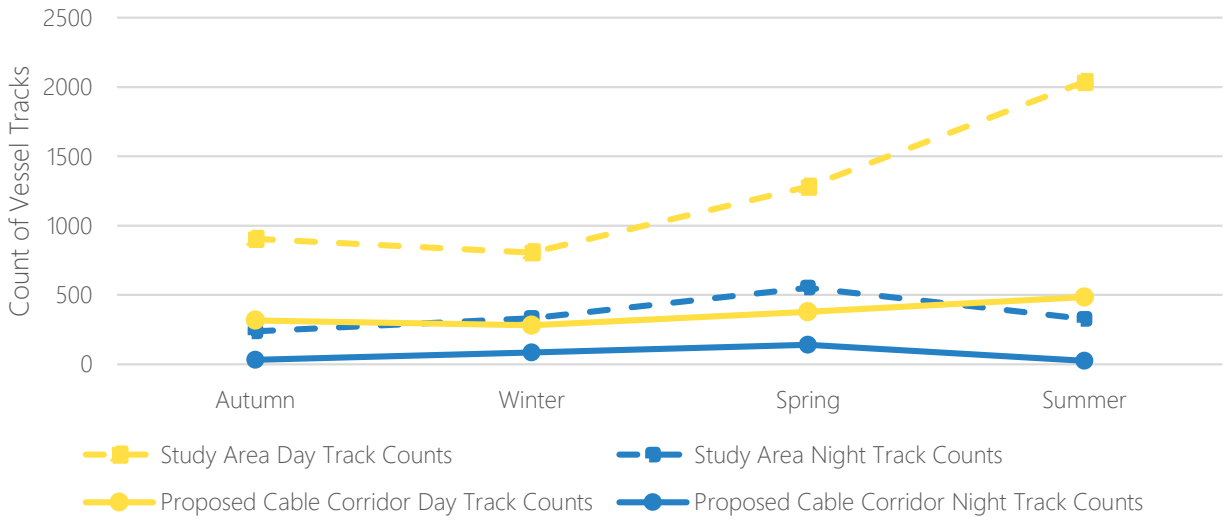
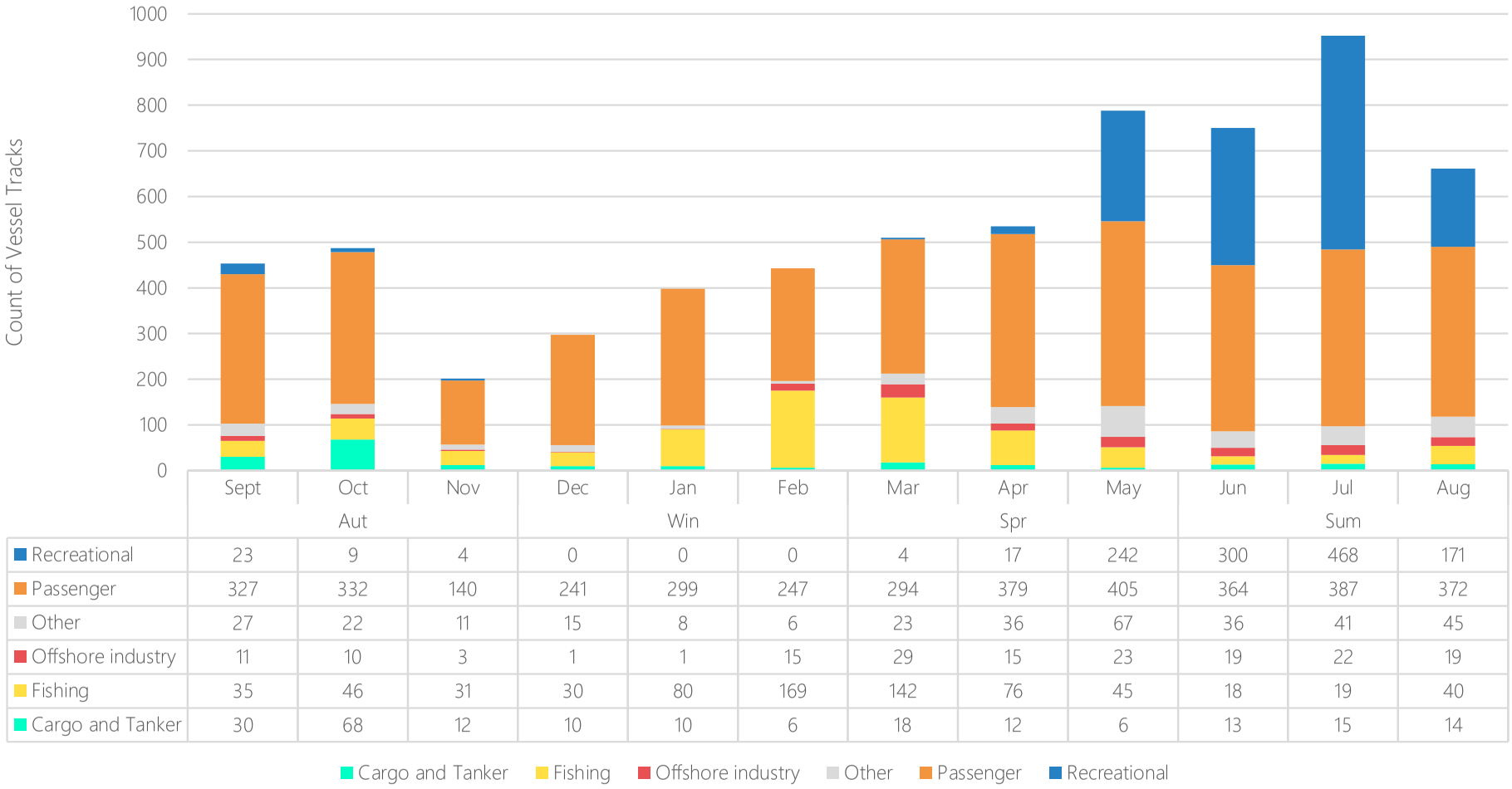


