SCOTTISH HYDRO ELECTRIC POWER DISTRIBUTION PLC

Mainland Orkney - Shapinsay Distribution Cable Replacement

Navigational Risk Assessment

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Navigational Risk Assessment

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GLOSSARY

ALARP
As Low As Reasonably Practicable

CLV
Cable Lay Vessel

CD
Chart Datum

COLREGS
Collision Regulations

DP
Dynamic Positioning

ESCA
European Subsea Cables Association

FLO
Fisheries Liaison Officer

FLMAP
Fishing Liaison Mitigation Action Plan

FSA
Formal Safety Agreement

GtGP
Guide to Good Practice

ICES
International Council for the Exploration of the Sea

IMO
International Maritime Organisation

MAIB
Marine Accident Investigation Branch

MGN
Marine Guidance Note

MMO
Marine Management Organisation

MCA
Maritime and Coastguard Agency

NRA
Navigation Risk Assessment

NM
Nautical Mile

NtM
Notice to Mariners

OOS
Out of Service

OREI
Offshore Renewable Energy Installations

PMSC
Port Marine Safety Code

RPM
Revolutions Per Minute

RNLI
Royal National Lifeboat Institution

RYA
Royal Yachting Association

SOLAS
International Convention on the Safety of Life at Sea

UK
United Kingdom

UKHO
United Kingdom Hydrographic Office

VMS
Vessel Monitoring System

1. SHIPPING AND NAVIGATION

1.1 Introduction

1.1.1 Aim of this section

This section identifies the potential risk to shipping and navigation arising from cable activities associated with installation of the replacement cable and the presence of the replacement cable during its operational lifespan.

Where relevant, any limitations related to the baseline conditions, data sources or scientific understanding / interpretation within the process of assessing the effects have been highlighted.

1.1.2 Data sources

Automatic Identification System (AIS) data from EMODnet covering 2021 has been used in this section. 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 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; all passenger vessels irrespective of size and fishing vessels greater than 15m. In recent years, AIS has increasingly been installed by other maritime users on smaller craft, including yachts, fishing vessels, and pleasure craft, making it a robust and reliable indicator of marine traffic.

Baseline conditions for shipping and navigation have been established by undertaking a desktop review of published information and available reports for the project in relation to shipping, fishing and navigation. The data sources used to inform the baseline description and assessment include the following:

- AIS data (EMODnet, 2021);
- Admiralty charts;
- Orkney/Shetlands Cable Route Shipping Study (Anatec, 2019);
- Royal Yachting Association (RYA) Data for 2021;
- North Coast and Orkney Fishing Liaison Mitigation Action Plan (FLMAP) (SHEPD, 2021);
- Royal National Lifeboat Institution incidents 2008 to 2022 (note that this data is not currently publicly available, but the data used in this report is from a previous download of the most recent dataset); and
- Marine Accident Investigation Branch (MAIB) annual reports 2018 to 2022, https://www.gov.uk/governmentcollections/maib-annual-reports.

1.1.3 Summary of stakeholder consultation

The project has been discussed in general terms at recent meetings with the following navigation related stakeholders:

- Orkney Islands Council, including Orkney Harbour Authority and Orkney Ferries
- Orkney Fisheries Association
- Scottish Fisherman's Federation
- Northern Lighthouse Board

- Maritime and Coastguard Agency (MCA)

There have been no specific mitigation measures discussed with these stakeholders.

A meeting to discuss the Project and this Navigational Risk Assessment (NRA) with Orkney Harbour Authority was held in December 2023. No specific mitigation was identified during the meeting, however the potential for a reduction of the standard 500m safety zone was raised and will be discussed with the installation Contractor once appointed. As no confirmation of a reduced safety zone was possible at this stage, the standard 500m safety zone has been used in this assessment.

As part of the ongoing discussions surrounding the installation campaign, Orkney Harbour Authority have provided an indicative cruise liner schedule for 2024. Similarly, Orkney Ferries have provided the passage plans for the Kirkwall to Shapinsay ferry, which transits across the Application Corridor. Both have been used in this assessment.

1.1.4 Study area

This section covers the marine components of the cable installation works through The String. The study area has been defined as 10km either side of the proposed Application Corridor.

The Application Corridor is 2.55km in length. The direction of installation will operate from the Head of Work landfall on Orkney, continuing to the Twi Ness landfall on Shapinsay as shown in Figure 1-1 (Drawing Reference: P2663D-LOC-003).

All AIS data and navigational features dataset presented in this report are limited to the area of the assessment, hereby known as the Study Area.

ORKNEY TO SHAPINSAY DISTRIBUTION CABLE REPLACEMENT

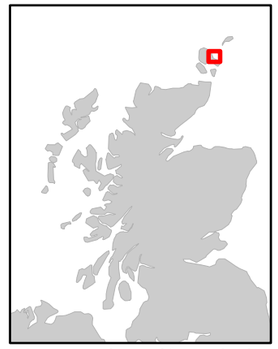
LOCATION OVERVIEW
Route Overview

Drawing No: P2663D-LOC-003 | **A**

Legend

Application Corridor

N
W E
S



NOTE: Not to be used for Navigation

Date	15 November 2023
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	MarineFIND; ESRI
File Reference	J:\P2663\P2663D\Mxd_QGZ\01_LOC\ P2663D-LOC-003.mxd
Created By	Oliver Bula
Reviewed By	Lewis Castle
Approved By	Vicky Fisk

Scottish & Southern Electricity Networks intertek

0 1 2 3 4 km

1.2 Guidance Methodology

The NRA methodology used in this section differs slightly from a significance assessment and 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

Whilst not necessarily directly applicable to marine cable projects, consideration to linear cables in relation to offshore renewable structures has been considered using:

- MCA MGN 543 (Merchant and Fishing) Safety of Navigation Offshore Renewable Energy Installations (OREIs) – Guidance on United Kingdom (UK) Navigational Practice, Safety and Emergency Response (MCA, 2016) and industry best-practice;
- Marine Guidance Note "Offshore Renewable Energy Installations (OREIs) - Guidance to Mariners operating in the vicinity of UK OREIs"; and
- Methodology for Assessing the Marine Navigational Safety Risks & Emergency Response of Offshore Renewable Energy Installations.

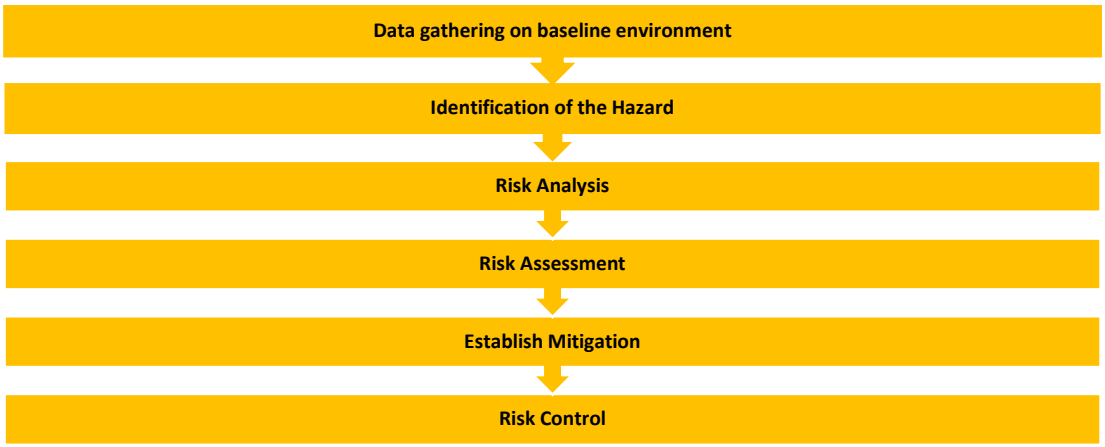
Where applicable, further consideration has been given to:

- Port Marine Safety Code (PMSC) (Dept. for Transport & Maritime and Coastguard Agency Nov 2016); and
- Guide to Good Practice on Port Marine Operations (GtGP) (Dept. for Transport & Maritime and Coastguard Agency Feb 2018).

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 and the steps and risk controls that are in place to reduce the overall impact of the hazard to As Low As Reasonably Practicable (ALARP).

The assessment process involves the following main steps presented in Figure 1-2.

Figure 1-2 Assessment steps



For the purposes of this document the definition of "Hazard", "Risk" and "Maximum Displacement" are detailed below.

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

- **Maximum Displacement** – defined as the maximum number of vessels affected and duration of displacement during the installation operations, as a result of the installation operations.

The steps presented in Figure 1-2 are described in more detail below.

1.2.2 Data gathering on baseline environment

To assess the potential effects resulting from the operation, it is necessary to establish the current shipping conditions and features that exist along and near the Proposed Development. A 10km buffer has been applied around the Project to ensure that all shipping patterns and navigational features are captured.

The analysis has included:

- Potential accidents resulting from navigation activities – MIAB & RLNI;
- Navigation activities affected by the Project;
- Project structures that could affect navigation activities, such as external protection installed on the seabed;
- Project phases that could affect navigation activities;
- Other structures and features that could affect navigation activities;
- Vessel types involved in navigation activities;
- Conditions affecting navigation activities; and
- Human actions related to navigation activities for use in hazard identification (if possible).

1.2.3 EMODnet dataset grouping

The EMODnet vessel density maps have been created from AIS data, collected by coastal stations and satellites. They provide the total ship presence time for 14 individual ship categories (as given in Table 1-1) for every month of 2021 on a 1km grid that follows the EEA / Inspire standards.

Table 1-1 EMODnet ship category descriptions

EMODnet Ship Category	AIS Ship Type Description
Other	Wing in ground (WIG), Other, Spare, Diving Ops, Reserved
Fishing	Fishing
Service	Pilot vessel, Search and Rescue vessel, Port Tender, Anti-pollution equipment, Medical Transport
Dredging or underwater operations	Dredging or underwater ops
Sailing	Sailing
Pleasure craft	Pleasure craft Category A to B
High-speed craft	High-speed craft
Tug and towing	Towing, Tug
Passenger	Passenger Category A to B
Cargo	Cargo Category A to B
Tanker	Tanker Category A to B
Military and law enforcement	Military ops, Law Enforcement
Unknown	Unknown

Source: EMODnet (2021)

The ship category 'unknown' does not have relevant details in the raw AIS data and, therefore, cannot be assigned to a relevant category.

1.2.4 RNLI dataset grouping

RNLI incident callout data documents marine incidents between 2008 and 2021. For this assessment, the assigned classifications have been further grouped so the data can be visualised and assessed clearly. Table 1-2 details the applied grouping.

