Kyleakin Feed Mill Pier

Navigational risk assessment

Marine Harvest (Scotland) Ltd

November 2016

Creating sustainable solutions for the marine environment

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Notice

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Executive Summary

ABPmer has been commissioned by Marine Harvest (Scotland) Ltd to undertake a Navigational Risk Assessment (NRA), which details the risks generated by the construction and operational phases of the proposed marine works associated with the Kyleakin Feed Mill.

A risk workshop was held to draw out expert opinion from the local stakeholders. Relevant guidance and information published by industry bodies and regulators has also been reviewed and incorporated to the NRA process. To inform the stakeholder group, information defining the baseline navigational environment was provided, which included a traffic assessment using AIS data collected in 2015, augmented by published and anecdotal information on recreational vessel use.

In total, 29 hazard scenarios were identified and assessed. A total of 14 hazard scenarios were identified for the construction phase and 15 hazard scenarios for the operational phase.

From the NRA process, 24 mitigation measures were identified, split between the Construction and Operational phases of the proposed development. Following implementation of appropriate mitigation, marine risk to navigational receptors can be maintained within a level that is 'as low as reasonably practicable'.

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1 Introduction

1.1 Background to project

The Marine Harvest Company is one of the largest seafood companies in the world, and the largest producer of Atlantic salmon. The company is represented in 24 countries and supplies sustainably farmed salmon and processed seafood to more than 70 markets worldwide. In order to supply fish feed, the Company wishes to develop a feed mill which is strategically located to support is local and regional fish farming operations.

Marine Harvest (Scotland) Ltd, a division of the Marine Harvest Company, has drawn-up plans to create a feed mill plant at Allt Anavig Quarry in Kyleakin, which is located on the Isle of Skye. The proposed development includes both terrestrial and marine works, which means that both planning permission and marine licensing are required for its construction.

This study has been commissioned to consider any marine risk created by construction activities and the subsequent marine use of the pier facility. The output of this study is a set of Navigational Risk Assessments (NRA)s which will be used in support of the Environmental Statement (ES). The following sections provide an overview of the study area and the legislation and guidance used in the preparation of this report.

1.2 Study area overview

The proposed Kyleakin Feed Mill development is located at a former sand and gravel quarry and there is an existing pier that was used as part of the quarry operation at the site. The development site is adjacent to the Kyle Akin narrows and the Skye Bridge crossing from the Scottish mainland. Figure 1 identifies the study area as an inset to the wider geographic area. For the purposes of this NRA, the study area includes Loch Alsh and Plockton at its Eastern side; and extends to the Island of Scalpay at its Western extent. This includes a sea area immediately to the north of the Kyleakin Feed Mill development which is termed the 'Inner Sound'.

1.3 Legislation and guidance

The following section identifies relevant legislation relating to navigational assessments for marine developments.

1.3.1 Primary legislation

International protocols and conventions relating to safety, laws of the sea and pollution apply to shipping and ports. The UK Government has a responsibility to ensure that measures are implemented in order to honour its commitments to these protocols, not least of these is the UK's responsibility under Article 60(7) of the United Nations Convention on the Law of the Sea (UNCLOS) relating to provisions for 'Artificial islands, installations and structures in the exclusive economic zone'. An NRA is one process by which the necessary considerations of developments can be evaluated.

Within UK territorial waters, the UK Government uphold the right of innocent passage as defined in Article 17 of UNCLOS, beyond the 12 nm-(nautical-mile) limit of UK territorial waters shipping has the freedom of navigation. The regulation of shipping should be carried out by the 'flag state control' operated by the country in which the ship is registered. As this has proved unsatisfactory 'port state

control' has become common in national jurisdictions. Under this regime the UK Government represented by the inspection division of the Maritime and Coastguard Agency (MCA) exercises the rights of the port state to inspect and if appropriate detain sub-standard ships.

Sea ports and harbours provide the interface between the land, near shore and open sea. The UK Marine Policy Statement (2011) identifies, in relation to port developments and marine safety, that: "*Marine plan authorities and decision makers should take into account and seek to minimise any negative impacts on shipping activity, freedom of navigation and navigational safety; and ensure that their decisions are in compliance with international maritime law*" (HM Government, 2011).

The majority of port operations are administered by a Statutory Harbour Authority (SHA). Every SHA is self-governed with specific legislation (Acts of Parliament) creating the SHA as an entity, with further powers and amendments made over time in response to the changing scope and remit of the SHA. Underpinning the powers of an SHA is a range of national legislation which places statutory responsibility on the Harbour Master to ensure navigation and safety within the harbour limits, this includes the 'Harbours, Docks and Piers Clauses Act 1847' and the 'British Transport Docks Act 1972'. Under such legislation, the Harbour Master may issue general or specific directions to control movements of vessels within their SHA in order to ensure safety.

The proposed Kyleakin Feed Mill development is located outside of an established SHA and therefore the competent authority with respect to navigation is the MCA.

1.3.2 Secondary guidance

In the absence of specific navigational guidance relating to the development and operation of the proposed Kyleakin Feed Mill development outside of an SHA, the following secondary guidance documents have been used in preparation of the NRAs. These documents provide information regarding the issues that should be taken into consideration when assessing the effect on navigational safety:

- International Maritime Organization (IMO) Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule making process (IMO, 2013);
- Maritime and Coastguard Agency (MCA), Marine Guidance Note 543 (MGN 543 Merchant + Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response (MCA, 2016);
- Department for Transport (DfT) and MCA; Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREI) (DfT / MCA, 2013); and
- DfT Port Marine Safety Code (DfT, 2016).

As the competent authority for marine safety, the MCA has been consulted in the planning and creation of the supporting NRA. In addition, in its capacity as the General Lighthouse Authority, the Northern Lighthouse Board has been consulted with respect to the lighting and marking of marine structures and marine works associated with the pier development.

1.3.3 ALARP principle

Within the DfT's Port Marine Safety Code, the term ALARP is defined; this stands for 'as low as reasonably practicable'. It is an industry wide concept applying to both health and safety and port marine safety. The core concept is that of 'reasonably practicable' which involves weighing up risk against the effort, time and money needed to control it. The Port Marine Safety Code specifically references ALARP in respect of the Marine Safety Management System (MSMS) and NRAs.

2 Data Sources

The following section details the origin of the data used to create the baseline and inform the NRAs.

2.1 Automatic identification system data

Automatic Identification System (AIS) data has been used from the year 2015. The data has been provided by the Marine Management Organisation (MMO) and decoded by ABPmer to create a geodatabase of anonymised vessel transits. The data was collected by the UK Maritime and Coastguard Agency (MCA) using their network of AIS receivers. The data represents a composite of 84 days of AIS data collected in 2015. The following periods of time form the dataset:

- 1 to 7 from each of the following: January, February, March, April, May, June, July, August, and November 2015;
- 8 to 14 of October 2015;
- 29 August to 4 September 2015; and
- 3 to 9 December 2015.

AIS signals are broadly classified as 'Class A' and 'Class B', where AIS-A is carried by international voyaging ships with gross tonnage (GT) of 300 or more tonnes, and all passenger ships regardless of size. AIS-B is carried by smaller vessels and is aimed at smaller commercial vessels, the fishing sector and recreational vessel users; however, the use of AIS-B is non-compulsory. Both AIS-A and AIS-B data have been used within this study.

The AIS data has been broken down using the following vessel categories which are taken directly from the AIS data transmissions:

- Non-Port service craft;
- Port service craft;
- Vessels engaged in dredging or underwater operations;
- High Speed Craft;
- Military or law enforcement vessels;
- Passenger vessels;
- Cargo vessels;
- Tankers;
- Fishing; and
- Recreational.

2.2 Recreational activity

Data for recreational activity in the study area has been collated using a variety of methods. Quantitative data is has been derived from AIS-B records, however it is recognised that only a small percentage of recreational craft carry AIS transceivers as the use of AIS-B is non-mandatory. Therefore, patterns of activity by recreational craft from AIS sources alone were considered to significantly underplay their true frequency and routeing patterns. Therefore, to provide a more comprehensive set of information to define recreational use, anecdotal and website information has been compiled, this included information from: local Yacht and Sailing Clubs, Royal Yachting Association (RYA) routeing information, race route maps, analysis of passage plans and yachting guides.

2.3 Navigational features

Navigational features have been considered in this assessment, and have been identified using information from UK Hydrographic Office (UKHO) Admiralty Chart numbers 2498 and 2540.

2.4 Maritime incidents

To characterise maritime incidents occurring within the study area, available data has been pooled from a number of sources. These included records held by the Royal National Lifeboat Institution (RNLI) call out data and Marine Accident Investigation Branch (MAIB) records.

2.5 Metocean

Information relating to the metocean environment, relevant to navigational interests with the study area has been drawn from a range of sources including Admiralty information, modelling carried out for the project and meteorological observations. Tidal information has been provided by Admiralty Total Tide, with currents at different states of tide taken from the report 'Kyleakin Pier Development - Coastal Processes and Hydraulic Modelling' (RPS, 2016). Wind information has been collated by RPS over a 17 year period and is presented as a wind rose.

3 Navigational Baseline

The following sections review the baseline condition for commercial shipping and recreational navigation within the study area. Where relevant, factors relating to the Kyleakin Feed Mill development marine works and the operation of the pier have been highlighted. The following elements are covered in the baseline:

- Navigational Environment;
- Statutory Responsibilities and Management Procedures;
- VTS Arrangements;
- Aids to Navigation;
- Emergency response; and
- Marine Incidents.

3.1 Navigational environment

The proposed facility is located on the northern side of the Isle of Skye near the town of Kyleakin. The approaches to the facility will involve navigation through the Minch (either North Minch or The Little Minch) which separate the Western Isles from the Isle of Skye. This area is sheltered from the Atlantic Ocean by the Western Isles, but is subject to swell from the North originating in the Norwegian Sea and from the South originating in the Irish Sea.