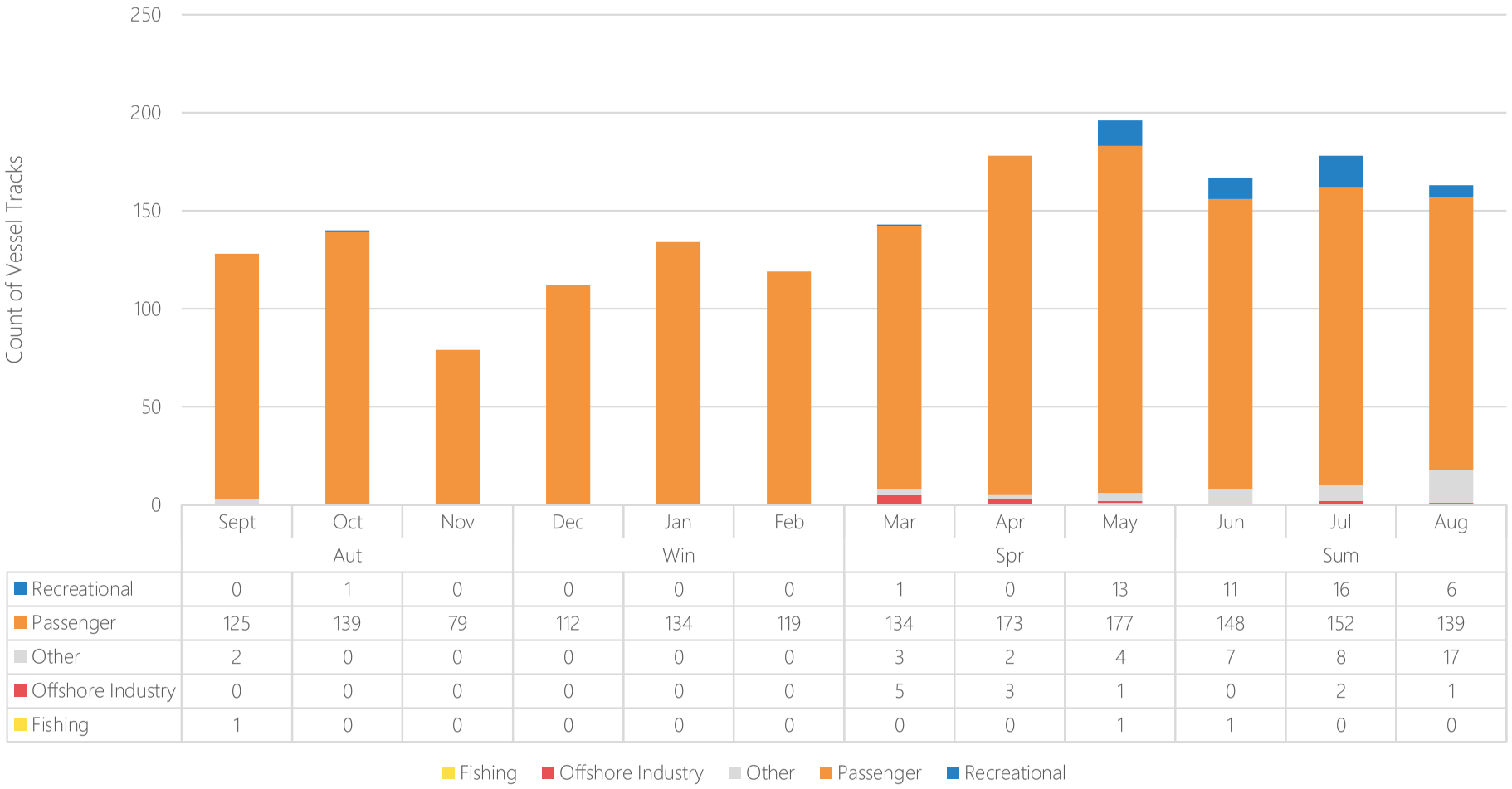
Figure 3-2 Vessel Tracks Per Season and Day/Night.

In total, fewer vessels are observed during the night (18:30 – 06:30), accounting for 22% and 16% of the total number of tracks within the study area and proposed cable corridor, respectively. Overall, this represents a 55% reduction in vessels traffic during the night within the study area and a 68% reduction within the proposed cable corridor (Figure 3-6). All vessel types observed a reduction in tracks during the night, with passenger vessels decreasing from a total of 6,485 during the day to 1,727 during the night.



	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
		Aut			Win			Spr			Sum	
Recreational	23	9	4	0	0	0	4	17	242	300	468	171
Passenger	327	332	140	241	299	247	294	379	405	364	387	372
Other	27	22	11	15	8	6	23	36	67	36	41	45
Offshore industry	11	10	3	1	1	15	29	15	23	19	22	19
Fishing	35	46	31	30	80	169	142	76	45	18	19	40
Cargo and Tanker	30	68	12	10	10	6	18	12	6	13	15	14

Figure 3-3 Seasonal and Monthly Summary of Vessel Types Within the Study Area.



	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
		Aut			Win			Spr			Sum	
Recreational	0	1	0	0	0	0	1	0	13	11	16	6
Passenger	125	139	79	112	134	119	134	173	177	148	152	139
Other	2	0	0	0	0	0	3	2	4	7	8	17
Offshore Industry	0	0	0	0	0	0	5	3	1	0	2	1
Fishing	1	0	0	0	0	0	0	0	1	1	0	0

Figure 3-4 Seasonal and Monthly Summary of Vessel Types Within the Proposed Cable Corridor.

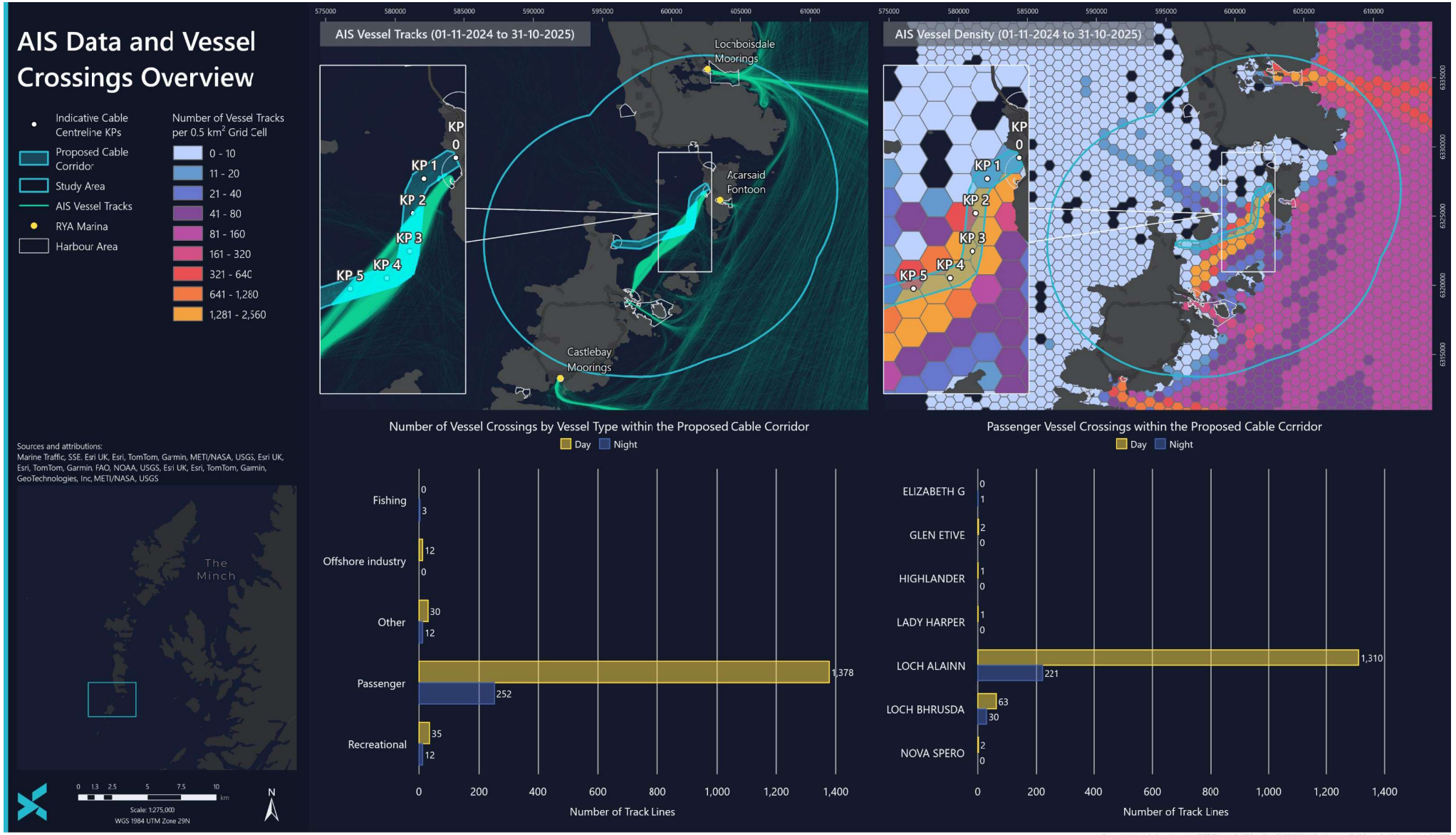


Figure 3-5 AIS Data Summary, Including Vessel Tracks, Vessel Densities, and Vessel Type Counts.