Table 1-2 Applied grouping of RNLI data

RNLI Data Classification	Intertek Grouping for Assessment
Vessel abandoned derelict or adrift	Abandoned Vessel
Vessel abandoned, derelict or adrift	
Capsize	Capsize
Collision	Collision and Allision
Collision with object on surface	
Collision with other craft	
Collision with rocks	
Collision with submerged object	
Hit by craft	
Criminal activity	Criminal activity
Equipment failure	Equipment failure
Fire	Fire on board vessel
Fire / Explosion	
Fouled propeller / impeller	Fouled Propeller
Stranded	Grounding
Stranding or grounding	
Stuck in mud	
Leaks / Swamping	Leak & Swamping
Machinery failure	Machinery failure
Man overboard	Man overboard
Adverse conditions	MetOcean Conditions
Blown / Swept out to sea	
Currents	
Cut off by tide	
Flooding	
High winds	
In danger of being carried away by tide	
In danger of drowning	
Overcome by crashing waves	
Rip current	
Sudden wave	

RNLI Data Classification	Intertek Grouping for Assessment
Swamping	
Aircraft crashed	Other
Aircraft thought to be in trouble	
Ambulance or doctor call	
Animal in trouble	
Attempting recovery of item	
Attempting rescue of a casualty	
Attempting rescue of an animal	
Attempting to evade police	
Cause (other)	
Cliff collapsed	
Marine Debris or Object	
Medical condition	
Missing or overdue	
Motor vehicle in the sea	
No service	
Open channel VHF	
Other	
Risk taking behaviour	
Safety Cover	
Signal blocking VHF channel	
Slippery or uneven surface	
Sporting injury	
Stepped to edge e.g. to take photo or look at the scene	
Thought to be in trouble	
Trapped in motor vehicle	
Unexploded bomb / mine	
Unknown	
Unsure of position (lost)	
Dementia senility or other similar condition	Personal Incident
Disability	
Exhaustion / fatigue / cold	
Fear of drowning	
Fell from height on craft (e.g. rigging or mast)	
Footing gave way	
Human error	
Ill crewman on vessel	
Illness	
Injured	

RNLI Data Classification	Intertek Grouping for Assessment
Person ill	
Person in distress	
Person Injured	
Person missing	
Person on shoreline in difficulty	
Person recovery	
Person to be taken ashore	
Person to be taken ashore from a vessel	
Fishing gear snagged on underwater obstruction	Snagging
Steering failure	Steering Failure
Cargo shifted	
Gas leak	
Out of fuel	
Sail failure / dismasting	Vessel Distress
Vessel overdue	
Vessel thought to be in trouble	
Vessel unsure of position	
Vessel dragging anchor	Vessel Dragging Anchor
Sinking / Sunk	Vessel Sinking or Sunk
Darkness or poor visibility	Visibility

1.2.5 Identification of the hazard

The hazard identification phase seeks to build on the work of the data gathering and identify known hazards expected to be encountered as a result of the marine operations and presence of project vessels.

The hazards have been identified in relation to where the Project may make it more likely that existing vessels will deviate from the Collision Regulations (COLREGs), either as an intended or unintended action.

This may include any effects which the Project might have on existing vessels such as vessels giving appropriate clearance to cable operations when undertaking cable installation and obstruction to the light and sound signals made by vessels and navigational aids in particular circumstances.

The approach used for hazard identification comprises a combination of both creative and analytical techniques, the aim being to identify all relevant hazards. Where relevant, consultation has been undertaken with stakeholders to help to identify hazards. The creative element is to ensure that the process is proactive and not confined only to hazards that have materialized in the past.

1.2.6 Risk analysis

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 assesses their impact on navigational safety.

Risk is the combination of frequency and consequence which are defined in Table 1-3 and Table 1-4. The definitions below have been developed using the IMO guidelines which includes effects on human safety and ships, however, this assessment also focuses on displacement of existing vessels and this is the most likely consequence of the proposed development.

Table 1-3 Frequency of a hazard

Value	Description	Definition
1	Extremely Remote	Likely to occur once in the lifetime of the project (25 years)
2	Remote	Likely to occur once per year
3	Probable	Likely to occur once per month
4	Very Probable	Likely to occur once per week
5	Frequent	Likely to occur once per day

Table 1-4 Consequence of a hazard

Value	Description	Definition		
		Effects on Human Safety	Effect on Ship(s)	Displacement of Vessel(s)
1	Minor	Single or minor injuries	Single local equipment damage	Temporal displacement of vessel (hours)
2	Significant	Multiple minor injuries	Multiple local equipment damage	Temporal displacement of vessel (days)
3	Severe	Multiple or severe injuries	Non-severe ship and equipment damage	Temporal displacement of vessel (weeks)
4	Serious	Single fatality or multiple severe injuries	Severe damage to ship and equipment	Temporal displacement of vessel (months)
5	Catastrophic	Multiple fatalities	Total loss of ship and equipment	Permanent displacement of vessels

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

1.2.7 Risk assessment

IMO Guidelines above define a hazard as "something with the potential to cause harm, loss or injury" the realisation of which results in potential accidents and, in this case, vessel displacement. The potential for a hazard to be realised can be combined with an estimated (or known) consequence of 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.

Having established the frequency and consequence of the hazard, a risk assessment has been carried out using a risk matrix, adapted from the guidance above, presented in Table 1-5.

Table 1-5 Risk matrix

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

At the low end of the scale, frequency is extremely remote and consequence minor; risk can be said to be negligible. At the high end, where hazards are defined as frequent and the consequence catastrophic, then risk is intolerable.

The result of using this matrix approach is to ensure that the level of risk is reduced to ALARP for the effects that the Project has on the baseline shipping environment. This is undertaken prior to any mitigation. Best Practice and Project Specific Mitigation will then be applied to generally reduces the effects to ALARP.

Definitions of the risk levels are provided in Table 1-6 below.

Table 1-6 Definitions of risk levels with respect to vessel displacement

Score	Classification	Definition
1-2	Negligible	A hazard which causes noticeable changes in the navigation environment but without effecting its sensitivities. Generally considered as insignificant.
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.
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 As Low As Reasonably Practicable (ALARP) and that no further measures are feasible.
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.
15-25	Intolerable	Regarded as unacceptable prior to any mitigation measures being considered.

1.2.8 Establish mitigation

The risk assessment includes a review of existing hazards and their associated mitigation measures. As a result, new mitigation measures (or changes to existing mitigation measures) 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 will allow recommendations to be made to enhance safety.

Mitigation measures are the actions or systems proposed to manage or reduce the potential negative effects identified. 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.

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

- **Avoid or Prevent:** In the first instance, mitigation should seek to avoid or prevent the adverse effect at source, for example, by routing the marine cables away from a hazard.
- **Reduce:** If the effect is unavoidable, mitigation measures should be implemented which seek to reduce the significance of the hazard.

- **Offset:** If the hazard can neither be avoided nor reduced, mitigation should seek to offset the hazard through the implementation of compensatory mitigation.

Mitigation measures fall into two categories: mitigation which forms part of the Project design which are referred to as Best Practice (BP) Mitigation; and mitigation which is part of the construction of the Proposed Development, which is referred to as Project Specific Mitigation.

1.2.9 Risk control

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

The risk assessment is repeated taking into consideration the application of Best Practice and Project Specific Mitigation. 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.

Risks that have been assessed as **Major** or above after considering mitigation will 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.

1.3 Marine Campaign Works

The Project Description (P2663- R2629) provides details of the proposed route and operational aspects of the marine campaign works such as cable installation, site preparation and cable protection methods. A schedule is also included estimating the timeframe for the various marine activities.

Most operations will be performed on a **24-hour** basis. Durations presented are exclusive of weather downtime above vessel working limits and any third-party influences that may increase the duration or interrupt operations. No burial is planned along the route. The exact locations of several types of deposit are the subject of ongoing detailed design and studies related to cable stabilisation.

Existing vessels will be requested to remain at least **500m** from project vessels whilst they are engaged in cable installation activities, resulting in a width of **1km**. This is due to the cable lay vessel's limited ability to manoeuvre whilst undertaking operations.

Unless otherwise directed by Notice to Mariners (NtMs), the entire cable route corridor will be required to be kept clear of all fishing gear (mobile and static) until the end of the works, including the post lay survey period.

Pertinent information from the project description that is directly relevant to the marine activities for the NRA is outlined below.

The Application Corridor is 250m wide by 2.55km long meaning some working vessels with higher progress rates could cover potentially cover the entire corridor within a working day.

Pre-lay survey
A visual pre-lay survey may be undertaken across the entire cable route utilising a remotely operated vehicle (ROV). The ROV will have a maximum speed of approximately **150m/hr** and the survey is estimated to take approximately **1 day** to complete (excluding weather).

It is anticipated that a mobile survey vessel will be required for these works that will give way to larger vessels (ferries etc) if required.

Pre-lay grapnel run (PLGR)
It is anticipated for the PLGR to take up to **2 days**. This usually clears the route of any debris such as OOS cables and fishing gear etc.

Boulder clearance

Large boulders that cannot be avoided during the route engineering process may need to be cleared on a case-by-case basis. The progress rate for this operation is currently unknown as it depends on the extent of boulders found that require clearance, but boulder removal is estimated to take up to **3 days**. If required, boulder relocation would be undertaken by a hydraulic operated 'Orange Peel' grab.

Cable shore end pull-in operations

The first cable pull in operations are expected to take approximately **2 days** to complete and the Cable Lay Vessel (CLV) will be stationed around the 10m water depth contour.

Cable lay operations

Once the cable is successfully pulled (first cable pull-in) to its required position onshore, the buoyancy units will be removed and the CLV will commence laying operations until the second cable pull in. The CLV is a DP2 (Dynamic Positioning) class vessel and based on previous project experience, the expected cable laying speed will be between **200m/hr** and **450m/hr**. The confirmed length of the cable lay operations between Orkney and Shapinsay will be **3 days**. .

Cable shore end pull-in operations

Once the cable is laid across the seabed, the cable lay vessel will remain on station at the 10m water depth contour at the other shore end. The cable will then float off the vessel to shore to complete the second cable pull in operation taking another **2 days.**

Articulated pipe installation

The cable protection strategy may include the installation of Articulated Pipe in very shallow water. Generally, this is installed following the cable pull-in operations by divers or from the CLV, or by a combination of both methods where areas require articulated piping. The dive support vessel will be anchored using up to two spud legs up to 10m LAT, with the potential for a 4-point mooring spread to be temporarily deployed at up to two locations at the Head of Work between 10m – 18m LAT. There is the potential for the mooring spread to be left in place between working days, marked with surface buoys and lights, however this will be subject to approval from the Orkney Harbour Authority. Previously observed speeds for installing articulated piping were approximately **25m a day**, and durations are estimated at **15 days for the Head of Work (Orkney)** and **22 days for Twi Ness (Shapinsay).** It is noted that this could be shorter in duration depending on the installation method, however this duration has been used for the assessment as a worst-case scenario. The timescales indicated are calculated using diver installation, and therefore represent a worst-case scenario.