Once vessels have left the Minch and follow a route towards the Skye Bridge, the route used is either the Inner Sound (East of the Island of Rona) or the Sound of Raasay to the West of Rona. Both of these Sounds provide route options towards the Skye Bridge and onwards to the Kyle of Lochalsh. The Inner Sound is well sheltered other than from the North where it is exposed to swell travelling in a Southerly direction from the Norwegian Sea. Larger vessels will transit through the Inner Sound whereas smaller vessels may avoid this area and use the Sound of Raasay. See Figure 1 and Figure 2 for locations.

The Ministry of Defence (MoD) practice and exercise areas (PEXA) are located in the Inner Sound between the Island of Rona and the mainland, which extends down to the area between the Island of Raasay and the mainland. These are identified as Danger Area D710 and Exercise Area X5717. These areas contain an important MoD test range, the British Underwater Test and Evaluation Centre (BUTEC), which is used for defence test and evaluation purposes including noise trials (MoD, 2016). The pier development occupies MoD Exercise Area X5721 which is used mainly as a crew interchange and transit area for vessels on MoD activities. See Figure 2 for locations.

The approaches to the proposed facility include a buoyed navigation channel. The established aids to navigation for this provide a clearly marked navigation channel leading to the Skye Bridge. See Section 3.4 for more information on the aids to navigation. The tidal regime at Kyleakin results in strong currents directed through the Skye Bridge and the adjacent island and rocky outcrops between the Scottish Mainland and the Isle of Skye. A more detailed description of the currents is provided in Section 4.1. There are several isolated shallow rocky areas on either side of the main navigation channel leading to the Skye Bridge, these include the 'Black Eye Rock', 'Bow Rock' and the drying area termed 'Bogha Beang' located toe the West of the pier development. See Figure 3 for locations.

3.2 Statutory responsibilities and management procedures

There are two SHA's nearby to the project at the ports of Kyle of Lochalsh and Kyleakin. These ports are operated by the Highland Council who is the SHA and the Local Lighthouse Authority (LLA) for both ports.

The Highland Council's, duties and responsibilities as a SHA are drawn from the history of Acts and legislation, for the Ports of Kyle of Lochalsh and Kyleakin. Most notable of these is the Highland Regional Council (Harbours) Order 1991, which placed 27 ports and harbours under the jurisdiction of the Highland Council. The Highland Council is the LLA within the meaning of the Merchant Shipping Act 1995.

Within these harbours, the principal responsibility for navigational safety and the safe operation of the harbour lies with the Harbour Master who is empowered to regulate shipping by virtue of Section 52 and 53 of the Harbours, Docks and Piers Clauses Act 1847. This level of control enables the Harbour Master to regulate the movements of traffic within the harbour area to minimise the risk of collision and ensure the safe and timely movement of vessels. The location of the harbour boundaries are shown on Figure 3. The Kyleakin Feed Mill development is not located in an existing SHA.

3.3 Recreational facilities

Facilities within the study area are located at the ports of Kyleakin and Kyle of Lochalsh. Kyleakin has three 15 tonne visitor moorings and a pontoon which provides 180 m of berthing space for vessels. Kyle of Lochalsh has a pontoon which can accommodate 20 vessels. A further focus of recreational activity is Plockton, located to the North of the study area, this harbour's interest is managed by the Plockton Harbour Community Interest Company providing 15 moorings for visiting yachts and access to two pontoons. Further anchor areas are commonly used within the area for residential and visiting yachts.

3.4 Aids to navigation

Within the study area there are a range of aids to navigation including a marked channel, an AIS buoy and a Racon buoy. See Figure 3 for the location of buoys.

The buoyed channel is used to indicate where it is safe for vessels to navigate and will generally keep to the deep water in an area. The channel is lined with lateral marks which are either green or red to indicate which side a vessel should pass them. The lateral marks used within the study area are buoys and land-based lights. To differentiate the buoys their shape is either a 'can' shape for Port and a 'cone' shape for Starboard. In addition, the light which is displayed will be different for each mark. The marked channel begins at String Rock on the eastern side of Kyle Akin and proceeds in a Westerly direction under the Skye Bridge and ends at the deeper water of Inner Sound.

The AIS buoy (see Figure 3 for location) contains a transmitter which will be received by vessels navigating within the area. The purpose of this buoy is so that its position can be known to a vessel that doesn't have visual contact with the buoy. This is particularly useful during periods of reduced visibility.

The Racon buoy is located to the west of Carrach Rock and when a vessel's radar interrogates the buoy the corresponding letter will be displayed on the radar screen (the letter T for this buoy). Similarly to the AIS buoy, the purpose of this is so that the mark can be identified even if the vessel does not have visual contact.

3.5 Anchoring

Within the study area there are designated anchorages located on the southern side of the Plock of Kyle and in Loch Na Beiste; for location, see Figure 3. The seabed in the immediate vicinity of the pier development varies from rock and shells to fine sand. These materials do not provide good holding ground for anchoring and so are unlikely to be used by vessels other than in an emergency situation.

For recreational vessels and smaller fishing vessels, there are a number of anchorages in the Kyle of Lochalsh and Kyleakin area, two anchorages to the East of Kyleakin; one in Ob nam Portan and one in Loch na Beiste. There are numerous anchorages along the north shore which give shelter in Northerly winds.

3.6 Emergency response

A range of emergency response is available within the study area. The following organisations can be called upon to render assistance in the instance that a marine emergency occurs.

3.6.1 HM Coastguard

The MCA is responsible for the initiation and co-ordination of all civilian maritime Search and Rescue (SAR) within the UK Maritime Search and Rescue Region. This includes the mobilisation, organisation and tasking of adequate resources to respond to persons either in distress at sea, or to persons at risk of injury or death along the shoreline within the UK. HM Coastguard has access to a range of resources including Aircraft and Coastal search teams. The study area under consideration falls within the jurisdiction of the Stornoway Coastguard Operations Centre.

3.6.2 RNLI

There is one lifeboat station in the vicinity of the project located at Kyle of Lochalsh, shown on Figure 3. The lifeboat station operates 24 hours a day and uses an inshore B class Atlantic 75 lifeboat.

3.7 Marine incidents

This section reviews marine incidents that have occurred within the study area over the past 10 years (subject to the availability of data). The analysis is intended to provide a general indication as to whether the study area is in an area of low or high risk in terms of marine incidents. Data from the MAIB and the RNLI has been obtained, covering the following timescale:

- MAIB: information includes accident to ships and personnel report to the MAIB within the period of 2006 to 2015 inclusive.
- RNLI: complete dataset of all callouts from 2006 to 2015 inclusive.

The study team has amalgamated these datasets, allowing for differences in classifications for identifying accidents and incidents between the two datasets. Where possible, duplication of data has also been removed (as the same incident may be recorded by both organisations). The complete combined dataset has been presented spatially in Figure 4. Due to the size and complexity of the data record, the tabulated information has been included in Appendix A. Table 1 provides a compiled view of marine incidents within the study area addressed by this document.

Table 1. Marine incident summary for the study area (2006 to 2015)

Incident Category	Year										Total	Annual Frequency
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015		
Capsize/Sinking	1		2	1							4	0.4
Collision									1	1	2	0.2
Equipment failure (vessel)	5	3	2	4	3	2	3	1	3	4	30	3
Fire/Explosion	1	1		1			1				4	0.4
Grounding	2	2		1		2	1	1	1	1	11	1.1
Leaks/Swamping	1						1	2			4	0.4
Other nautical safety	2	1		1	2	2	1		2		11	1.1
Person in distress										1	1	0.1
Total	**12**	**7**	**4**	**8**	**5**	**6**	**7**	**4**	**7**	**7**	**67**	**6.7**

From Table 1, it can be noted that the most commonly occurring incident within the wider study area is that of 'Equipment failure (vessel)' followed jointly by 'Grounding' and 'Other Nautical Safety' incidents. When the location of these is examined on Figure 4 it can be seen that incidents generally occur close to the coastline, with the highest concentrations on the Isle of Skye coastline between the Island of Scalpay, Pabay and the Skye Coastline near Broadford and Kyleakin.

The more serious marine incidents of ship-to-ship collision, fire/explosion and sinking/capsize occur relatively infrequently within the study area with 10 reported occurrences within the 10 year period (15% of total incidents in the area). There were four reported 'Capsize/Sinking' incidents of which two were small recreational craft and two were fishing vessels. The 'Fire/Explosion' incidents involved small recreational and fishing craft and the two collisions involved small recreational craft.

4 Metocean

This section describes the Metocean conditions at the study area which will affect vessel manoeuvring. The conditions considered are:

- Tides;
- Wave climate; and
- Wind conditions.

4.1 Tides

Information from Admiralty Total Tide shows that the annual extreme tide levels for 2016 are a low water of 0.1 m above chart datum and a high water of 5.9 m above chart datum. The average tidal ranges average 4.7 m on a spring tide and 1.8 m on a neap tide with tide timings base on Ullapool.

Tidal streams in the area are at their highest through Kyle Rhea and at the Skye Bridge. At Kyle Rhea the North going stream starts at 6 hours after high water at Ullapool and reaches a rate of 7 knots during a spring tide. The South going stream starts at high water at Ullapool and can reach a rate of up to 8 knots during a spring tide. During instances of highest tidal rates eddies form and large waves can result where wind opposes tide.

At the Skye Bridge the Easterly tidal stream starts 4 hours and 20 minutes before high water at Ullapool during a spring tide and at high water Ullapool on a neap tide. The Westerly tidal stream starts fours after high water Ullapool during a spring tide and 6 hours after high water Ullapool on a neap tide. Appendix B shows a tidal stream atlas for hourly intervals from high water minus six hours to high water plus six hours on a spring and a neap tide. The tidal set in this area is complex with eddies forming and the tidal set for a spring tide being opposite to the tidal set for a neap tide at certain states of the tide.

4.2 Waves

Kyleakin is well sheltered by the surrounding land although there is the potential for larger waves to affect the area from a northerly direction due to the large fetch from this direction. Image 1 shows a wave rose for the marine works site derived from data gathered from an inshore located in close proximity to the pier development site.