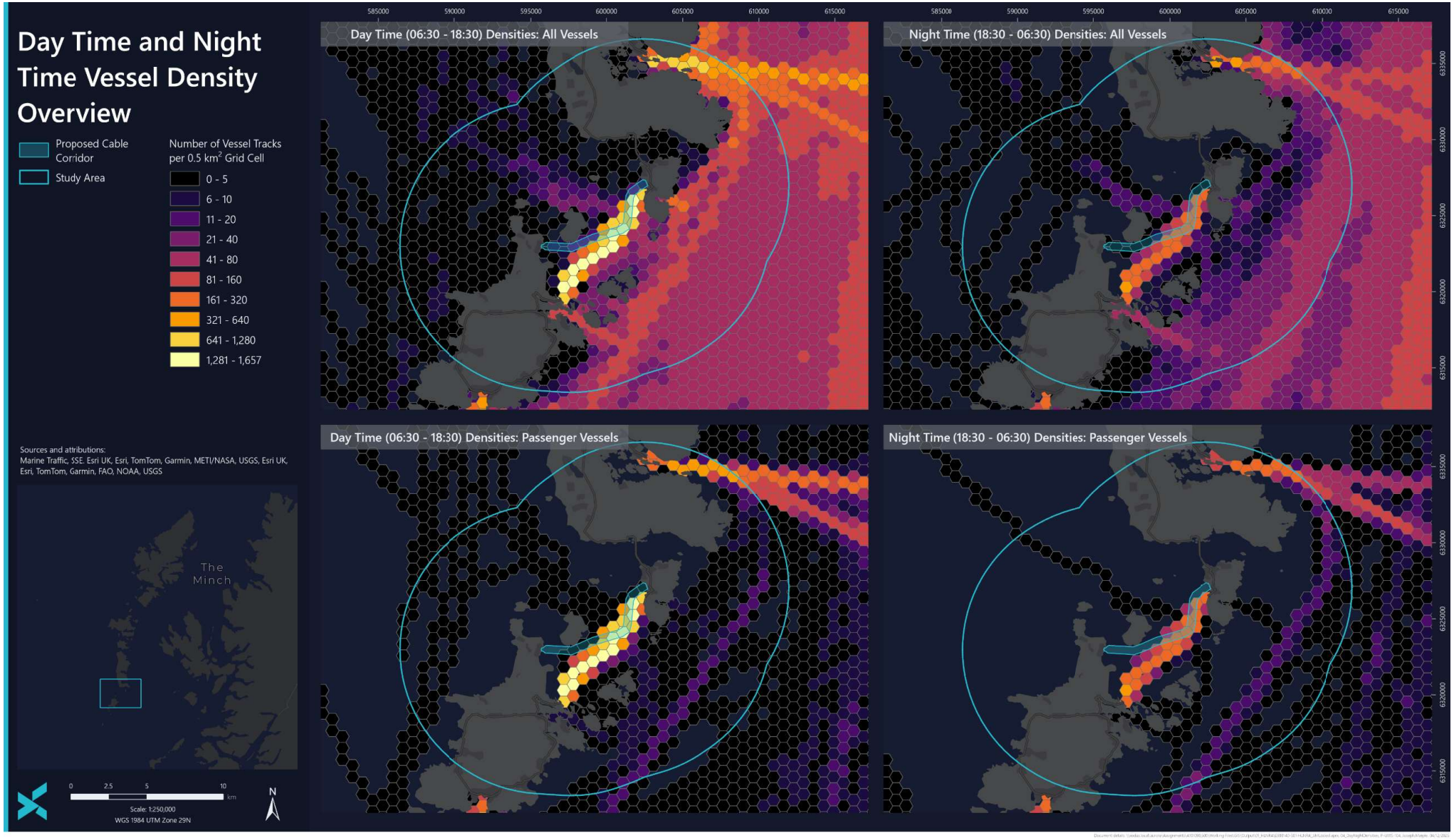


Figure 3-6 Day and Night Vessel Densities.

3.2.2 Vessel Type

A breakdown of the various vessel types occurring within the study area and proposed cable corridor is provided in Table 3-2, and the track line densities of each vessel category are provided in Figure 3-7. An overview of each vessel category is provided below.

Passenger Vessels

Passenger vessels are the most frequently observed vessels within both the study area and the proposed cable corridor, accounting for 58.5 and 93.9% of total tracks across each area. Roll-on/Roll-off (Ro-Ro)/Passenger vessels were the most frequently occurring vessel type within the passenger vessel category. Within the study area they accounted for 99.4% of passenger vessel tracks in daytime and 98.7% in night-time tracks. A similar trend is present for the proposed cable corridor, where Ro-Ro/Passenger Ship accounted for 99.6% of passenger vessel tracks both during the daytime and night-time tracks. Within the study area a 74.4% reduction in journeys during the night was observed, compared to the day for passenger vessels, and an 81.7% reduction was also observed for tracks that crossed the proposed cable corridor (Table 3-2).

The Loch Alainn vessel accounted for 93.9% of the total number of tracks crossing the proposed cable which combined made a total of 1,531 crossings during the study period (Table 3-3). Of these 1,531 tracks, 1,310 (85.6%) occurred during the day and 221 (14.4%) during the night. Loch Alainn has a length of 43.54 m and a DWT of 119 t.

Cargo Vessels and Tankers

Cargo vessels and tankers are the second least frequently observed vessel types, accounting for 3.3% and 0.0% of vessel tracks within the study area and proposed cable corridor, respectively. During the daytime, the predominant sub-category is cargo vessels, which account for 72 tracks (62.1%) in the study based on the total tracks in the cargo and tanker vessel category. A significant proportion of night-time tracks within this category (Table 3-2) is also attributed to cargo vessels, representing 79 tracks (80.6%) in the study area.

Fishing Vessels

Fishing vessels accounted for 11.3% and 0.2% of vessel tracks within the study area and proposed cable corridor, respectively. These tracks were predominantly observed during the daytime in the study area, with 405 tracks (8.1%). Conversely, the majority of 3 tracks (1.10%) were observed in the night-time in the proposed cable corridor. Nonetheless, it should be noted that the AIS dataset categorises fish carriers, fishery research vessels, and fishery patrol vessels under the fishing category, despite these vessels not engaging in commercial fishing activities. A total of 94 tracks (12.9% of all fishing tracks) from these vessel types were recorded within the study area.

Fishing tracks intersected the proposed cable corridor primarily between KP 3 and KP 6, and the tracks within the corridor are straight in nature, suggesting that the vessel are in transit, and not actively engaged in fishing. It is worth noting that due to their size, smaller inshore vessels are less likely to have AIS equipment installed, and therefore may be under-represented in the data.

Offshore Industry Vessels

Offshore industry vessels are the least frequently observed, accounting for 2.6% and 0.7% of vessel tracks within the study area and the proposed cable corridor, respectively, and are associated with seven individual vessels. The most frequently observed vessel, with 139 tracks (77.2% of the total offshore industry tracks), was Steadfast (MMSI: 232002180). Steadfast is a high-speed craft offshore vessel with a length of 14 m and was observed almost exclusively during the night. High-speed craft were the most common sub-category within the offshore industry vessel category, comprising 162 daytime tracks (99.4%) in the study area and 12 daytime tracks (100%) in the proposed cable corridor.

Recreational Vessels

Recreational vessels were also observed, accounting for 19.1% and 2.8% of vessel tracks within the study area and the proposed cable corridor, respectively. The leading sub-category was sailing vessels, which accounted for 66.5% and 39.6% of daytime tracks within the recreational category in the study area and the proposed cable corridor, respectively. It's worth noting that due to their size recreational vessels are less likely to have AIS equipment installed and therefore may be under-represented in the data.

Other Vessels

Other vessels represent the second most frequent AIS vessel category, accounting for 5.2% and 2.5% of vessel tracks within the study area and the proposed cable corridor, respectively. Within the study area, most of these vessels were observed during the daytime, with 252 tracks (74.8% of the total other vessel tracks). Similarly, in the proposed cable corridor, tracks were recorded mainly during the daytime, with 31 tracks (72.1%) recorded during the day compared to 12 tracks (29.9%) at night.