Rock bags, clump weights and rock anchors for cable stabilisation

Rock bags, clump weights and rock anchors are anticipated to be used as a means of stabilising the cable when deemed necessary by the On Bottom Stability Analysis. The Marine Licence application includes provision for a maximum installation of 86 rocks bags, 8 clump weights and 8 rock anchors, and the duration for installation has been confirmed as **14 days**.

Mattress installation

Two cable crossings (of the operational Orkney – Shapinsay distribution cable and one out of service (OOS) cable identified during the survey) will be required along the proposed route. In order to cross the cables, concrete mattresses are proposed to protect both the existing cable and the proposed cable. Crossing designs have not yet been finalised, however it is considered likely that there will be three pre lay concrete mattresses (6m long, 3m wide) and four post lay rock bags at the crossing locations.

Typical mattress installation speeds are around **1 mattress every 2 hrs** (due to more complex installation procedures than those required for other forms of cable stabilisation) and, with eight mattresses anticipated in total, would consequently take approximately **16 hours.**

Operational phase

Routine inspections to examine the subsea infrastructure would take place periodically every 5-8 years after installation during the lifetime of the cable and would utilise an ROV where practical to do so. This would involve a 500m radius around the survey vessel moving at 150m/hr.

1.4 Existing Baseline Assessment

1.4.1 Shipping overview

12 months of AIS data from January to December 2021 were analysed within 10km of the cable corridor to examine the types and patterns of shipping activity occurring near the Application Corridor. The total average monthly vessel density can be observed in Figure 1-5 (Drawing Reference: P2663D-AIS-001). Average vessel hours across the Application Corridor varied from between 10 – 50 hours a month.

A total vessel density of over 16,000 vessel hours were recorded across the Study Area in 2021. The distribution of the vessel categories is presented in Figure 1-3. The majority of the vessel hours consist of tug and towing (21.2%), service (18.9%) and passenger (16.6%) vessels. Fishing and pleasure craft are among the lowest recorded vessel hours in the Study Area.

Figure 1-3 Vessel distribution across the Orkney - Shapinsay study area

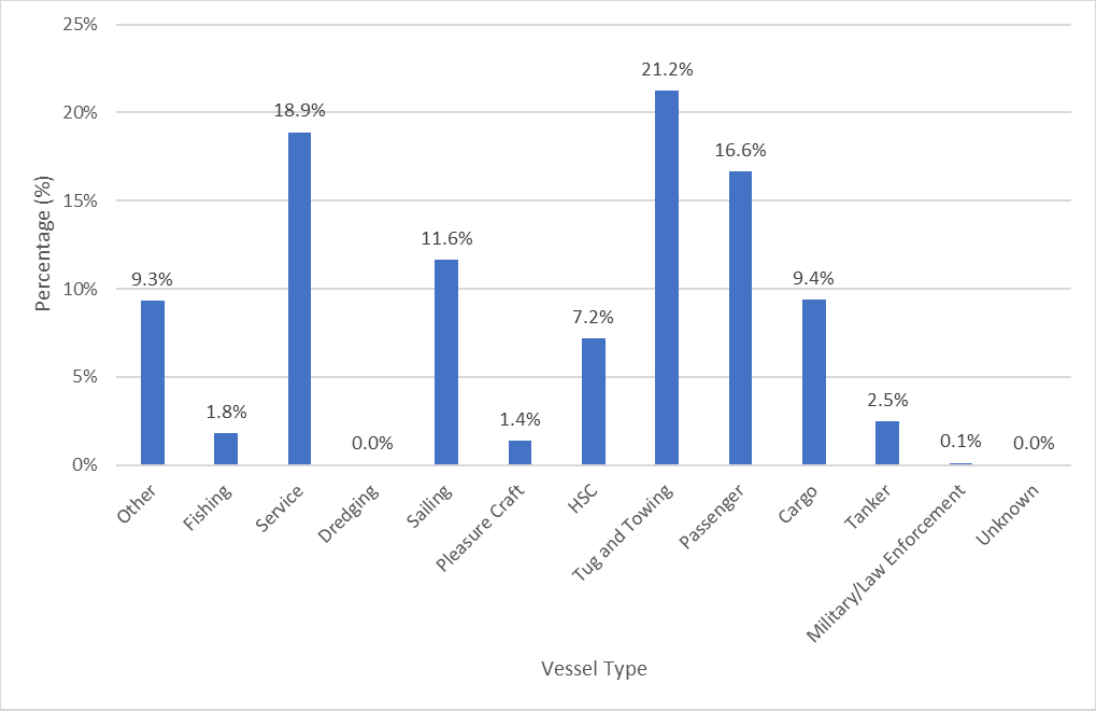
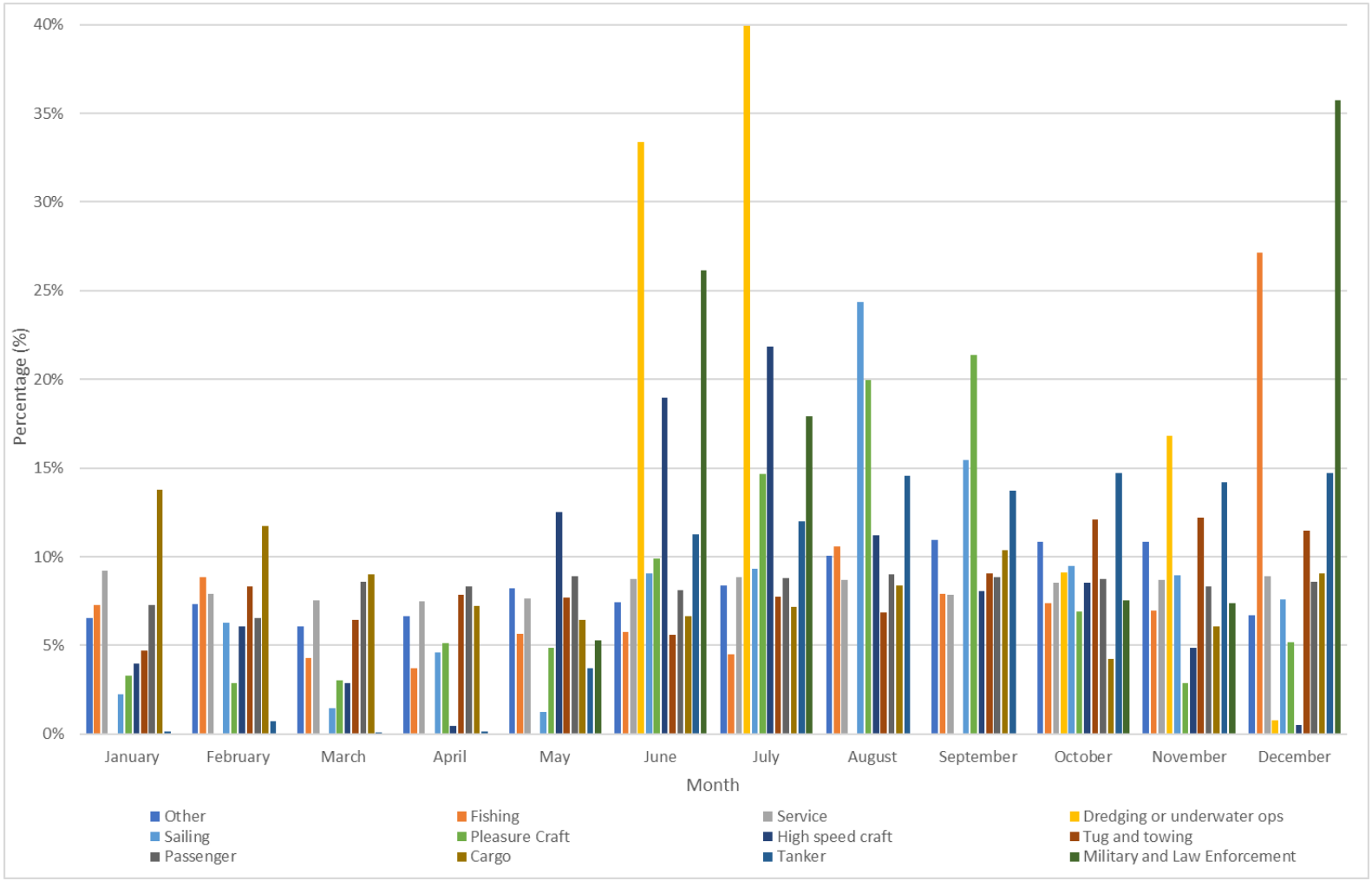


Figure 1-4 highlights the seasonal changes in vessel distribution. The first half of the year shows little variation, with cargo vessels the most commonly observed category in January and February. Recreational craft were more frequent in the summer months, with high-speed craft, sailing and pleasure craft showing peaks of up to 25% of all vessels each month. Dredging and underwater operations vessels were recorded in high levels in June and July in particular (up to 40%), indicating a dredging or construction campaign was ongoing. Military and law enforcement vessels peaked in December (35.7% of all vessels), with increases also seen in June and July implying an operation was underway during this period. Fishing vessels peaked in December (27%) but maintained a density of under 10% for all remaining months except August (10.5%). This is important to note as installation

typically takes place in summer due to the more favourable weather conditions, implying that fewer fishing vessels will be present during this window.

Passenger vessels stayed at a consistent level throughout the year, which is expected due to regular ferry services operating in the Study Area.