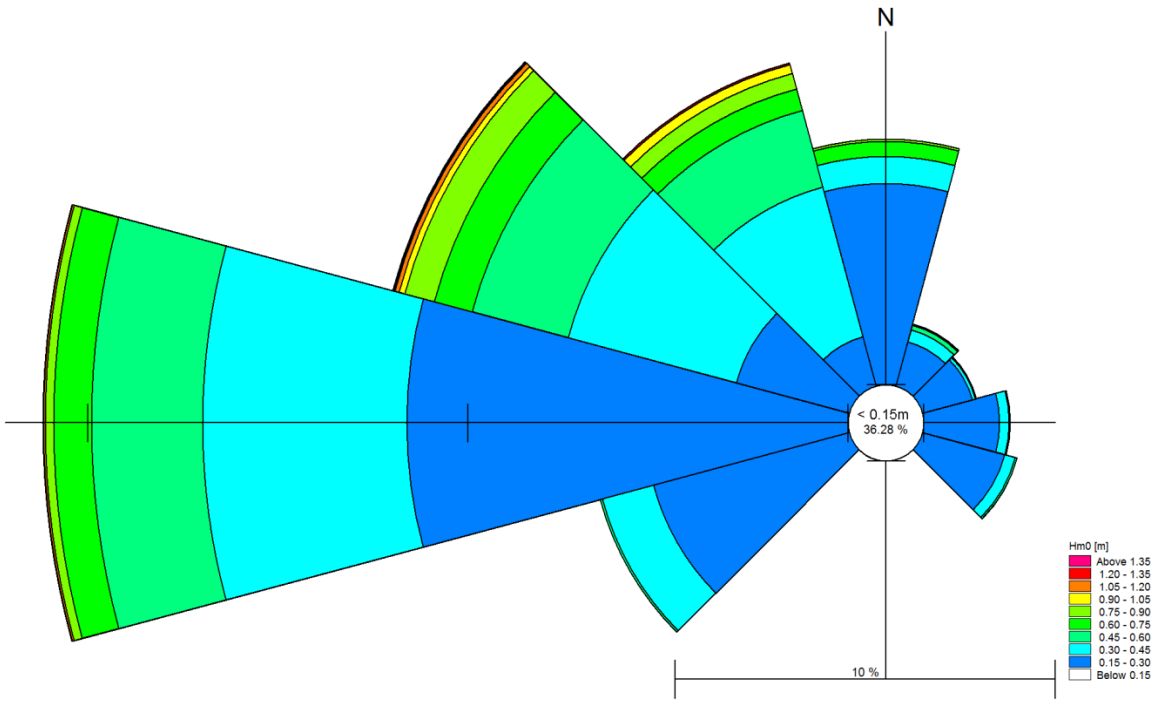


Image 1. Rose plot of wave height against direction

Image 1 shows that the largest percentage of waves comes from a westerly direction and are less than 0.9 m in height. The greatest proportion of waves larger than 0.9 m are from the north-west, this is likely due to the larger fetch in this direction.

4.3 Wind conditions

The offshore wind conditions have been collated by RPS using data gathered over a 17 year period and have been plotted as a wind rose (see Image 2). The wind rose is based on data from the ECMWF Operational Atmospheric model archive for the period 1991 to 2016 for a point at 57.5N 6.0W. The wind speeds have been increased by 17% as per recommendation in BS EN 1991-1-4:2005+A1:2010 to bring the wind speeds from overland to over water values.

The wind speed and direction shown in Image 2 indicates the prevailing wind is from a southerly or south-easterly direction with speeds up to 28 m/s. This level of wind is substantial; however the area is sheltered from this direction by the Isle of Skye.

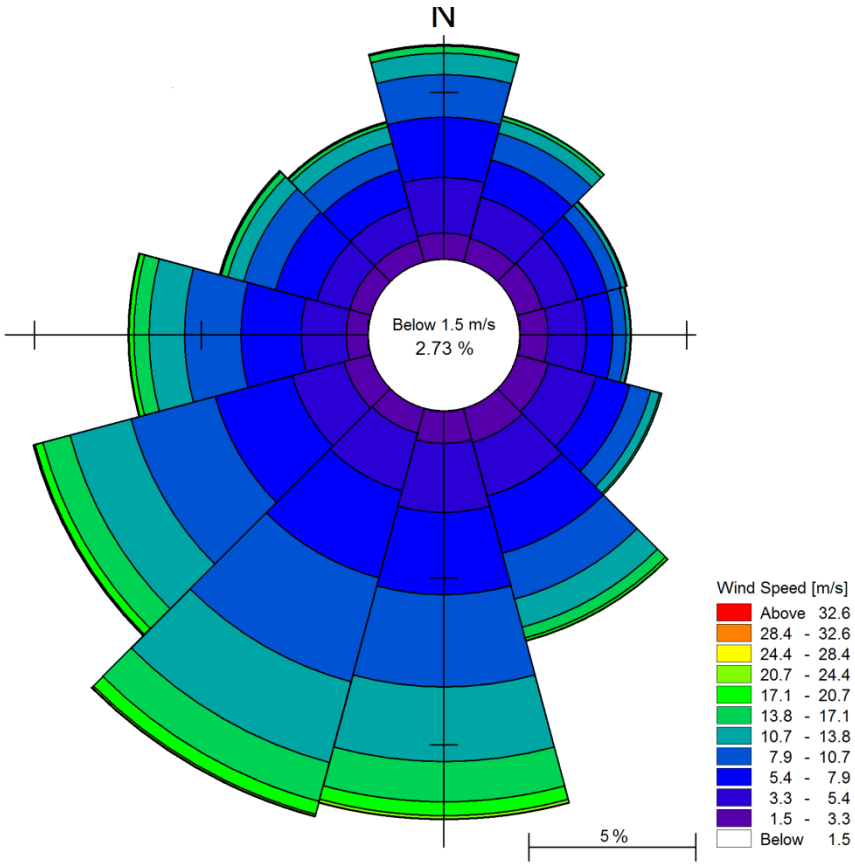


Image 2. Wind rose

Anecdotal information from the Master of the quarry coaster vessel that frequented the quarry pier during the 1980s (*Pers.Comms*. Capt. Pete Davies, November 2016), indicates that at the site the most disadvantageous wind direction for vessels using the Pier is a wind from the North West. This would provide a lee shore situation, which pushes vessels into shallow water as the vessel approaches, or departs the Pier.

A lee shore, also termed windward shore, is defined as: 'a shore lying on the lee (downwind) side of a vessel, onto which a ship could be blown in foul weather'.

4.4 Reduced visibility

Reduced visibility occurs when atmospheric conditions prevent line-of-sight in the day, or the observation of lights at night. These conditions can occur due to heavy rain, snow or mist and fog conditions. There are no records for reduced visibility for the site, however, anecdotal information from the Master of the quarry coaster vessel that frequented the quarry pier during the 1980s (*Pers.Comms*. Capt. Pete Davies, November 2016), indicates that a least two days of dense fog per year is usual.

5 Marine Traffic Analysis

This section presents both recreational navigation and commercial shipping traffic within the study area, using information collated from vessel traffic survey analysis, augmented by written information regarding recreational use and anecdotal information from the recreational and fishing community. Information on commercial shipping is presented in Figure 5 to Figure 7 and recreational boating is presented in Figure 8.

5.1 Recreational vessel movements

5.1.1 Recreational vessel transits / cruising areas / racing areas

Through analysis of yacht club information and anecdotal discussions with recreational boaters the recreational usage of the area has been determined. Transits of recreational craft using AIS-A or AIS-B and a heat-map of recreational vessel transits published by the RYA are shown in Figure 8. The heat-map provided by the RYA has been created from AIS data collected over the summers of 2011 to 2013 and the resulting density is presented as grid of 1 by 1 nm squares (RYA, 2016). It should be noted that not all recreational craft will carry AIS. Overlaid on the RYA heat-map density grid are transit lines from AIS data collected the MCA's network of AIS receivers. It is noted from Figure 8 that a number of recreational transits end South of Rubha na h-Uamha point, this is likely due to Very High Frequency (VHF) signal range and the location of the AIS receiver. It is therefore probable that the RYA's heat-map density grid and the data collected from the MCA's network of AIS receivers do not provide a clear indication of recreational vessel traffic in the study area. This study has therefore relied on anecdotal information to better identify likely transit routes.

5.1.2 Yachting

Yachting covers a variety of boating activities, which for the purposes of this assessment include motor boating, keelboat cruising and racing. In general cruising takes place all year round with increased intensity in the summer months, any recreational sailing will also be heavily biased towards the weekend. The Skye sailing Club based in Portree holds the Kyles' Cup race starting at Kyle of Lochalsh, racing through the Inner Sound and finishing at Kyleakin. The race has been run for two consecutive years and was last held in July 2016. Yacht charters operate around the Isle of Skye and the surrounding waters with the majority of charters taking place in summer months.

It can be seen from Figure 8 that during the period when the AIS data was recorded recreational vessels transiting through the Skye Bridge passed Kyleakin Pier at approximately 0.2 nm. Recreational vessels also regularly transit to and from areas to the West of the Isle of Scalpay and Rassay. Anecdotal information from the Kyle of Lochalsh Harbour Master (*pers. comms.* 01 Nov 2016) indicates that recreational vessels transit inshore along the Isle of Skye coast, passing the pier development site at times when the water depths allow. In addition, a number of transit routes exist towards Plockton, along following the Scottish Mainland coastline. These routes are not shown on AIS transits due to signal reception difficulties attributed to land mass interference.