Table 3-2 Vessel Categories by Day/Night within the Study Area and Proposed Cable Corridor.

VESSEL CATEGORY	VESSEL TYPE	PROPOSED CABLE CORRIDOR							STUDY AREA						
		Day Track Line Counts		Night Track Line Counts		Percentage Change from Day to Night	Total	Proportion of Total Track Lines	Day Track Line Counts		Night Track Line Counts		Percentage Change from Day to Night	Total	Proportion of Total Track Lines
		Track Count Day (06:30-18:30)	Proportion of Track Lines	Track Count Night (18:30-06:30)	Proportion of Track Lines				Track Count Day (06:30-18:30)	Proportion of Track Lines	Track Count Night (18:30-06:30)	Proportion of Track Lines			
Passenger	Passenger	6	0.4%	1	0.4%	-83.3%	7	0.4%	32	1.1%	3	0.4%	-90.6%	35	0.5%
	Passenger Ship	0	0.0%	0	0.0%	N/A	0	0.0%	12	0.4%	2	0.3%	-83.3%	14	0.2%
	Ro-Ro/Passenger Ship	1,373	99.6%	251	99.6%	-81.7%	1,624	93.5%	2,971	98.5%	767	99.4%	-74.2%	3,738	57.7%
Passenger Total		**1,379**	**94.6%**	**252**	**90.3%**	**-81.7%**	**1,631**	**93.9%**	**3,015**	**60.0%**	**772**	**53.3%**	**-74.4%**	**3,787**	**58.5%**
Cargo/Tanker	Bulk Carrier	0	0.0%	0	0.0%	N/A	0	0.0%	2	1.7%	0	0.0%	-100.0%	2	0.0%
	Cargo	0	0.0%	0	0.0%	N/A	0	0.0%	72	62.1%	79	80.6%	9.7%	151	2.3%
	Cargo/Containership	0	0.0%	0	0.0%	N/A	0	0.0%	1	0.9%	1	1.0%	0.0%	2	0.0%
	General Cargo	0	0.0%	0	0.0%	N/A	0	0.0%	41	35.3%	18	18.4%	-56.1%	59	0.9%
Cargo/Tanker Total		**0**	**0.0%**	**0**	**0.0%**	**N/A**	**0**	**0.0%**	**116**	**2.3%**	**98**	**6.8%**	**-15.5%**	**214**	**3.3%**
Fishing	Fish Carrier	0	0.0%	0	0.0%	N/A	0	0.0%	76	18.8%	12	3.7%	-84.2%	88	1.4%
	Fishery Patrol Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	4	1.0%	1	0.3%	-75.0%	5	0.1%
	Fishery Research Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	1	0.2%	0	0.0%	-100.0%	1	0.0%
	Fishing	0	0.0%	3	100.0%	100.0%	3	0.2%	145	35.8%	142	43.6%	-2.1%	287	4.4%
	Fishing Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	143	35.3%	122	37.4%	-14.7%	265	4.1%
	Trawler	0	0.0%	0	0.0%	N/A	0	0.0%	36	8.9%	49	15.0%	36.1%	85	1.3%
Fishing Total		**0**	**0.0%**	**3**	**1.1%**	**100.0%**	**3**	**0.2%**	**405**	**8.1%**	**326**	**22.5%**	**-19.5%**	**731**	**11.3%**
Offshore industry	High Speed Craft	12	100.0%	0	0.0%	-100.0%	12	0.7%	162	99.4%	5	100.0%	-96.9%	167	2.6%
	Offshore Supply Ship	0	0.0%	0	0.0%	N/A	0	0.0%	1	0.6%	0	0.0%	-100.0%	1	0.0%
Offshore Industry Total		**12**	**0.8%**	**0**	**0.0%**	**-100.0%**	**12**	**0.7%**	**163**	**3.2%**	**5**	**0.3%**	**-96.9%**	**168**	**2.6%**
Recreational	Pleasure Craft	20	55.6%	8	66.7%	-60%	28	1.6%	370	34.4%	42	25.9%	-88.6%	412	6.4%
	Sailing Vessel	15	41.7%	4	33.3%	-73.3%	19	1.1%	704	65.4%	119	73.5%	-83.1%	823	12.7%
	Yacht	1	2.8%	0	0.0%	-100.0%	1	0.1%	2	0.2%	1	0.6%	-50.0%	3	0.0%
Recreational Total		**36**	**2.5%**	**12**	**4.3%**	**-66.7%**	**48**	**2.8%**	**1,076**	**21.4%**	**162**	**11.2%**	**-84.9%**	**1,238**	**19.1%**
Other	Buoy-Laying Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	5	2.0%	0	0.0%	-100.0%	5	0.1%

VESSEL CATEGORY	VESSEL TYPE	PROPOSED CABLE CORRIDOR							STUDY AREA						
		Day Track Line Counts		Night Track Line Counts		Percentage Change from Day to Night	Total	Proportion of Total Track Lines	Day Track Line Counts		Night Track Line Counts		Percentage Change from Day to Night	Total	Proportion of Total Track Lines
		Track Count Day (06:30-18:30)	Proportion of Track Lines	Track Count Night (18:30-06:30)	Proportion of Track Lines				Track Count Day (06:30-18:30)	Proportion of Track Lines	Track Count Night (18:30-06:30)	Proportion of Track Lines			
	Command Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	0	0.0%	1	1.2%	100.0%	1	0.0%
	Diving Support Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	2	0.8%	0	0.0%	-100.0%	2	0.0%
	Landing Craft	0	0.0%	0	0.0%	N/A	0	0.0%	13	5.2%	3	3.5%	-76.9%	16	0.2%
	Light, with Sectors	0	0.0%	0	0.0%	N/A	0	0.0%	0	0.0%	1	1.2%	100.0%	1	0.0%
	Military Ops	0	0.0%	0	0.0%	N/A	0	0.0%	1	0.4%	0	0.0%	-100.0%	1	0.0%
	Other	10	32.3%	3	25.0%	-70.0%	13	0.7%	40	15.9%	20	23.5%	-50.0%	60	0.9%
	Pilot Vessel	2	6.5%	3	25.0%	50.0%	5	0.3%	34	13.5%	6	7.1%	-82.4%	40	0.6%
	Port Hand Mark	0	0.0%	0	0.0%	N/A	0	0.0%	3	1.2%	2	2.4%	-33.3%	5	0.1%
	Replenishment Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	1	0.4%	0	0.0%	-100.0%	1	0.0%
	Research/Survey Vessel	0	0.0%	0	0.0%	N/A	0	0.0%	0	0.0%	3	3.5%	100.0%	3	0.0%
	Reserved	0	0.0%	0	0.0%	N/A	0	0.0%	12	4.8%	2	2.4%	-83.3%	14	0.2%
	SAR	2	6.5%	1	8.3%	-50.0%	3	0.2%	13	5.2%	6	7.1%	-53.8%	19	0.3%
	SAR Aircraft	0	0.0%	0	0.0%	N/A	0	0.0%	3	1.2%	4	4.7%	33.3%	7	0.1%
	Tug	15	48.4%	3	25.0%	-80.0%	18	1.0%	35	13.9%	6	7.1%	-82.9%	41	0.6%
	Unspecified	0	0.0%	0	0.0%	N/A	0	0.0%	4	1.6%	0	0.0%	-100.0%	4	0.1%
	Utility Vessel	1	3.2%	2	16.7%	100.0%	3	0.2%	46	18.3%	17	20.0%	-63.0%	63	1.0%
	Work Vessel	1	3.2%	0	0.0%	-100.0%	1	0.1%	40	15.9%	14	16.5%	-65.0%	54	0.8%
Other Total		**31**	**2.1%**	**12**	**4.3%**	**-61.3%**	**43**	**2.5%**	**252**	**5.0%**	**85**	**5.9%**	**-66.3%**	**337**	**5.2%**
Grand Total		**1,458**	**100%**	**279**	**100%**	**-80.9%**	**1,737**	**100.0%**	**5,027**	**100%**	**1,448**	**100%**	**-71.2%**	**6,475**	**100.0%**