Figure 1-4 Seasonality changes in vessel traffic across the Orkney – Shapinsay Application Corridor

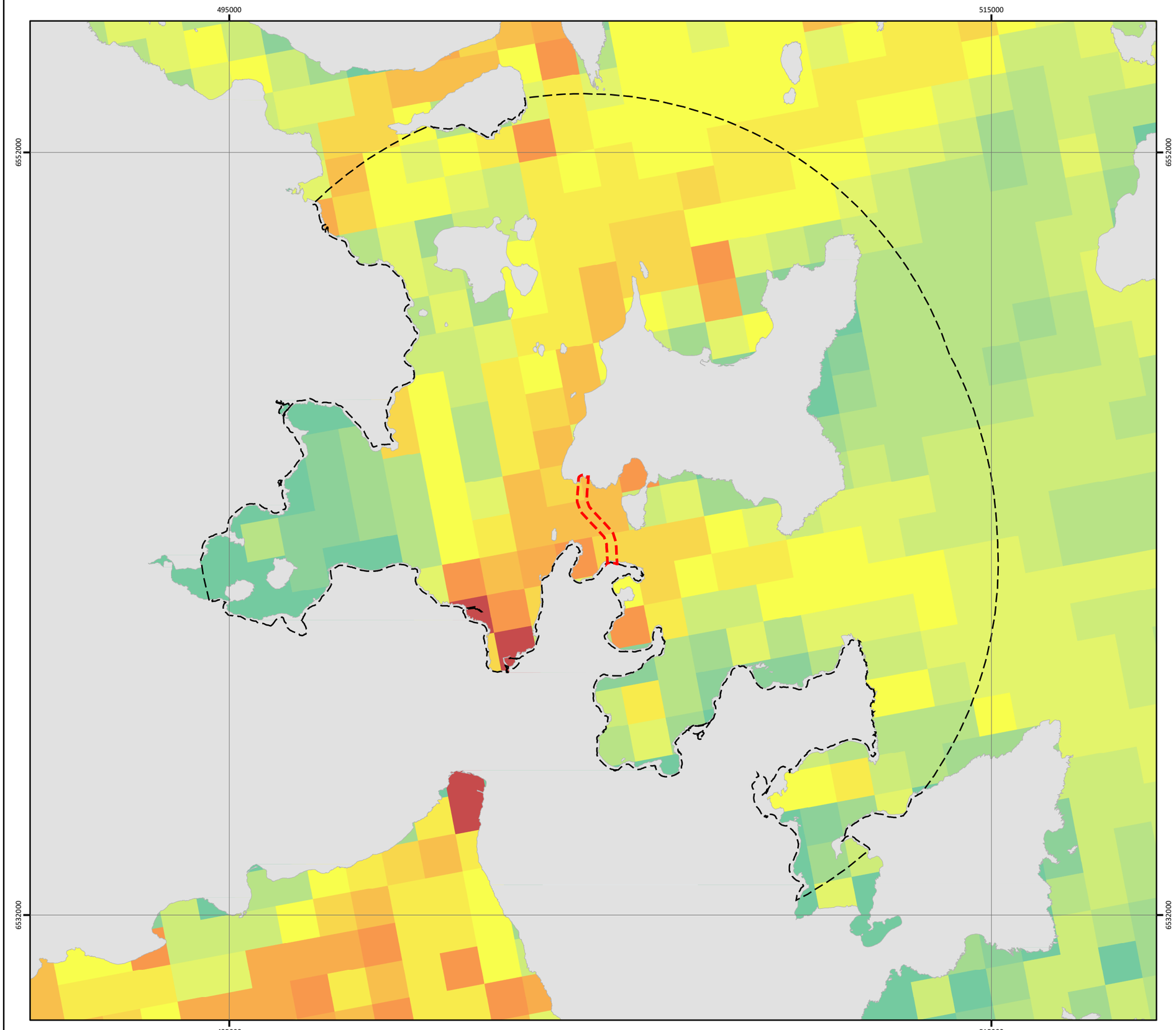


The vessel density across the Study Area is varied, with a higher density in the Bay of Kirkwall and in narrower areas such as The String (Figure 1-5, Drawing Reference: P2663D-AIS-001). Vessel density in the Bay of Kirkwall is very high (more than 500 vessel hours per month) due to the volume of ferry, cargo and cruise traffic entering and exiting the port as well as the increased presence of recreational vessels that stay within the bay. The areas of higher vessel density to the south and west of Shapinsay correspond with the ferry routes that operate from Kirkwall to Orkney's North Isles. The vessel density across the Application Corridor averages at 29 vessel hours per month. At the landfall sites, the vessel density decreases to between 10 – 20 hours per month.

ORKNEY TO SHAPINSAY DISTRIBUTION CABLE REPLACEMENT

AIS VESSEL DENSITY
Average Monthly Vessel Hours (2021) All Vessels

Drawing No: P2663D-AIS-001	A



Legend

- Application Corridor
- 10km Buffer

EMODnet 2021 Vessel Density
Vessel Hours (per km²)

- < 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 200
- 200 - 500
- > 500

NOTE: Not to be used for Navigation

Date	29 November 2023
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	EMODnet; OS; ESRI
File Reference	J:\P2663\P2663D\Mxd_QGZ\06_AIS\ P2663D-AIS-001.mxd
Created By	Oliver Bula
Reviewed By	Lewis Castle
Approved By	Vicky Fisk

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0 1.5 3 4.5 6 km

1.4.2 Navigational features and anchorages

There is an IMO Area to be Avoided traffic routing scheme around the West, North and East of the Orkney Islands, where vessels of more than 5,000 gross tonnage that carry oil or other hazardous material should avoid. The Application Corridor is contained within this area, which covers the majority of the Orkney Islands excluding Scapa Flow and the Pentland Firth.

The closest port to the Application Corridor is the Shapinsay Ferry Terminal, which is located approximately 860m from the eastern edge of the Application Corridor. The terminal operates a regular service between Kirkwall, Mainland Orkney and Balfour, Shapinsay, with six return services a day. The Kirkwall – Lerwick and Kirkwall – Aberdeen ferry routes cross the Application Corridor and will most likely interact with the project.

Kirkwall, which falls under the management of the Orkney Islands Council Harbour Authority, is the next closest port to the Application Corridor. The harbourside consists of a ferry terminal, marina and cruise port. Several vessels leaving the harbour are likely to interact with the project, including ferries and cruise ships entering or leaving the cruise terminal. Ferries from Kirkwall operate between Lerwick and Aberdeen from the Northlink Ferry Terminal to the west of the Bay of Kirkwall. The North Isles route operates from the Kirkwall Orkney Ferry Terminal, with sailings to Eday, North Ronaldsay, Papa Westray, Pierowall, Sanday, Stronsay and Westray. The routes between Kirkwall and Aberdeen/Lerwick both cross the Application Corridor, whilst the North Isles ferry routes do not. As a result, it is likely that the project will interact with ferries operating on these routes. No timetable is available presently for Summer 2024, however based on the Summer 2023 timetable the Aberdeen/Lerwick route will stop at Kirkwall four times a week in the late evening.

During the summer period of 2024, over 90 cruise ships are either scheduled to dock in Kirkwall or utilise the Kirkwall Bay Anchorage. Whilst the cable installation will operate over a limited period of time during the summer months (with exact dates currently unknown), it is not currently known exactly how many cruise ships the Project will interact with, but it is likely that the Project and any cruise ships that cross The String will interact.

The closest anchorage is located in the Bay of Carness, approximately 700m south-west of the Application Corridor. The bay also contains a finfish aquaculture site. Analysis of anchored vessels completed for the Orkney/Shetlands Cable Route Shipping Study (Anatec, 2019) (part of the Environmental Desk Study Report completed for the cable route) found that no vessels were recorded to have anchored anywhere along the Application Corridor, and that all anchoring was recorded in the Bay of Kirkwall and Elwick Bay.

Within the Study Area, there are navigational buoys located north of the Bay of Kirkwall and continuing north until south of Gairsay. The buoys indicate safe navigational directions for vessel traffic through the Wide Firth. Lighthouses are also located at the Kirkwall ferry terminal and Helliar Holm, a small island in The String.

1.4.3 Royal Yachting Association (RYA)

RYA clubs, training centres, marinas as well as the RYA AIS data within the Study Area are illustrated in Figure 1-6 (Drawing Reference: P2663D-RYA-001). The figure also presents a heat map of AIS data of the recreation boating activity across the study area.

The RYA AIS intensity data shows that recreational activity across the Application Corridor is considered moderate to high. The intensity increases to high within the Bay of Kirkwall, which is expected based on the location of Kirkwall Marina in the bay (located 3.5km from the Application Corridor), as well as two RYA clubs (one of which is Orkney Sailing Club, located at Kirkwall Marina) and one RYA training centre (Orkney Sailing Club Training Centre, located 3.9km from the Application

Corridor to the west of the Bay of Kirkland). Based upon this, recreational activity may be affected during the cable installation operations.

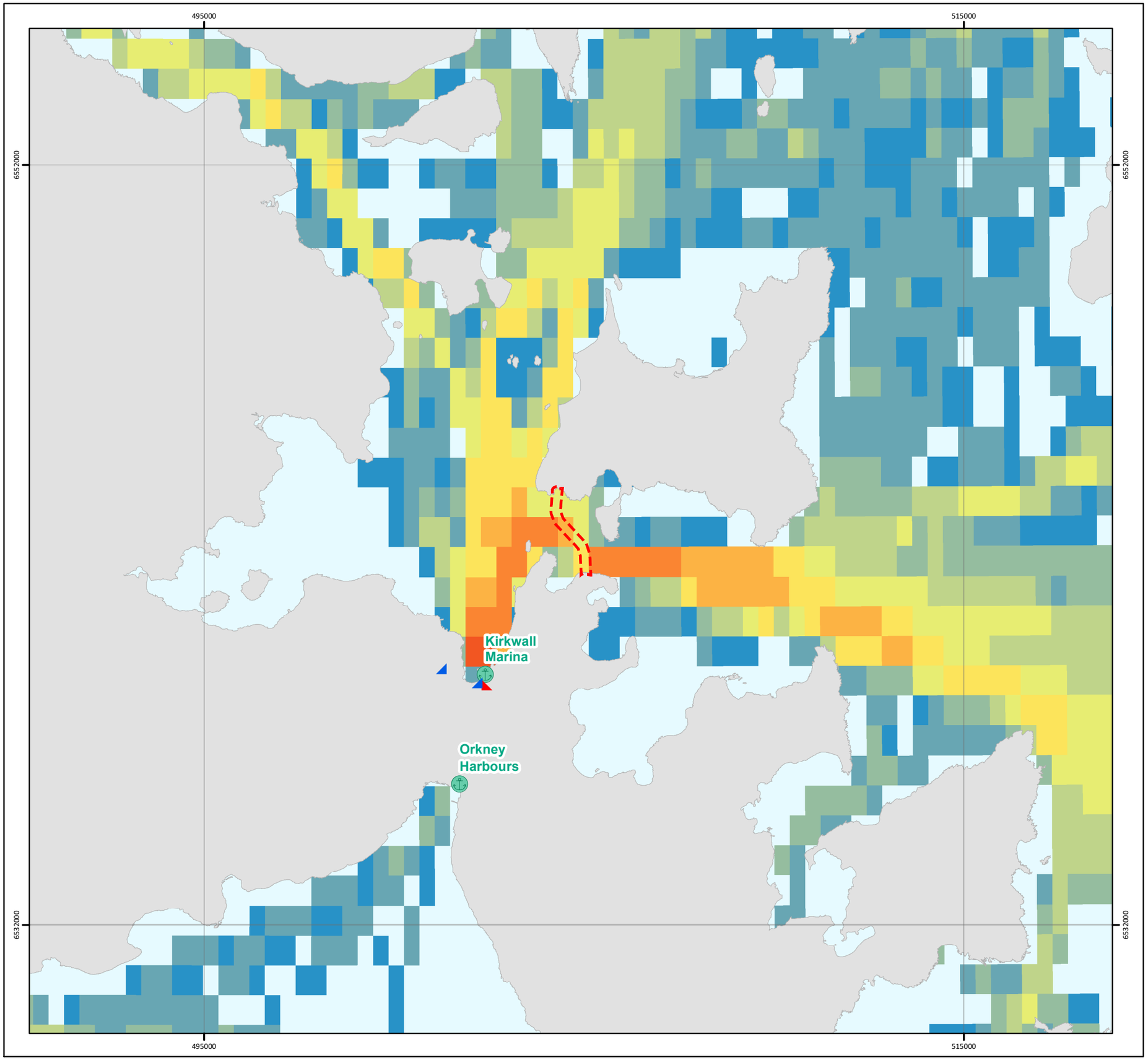
The Orkney Marine and Coastal Recreation Survey (Orkney Islands Council, 2022) shows the Application Corridor is contained within the general sailing area of the Orkney Islands and is located on the edge of the club sailing area based in the Bay of Kirkwall.