5.1.3 Sea kayaking

The study region is a popular location for sea kayaking due to the quality of the scenery and challenges of navigating a small unpowered craft in the area's tidal flows and wave conditions. There are a range of training centres located on the Isle of Skye and surrounding areas offering courses, day trips and expeditions. Kayaks that navigate along the coast will typically keep close to the shoreline to

gain protection from wind conditions under any steep sided foreshore. These smaller craft will plan their passage to make use of the tidal conditions and back eddies. If there are any waves at the time of the passage, sea kayaks will typically stand further out to sea, beyond any shore breaks. Nearly all transits by sea kayaks will be carried out in daylight hours. It is highly likely that transits by sea kayak will pass the pier facility in close proximity to the built infrastructure.

5.2 Fishing vessel transits

Fishing vessel activity is provided on Figure 6, which depicts AIS fishing vessel information. This shows that the main transit routes for fishing vessels run either side of the island of Eilean Môr and converge at the approach to the Skye Bridge (see Figure 2 for location names). Anecdotal information from the Kyle of Lochalsh Harbour Master (*pers. comms.* 01 Nov 2016) indicates that fishing vessels transit inshore along the Isle of Skye coast, passing the pier development site at times when the water depths allow.

5.3 Commercial transit routes

AIS data, representative of 84 days of AIS collected in 2015 has been used to create transit lines shown in Figure 5 and 6 (see Section 2.1 for data description). The view is broken down into classes of vessel identified by type; transit lines for individual vessel types are shown in Figure 6. The vessel types have been taken from AIS classifications inherent within the AIS signal. Table 2 shows the count of vessel transits entering the study area from the 84 days of recorded AIS data in 2015. This count is then scaled to provide a representative yearly vessel count.

Table 2. Vessel transits by ship type group in the study area

Vessel Category 84 Day Period	Transit Line Count (84 days)	Scaled (Yearly) Transit Count	Transit Count Percentage (%)
Unknown*	3	13	0.2
Non-Port Service	47	204	2.6
Port Service	357	1,551	19.5
Dredging/Underwater Ops	82	356	4.5
Military/Law Enforcement	129	561	7
High Speed Craft	0	0	0
Passenger	26	113	1.4
Cargo	845	3,672	46.1
Tankers	0	0	0
Fishing	221	960	12
Recreational	123	534	6.7
Grand Total	**1,833**	**7,964**	**100**

* Vessel type 'unknown' is an AIS record which is not correctly transmitting its vessel type at the time of data collection, and cannot therefore be assigned a vessel type. It is included in the dataset to ensure full representation of known vessel activity.

Data Source: Data is representative of 84 days of AIS-A and AIS-B data from MCA terrestrial AIS receivers:

- 1 to 7 from January, February, March, April, May, June, July, August, November 2015;
- 29 August to 04 September 2015;
- 08 to 14 October 2015; and
- 03 to 09 December 2015.

See Section 2.1 for more information.

To provide a measure of the vessels transiting past the pier development site, a transect has been applied as shown in Figure 5. This provides a count of all vessel transits in the 84 day AIS data collection period. This count is then uplifted to provide a representative yearly vessel count which shows that approximately 1,600 transits cross into, or through the area during one year.

Table 3. Vessel transits by ship type group transiting the project area

Vessel Category 84 Day Period	Transit Line Count (84 Days)	Uplifted (Yearly) Transit Count	Transit Count Percentage (%)
Unknown*	0	0	0
Non-Port Service	4	17	1.1
Port Service	26	113	7
Dredging/Underwater Ops	20	87	5.4
Military/Law Enforcement	3	13	0.8
High Speed Craft	0	0	0
Passenger	3	13	0.8
Cargo	298	1,295	80.1
Tankers	0	0	0
Fishing	15	65	4
Recreational	3	13	0.8
Grand Total	**372**	**1,616**	**100**

* Vessel type 'unknown' is an AIS record which is not correctly transmitting its vessel type at the time of data collection, and cannot therefore be assigned a vessel type. It is included in the dataset to ensure full representation of known vessel activity.

Data Source: HM Government, 2016. Data is representative of 84 days of AIS-A and AIS-B data from MCA terrestrial AIS receivers:

- 1 to 7 from January, February, March, April, May, June, July, August, November 2015;
- 29 August to 04 September 2015;
- 08 to 14 October 2015; and
- 03 to 09 December 2015.

It can be seen from Table 3 and Figure 6 that the highest percentage of vessels transiting the project area are is for cargo vessels (80.1%). Cargo vessel routes cover many routes through the study area; these routes converge at the approaches to the Skye Bridge. It should be noted that cargo vessels do not pass in close proximity to the pier development, and are at all times within the buoyed channel leading to, and from, the Skye Bridge.

The second highest vessel count transiting through the project area is for port service craft (7%). This is mainly attributed to tug vessels associated with the aquaculture industry in the area. The next highest proportion of vessels is dredging/underwater ops (5.4%); these transits are largely for dive support vessels associated with the aquaculture industry. Routeing for all vessel types is shown on Figure 6.

5.4 Traffic density

By combining the AIS vessel transit data, a density grid with a cell size of 250 m by 250 m has been produced (Figure 7) which includes all vessel type classifications. Figure 7 shows that the highest density of traffic transits to the east of Eilean Môr and through the Skye Bridge. Other notable high density traffic routes are through Loch Carron, mainly used by cargo vessels and north of Scalpay heading to the port facilities and fish farms between Scalpay, Raasay and the Isle of Skye.

6 Kyleakin Feed Mill Marine Scheme Details

The new pier will be constructed around the footprint of the existing pier with a new outer berth created from concrete caissons to form an L-shaped pier. This will create two berths, an outer (North facing) berth and a longer side (East facing) berth. Dredging will be required to create an approach area and berthing pockets to maintain vessels afloat at all states of the tide. The berths will be fitted with conveyors from the ship loader on the outer berth and from the rail mounted ship unloader on the side berth. Image 3 below provides a scaled view of the pier development. The outer berth will have a 79 m berthing face, and the side berth a 160 m berthing face. Protective fending will be fitted along each berthing face; with a fender system capable of taking impact loads on the corner of the 'L' shape, which is strategically placed for vessels using the corner to land during berthing and un-berthing.

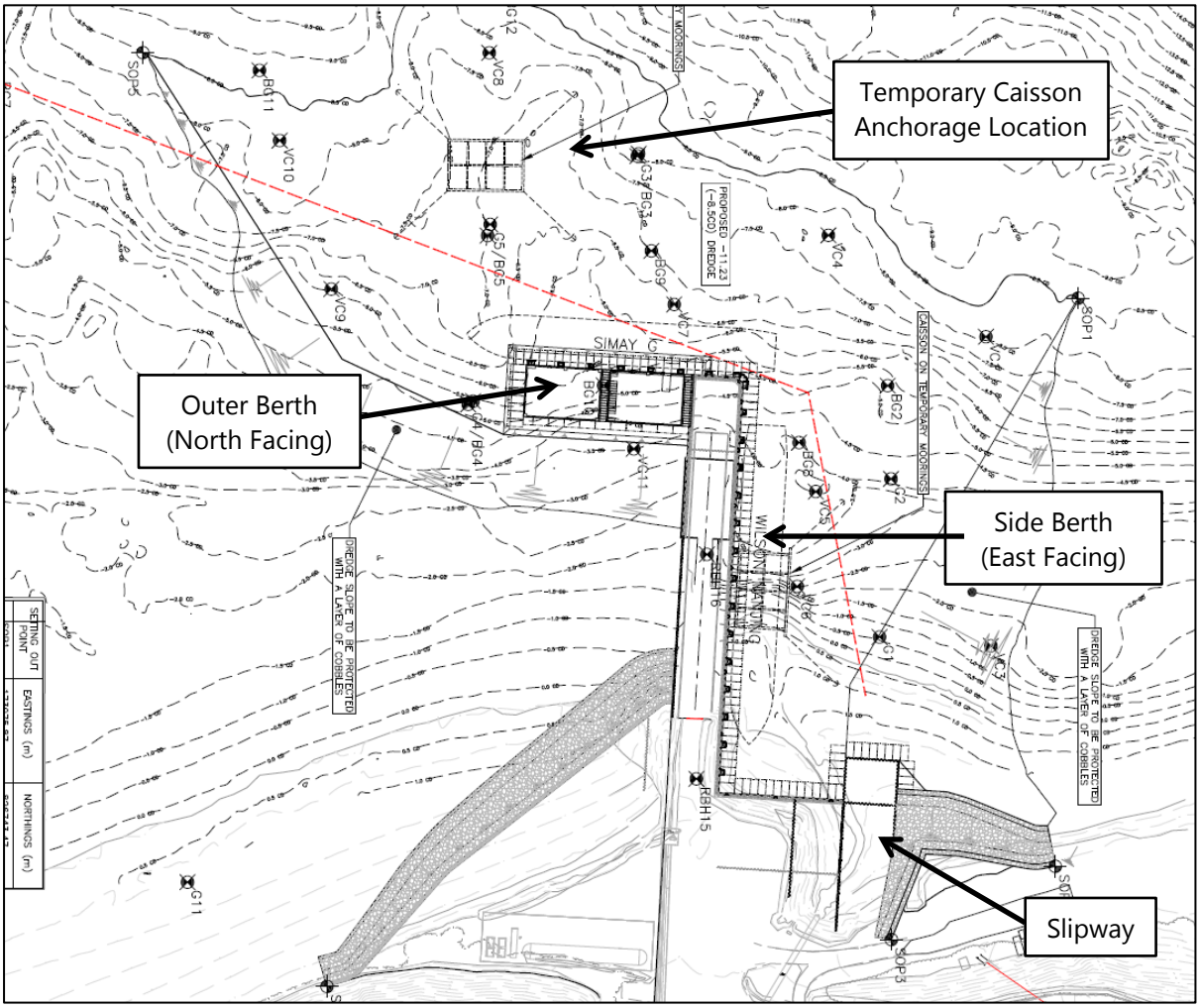


Image 3. Pier development

To assist in the pier development, design vessels have been used to consider the berthing requirements and fendering arrangements. These vessels are shown in Appendix C and are used in this report to consider the likely handling characteristics, space requirement and navigational controls needed to bring these vessels into, and out of the pier development.