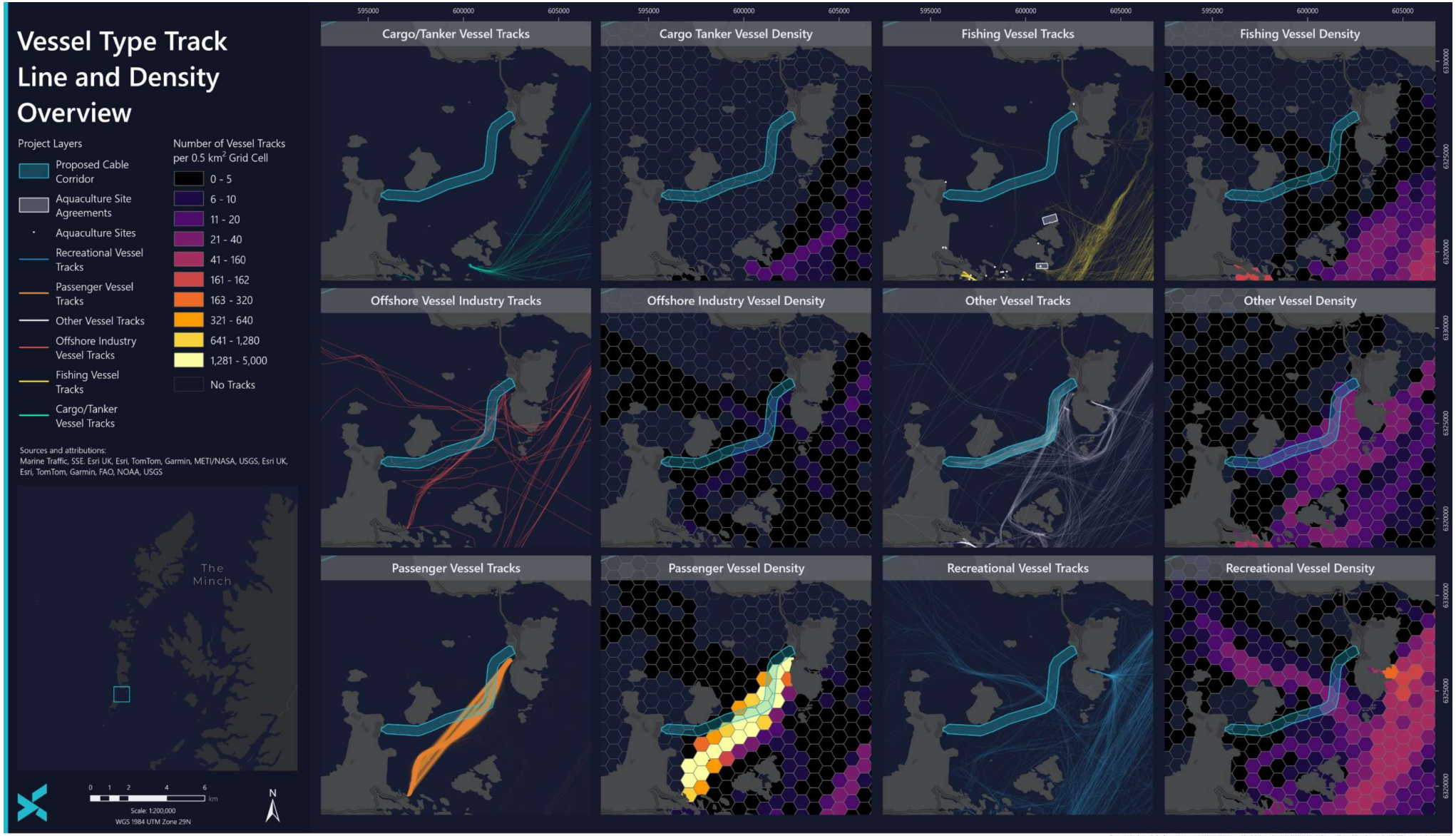


Figure 3-7 Vessel Type Tracks and Densities.

Table 3-3 Track Line Summary for Passenger Vessels.

VESSEL NAME	MMSI	LENGTH (m)	DWT (t)	SERVICE	STUDY AREA			PROPOSED CABLE CORRIDOR		
					Day	Night	Total	Day	Night	Total
ISLE OF LEWIS	232002521	101.25	867.00	Stornoway - Castlebay	6	3	9	0	0	0
LOCH BHRUSDA	232002598	35.40	80.00	Eriskay - Barra	100	38	138	63	30	93
LOCH ALAINN	232003073	43.54	119.00	Fishnish - Barra	2311	435	2,746	1310	221	1,531
CLANSMAN	232003288	101.00	777.00	Oban - Lochboisdale	11	10	21	0	0	0
SEAHORSE 2	232004949	25.40	39.23	Oban - Galmisdale	4	0	4	0	0	0
ELIZABETH G	232010109	23.00	110.36	Oban - Oban	3	1	4	0	1	1
LADY HARPER	232042777	7.00	14.45	Unknown - Barra	14	1	15	1	0	1
ISLE OF MULL	232343000	90.10	451.00	Castlebay - Lochboisdale	192	139	331	0	0	0
LORD OF THE ISLES	232605000	84.63	464.00	Oban - Lochboisdale	348	141	489	0	0	0
HEBRIDEAN PRINCESS	232649000	71.63	240.00	Castlebay - Lochmaddy	7	0	7	0	0	0
HJALMAR BJORGE	235012833	23.00	110.36	Oban - Kyle Of Lochalsh	1	0	1	0	0	0
NOVA SPERO	235022282	20.00	86.91	Scarinish - Tarbert	3	1	4	2	0	2
HIGHLANDER	235097987	7.00	14.45	Stornoway - Unknown	3	0	3	1	0	1
ISLE OF ARRAN	235104000	84.92	660.00	Castlebay - Lochboisdale	3	0	3	0	0	0
SPEIDEREN	235112867	22.00	102.28	Tobermory - Lochboisdale	3	0	3	0	0	0
GLEN ETIVE	235116565	27.00	145.15	Castlebay - Canna	5	0	5	2	0	2
SPITSBERGEN	258157000	100.54	687.00	Castlebay - Stornoway	0	1	1	0	0	0
SILVER ENDEAVOUR	311000932	164.50	2070.00	Portsmouth - Leith	0	1	1	0	0	0
BOLETTE	311000986	237.83	7327.00	Stornoway - Liverpool	1	1	2	0	0	0

3.2.3 Anchoring Summary

Figure 3-8 provides an overview of vessels at-anchor, including the time spent at anchor for each vessel type. Vessel track segments were classified as "at-anchor" if the vessel's status was set to 1 (at-anchor) and its speed was less than 0.5 knots. Within the study area a total of sixteen vessels spent an estimated 559.1 hours (23.3 days) at anchor (Table 3-4). Notably, no vessels were at-anchor within the proposed cable corridor during the study period, as reported by AIS data.

Other vessel type category accounted for the majority of anchoring activity, spending approximately 243.2 hours at-anchor – 43.5% of the total anchoring time within the study area (Table 3-4). Additionally, fishing vessel types accounted for 215.7 hours (38.6%) at-anchor (Table 3-4).

Table 3-4 Vessels at-Anchor Overview.