ORKNEY TO SHAPINSAY DISTRIBUTION CABLE REPLACEMENT

ROYAL YACHTING ASSOCIATION

RYA UK Coastal Atlas of Recreational Boating

Drawing No: P2663D-RYA-001 | **A**



Legend

- Application Corridor
- RYA Club
- RYA Training Centre
- Marina

AIS Intensity (Recreational Yachting)

Intensity

- Low
- High

N
W E
S

NOTE: Not to be used for Navigation

Date	14 November 2023
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
Data Source	OS; RYA; ESRI
File Reference	J:\P2663\P2663D\Mxd_QGZ\07_RYA\ P2663D-RYA-001.mxd
Created By	Oliver Bula
Reviewed By	Lewis Castle
Approved By	Vicky Fisk

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0 1.5 3 4.5 6 km

1.4.4 Fishing Overview

The Commercial Fishing section (Section 1.4.4) provides a detailed assessment of the effects that the installation and operation of the cable could have on fishing within the Study Area.

Many different fishing gears and fishing methods are used by commercial fisheries. Each gear type is used for specific activities and different gears can have very different impacts on the marine environment and cable security. Furthermore, it is possible for smaller fishing vessels to bottom out if they become snagged on subsea cables.

This section has used information provided in the North Coast and Orkney FLMAP and Vessel Monitoring System (VMS)/vessel traffic data to identify the main areas of fishing in relation to the Project which may be disrupted during the installation campaign.

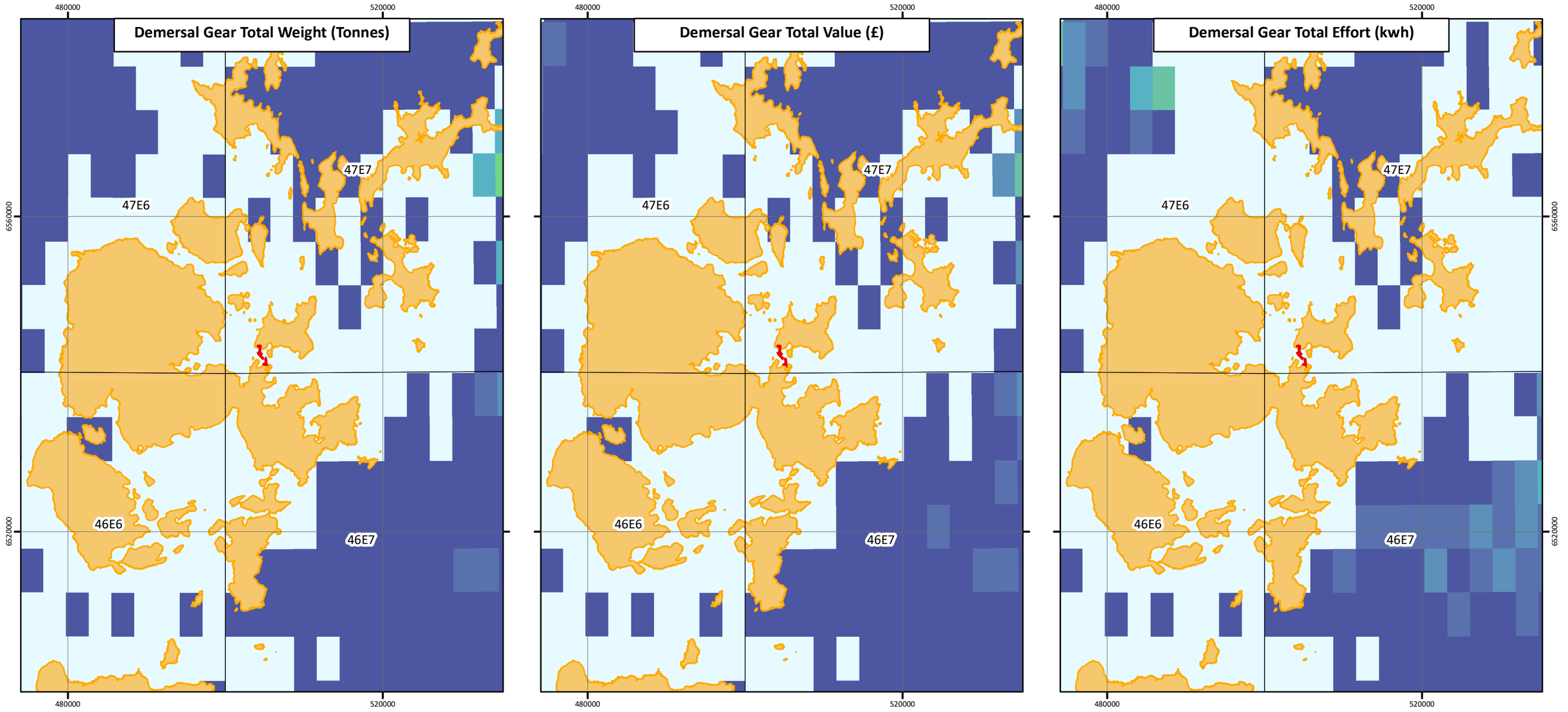
The VMS data shows that there is no recorded fishing activity across the Application Corridor. The closest recording fishing activity is located east of Shapinsay in the Stronsay Firth, however weight, effort and catch value were all low but consistent with the surrounding areas.

The Application Corridor is contained within International Council for the Exploration of the Sea (ICES) rectangle 47E7, which has an average of £9,641,084 landings value per year (based on MMO landings data from 2015-2019). Demersal trawl and seines, followed by pots and traps, contributed to the majority of the landings. Common species landed include herring and crabs with smaller amounts of scallop and lobster landed also (Section 6 of the FLMAP). Bottom (demersal) trawling, such as otter trawling, and scallop dredging, are also common fishing activities within the Pentland Firth, but low levels occur within the Study Area itself. Demersal gear types pose a significant risk to the cable as they are towed along the seafloor and can snag and damage subsea cables. The depth of penetration indicates the risk to the cable from fishing gear; however, fishermen do reduce penetration where possible to decrease risk of losing equipment and consume less fuel. Depending on the substrate, scallop dredging can result in a penetration up to 35 cm deep.

The size (6m to 19m) of static gear vessels vary however smaller fishing vessels may not be recorded by AIS/VMS. Creeling conducted by vessels under the length of 10m, working nearshore between the Orkney islands will most likely be the primary source of conflict during any cable works as creeling activity by this size of vessel is typically confined to the nearshore area.

Based on MMO Surveillance Sightings from 2016-2020, within a 10km radius of the Application Corridor there were low levels of activity from potters and whelkers. To further characterise this, a scouting gear survey was conducted in June 2023. Over the course of the one-day survey, 17 observations were made consisting of five different identified vessels working in the vicinity of the Application Corridor. The marine survey also identified static gear across the Application Corridor (Spectrum Geosurvey, 2023).

Fishing effort in the region follows a seasonal pattern with activity varying to shelter from adverse weather conditions, reacting to seasonal changes and exploiting target species (Coleman and Rodrigues, 2016).



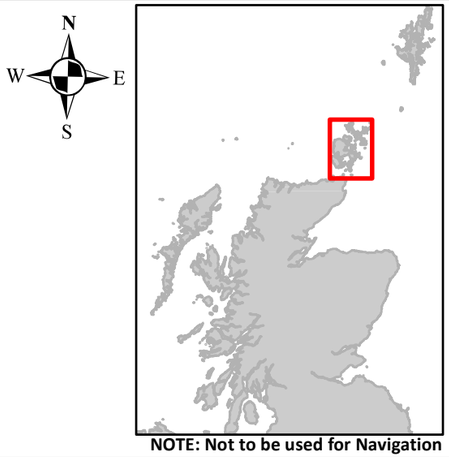
ORKNEY TO SHAPINSAY DISTRIBUTION CABLE REPLACEMENT

FISH AND FISHING ACTIVITY - Fishing Activity for ≥ 15m UK Vessels 2019 by ICES Sub Rectangle (Demersal Gears) Drawing No: P2663D-FISH-005 | A

Legend

- Application Corridor
- ICES Rectangle

Total Weight (Tonnes)	Total Value (£ Sterling)	Total Fishing Effort (kilowatt/hours)
> 0 - 10 (Tonnes)	> £0 - £10,000	> 0 - 2,500 (kilowatt/hours)
> 10 - 20	> £10,000 - £20,000	> 2,500 - 5,000
> 20 - 40	> £20,000 - £40,000	> 5,000 - 10,000
> 40 - 80	> £40,000 - £80,000	> 10,000 - 20,000
> 80 - 160	> £80,000 - £160,000	> 20,000 - 40,000
> 160 - 320	> £160,000 - £320,000	> 40,000 - 80,000
> 320 - 640	> £320,000 - £640,000	> 80,000 - 160,000
> 640 - 1,280	> £640,000 - £1.28 million	> 160,000 - 320,000
> 1,280 - 2,560	> £1.28 - £2.56 million	> 320,000 - 640,000
> 2,560 (Tonnes)	> £2.56 million	> 640,000 (kilowatt/hours)



NOTE: Not to be used for Navigation

Date	15 November 2023
Coordinate System	WGS 1984 UTM Zone 30N
Projection	Transverse Mercator
Datum	WGS 1984
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Created By	Oliver Bula
Reviewed By	Lewis Castle
Approved By	Vicky Fisk

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0 5 10 15 20 km

1.4.5 Marine accident data

This section reviews maritime incidents that have occurred within 10km of the cable route across The String, Shapinsay Sound and Wide Firth. The analysis is intended to provide a general indication as to whether the area of the Project 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 development could add to the existing maritime safety risks in the area.