The foreshore East of the pier is to be piled to provide a new quayside at the end of the dredged pocket and a slipway for use by fish farm landing crafts. The marine works are anticipated to take 52 weeks from commencement to a fully operational status. The following section provides further information on the construction phase of the project, focusing on the marine-side component of the works and the vessels that will be involved.

6.1 Construction phase

The estimated sequence of marine construction works is:

- Piling of the pier, quayside and slipway.
- Dredging works for new berth pockets and approach area, preparation of the foundation for the caisson outer berth.
- Construction of the foundation bund and concrete base for the caisson outer berth.
- Piling of the crane beam and concrete works to the new pier.
- Completion of the caisson outer berth.
- Following this, the conveyors, ship loader and unloader will be installed on the Pier.

The detailed construction method will be subject to confirmation with the marine contractor(s). Marine craft used in the marine construction works are anticipated to be:

- Pontoon or barge mounted backhoe dredger, clearing material into barges for short-haul to the shore side placement area.
- Trailing Suction Hopper Dredger (TSHD) working on-site to create the required approach and berthing depth. Assuming a small TSHD is used, this is in the order of 5 weeks of work (*circa* 55 dredge runs). The TSHD will connect to a pipeline at a buoyed mooring point, to discharge material to the shore side placement area.
- Pontoons / Platforms moored in place with spud legs will be required as a working base for marine engineering activity.
- Delivery of the caisson will require two tugs (one ahead, one astern) to tow a caisson to site. When the caisson arrives, it will require anchoring prior to placement in its intended location. The temporary anchorage location is shown on Image 1. There are two caissons required by the pier development; they will be towed to site in two separate operations.
- Pontoon / Platform moored in place with spud legs will be required as a working base for the diving activities. Commercial divers will be required to prepare and position marine infrastructure.
- A barge or small coaster vessel will deliver construction material and Indivisible Loads to site at the commencement of the build and at key points during the construction phase.
- The marine contractors will use small workboats and a small rescue/crew transfer boat to access marine plant, platforms and barges during the marine construction works.

6.2 Operational phase

It is anticipated that once operational the following vessel movements will take place at the pier development:

- Bulk vessels delivering raw materials at the side berth 2 per week
- Cargo carriers being loaded with fish feed at the outer berth 2 per week
- Tankers delivering vegetable oils at the outer berth 1 per week
- LNG vessels delivering to the plant at the outer berth 0.5 per week
- One landing craft visit to the slipway to collect fish feed 1 per week

In terms of vessel movement, this translates to:

Table 4. Operational phase anticipated vessel movements

Vessel Category	Vessel Calls (Weekly)	Movements (Weekly)	Uplifted (Yearly) Movement Count
Bulk	2	4	208
Cargo	2	4	208
Tanker Conventional	1	2	104
LNG Tanker	0.5	1*	52
Landing Craft	1	2	104
Total			**676**

* two movements, every other week

During the operational phase, a total 676 vessel movements are anticipated per year, as a consequence of the scheme.

6.3 Decommissioning

There are no plans for decommissioning the facility.

7 Hazard Workshop

In order to assess navigational risk during the construction and operational phases of the proposed Kyleakin Feed Mill development; a hazard workshop with maritime community stakeholders was undertaken. The hazard identification workshop was held on 01 November 2016 in Kyleakin. During the workshop, a presentation was given of the available baseline data and exercises were carried out to identify potential marine hazards associated with the proposed scheme.

The aim of the workshop was to identify navigational safety concerns relative to the study's scope. In addition, attendees at the workshop provided anecdotal information regarding marine use of the study area, which enhanced the level of detail collected through the navigation baseline activities.

The output from the workshop was documented and shared with attendees. A total of 14 hazard scenarios were identified for the construction phase and 15 hazard scenarios for the operational phase.

7.1 Attendance

The marine stakeholder attendees at the hazard workshops are shown in Table 5. This list was drawn from known stakeholders. This list is not exhaustive, but is representative of those with interests in the area.

Table 5. Hazard identification workshop attendees

Attendee	Organisation
Chris Read	Marine Harvest
Steven Driver	Northern Lighthouse Board
Robert Thomson	Highland Council
Jimmy Fergusson	QinetiQ
Tom Rea	Wallace Stone
Monty Smedley	ABPmer

In addition to the above named attendees, consultation was also carried out with the following organisations and individuals who were unable to attend the workshop:

- MCA Coastal Operations Officer
- RYA Regional RYA representative

7.2 Hazard workshop process

As part of the workshops, key marine hazards associated with the construction and operation were discussed and noted. Where appropriate, vessel types were considered separately to ensure the risk levels were assessed for each and so that the control options could be identified on a type-specific basis, for example, risk control measures for construction craft which may be floating platforms with spud legs used as anchors, present different risks to operating recreational vessels. Other general hazards associated with the construction and operational phases, such as dropped objects, man overboard, pollution incidents and SAR operations, were also discussed. Table 6 details definitions of specific hazard types were taken from Department for Transport (DfT) and MCA (2013); Methodology

for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREI).

Table 6. Hazard definitions

Category	Description
Foundering	To sink below the surface of the water.
Collision	Collision is defined as a vessel striking, or being struck, by another vessel, regardless of whether either vessel is under way, anchored or moored; but excludes hitting underwater wrecks.
Allision	Defined as a violent contact between a vessel and a fixed structure.
Contact	Contact is defined as a vessel striking, or being struck, by an external object that is not another vessel or the sea bottom.
Fire	Fire is defined as the uncontrolled process of combustion characterised by heat or smoke or flame or any combination of these.
Explosion	An explosion is defined as an uncontrolled release of energy which causes a pressure discontinuity or blast wave.
Loss of hull integrity	Loss of Hull Integrity (LOHI) is defined as the consequence of certain initiating events that result in damage to the external hull, or to internal structure and sub-division, such that any compartment or space within the hull is opened to the sea or to any other compartment or space.
Flooding	Flooding is defined as sea water, or water ballast, entering a space, from which it should be excluded, in such a quantity that there is a possibility of loss of stability leading to capsizing or sinking of the vessel.
Grounding	Grounding is defined as the ship coming to rest on, or riding across underwater features or objects, but where the vessel can be freed from the obstruction by lightening and/or assistance from another vessel (e.g. tug) or by floating off on the next tide.
Stranding	Stranding is defined as being a greater hazard than grounding and is defined as the ship becoming fixed on an underwater feature or object such that the vessel cannot readily be moved by lightening, floating off or with assistance from other vessels (e.g. tugs).
Machinery related accidents	Machinery related accidents are defined as any failure of equipment, plant and associated systems which prevents, or could prevent if circumstances dictate, the ship from manoeuvring or being propelled or controlling its stability.
Payload related accidents	Payload related accidents include loss of stability due to cargo shifting and damage to the vessel's structure resulting from the method employed for loading or discharging the cargo. This category does not include incidents which can be categorised as Hazardous Substance, Fires, Explosions, Loss of Hull Integrity, Flooding accidents etc.
Hazardous substance accidents	Hazardous substance accidents are defined as any substance which, if generated as a result of a fire, accidental release, human error, failure of process equipment, loss of containment, or overheating of electrical equipment; can cause impairment of the health and/or functioning of people or damage to the vessel. These materials may be toxic or flammable gases, vapours, liquids, dusts or solid substances.

Category	Description
Accidents to personnel	Accidents to personnel are defined as those accidents which cause harm to any person on board the vessel e.g. crew, passengers, stevedores; which do not arise as a result of one of the other accident categories. Essentially, it refers to accidents to individuals, though this does not preclude multiple human casualties as a result of the same hazard, and typically includes harm caused by the movement of the vessel when underway, slips, trips, falls, electrocution and confined space accidents, food poisoning incidents, etc.
Accidents to the general public	Accidents to personnel are defined as those accidents which lead to injury, death or loss of property amongst the population ashore resulting from one of the other ship accident categories.
Capsizing	The overturning of a vessel after attaining negative stability.

After the workshop, the risks associated with the hazards were ranked based on the discussions held during the workshop and the mitigation measures that were identified. A combined total of 29 hazard scenarios were identified during the workshop; these are shown alphabetically in Table 7 and Table 8.

Table 7. Hazard log for the construction phase

Assessment Number	Hazard Category	Hazard Scenario
1	Accidents to personnel	Man overboard during dredge/construction works
2	Accidents to personnel	Diving operations associated with the marine works
3	Allision	Dredge/construction plant impact with marine works during construction phase
4	Allision	Recreational or fishing vessel allision with dredge pipeline/buoy.
5	Collision	Dredge/construction plant collision with recreational vessel
6	Collision	Tug and tow collision with recreational vessel
7	Collision	Caissons temporarily anchored in study area presenting a risk of collision
8	Fire/Explosion	Dredge/construction plant on-board fire
9	Flooding	Dredger flooding whilst engaged in operations
10	Grounding	Dredger grounding whilst engaged in operations
11	Hazardous substance accidents	Accidental spill during marine works
12	Machinery related accidents	Heavy lift failure, or failure of lifting gear
13	Other	Vessel damage due to weather conditions.
14	Payload related accidents	Incorrect payload distribution/loading affects vessel stability.

Table 8. Hazard log for the pier operational phase

Assessment Number	Hazard Category	Hazard Scenario
1	Accidents to personnel	Man Overboard
2	Allision	With navigational buoy
3	Allision	With Skye bridge
4	Allision	With pier structure
5	Collision	Vessel transiting to/from Kyleakin with submarine

Assessment Number	Hazard Category	Hazard Scenario
6	Collision	Vessel transiting to/from Kyleakin with commercial vessel
7	Collision	Vessel transiting to/from Kyleakin with recreational vessel
8	Fire/Explosion	Alongside berth
9	Flooding	Vessel transiting to or from Kyleakin
10	Grounding	Vessel on approaches
11	Hazardous substance accidents	Fuel spillage into water
12	Hazardous substance accidents	Organic material into water
13	Machinery related accident	Loss of power leading to collision/allision/grounding
14	Payload related accident	Incorrect loading/unloading of vessel
15	Ranging	Adverse weather conditions affecting moored vessels

From the 29 hazard scenarios identified in Table 7 and Table 8, the attendees considered the possible hazards scenarios according to their 'Most Likely' and 'Worst Credible' outcomes. The assessment of risk is based upon the descriptions of the 'Most Likely' and 'Worst Credible' to determine a likely frequency and outcome for each hazard occurring, as informed by the accident/incident records identified in Section 3.7 along with knowledge gained from working on projects of similar scale and complexity. In making the assessment, the outcome of each hazard scenario on the receptors of 'people, environment, property, business' was evaluated to give a baseline risk with no mitigation measures in place.