VESSEL CATEGORY	VESSEL NAME	HOURS SPENT AT-ANCHOR	PROPORTION
Cargo/Tanker	MIKAL WITH	17.6	3.1
	MOWI FIGHTER	6.3	1.1
	SONILAND	10.2	1.8
Fishing	INTER ATLANTIC	49.9	8.9
	INTER SCOTIA	88.6	15.9
	MIGDALE	44.9	8.0
	RONJA COMMANDER	20.1	3.6
	RONJA VIKING	12.1	2.2
Offshore industry	STEADFAST	32.7	5.8
Other	ALBA NA MARA	12.0	2.1
	ANNIE E	80.1	14.3
	CDN WARSHIP 336	12.0	2.2
	KOMMANDOR CLAIRE	73.5	13.1
	MOWI HUNTER	33.7	6.0
	PHAROS	31.8	5.7
Passenger	HEBRIDEAN PRINCESS	33.4	6.0
Grand Total		559.12	100%

Figure 3-8 Vessels at-Anchor Summary Displayed in Vessel Tracks and Vessel Track Densities Across the Study Area

4 FORMAL SAFETY ASSESSMENT

4.1 Results

The Eriskay to Barra proposed cable corridor passes through a well trafficked and marked navigation channel, predominantly associated with the Ardmhor (Barra)-Eriskay ferry route, and vessels transiting through Barra Sound (Figure 3-1). At the highest rate, 54 vessel tracks were recorded in the 10 NM study area on the busiest day in the MTS study period. On the busiest day within the proposed cable corridor, only 10 vessel tracks were reported. The slow-moving cable installation vessels, which will be limited in their ability to manoeuvre, pose little threat to the established ferry services which operate parallel and to the south of the proposed cable corridor, and this positioning, coupled with ferry operators normally robust communication standards and light traffic present when compared to other areas of Scottish waters, heavily mitigates the risks of collision.

The assessment identified eight distinct hazards / impacts to shipping from the Project. The individual summaries of these assessments of the identified hazards can be seen in Table 4-1 below. The eight hazards are:

- Vessel collision (third party vessel with project vessel) during installation, maintenance and decommissioning;
- Disruption to established vessel routes and areas during installation, maintenance and decommissioning;
- Interactions with vessel anchors during installation, maintenance and decommissioning;
- Interactions with vessel anchors during normal operations;
- Interactions with fishing gear during installation, maintenance and decommissioning;
- Interactions with fishing gear during normal operations;
- Reduction in under keel clearance during normal operations; and
- Electromagnetic field (EMF) effects and compass deviation.

From the initial assessments undertaken, one identified no risk, whilst four were assessed as being Broadly Acceptable therefore, no further consideration of risk reduction measures is necessary for these hazards. The remaining three were assessed as Tolerable if ALARP and therefore required further consideration. However, no additional risk reduction measures above the embedded mitigations were considered appropriate, and no recommendations have been made following the assessment. The assessment therefore determined that all risks to navigation associated with the development are considered ALARP. A brief summary of the key considerations of each impact included in the sections following.

4.1.1 Vessel Collision – Installation, Maintenance and Decommissioning

Vessel collision risk is highest at the busiest section of the Sound nearest Eriskay (around Kilometre Point (KP) 2 to KP 5 (See Figure 3-5) and within daylight hours, see Figure 3-2. The Project includes several specific embedded mitigation measures designed to minimise vessel interactions and reduce collision risk, namely:

- Issuing of NtMs;
- The proposed implementation of a 500 m RCZ (or other agreed distance following consultation with stakeholders) in January 2026 for the Barra - Eriskay ferries;

- Potential provision of a guard vessel or small support vessel on standby to reduce risk of collision if vessels pass too close to the installation vessel. The requirement for a guard vessel will be considered through consultation with the ferry operator CalMac, the relevant SHA as required, and Installation Contractor;
- Compliance with IRPCS, including displaying appropriate lights and day shapes; and
- Engagement with navigational consultees (Relevant harbour authorities such as Comhairle nan Eilean Siar and the Eriskay – Barra ferry operators).

The vast majority of the traffic passes to the east and south of the cable corridor between KP 3 and KP 4, and is routine traffic which will not normally interact/cross paths with the installation vessels. The Project activities are not determined currently but are anticipated to last for a short duration (including weather down time) given the relatively short cable lay (expected installation time of approximately 3 months) of. In addition, any Vessel Traffic Service (VTS) operated by the statutory harbour authority or the ferry pier operator will ensure vessels transiting through Barra Sound are aware of the cable installation activities, and necessary safety and navigation requirements. Furthermore, the VTS allows vessels to be monitored using radar, meaning that potentially unsafe situations will be identified and mitigated in advance. These considerations combine to provide considerable inherent collision safety over and above the industry standard mitigations, such as guard vessel protection (as required), NtMs and weather condition limits.

Considering the limited duration of potential interaction between the installation vessel and vessels operating in the area, as well as the high efficacy of the embedded mitigation measures described above, the likelihood is considered 'Remote'. The worst-case credible outcome of a collision would be loss of life, so a consequence severity is assessed as 'High'. This results in overall assessment of 'Tolerable if ALARP' As such consideration of additional risk reduction measures should be made.

However, given the very short duration of the operations in the navigable channel and at periods of low traffic, no further measures are considered to represent justifiable or effective risk reduction. The risk is therefore considered ALARP.

4.1.2 Disruption to Established Vessel Routes and Areas – Installation, Maintenance and Decommissioning

The risk of disruption to vessels is most relevant to the lifeline ferry service between Barra and Eriskay from the slow moving and restricted installation vessels. The ferries run parallel to the cable corridor, with tracks showing closest on average to KP 0, KP 2, KP 3 and KP 4 (see Figure 3-6), and within the busiest hours being during daytime hours. In addition, there is potential to disrupt larger vessels under transiting to/from Eriskay and Barra. The embedded mitigation measures outline in Section 1.2 will reduce the potential to significantly disrupt existing vessel activity, specifically:

- Reduction of the RCZ from 500 m to 250 m (or other agreed distance) for the Eriskay-Barra ferries, and vessels transiting to/from Eriskay and Barra, through engagement with relevant local Comhairle nan Eilean Siar Harbour Authority, and the ferry operators, CalMac;
- Engagement with navigational consultees (Comhairle nan Eilean Siar Harbour Authority, and the CalMac ferry operators); and

- Deconfliction with the Eriskay-Barra ferry timetable where practicable, including consideration of night-time operations.

The measures combine with the limited duration of the proposed cable installation activities to provide considerable inherent mitigation to ensure disruption to existing vessel movements are minimised.

Considering the limited duration of potential interaction between the installation vessels, ferries and vessels operating in the area, as well as the high efficacy of the embedded mitigation measures described above, the likelihood is considered 'Remote'. The worst-case credible outcome would be protracted delays to ferry schedules, so a consequence severity is assessed as 'Medium'. This results in overall assessment of 'Broadly Acceptable' and no further consideration of additional risk reduction measures required.

4.1.3 Interaction with Vessel Anchors – Installation, Maintenance and Decommissioning

The interaction of vessels anchors with the cable during the activities associated with installation maintenance or decommissioning of the Project is considered highly unlikely. The principal reason being that there are no charted anchorage areas in the vicinity of the proposed cable corridor, and no anchoring activity in the vicinity of the proposed Project cable corridor was identified in the baseline data (See Figure 3-8). This reflects the fact that the cable corridor is wholly situated within a charted subsea cables area, and crosses the navigable area through Barra Sound. Embedded mitigation measures further reduce the risk of vessels' anchors interacting with cables during the installation, maintenance and decommissioning phases, including the issuing of NtMs and navigation warnings, and potential use of a guard vessel or small support vessel to advise vessels as required.

If a vessel fouls its anchor on the subsea cable, there is the potential for the severe damage or foundering to occur if inappropriate attempts to recover the anchor are made. Injury could also occur through interactions with lines under load. Thus, the consequences are considered to be 'Medium'. This is combined with a 'Remote' assessment of likelihood, given the mitigation outlined above and the fact that vessels are not expected to anchor in the vicinity of the cable corridor. This results in an overall assessment of 'Broadly Acceptable', and no further mitigation is required.