The most recently available 13 years of data from RNLI and the last five MIAB annual reports have been analysed. It is noted that the same incident data could have been recorded by both sources.

1.4.5.1 RNLI

The most recent 13-year period available of RNLI data (collected between 2008 and 2021) has been plotted spatially and analysed across the study area.

The dataset is a condensed Return of Service data from RNLI callouts across the United Kingdom. It is worth noting that there are records present that have not been spatially adjusted to their exact locations but does give an indication of the number of marine incidences in the area.

A total of 70 launches across the Study Area (all to unique incidents) were recorded by the RNLI (excluding hoaxes and false alarms) over the last 13 years. This corresponds to an average of around five incidents per year indicating, that the number of incidents in the Study Area is very low.

Incident type and corresponding years for across the study area are presented in Figure 1-8. RNLI categories that are not relevant to this assessment have assigned to the category 'Other'.

Figure 1-8 RNLI yearly callouts

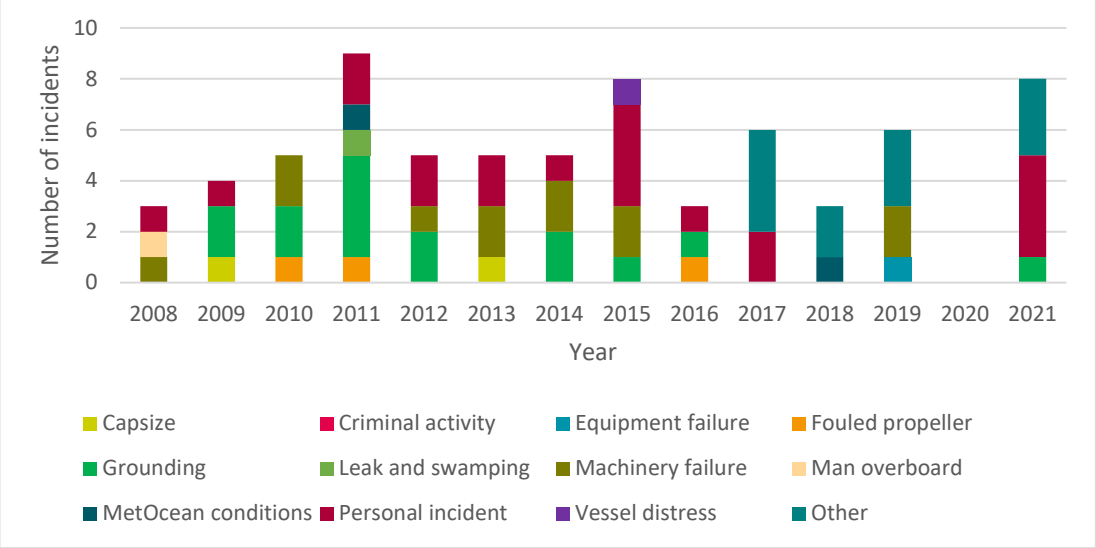


Figure 1-9 (Drawing Reference: P2663D-RNLI-001) presents the locations of incidences recorded by the RNLI. No incidents were recorded in the Study Area for 2020.

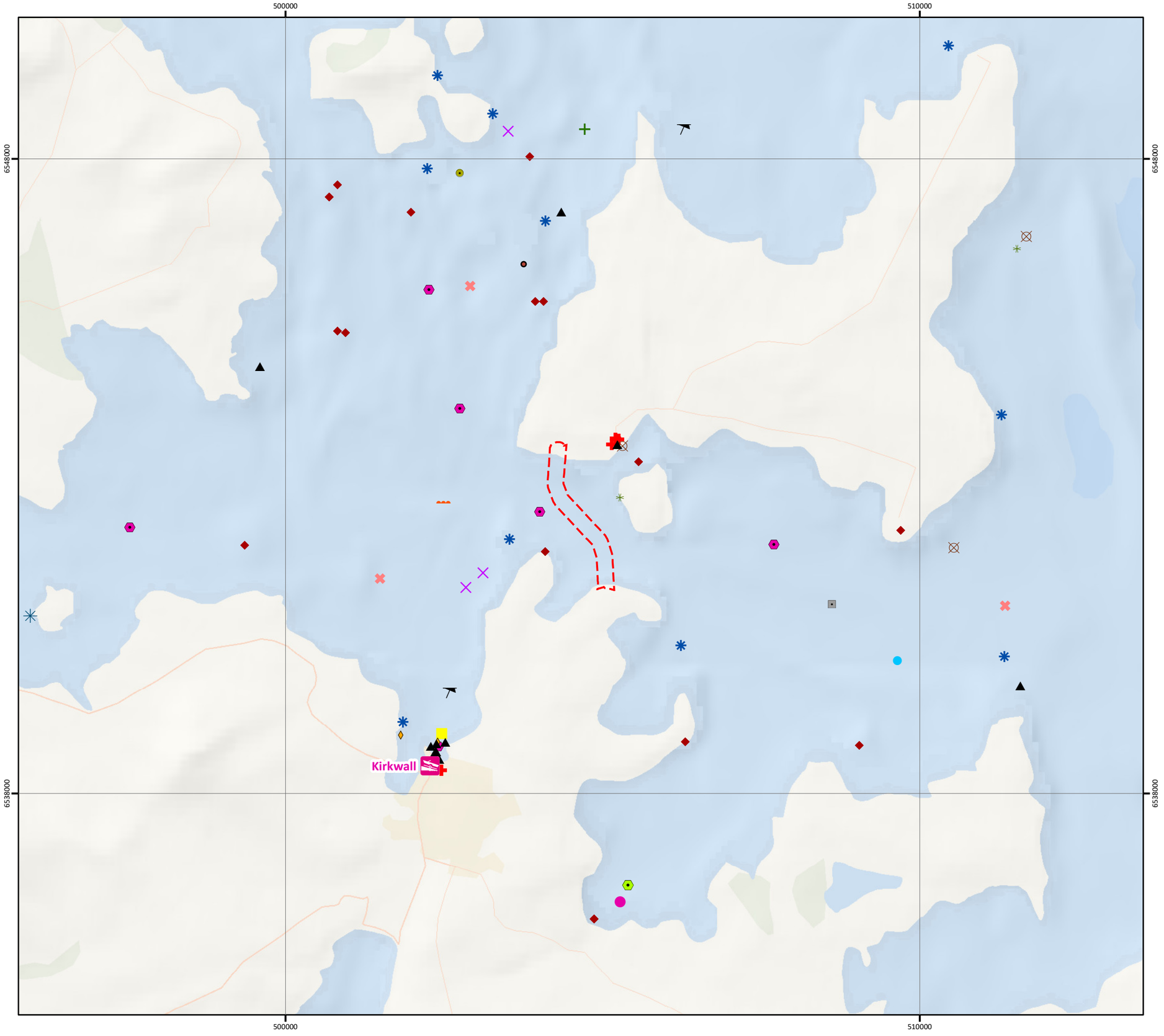
The most common type of incident recorded were personal incidents (such as injuries), followed by Grounding related incidents. The increase in other incidents in more recent years is due to a lack of information regarding the reason for the call out, but the majority of incidents relate to commercial fishing vessels requiring incidents or the investigation of reports of a body in the water. No collisions were reported in the Study Area. As the majority of incidents recorded relate to personal reasons such as ill health and transportation of a person to hospital, and groundings often as a result of the sea

conditions at the time of the incident or unfamiliarity with the area, it is not expected that the vessels and activities considered as part of the Project will increase the risks to the existing baseline of marine safety.

ORKNEY TO SHAPINSAY DISTRIBUTION CABLE REPLACEMENT

RNLI
Return of Service Data 2008 - 2021

Drawing No: P2663D-RNLI-001	A

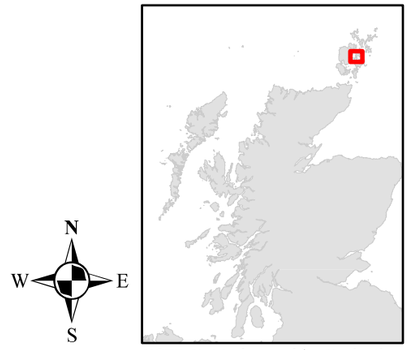


Legend

- Application Corridor
- RNLI Lifeboat Station

RNLI Returns of Service Incidents

- Adverse conditions
- Ambulance or doctor call
- Attempting rescue of a casualty
- Capsize
- Cut off by tide
- Equipment failure
- Fouled propeller / impeller
- Human error
- Ill crewman on vessel
- Illness
- In danger of drowning
- Leaks / Swamping
- Machinery Failure
- Man overboard
- Other
- Out of fuel
- Person in distress
- Person missing
- Person recovery
- Slippery or uneven surface
- Stranding / Grounding
- Thought to be in trouble
- Unknown



NOTE: Not to be used for Navigation

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Projection	Transverse Mercator
Datum	WGS 1984
Data Source	RNLI; OS; GEBCO; ESRI
File Reference	J:\P2663\P2663D\Mxd_QGZ\08_RNLI\ P2663D-RNLI-001.mxd
Created By	Oliver Bula
Reviewed By	Lewis Castle
Approved By	Vicky Fisk

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0 1 2 3 4 km

1.4.5.2 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 12 nautical miles (NM) and carrying passengers to or from a UK port. However, the MAIB will 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.

The last five years of annual MAIB reports from 2018 to 2022 have been analysed to determine if any accidents have occurred within or nearby to the Application Corridor. The findings have been summarised below as:

- **2022**: 5th July - Grounding of a UK registered ro-ro passenger ferry (MV Alfred) on Swona Island, Scotland (approximately 30km south of the Application Corridor).
- **2021**: No incidents or accidents relating to vessels at sea within the vicinity of the study area.
- **2020**: No incidents or accidents relating to vessels at sea within the vicinity of the study area.
- **2019**: No incidents or accidents relating to vessels at sea within the vicinity of the study area.
- **2018**: 18th July - Grounding of the Netherlands registered general cargo vessel Priscilla in the Pentland Firth, Scotland (no location given, but the Pentland Firth is located approximately 22km south of the Application Corridor).