7.2.1 Hazard scenario causes

Each hazard scenario was considered to determine the possible causes both individually or in combination. Table 9 and Table 10 give a frequency of the causes identified during the hazard scenario process for the construction and operational phases of the project

Table 9. Cause frequency for the construction phase

Cause	Frequency
Human error/fatigue - Ship Personnel	12
Human error	12
Competence	12
Inadequate procedures in place onboard vessel	11
Vessel breakdown or malfunction	11
Communication failure - Personnel	10
Inadequate training/competence - Others	10
Adverse weather conditions	9
Inadequate bridge resource management	8
Risk Assessment, Incomplete/not reviewed	7
Communication failure - equipment	6
Vessel has unreported defect	6
Incapacitated master (drinks/drugs)	6
Incorrect assessment of tidal flow	6
Inadequate procedures shoreside	5

Cause	Frequency
Failure to follow passage plan	5
Human error/fatigue - Port/Marine Personnel	5
Communication failure - Operational/procedural	5
Failure to comply with safe systems of work	5
Ship/Tug/Launch failure	5
Restricted visibility	5
Excessive vessel speed	5
Inadequate maintenance/inspection	4
Language problems	4
Fire/Explosion	4
Tug failure towing equipment	4
Unplanned interaction with recreational/fishing craft	4
Failure to comply with Towage guidelines	3
High traffic density	3
AIS failure	3
COLREGS failure to comply	3
Loss of watertight integrity	2
Port Equipment (inc. craft) mechanical breakdown/system malfunction	2
Shoreside light backscatter	2
Malicious action by external parties	2
Interaction	2
Weather & hydro failure - equipment	1
Non-attendance of boatmen	1
Vessel fails to notify hazardous cargo	1
Notice to Mariners failure to observe	1
Loss of vessels stability (due to other than loss of watertight integrity)	1
Vessel Ramps or Hatches not secure	1
Port infrastructure failure	1
Protest by external parties	1
Illegal discharges into the water	1
Inadequate number/type tugs	1

The top identified cause for the construction phase is jointly 'Human error/fatigue - Ship Personnel', 'Human error' and 'Competence' with a frequency of 12. The top selected causes can be described as human factors relating to errors of judgement or competence.

Table 10. Cause frequency for the operational phase

Cause	Frequency
Inadequate procedures in place onboard vessel	15
Human error	13
Human error/fatigue - Ship Personnel	12
Communication failure - Personnel	10
Inadequate bridge resource management	9
Vessel breakdown or malfunction	8
Adverse weather conditions	8
Inadequate procedures shoreside	6
Inadequate maintenance/inspection	6
Inadequate training/competence - Others	6

Cause	Frequency
Competence	6
Communication failure - Operational/procedural	6
Incorrect assessment of tidal flow	5
Language problems	5
Failure to observe standing notices	5
Failure to comply with safe systems of work	5
Restricted visibility	5
Excessive vessel speed	5
Failure to follow passage plan	4
Fire/Explosion	4
Vessel has unreported defect	4
Port Equipment (inc. craft) mechanical breakdown/system malfunction	4
Malicious action by external parties	4
Human error/fatigue - Port/Marine Personnel	3
COLREGS failure to comply	3
Loss of watertight integrity	3
Ship/Tug/Launch failure	3
Incapacitated master (drinks/drugs)	3
Risk Assessment, Incomplete/not reviewed	2
Shoreside light backscatter	2
Illegal discharges into the water	2
Incorrect draught advised/promulgated	1
Failure of Aid to Navigation (out of position/unlit)	1
Failure of berth mooring systems	1
Loss of vessels stability (due to other than loss of watertight integrity)	1
Vessel Ramps or Hatches not secure	1
Unplanned interaction with recreational/fishing craft	1
Incorrect ballasting	1

The top selected causes for the operational phase are 'Inadequate procedures in place onboard vessel' with a frequency of 15, the second highest selected cause is 'Human error' with a frequency of 13 and the third highest is 'Human error/fatigue - Ship Personnel' with a frequency of 12.

The list of causes shown in Table 9 and Table 10 have been created from the expert judgement of marine professionals, the next stage of the process considers these causes in the context of controls that may be applicable to prevent the hazard scenario from occurring.

7.2.2 Risk controls

Each of the 29 hazards scenarios were then considered in light of embedded risk controls which are available at, or can be deployed at pier development in response to a marine emergency. It should be noted that embedded mitigation, in the context of marine safety, relate to process, practices and available safety resources that are in existence irrespective of the project scheme. These might include (for example) International regulations (such as the International Regulations for Preventing Collisions at Sea, 1972) or training of personnel (such as the International Standards of Training, Certification and Watchkeeping for Seafarers (STCW)) or search and rescue provision (such as the UK Coastguard service). Table 11 details the embedded risk controls that were identified in the risk assessments.

Table 11. Embedded risk controls

Embedded Control	Frequency
Standing Orders/SOPs	15
Communications equipment	13
Emergency services equipment - shore side	13
Passage planning	11
Visual observation (clear line of sight)	11
Standards of Training, Certification and Watchkeeping for Seafarers (STCW)	11
International COLREGS 1972 (as amended)	8
Requirement for notification of vessel defects	8
Weather forecasting	7
Accurate tidal measurements	6
Safe systems of work (HSE)	6
Arrival/Departure, advance notice of	5
Notices to mariners	5
Vessel maintenance	4
Vessel secured for sea	4
Communications - Traffic broadcast	3
Hazardous cargoes, advance notice of	3
Availability of pollution response equipment	3
Vessel inspection/survey	3
Draught, Accurate, declared and within max limits	2
Contingency plan exercises	2
Training of pollution response personnel	2
Loading/unloading plan	2
Vessels own safety procedure	2
Safe allocation of berths (depth, available, suitable)	1
Oil spill contingency plans	1
Availability of latest hydrographic information	1
Shore side signage	1
Ramps/hatches closed when underway	1
Vessel MARPOL compliance	1
Places of refuge	1

After determining which controls are applicable to each hazard scenario a current risk score was calculated by determining the likelihood reduction and consequence reduction for each risk control. Table 12 and Table 13 show the hazard scenarios ranked by current risk after embedded risk controls have been considered.

Table 12. Construction phase: ranked scenarios

Hazard Category	Hazard Scenario	Baseline Risk	Current Risk
Allision	Recreational or fishing vessel allision with dredge pipeline/buoy.	6.00	5.90
Other	Vessel damage due to weather conditions.	5.94	5.84
Grounding	Dredger grounding whilst engaged in operations	6.63	5.83
Allision	Dredge/construction plant impact with marine works during construction phase	5.94	5.33
Fire/Explosion	Dredge/construction plant on-board fire	5.00	4.73

Hazard Category	Hazard Scenario	Baseline Risk	Current Risk
Machinery related accidents	Heavy lift failure, or failure of lifting gear	5.69	4.49
Hazardous substance accidents	Accidental spill during marine works	5.63	4.17
Collision	Caissons temporarily anchored in study area presenting a risk of collision	4.75	4.01
Collision	Tug and tow collision with recreational vessel	4.25	3.43
Payload related accidents	Incorrect payload distribution/loading affects vessel stability.	5.75	3.37
Collision	Dredge/construction plant collision with recreational vessel	4.06	3.31
Accidents to personnel	Diving operations associated with the marine works	4.56	3.22
Accidents to personnel	Man overboard during dredge/construction works	4.50	2.77
Flooding	Dredger flooding whilst engaged in operations	4.94	2.63

Table 13. Operational phase: ranked scenarios

Hazard Category	Hazard Scenario	Baseline Risk	Current Risk
Allision	With pier structure	6.94	6.01
Grounding	Vessel on approaches	5.75	5.31
Allision	With navigational buoy	5.94	5.30
Allision	With Skye bridge	5.44	4.80
Ranging	Adverse weather conditions affecting moored vessels	4.63	4.50
Machinery related accident	Loss of power leading to collision/allision/grounding	5.25	3.93
Flooding	Vessel transiting to or from Kyleakin	4.56	3.67
Collision	Vessel transiting to/from Kyleakin with commercial vessel	4.33	3.65
Collision	Vessel transiting to/from Kyleakin with submarine	4.27	3.62
Hazardous substance accidents	Fuel spillage into water	4.44	3.56
Collision	Vessel transiting to/from Kyleakin with recreational vessel	4.00	3.33
Fire/Explosion	Alongside berth	3.46	2.96
Payload related accident	Incorrect loading/unloading of vessel	3.88	2.82
Accidents to personnel	Man Overboard	4.88	2.49
Hazardous substance accidents	Organic material into water	2.44	1.68
Allision	With pier structure	6.94	6.01
Grounding	Vessel on approaches	5.75	5.31
Allision	With navigational buoy	5.94	5.30
Allision	With Skye bridge	5.44	4.80
Ranging	Adverse weather conditions affecting moored vessels	4.63	4.50

The risk scores associated with each of the 29 hazard scenarios has been set on a scale of zero to ten. The classification of each score is given in Table 14

Table 14. Risk classification

Classification	Hazard Score
Very High Risk	9.00 – 10.00
High Risk	6.00 – 8.99
Medium Risk	4.00 – 5.99
Low Risk	1.00 – 3.99
Negligible Risk	0.01 – 0.99

Additional controls were identified by the stakeholders were documented to ensure that risk levels were maintained to 'As Low As Reasonably Practicable', these further applicable controls are safety recommendations which were then assigned a likelihood and consequence reduction to allow the calculation of a final risk score. The full set of NRAs is shown in Appendix D for the Construction Phase and Appendix E for the Operational Phase.