4.1.4 Interaction with Vessel Anchors – Normal Operations

As the operations phase of the Project endures for the lifetime of the cable, the likelihood is considered to be greater. Indeed, during the operations no guard vessel patrol or recent NtMs will inform vessels of the cable. Similarly, the risk of vessel breaking down and adverse weather conditions throughout the lifetime of the cable present an increased possibility of a vessel requiring to drop anchor in case of emergency. In such a scenario adverse weather would potentially exacerbate the incident endangering the risk of any crew. Embedded mitigation measures reduce this risk, including:

- Provision of as-built survey data to the UKHO and Kingfisher for inclusion on Admiralty Charts, and KIS-ORCA charts; and
- Cable marker beacons will be installed at each landfall location, warning mariners of the presence of cables on the seabed in the area.

As detailed above, the consequence of fouling an anchor is considered to be 'Medium'. The mitigation detailed above, combined with the low probability of a vessel either anchoring intentionally or requiring to emergency anchor in the proposed cable corridor means that the likelihood is 'Remote' is assigned. This results in an overall assessment of 'Broadly Acceptable', and no further mitigation is required.

4.1.5 Interactions with Fishing Gear – Installation, Maintenance and Decommissioning

The interaction of fishing gear with the cable during the activities associated with installation maintenance or decommissioning is considered highly unlikely. The principal reason being that no demersal fishing behaviour is seen in the AIS data; fishing vessels are recorded only transiting the area (See Figure 3-7). This reflects the fact that the cable corridor crosses the navigable channels through Sound of Barra, and is within a charted subsea cables area, thus demersal trawling in this area is unlikely for safety reasons. Embedded project mitigation includes:

- Use of a FLO during the cable installation activities;
- Issuing of NtMs, including Kingfisher Bulletins;
- Potential use of a guard vessel or small support vessel to advise vessels, as required; and
- Adherence to the Outer Hebrides FLMAP.

If a vessel fouls its fishing gear on the subsea cable, there is the potential for the severe damage or foundering to occur if inappropriate attempts to recover the gear are made. Injury and loss of life could also occur through interactions with lines under load. Thus, the consequences are considered to be 'High'. This is combined with a 'Remote' assessment of likelihood, given the mitigation outlined above and the fact that vessels are not expected to engage in demersal fishing in the vicinity of the cable corridor. This results in an overall assessment of 'Tolerable if ALARP', however given the presence of multiple existing subsea cables in the area, there is no material change from baseline conditions, and no further mitigation is required.

4.1.6 Interactions with Fishing Gear – Normal Operations

The proposed cable will be surface laid in the subtidal area, but the cable is expected to self-bury over time. Cast-iron split pipe will be utilised to help protect and stabilise the cable in the nearshore and will be applied at a small rock outcrop just past MLWS on the Barra end of the cable route. A worst-case total of 327 m of split pipe protection may be required for cable stabilisation and protection in the subtidal. Split pipe or concrete mattresses may also be used where the proposed subsea cable crosses the existing live and OoS cables. Additionally, the sea earths (i.e., the two earthing wires) will separate and continue on the surface of the seabed for up to 50 m. The operational impact from the cable is likely to be minimal due to the expected self-burial and during the operations no FLO, guard vessel patrol or recent NtMs will be present to inform fishers of the presence of the cable. This notwithstanding, demersal trawling activity is not expected to occur in the vicinity of the proposed cable corridor, given the existing subsea cable, and the presence of the navigable channels. Embedded mitigation further reduces the risk of interactions with fishing gear during the operation phase:

- SHEPD advise fishers to follow the advice provided by SOLAS, UKHO, and the Mariner's Handbook, and avoid demersal trawling over subsea cables;

- Provision of as-built survey data to the UKHO and Kingfisher for inclusion on Admiralty Charts, and KIS-ORCA charts; and
- Cable marker beacons will be installed at each landfall location, warning mariners of the presence of cables on the seabed in the area.

As detailed above, the consequence of fouling fishing gear is considered to be 'High'. The mitigation detailed above, combined with the low probability of a vessel engaging in demersal trawling in the proposed cable corridor means that the likelihood is 'Remote' is assigned. This results in an overall assessment of 'Tolerable if ALARP', however given the presence of multiple existing subsea cables in the area, there is no material change from baseline conditions, and no further mitigation is required.

4.1.7 Reduction in Under Keel Clearance – Normal Operations

The cable will be surface laid and self-buried between Mean Low Water Springs (MLWS) at Eriskay and MLWS at Barra, where depths increase steeply towards the open channel. SHEPD have in place design criteria for mitigating this in accordance with MCA guidance, keeping depth reductions below 5% in existing water depth, unless otherwise agreed with MCA (at shallow areas). Additionally, the provision of as-built survey data of the surface laid but self-buried cable and the presence of cable marker beacons also reduce this risk. As the vast majority of vessel tracks are concentrated in deeper water the likelihood of any related issues is considered to be 'Remote' with a consequence outcome of 'Low' (Minor damage to equipment). This impact is therefore assessed to be 'Broadly Acceptable' and warrants no further consideration.

4.1.8 Electromagnetic field (EMF) and compass deviation effects – Normal Operations

Magnetic compasses are designed to work with the earth's stationary geomagnetic fields and can therefore be affected by other stationary magnetic fields such as ones generated by direct current (DC) cables. Alternating current (AC) cables such as the 33 kilovolts (kV) cable proposed for this Project generate an oscillating sinusoidal EMF with respect to time, which fluctuates in polarity with frequency of 50 hertz (Hz). The average EMF strength is therefore 0 microteslas (μT), meaning that the deviation effect on ships' compasses will therefore be 0 degrees. There is therefore No Risk from EMFs from the Project on compass deviation, and this hazard is therefore not considered further in this high-level NRA.

4.1.9 Initial Risk Assessment Output

The following table captures the results of the FSA process and results of the high-level NRA. All hazards are ultimately assessed as being ALARP with no recommendations for additional risk reduction measures or further action beyond continual monitoring of the risks for changes to the project / assessment basis.

Table 4-1 Navigational Risk Assessment output / Hazard Log

PHASE / ACTIVITY	HAZARD / IMPACT	EMBEDDED MITIGATION		WORSE CASE OUTCOME	LIKELIHOOD	CONSEQUENCE	INITIAL RISK	ADDITIONAL RRMS	RESIDUAL RISK	COST / BENEFIT	NOTES
		MANDATORY / INDUSTRY PRACTICE	PROJECT SPECIFIC MEASURES								
Installation / Maintenance / Decommissioning	Vessel Collision Passing vessel collides with installation vessel (restricted in its manoeuvrability)	IRPCS Port Bylaws and General Directions VTS Communication (From Port) Guard Vessels (as required) and RCZ AIS Broadcast Notice to Mariners Notification of Regular Runners Wave / Wind limits Cardinal marker (Bo Tanna, East pointing) present in cable corridor (Aid to Navigation, AtoN)	Short operational duration Installation schedule deconflicted with Ferry schedule and peak times in so far as practicable Reduced RCZ for vessels which are regularly present, reducing disruption	Operations halted indefinitely Loss of a crew member, or multiple serious injuries Major/Severe damage to vessel	Remote	High	Tolerable	None Identified	ALARP	NA	Short installation duration across navigable area including deconflicting with the ferry sailings where possible, in addition to embedded mitigation represents substantial inherent risk reduction which brings the likelihood to remote. No further risk reduction measures have been considered necessary / effective due to the associated existing inherent safety. Reduced RCZ is recommended to account for ferries and pleasure vessels likely to be present during installation works under which will reduce disruption where the cable corridor intersects with busy routes and would restrict vessel passage with the normal 500m recommendation. (Maintenance Inspection and Decommissioning activities assumed to be similarly short and outwith busy hours)