A total of two marine incidents were reported across or near the study area, corresponding to an average of 0.4 incidents a year. Alongside the reported incidents from the MIAB annual reports, a machinery failure and subsequent grounding of the UK registered ro-ro passenger ferry Pentalina at St Margaret's Hope, South Ronaldsay occurred on 29th April 2023. This is located approximately 20km south of the Application Corridor.

It is worth noting that none of the incidents relate to a collision with other vessels so this area of the sea can be deemed relatively incident free.

1.5 Hazard Identification

Marine operations and their associated hazards have been identified and listed in Table 1-7. A hazard has been assigned to each aspect of the marine operation including the zone of influence, resulting in a worst-case assessment. The zone of influence is usually dictated by the progress rates in a given working 24-hour and the size of exclusion zones around the vessels. The route corridor length is very short, and in theory all project vessels could quite easily cover it in a 24-hour period. Therefore, the zone of influence is largely defined by the exclusion zone around the vessel.

Table 1-7 Marine operations and identified hazards – shipping and navigation

Project Phase	Operation	Hazard Identified	Receptor	Zone of Influence
Pre-Lay	Pre-Lay Survey	▪ Displacement of vessels due to avoidance of project vessels ▪ Vessel Collision ▪ Accidental anchoring on surface laid cable ▪ Fishing interaction with Surface laid cable ▪ Project vessels blocking navigational features	Project vessels; Commercial shipping; Recreational, boating and fishing vessels	1km wide
	Pre-Lay Grapnel Run			1km wide
	Boulder Clearance			1km wide x 0.4km along centreline (in any 24-hour period)
Installation	Shore End Operations (cable pull in)			1km wide at each shore end point (in any 24-hour period)
	Cable Lay			1km wide

Project Phase	Operation	Hazard Identified	Receptor	Zone of Influence
	Mattress Installation	▪ Extreme weather conditions ▪ Reduced Visibility ▪ Change in water depth		1km wide at crossing location for 24 hours
	Articulated Pipe Installation			1km wide and 450m in length at each shore end
	Rock Bag/ Clump Weight/ Rock Anchor Installation			1km wide along centreline (in any 24-hour period)
Operation and maintenance	Routine Inspection			1km wide

2. RISK ANALYSIS

The descriptions and definitions in the below risk analysis takes into consideration the applied mitigation needed to reduce the hazards to ALARP, resulting in the **residual risk ratings**.

2.1 Displacement of Vessels due to the Avoidance of Project Vessels

Existing vessels may have to re-route around or reduce speed on approach to the project vessels which may causing a disturbance in the existing shipping patterns.

The presence of the project vessels will add an additional hazard for mariners to be aware of, which will potentially make them more vigilant when navigating through the area. In most cases, there is ample 'sea room' for existing shipping to manoeuvre around the project vessels. However, due to the narrow width of The String (1.5km at its narrowest point to the west of the Application Corridor) and the location of Helliar Holm to the west of the Application Corridor, it is possible existing vessels will need to give way to each other to ensure there is enough room to safely manoeuvre.

Most project vessels will be moving along at a moderate progress rate and are generally quite mobile (speed is dependent on specific activity), therefore any disruption will be temporary and short term in any one location. As shipping will have to make minor diversions to avoid the project vessels, their frequency has been assessed as **Remote**. For slower operations (cable lay and potentially any activity requiring the use of the diver support vessel), disruption due to the presence of project vessels could be **Very Probable**.

The consequence has been assessed as **Significant** because it will be very short-term, temporary, and acceptable alternatives for route planning are available for shipping traffic to manoeuvre around project vessels. If multiple vessels need to pass at the same time, vessels may need to wait in turn for a passable space which could result in delays especially to the regular ferry service between Kirkwall and Shapinsay.

2.2 Vessel Collision

Existing vessels may have to re-route around project vessels 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 shipping lanes, near fishing grounds and at landfall areas.

Vessels will be operating in compliance with international shipping standards, therefore, vessel masters will be competent and adept at navigating in unfamiliar waters.

The probability of a vessel-to-vessel collision is **Extremely Remote,** but the consequence could be **Catastrophic.**

2.3 Accidental Anchoring on Surface Laid Cable

Vessel anchors will have the potential to interact with the cable if anchors are deployed along the route. If the cable is damaged, then existing shipping may be slightly disrupted when carrying out cable repair operations.

It is considered unlikely that an anchor will be deployed within the Application Corridor due to its location away from anchorage areas. The probability of an anchor deployment on a surface laid cable has been determined to be very unlikely but may occur in the event of an emergency, extreme weather conditions or accidental deployment of an anchor.

The probability of a ships anchor interacting with the cables are **Extremely Remote**, but the consequence on the ship itself and human safety could be **Severe**.

2.4 Accidental Snagging of Fishing Gear on Unburied Cable

Fishing vessel gear will have the potential to interact with the cable along its full route length as no burial is planned.

Once established, appropriate mitigation is needed to ensure the cable is suitably protected against the type of fishing (i.e. static gear) and anchoring in the area. While it is advised by the MCA and in the Mariners Handbook and as per European Subsea Cables Association (ESCA) standard industry guidelines that fishing should be avoided across subsea cables, it is assumed that fishing may occur across the cable once installed.

A NtM will be issued prior to installation commencing containing all relevant information regarding the installation phase, including locational information and timescales. The NtM will be circulated by Orkney Harbour Authority.

During the installation phase, there will be a designated Fisheries Liaison Officer (FLO). With these services in place, there will be a FLO monitoring body present during the installation process. The project FLO can disseminate information to the project vessels regarding seasonal variations in fishing patterns and identifying fishing gear/pots.

Complete fishing clearance from the installation corridor will be maintained until the works have been completed. This will be co-ordinated via the FLO and communicated by NtM.

Once installation is complete, an assessment of the potential hazards the installed cable poses to other marine users will be submitted to the Marine Directorate. The installed cable will also be mapped on Admiralty charts and provided to the fishing industry as part of the KIS-ORCA dataset.

The probability of a fishing gear interacting with the cables is **Extremely Remote**, supported by no known snagging incidents involving the existing surface laid cable, but the consequence of snagging could be **Serious** since it could cause damage to vessels and equipment.

2.5 Project Vessels Blocking Navigational Features

Project vessels have the potential to block key navigational features such as anchorages or approaches to ports.

No anchorages are present within the Application Corridor. The closest anchorage is located in Elwick Bay, approximately 1.2km east of the Application Corridor, and two visitor berths are also available within the bay for fishing vessels. Other nearby anchorages are located in the Bay of Kirkwall, with one located in the centre of the bay and two further anchorages located close to the shore of Kirkwall. The anchorages in the Bay of Kirkwall are likely to be used by larger vessels such as cruise ships. Some displacement of vessels may occur and consideration to existing vessels anchoring may need to be carried out for the pull in operations. The cable is within the Orkney Harbour Authority limits.

The effects of the installation campaign are temporary, and the shore end pull in operation at the Twi Ness landfall (which has the potential to affect ferries leaving the Shapinsay Ferry Terminal) will take one day to complete. There is the possibility that vessels will be able to manoeuvre around the installation vessel. Based on this duration and the likelihood of manoeuvrability, the probability is expected to be **Probable** and the consequence **Significant.**

Cable protection installation operations have longer durations but the more time-consuming installations, such as articulated pipe, are confined to shore ends and therefore frequency of blocking navigational features during these operations have been assessed as **Remote**.

2.6 Extreme 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, the project vessels may need to shelter in port if weather exceeds working limitations. This would mean seeking shelter before the weather reaches the limitations of the vessel and its crew, reducing the residual frequency. 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 project vessels encountering extreme weather is **Remote**, and the consequence is likely to be **Significant**. In the risk assessment, the residual frequency is represented by Remote; although vessels should always shelter before reaching working limits, the weather can change unpredictably, and adverse weather could be encountered multiple times in winter months.

2.7 Reduced Visibility

Navigating a ship in reduced visibility because of fog or heavy rain presents a set of challenges where vessel masters should follow the relevant Marine Guidance Notes (MGN) for preventing collisions at sea.

When the ship's officer gets information regarding such upcoming weather condition, they should take the necessary precautions to ensure that the ship sails through reduced visibility area without confronting any kind of collision or grounding accident. Some precautions are as follows:

- Keep the foghorn ready: Ensure that the foghorn is working properly for the restricted area. If the horn is air operated, drain the line prior to opening the air to the horn.
- Reduce speed: Reduce the speed of the ship depending on the visibility level. If the visibility is less, bring down the ship to manoeuvring RPM (revolutions per minute).
- Ensure navigation equipment and light are working properly: Ensure that all important navigating equipment and navigation lights are working properly during restricted visibility. The officer on watch must ensure that the navigation charts are properly checked for correct routeing.

Vessel masters shall be aware of their radar settings and use known objects such a channel buoys to confirm correct calibration to ensure vessels without AIS transponders are located on radar in reduced visibility which may lead to a collision of grounding.

The probability of project vessels encountering weather that caused reduced visibility (excluding night-time hours) is **Remote,** but the consequence is likely to be **Significant**.

2.8 Change in Water Depth – Affecting Safe Navigation

Exact deposit amounts are not currently known; however it is anticipated they will consist of rock bags and concrete mattresses with cast iron split pipe in the intertidal area. Concrete mattresses have a height of 0.3m, rock bags have a height of up to 0.7m. The UK Maritime and Coastguard Agency (MCA) require that any contingency cable protection works must ensure existing and future safe navigation is not compromised. Generally, they are prepared to accept a maximum of 5% reduction in surrounding depth referenced to chart datum (CD) if the depth reductions do not compromise safe navigation.

Cable protection, if installed within depths of less than 10m, has the potential to change the chart datum by more than 5%. Any rock bags to be used from 8m LAT will be a maximum height of 0.4m to reduce the possibility of a water depth reduction of more than 5%.

There are two planned cable crossings across the existing operational Orkney – Shapinsay distribution cable and an OOS cable identified during the survey. Based on depths of more than 10m at the cable crossing, cable protection deposits will not exceed the 5% depth MCA requirement.

No additional cable protection is expected. Water depth has been assessed as navigable at both crossing locations. Crossing design will be such as not to reduce navigable water depth by more than 5%.