Table 15 details the further applicable controls which were identified as recommendations for potential mitigation for the Kyleakin Pier project along with the frequency in which they were applied to the hazard scenarios.

Table 15. Further applicable controls

Control	Frequency
Aids to navigation, Provision & maintenance of	2
AIS coverage	4
Availability of latest hydrographic information	1
Availability of pollution response equipment	14
Communications equipment	7
Consultation with local harbour authorities	4
Contingency plan exercises	17
Dangerous substances in harbour areas 2016	1
Dedicated VHF channel	7
Dredging programme	1
Hydrographic surveying program	1
Liaison with QinetiQ	6
Marine liaison officer	14
Marine Liaison officer/pier master	15
Marine Safety Management System	20
Navigational lights	1
Notices to mariners	4
Oil spill contingency plans	14
Places of refuge	14
PMSC compliance	21
Port Emergency Plan	16
Safe allocation of berths (depth, available, suitable)	1
Safe systems of work (HSE)	3
Shore side facility maintenance programme	1
Tidal flow atlas	7
Training of pollution response personnel	15
Training of port marine/operations personnel	17

8 Formal Safety Assessment

This section documents the formal safety assessment relating to the construction and the operational phases of the development. Hazard scenarios that have been scored as medium risk or higher are considered significant, therefore these hazard scenarios have been brought forward into the impact assessment. The full set of risk assessments is shown in Appendix D and E.

8.1 Significance criteria

Impacts on shipping and navigation receptors, that were formulated based on hazards scenarios identified at the workshop, were assessed using a consistent scale of sensitivity and magnitude, as described in the following sections.

8.1.1 Sensitivity

A vessel or navigation receptor can only be sensitive if there is a pathway through which an effect can be transmitted between the source activity and the receptor. When a receptor is exposed to an effect, the overall sensitivity of the receptor is determined and that process incorporates a degree of subjectivity. Within the NRA process, expert opinion is used to define the sensitivity of a receptor, Table 16 identifies each definition.

Table 16. Receptor Sensitivity

Sensitivity	Definition
Very High	Very high level of safety impact for vessels and navigation receptors Very limited ability to adapt to impact
High	High level of safety impact for vessels and navigation receptors Limited ability to adapt to impact
Medium	Medium level of safety impact for vessels and navigation receptors Some ability to adapt to impact
Low	Low level of safety impact for vessels and navigation receptors Ability to adapt to majority of impact
Negligible	Negligible level of safety impact for vessels and navigation receptors Ability to adapt to all of impact
Neutral	No impact for vessels and navigation receptors

For the purposes of assessing the impact to marine receptors, sensitivity must be judged. The criteria range from neutral (sensitivity) to very high. The greater the safety effect, and/or the lower the ability to adapt to the effect, the greater the judged sensitivity. A safety impact is classified as any impact that may influence the navigational safety of the marine receptor.

8.1.2 Magnitude

When assessing the magnitude of an effect, the geographical extent, the duration and the frequency are considered. Determining the overall magnitude of navigational effects also incorporates a degree of subjectivity, as decisions are based on expert opinion, in combination with baseline data. The potential 'effects' of the proposed development from a navigational perspective, as identified through the hazard workshop and stakeholder feedback, are identified in Table 17.

Table 17. Effect Magnitude

Magnitude	Definition
Large Negative	Impact geographical area beyond the extent of Marine Works / Operational area Impact present on a permanent basis throughout the operational phase Impact occurs very frequently to constantly/permanently
Medium Negative	Impact localised to geographical extent of Marine Works / Operational area Impact present on a permanent basis throughout the operational phase Impact occurs frequently
Small Negative	Impact localised to geographical extent of Marine Works / Operational area Impact present on a temporary basis Impact relatively infrequent
Neutral	No impact on vessels or navigational receptors
Positive	Navigation receptors benefit as a result of the impact

8.1.3 Significance

Applying the sensitivity of the receptor and the magnitude of the potential effect, the significance is determined according to the matrix shown in Table 18.

Table 18. Significance Classification

Criteria		Magnitude				
		Large Negative	Medium Negative	Small Negative	Neutral	Positive
Sensitivity	Very High	Major Adverse	Major Adverse	Moderate to Minor Adverse	No Effect	Major to minor beneficial
	High	Major Adverse	Major to Moderate Adverse	Minor Adverse	No Effect	Major to minor beneficial
	Medium	Moderate Adverse	Moderate to Minor Adverse	Minor Adverse	No Effect	Moderate beneficial
	Low	Minor Adverse	Minor Adverse	Insignificant	No Effect	Minor beneficial
	Negligible	Minor/ Insignificant	Insignificant	Insignificant	No Effect	Insignificant
	Neutral	No Effect	No Effect	No Effect	No Effect	No Effect

The assessment of significance assumes that the embedded risk controls detailed in Table 11 are in place. In accordance with the requirements of the Port Marine Safety Code, which references the 'ALARP' concept, each hazard scenario is considered in isolation, with further controls added to lower the risk to a point which is 'as low as responsibly practicable'. The following assessment presents the risks that are scored above a 'medium' threshold (see Table 14). The assessments then outline specific mitigation (termed 'further applicable controls') identified through stakeholder/workshop engagement and based on expert opinion. It should be noted however, that a control that may be introduced to manage a higher scoring risk (for example, Aid to Navigation such as lights or buoys) may also apply to reduce risk in lower scoring hazard scenarios. To view the full output of the NRA, see Appendices D and E.

8.2 Construction impacts

The NRAs from Table 12 for construction which have been assessed with an outcome of medium (or above) have been taken forward into this impact assessment. These are summarised in Table 19.

Table 19. NRAs brought forward into the impact assessment

Hazard Category	Hazard Scenario	Current Risk
Allision	Recreational or fishing vessel allision with dredge pipeline/buoy.	5.90
Allision	Dredge/construction plant impact with marine works during construction phase	5.33
Collision	Caissons temporarily anchored in study area presenting a risk of collision	4.01
Fire/Explosion	Dredge/construction plant on-board fire	4.73
Grounding	Dredger grounding whilst engaged in operations	5.83
Hazardous substance accidents	Accidental spill during marine works	4.17
Machinery related accidents	Heavy lift failure, or failure of lifting gear	4.49
Other	Vessel damage due to weather conditions	5.84

8.2.1 Allision - Recreational or fishing vessel allision with dredge pipeline/buoy

Recreational and fishing vessels transiting proximate to the pier development have the potential to be involved in vessel-to-pipeline/buoy contact (allision) risk with the dredge pipeline or the marker buoy. Allision risk will be increased during times of adverse weather when wind activity and wave action has the potential to adversely affect vessel manoeuvring and in periods of reduced visibility where it will be difficult to see the pipeline and any buoys. Any contact has the potential to result in some damage which may lead to a pollution event (e.g. fuel or oil spill).

This potential effect would have a medium level of sensitivity as vessels have some ability to adapt to the situation through the application of their engines to manoeuvre or use of anchors to avoid an allision. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase whilst the pipeline is in place (during the dredging works) leading to a magnitude of medium negative and an overall ranking of **moderate to minor adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer – provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations.
- AIS coverage - all dredge/construction vessels, including barges to carry AIS (A or B). This will assist in identifying the pipeline whilst the dredger is connected.
- Marine safety management system - prior to commencement of marine operations, consideration and creation of a Marine-SMS which details the marine side operations and how these will be managed. Detailed Safety Operating Instructions (SOPs) may also be established to compliment the Marine-SMS.

- PMSC compliance – the application of a Marine-SMS, which recognises the need for contractors' RAMS to be agreed in advance of marine works.
- Oil Spill Contingency Plan – the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.
- Notices to mariners – issued by Kyle of Lochalsh Harbour Authority to inform vessels of the dredge activities.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Aids to navigation – buoy marking the end of the pipeline to be lit in agreement with NLB.
- Contractor risk assessment method statement (RAMS) – reviewed and agreed prior to use.

Following the implementation of mitigation measures, specifically appointment of a marine liaison officer, the lighting of the marker buoy, the use of a Marine-SMS and the associated SOPs, the sensitivity is reduced to low resulting in a residual effect of **minor adverse**.

8.2.2 Allision - Dredge/construction plant impact with marine works during construction phase

Dredge/construction plant used during the marine works have the potential to create vessel-to-fixed-structure contact (allision) risk. These vessels include jack-up platforms, barges, tugs and tows, dredging plant and workboat support craft. It should be noted that construction activities carried out from platforms held in place by spud support legs are not subject to allision when the platform is elevated. However, when being manoeuvred into position there is a risk of contact between the vessel and structures within the marine construction area. Allision risk will be increased during times of adverse weather when wind activity and wave action has the potential to adversely affect vessel manoeuvring. Any contact has the potential to result in some damage which may lead to a pollution event (e.g. fuel or oil spill).

This potential effect would have a medium level of sensitivity as vessels have some ability to adapt to the situation through the application of their engines, anchors or adjusting moorings. In addition, it is likely that dredge and construction vessels would be moving at a slow speed whilst working making any allision a controlled outcome if avoidance action is taken. The potential effect from an allision will be localised to the immediate extent of the marine construction area. The impact has the potential to occur throughout the construction phase whilst vessels are manoeuvring leading to a magnitude of medium negative and an overall ranking of **moderate to minor adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer – provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations.
- AIS coverage - all dredge/construction vessels, including barges to carry AIS (A or B). This assists in identifying the locations of vessels in the event of an incident.
- Marine safety management system - prior to commencement of marine operations, consideration and creation of a Marine-SMS which details the marine side operations and how these will be managed. Detailed Safety Operating Instructions (SOPs) may also be established to compliment the Marine-SMS.