PHASE / ACTIVITY	HAZARD / IMPACT	EMBEDDED MITIGATION		WORSE CASE OUTCOME	LIKELIHOOD	CONSEQUENCE	INITIAL RISK	ADDITIONAL RRMS	RESIDUAL RISK	COST / BENEFIT	NOTES
		MANDATORY / INDUSTRY PRACTICE	PROJECT SPECIFIC MEASURES								
Installation / Maintenance / Decommissioning	Disruption to established vessel routes and areas	IRPCS Port Bylaws and General Directions VTS Communication (From Port) Guard Vessels (as required) and RCZ AIS Broadcast Notice to Mariners Notification of Regular Runners Wave / Wind limits	Short operational duration Installation schedule deconflicted with Ferry schedule and peak times in so far as practicable Engagement with the relevant Harbour Authority Reduced RCZ for vessels which are regularly present, reducing disruption.	Protracted operational delays	Remote	Medium	Broadly Acceptable	NA	ALARP	NA	Short installation duration across navigable area including deconflicting with the ferry sailings where possible, is considered to limit disruption risk to broadly acceptable levels. Reduced RCZ is recommended to account for ferries and vessels near Eriskay which will reduce disruption where the increased harbour traffic and cable lay would potentially restrict vessel passage with the normal 500 m recommendation. (Maintenance Inspection and Decommissioning activities assumed to be similarly short and outwith busy hours)
Installation / Maintenance / Decommissioning	Interactions with vessel anchors Vessel drags anchor across exposed cable	Notice to Mariners Guard Vessels (as required) and RCZ Wave / Wind limits	Vessel anchoring within the jurisdiction of the local Harbour Authority	Protracted operational delays Serious injury to person Notable damage to infrastructure or vessel	Remote	Medium	Broadly Acceptable	NA	ALARP	NA	Short installation duration across navigable channel limits the likelihood of anchoring to remote. Installation only in safe conditions and under the jurisdiction of the Harbour Authority limits the potential consequences to medium. (Maintenance Inspection and Decommissioning activities assumed to be similarly short and outwith busy hours)

PHASE / ACTIVITY	HAZARD / IMPACT	EMBEDDED MITIGATION		WORSE CASE OUTCOME	LIKELIHOOD	CONSEQUENCE	INITIAL RISK	ADDITIONAL RRMS	RESIDUAL RISK	COST / BENEFIT	NOTES
		MANDATORY / INDUSTRY PRACTICE	PROJECT SPECIFIC MEASURES								
Installation / Maintenance / Decommissioning	Interactions with fishing gear Fishing activity conducted in vicinity of cable and installation activities	Notice to Mariners Guard Vessels (as required) and RCZ Wave / Wind limits	FLMAP	Serious injury to person Notable damage to infrastructure or vessel	Remote	Medium	Broadly Acceptable	None Identified	ALARP	NA	Maintenance Inspection and Decommissioning activities assumed to be similarly short and outwith busy hours
Normal Operations	Interactions with vessel anchors Vessel drags anchor across cable	Promulgation of information on the installation and locations Cable Marker beacons at each landfall, marking cable presence As-built Locations of cable and protections supplied to UKHO (Admiralty) Industry guidance on avoidance of anchoring in the vicinity of subsea cables	Route Selection (Avoids designated anchorage areas)	Loss of a crew member, or multiple serious injuries Major/Severe damage to infrastructure or vessel	Unlikely	High	Tolerable	None Identified	ALARP	Measure Justified	In line with guidance provided by the UKHO and International Convention for the SOLAS, SHEPD recommend that fishing vessels should avoid trawling over installed seabed infrastructure. Vessels are also advised in the Mariners Handbook (NP100) not to anchor or fish (trawl) within 500 m of the cable.
Normal Operations	Interactions with fishing gear Fishing vessel drags gear across cable	Promulgation of information on the installation and locations As-built locations of cable and protections supplied to UKHO (Admiralty) and Kingfisher (KIS-ORCA) Cable Marker beacons at each landfall, marking cable presence	Cable protection measures	Loss of a crew member, or multiple serious injuries Major/Severe damage to infrastructure or vessel	Remote	Medium	Broadly Acceptable	NA	ALARP	NA	Given that trawling within 500m of a laid subsea cable is advised against in the Mariners Handbook (NP100), and the cable landfalls will be marked with beacons with the position charted by UKHO and KIS-ORCA, the risk is considered to be broadly acceptable and ALARP.

PHASE / ACTIVITY	HAZARD / IMPACT	EMBEDDED MITIGATION		WORSE CASE OUTCOME	LIKELIHOOD	CONSEQUENCE	INITIAL RISK	ADDITIONAL RRMS	RESIDUAL RISK	COST / BENEFIT	NOTES
		MANDATORY / INDUSTRY PRACTICE	PROJECT SPECIFIC MEASURES								
Normal Operations	Reduction in Under Keel Clearance	As-built Locations of cable and external protections supplied to UKHO (Admiralty) and Kingfisher (KIS-ORCA) Cable Marker beacons (AtoNs) at each landfall, marking cable presence	Cable external diameter only 127 mm Navigable water depths not reduced by more than 5% Cable trenched (as a minimum) from MHWS to MLWS where depth increases steeply	Minor injury to person minor damage to vessel	Remote	Low	Broadly Acceptable	NA	ALARP	NA	It is also noted that the vast majority of vessel movements are concentrated away from landfall in deeper water
Normal Operations	Electromagnetic field effects disturb magnetic compass navigation	NA	EMFs from AC cables do not affect magnetic compasses	No significant operational impacts	NA	NA	No Risk	NA	No Risk	NA	

5 CONCLUSION

The proposed Eriskay to Barra cable (EB-3) passes through a well trafficked and marked navigational area, predominantly carrying vessels in the Barra Sound area to and from Barra (Aird Mhòr) and Eriskay (Ceann a' Ghàraidh). The slow-moving cable installation vessels, which will be limited in their ability to manoeuvre, cross parallel to the main ferry routes and represent a potential hazard or impact to shipping in the area.

However, the operation is an appreciably minor activity given its short expected duration in the busiest parts of the channel, providing considerable inherent safety. The approach taken by the development is to continue to facilitate good communication between the installation contractor, SHEPD, CalMac and Comhairle nan Eilean Siar Harbour Authority to deconflict issues with ferries as much as possible, in addition to keeping a small support vessel on standby which can rapidly intervene if vessels pass too close to the installation vessels. Finally, a plan may be implemented which will deconflict the RCZ of 500 m to account for potential interactions at the harbour area in Eriskay and Barra that the vessel will start and end operations in, in relation to regular vessel traffic including ferries and piloted vessels. Ongoing awareness of the installation operation through the necessary involvement of relevant harbour authorities and promulgation of the operation details to Comhairle nan Eilean Siar Harbour Authority and mariners in general completes a very low risk profile for the activities. This is reflected in the assessment of the installation, maintenance and decommissioning phases of the project, which determined the risks associated with the surface activities are ALARP.

The cable will be surface laid and self-buried in the subtidal area between MLWS on Eriskay and MLWS on Barra. An exposed cable represents an obvious hazard to trawlers and anchoring before self-burial is achieved. However, the cable itself will make landfall within the jurisdiction of the harbour authority, well outside any designated anchoring areas. No demersal trawling activities are permitted in the vicinity of the cable, and there are no anchorages in the immediate vicinity of the installation corridor; this is reflected within the MTS (See Figure 3-7 and Figure 3-8). In addition, as-built locations of the cable and any external protection measures will be supplied to UKHO (Admiralty) and Kingfisher (KIS-ORCA) and the cable will be marked at leach landfall point by cable marker beacons (Aids to Navigation) which will be inspected and maintained for the life of the cable.

Given the inherent safety associated with the statutory harbour jurisdiction area, and industry standard practice, the risks posed to navigation from the presence of the seabed cable are therefore all considered to be ALARP.

6 REFERENCES

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