3. RISK ASSESSMENT

In this risk assessment the hazard has been ranked by expected risk, based on the estimated frequency and consequence with no mitigation measures applied creating a 'Inherent Risk' to the project. The exercise was repeated with compliance mitigation and industry best practice measures which results in a residual risk allowing the hazards to be reduced to ALARP. No hazards more than a moderate risk are present as identified in the risk assessment.

Table 3-3 in Section 3.2 presents the risk assessment conducted on the marine operations and associated hazards. All hazards have reached a risk level tolerable to the project through the ALARP process.

3.1 Risk Control

3.1.1.1 Compliance and Best Practise Mitigation

Compliance measures are required to be undertaken to meet environmental and health and safety legislation. When undertaking the assessment, it is assumed that these measures as well as Best Practise Mitigation will be complied with; either as a matter of best practice or to ensure compliance with statute.

The identification column (ID) in Table 3-1 and Table 3-2 have been cross referenced with the shipping and navigation mitigation measures outlined in the Marine Environmental Appraisal (MEA) (P2663D1-R6253).

3.1.2 Embeded Mitigation

Table 3-1 presents measures that the Orkney - Shapinsay Distribution Cable Replacement project will adhere to in order to ensure best practice and alignment with relevant international statute.

Table 3-1 Embedded mitigation – shipping and navigation

ID	Embedded Mitigation measure
EM1	Early consultation with relevant contacts to warn of impending activity, with vessels requested to remain at least 500m away from cable vessels during installation, repair and decommissioning.
EM2	Project vessels will 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.
EM3	All vessels used by the Project will exhibit signals in accordance with the UK Standard Marking Schedule for Offshore Installations.
EM4	Notice will be given to sea users in the area via Orkney Harbour Authority Notices to Mariners and Kingfisher Bulletins. . Particular attention will be paid to ensuring the following organisations receive the notifications: RYA, MCA, Northlink and Orkney Ferries.
EM5	'As-laid' co-ordinates of the cable route will be recorded and circulated to the UK Hydrographic Office (UKHO), KIS-ORCA service and any other relevant authorities. Cables will be marked on Admiralty Charts and fisherman's awareness charts (paper and electronic format).
EM6	Procedures to minimise disruption near high density shipping areas will include, for example, avoidance of anchoring near busy areas when Project vessels are waiting on weather; and the presence of a guard vessel where deemed necessary. Installation vessels will have passage planning procedures, holding positions (e.g. if waiting on weather), traffic monitoring (e.g. radar, AIS, and visual), means of communication with third-party vessels, and emergency response plans in the event a third-party vessel approaches on a collision course.
EM7	A guard vessel may be used during the installation campaign where a potential risk to the asset or danger to navigation has been identified.
EM8	Effective channels of communication will be established and maintained between the Project, commercial fishing interests and Orkney Islands Council Harbour Authority.

ID	Embedded Mitigation measure
EM9	Rock bag and articulated pipes will only be deployed where needed and the footprint of the deposits will be the minimum required to ensure cable safety and stability.

3.1.3 Project specific mitigation measures

In addition to the Embedded Mitigation measures above, Table 3-2 presents measures that the Project is committed to adopting.

Table 3-2 Project Specific measures – shipping and navigation

ID	Project Specific measure
PS1	A Harbour Works Licence will be applied for from Orkney Islands Council Harbour Authority, which will be applied for by SHEPD.

3.2 Risk Assessment Table

The risk assessment is shown Table 3-3.

Risk Assessment: Operation	Hazard	Inherent Risk							Risk Mitigation	Residual Risk							Comments
		Frequency	Consequence			Risk Rating				Frequency	Consequence			Risk Rating			
			Effect on Human Safety	Effect on Ship(s)	Displacement of Vessel(s)	Effect on Human Safety	Effect on Ship(s)	Displacement of Vessel(s)			Effect on Human Safety	Effect on Ship(s)	Displacement of Vessel(s)	Effect on Human Safety	Effect on Ship(s)	Displacement of Vessel(s)	
Pre and Post Lay Survey	Presence of project vessels	4	1	1	2	4	4	8	EM1, EM2, EM3, EM4, EM6, EM8, PS1	2	1	1	2	2	2	4	
	Vessel collision	2	5	5	N/A	10	10	N/A		1	5	5	N/A	5	5	N/A	Cannot assess vessel displacement if collision has occurred
	Project vessels blocking navigational features	4	1	1	2	4	4	8		3	1	1	2	3	3	6	
	Extreme weather conditions	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
	Reduced Visibility	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
Route Clearance (PLGR & Boulder)	Presence of project vessels	5	1	1	2	5	5	10	EM1, EM2, EM3, EM4, EM6, EM7 EM8, PS1	4	1	1	2	4	4	8	
	Vessel collision	2	5	5	N/A	10	10	N/A		1	5	5	N/A	5	5	N/A	Cannot assess vessel displacement if collision has occurred
	Project vessels blocking navigational features	4	1	1	2	4	4	8		3	1	1	2	3	3	6	
	Extreme weather conditions	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
	Reduced visibility	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
Cable Lay and Shore End Operations	Presence of project vessels	5	1	1	3	5	5	15	EM1, EM2, EM3, EM4, EM6, EM7 EM8, PS1	3	1	1	3	3	3	9	
	Vessel collision	2	5	5	N/A	10	10	N/A		1	5	5	N/A	5	5	N/A	Cannot assess vessel displacement if collision has occurred
	Project vessels blocking navigational features	4	1	1	3	4	4	12		3	1	1	3	3	3	9	
	Accidental anchoring on unburied cable	2	3	3	2	6	6	4		1	3	3	2	3	3	2	
	Accidental snagging of fishing gear on unburied cable	2	4	4	2	8	8	4		1	4	4	2	4	4	2	Maintain fishing clearance until after post-lay surveys (co-ordinated via FLO)
	Extreme weather conditions	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
	Reduced visibility	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
Articulated Pipe Installation	Presence of project vessels	5	1	1	3	5	5	15	EM1, EM2, EM3, EM4, EM6, EM7 EM8, EM9, PS1	2	1	1	3	2	2	6	Shore end ops so reduced frequency
	Vessel collision	2	5	5	N/A	10	10	N/A		1	5	5	N/A	5	5	N/A	Cannot assess vessel displacement if collision has occurred
	Project vessels blocking navigational features	3	1	1	3	3	3	9		2	1	1	3	2	2	6	Shore end ops only so reduced frequency
	Extreme weather conditions	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
	Reduced visibility	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
Concrete Mattress Installation **Rock Bag Installation** **Other Stabilisation Measures**	Presence of project vessels	5	1	1	3	5	5	15	EM1, EM2, EM3, EM4, EM6, EM7 EM8, EM9, PS1	3	1	1	3	3	3	9	
	Vessel collision	2	5	5	N/A	10	10	N/A		1	5	5	N/A	5	5	N/A	Cannot assess vessel displacement if collision has occurred
	Project vessels blocking navigational features	3	1	1	3	3	3	9		2	1	1	3	2	2	6	
	Extreme weather conditions	2	2	2	2	4	4	4		2	2	2	2	4	4	4	
	Reduced visibility	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
	Water depth reduction	2	1	1	1	2	2	2		1	1	1	1	1	1	1	Water depth assessed as navigable at all crossings. Concrete mattressing used if 5% depth change caused by rock bags and assessed once positions are known
Pre - Construction and Operation & Maintenance Survey	Presence of project vessels	4	1	1	2	4	4	8	EM1, EM2, EM3, EM4, EM6, EM8, PS1	2	1	1	2	2	2	4	Periodic inspections every 5-8 years
	Vessel collision	2	5	5	N/A	10	10	N/A		1	5	5	N/A	5	5	N/A	Cannot assess vessel displacement if collision has occurred
	Project vessels blocking navigational features	4	1	1	2	4	4	8		3	1	1	2	3	3	6	
	Extreme weather conditions	3	2	2	2	6	6	6		2	2	2	2	4	4	4	
	Reduced Visibility	3	2	2	2	6	6	6		2	2	2	2	4	4	4	

3.3 Conclusions

Vessel density across the Application Corridor is considered moderate, with an average density of 29 hours a month which reduces to 10-20 hours a month at the landfall locations. The most common vessel types observed were tugs and towing, followed by services vessels and passenger vessels. This is consistent with the regular ferry services operating multiple routes across The String (including a six times daily service between Kirkwall and Balfour) and the passage of cruise ships through the channel during the spring and summer. The Project could cause the displacement of vessels in the area due to the presence of project vessels, as well as potentially block navigational features such as the approaches to the ferry terminal at Balfour. The increased number of vessels in the Application Corridor could also increase the risk of vessel collisions or accidental anchoring on surface laid cable. Finally, the placement of cable protection and stabilisation deposits could lead to a change in water depth, affecting safe navigation.

The density of recreational vessels across the Application Corridor is considered to be moderate to high. The Application Corridor is located at the edge of a club sailing area which is based in the Bay of Kirkwall where the majority of recreational activity takes place.

The Application Corridor is located within ICES rectangle 47E7 which is characterised by demersal trawl and seine fishing, with pots and traps the second most common fishing method. Commonly targeted species include herring and crabs. Static fishing gear was observed during a scouting survey of the Application Corridor in June 2023, as well as route survey works. This could result in a potential snagging risk between surface laid cable or stabilisation deposits and any fishing gear.

The Application Corridor crosses two existing cables which will require additional placement of concrete mattress protection to protect both the existing and new cables. This has the potential to affect safe navigation in the area due to a change in water depth.

The risk assessment has identified that all identified hazards have been reduced to ALARP and, with the relevant best practice measures applied, no hazards exist that are above a moderate risk level. The greatest risk to the existing baseline has been assessed as the presence of project vessels during both the cable lay and shore end operations and the installation of cable stabilisation, and project vessels blocking navigational features during the cable lay and shore end operations, both of which have been assessed at a moderate frequency with severe consequences. This risk has been mitigated through embedded mitigation such as early engagement with relevant stakeholders (including Orkney Harbour Authority and Orkney Ferries) and the issuing of NtMs by Orkney Harbour Authority to inform marine users of the works and the exclusion zone. Additionally, any risks relating to changes in water depth due to deposits from the Project have been mitigated through adherence to the MCA's guidance and engineering design ensuring there is a no more than a 5% reduction in navigable depth throughout the Application Corridor. Project specific mitigation has also been applied to reduce the risk to ALARP, which will involve SHEPD applying for a Harbour Works Licence from Orkney Harbour Authority which will keep the Authority informed of the project's plans. Whilst disruption to vessels is likely due to the location of the Application Corridor in the narrow String Channel, the installation campaign will be temporary and transient with no permanent disruption to navigation in the area.

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