- PMSC compliance – the application of a Marine-SMS, which recognises the need for contractors' RAMS to be agreed in advance of marine works.
- Oil Spill Contingency Plan – the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Contractor risk assessment method statement (RAMS) – reviewed and agreed prior to use.
- Aids to navigation – all marine works are required to be lit.

Following the implementation of mitigation measures, specifically appointment of a marine liaison officer, the use of a Marine-SMS and the associated SOPs, the sensitivity is reduced to low resulting in a residual effect of **minor adverse**.

8.2.3 Collision - Caissons temporarily anchored in study area presenting a risk of collision

The caissons that will be used to create the outer berth will be transported by towage vessels. The caissons are likely to be at anchor until the marine works has proceeded sufficiently for them to be positioned. This presents the risk that vessels may be involved in a collision with a caisson when anchored or on passage to the marine works. This collision is most likely to occur at night and be caused by a vessel misunderstanding navigational lights and shapes or the lights not working. During periods of restricted visibility and adverse weather conditions due to the reduced ability for a vessel to react to the situation.

This potential effect will have a high level of impact due to the proximity to the main navigation channel, the temporary nature of the anchored caissons, meaning that the vessel Masters and navigators may not be aware of the collision risk, especially at times of reduced visibility or at night. During these times (night or reduced visibility) vessels will have limited time to react to the situation and take appropriate action to avoid collision. This impact could occur throughout the passage or whilst the caissons are at anchor. The impact is present on a temporary basis. This gives a magnitude of small negative resulting in an overall ranking of **minor adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer – will promulgate safety information to vessels in the area and will coordinate emergency response at the marine works.
- AIS coverage – The towage craft will require AIS (A or B), this will identify the tugs whilst towing the caissons.
- Notices to mariners – Issued by Kyle of Lochalsh Harbour Authority to inform vessels of the towage activities.
- Navigational lights – Caissons to be lit as per COLREGS, anchored caissons to display lighting agreed with NLB.

Following the implementation of mitigation measures, specifically notices to mariners and navigational lights the sensitivity is reduced to low and the residual effect is therefore assessed as insignificant.

8.2.4 Fire/Explosion - Dredge/construction plant on-board fire

During the construction phase, vessel fire is possible (potentially leading to an explosion, if uncontained). Vessel fires within a marine works site can have onward consequences for other vessels, infrastructure and shore side buildings or equipment in the vicinity. However, given the proximity of shore-side emergency response, uncontrolled situations are rare and will be contained relatively quickly. Immediate action by the crew in response to a fire is the most effective measure to prevent a larger marine emergency. Any response to a fire on-board a vessel, can lead to pollutants entering the water through the use of various fire suppression methods.

This potential effect would have a medium level of sensitivity due to the type of work being carried out by construction craft (such as hot works) and the range of vessels engaged with the marine works. The potential effects will be localised to the extent of the marine construction area and will be present for the construction phase only. A fire or explosion has the potential to occur throughout the construction phase, but is an infrequent risk, which leads to an assessed magnitude of small negative and an overall ranking of **minor adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer – provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations.
- Marine safety management system - prior to commencement of marine operations, consideration and creation of a Marine-SMS which details the marine side operations and how these will be managed. Detailed Safety Operating Instructions (SOPs) may also be established to compliment the Marine-SMS.
- PMSC compliance - marine-SMS applies, which recognises the need for contractors RAMS to be agreed in advance of marine works.
- Oil spill contingency plan - the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.

Following the implementation of mitigation measures, specifically the Marine-SMS and equipment to clean up any potential spill or pollutant, the sensitivity is reduced to low and the residual effect is therefore assessed as **insignificant**.

8.2.5 Grounding - Dredger grounding whilst engaged in operations

During the dredge activities within the construction phase for the marine aspects of the development, there is a risk of dredge vessels grounding in the vicinity of the marine works due to working close inshore, in complex tidal conditions with restricted ability to manoeuvre.

The potential effect would have a high level of sensitivity due to the limited time and ability for the vessel crew to react to the situation. The potential impact will be localised to the extent of the marine construction area and will be present for the construction phase only. The effect has the potential to occur throughout the construction phase, and has the potential to occur frequently which leads to an assessed magnitude of medium negative and an overall ranking of **major to moderate adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer – provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations.
- PMSC compliance – Marine-SMS applies, which recognises the need for contractors RAMS to be agreed in advance of marine works.
- Tidal flow atlas – provision of a tidal atlas for use on-board dredge and construction vessels, which provides tidal flow speed and direction through each hour of the tidal cycle.
- Oil spill contingency plan - the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.

Following the implementation of mitigation measures, specifically information available to vessel masters in the form of a tidal flow atlas, will provide an ability to adapt to the situation, leading to a sensitivity which is low with a residual effect which is **minor adverse**.

8.2.6 Hazardous substance accidents - Accidental spill during marine works

During the marine works there is an increased risk of accidental spillage of oil, fuel and chemical pollutants from the dredge plant, construction vessel activity and marine construction works. This may result in a reduction in water quality.

The prevailing weather conditions during any marine pollution event will dictate the path and extent of surface water sheens. There is a large aquaculture industry proximate to the marine works, so any spread of marine pollution could impact local industry. It will be the responsibility of the Contractor to provide suitable oil spill response equipment and in the event of an incident to liaise with Marine Harvest personnel.

Depending on the weather conditions, the potential effect will be either spread into the Inner Sound if the wind direction is Easterly or under the Skye Bridge and into Loch Alsh if the wind direction is Westerly leading to a high level of sensitivity. The impact has the potential to occur infrequently throughout the period; however, the volume of a spill is likely to be small scale due to the volume which could be spilled at any one time through construction activity. This leads to an assessed magnitude of small negative and an overall ranking of **minor adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer – will coordinate the pollution response with the contractor and local authorities as required.
- Oil spill contingency plan - the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- Marine safety management system - prior to commencement of marine operations, consideration and creation of a Marine-SMS which details the marine side operations and how these will be managed. Detailed Safety Operating Instructions (SOPs) may also be established to compliment the Marine-SMS.

- PMSC compliance - marine-SMS applies, which recognises the need for contractors RAMS to be agreed in advance of marine works.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.

Following the implementation of mitigation measures, specifically the requirement to have an oil spill contingency plan in place, the residual effect will be **insignificant**.

8.2.7 Machinery related accidents - Heavy lift failure, or failure of lifting gear

During the marine works there is a risk of lifting gear failure whilst a load is slung or a heavy load is transferred between a vessel and the shore. The nature of the loads during the dredge/construction phase of the marine works means that should a failure occur and the load be dropped onto a vessel, it would lead to major damage for the vessel and possible fatalities. The prevailing weather conditions will be the main factor leading to this impact occurring; especially high wind conditions affecting cranes and large swell causing movement of vessels.

The potential effect would have a high level of safety impact for vessels and crew, with limited ability to adapt to a quickly developing incident. The sensitive is therefore assessed as high. The potential effect would be localised to the extent of the study area and will be present for the construction phase only. However, the impact has the potential to occur infrequently throughout the period of the construction, which leads to an assessed magnitude of small negative and an overall ranking of **minor adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer - provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations.
- Oil spill contingency plan - the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- Contractor risk assessment method statement (RAMS) – reviewed and agreed prior to use.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Shore side facility maintenance programme – to ensure that all machinery is inspected and maintained.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.

Following the implementation of mitigation measures, specifically planning around sea conditions and the use of contractor RAMS, the sensitivity can be reduced to low as operations would be planned for suitable weather conditions and the magnitude would therefore be reduced to relatively infrequent, with the residual effect being assessed as **insignificant**.

8.2.8 Other - Vessel damage due to weather conditions

High wind speeds and swell developing from the North will affect dredge and construction craft operating at the marine works. The vessels will be operating close to shore in confined locations with shallow water. Any adverse weather conditions can increase the risk of allision with marine works, grounding or collision with other vessels within the dredge/construction area.

This potential impact will have a medium sensitivity due to the ability to react to building swell condition and the time available to move to a more sheltered location. The potential effect will be localised to the extent of the study area and will be present for the construction phase only. However, the impact has the potential to occur frequently throughout the period of the construction, which leads to an assessed magnitude of medium negative and an overall ranking of **moderate to minor adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer – will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations.
- Marine safety management system - prior to commencement of marine operations, Marine-SMS established.
- PMSC compliance - Marine-SMS applies, which recognises the need for contractors RAMS to be agreed in advance of marine works.
- Contractor risk assessment method statement (RAMS).
- Oil spill contingency plan - the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.

Following the implementation of mitigation measures, specifically weather predictions; the magnitude would be reduced to low with the residual effect being assessed as **minor adverse**.

8.3 Operational impacts

The NRAs from Table 13 for the operational phase which have been assessed with an outcome of medium (or above) have been taken forward into this impact assessment. These are summarised in Table 20.

Table 20. NRAs brought forward into the impact assessment

Hazard Category	Hazard Scenario	Current Risk
Allision	With pier structure	6.01
Allision	With navigational buoy	5.30
Allision	With Skye bridge	4.80
Grounding	Vessel on approaches	5.31
Ranging	Adverse weather conditions affecting moored vessels	4.50

8.3.1 Allision – With pier structure

The strong tidal flow on the approaches to the pier increases the risk that a vessel will make contact (allision) with the pier structure whilst manoeuvring to berth, especially in periods of adverse weather conditions when wind activity has the potential to adversely affect vessel manoeuvring. The conditions which will have the most adverse effect are a strong north-westerly wind and a strong (peak) ebb tide; see Appendix B for tidal flow conditions. The combination of these two external forces will provide challenging conditions for vessels Masters. Should an error of judgement be made, or the vessel sustains a defect to its propulsion (main engines, or bow thrusters), there is a potential of

Allision with either pier structure. Figure 9 and Figure 10 provides conceptual approaches and departure options for the design vessel 'Wilson Nanjing' and 'Simay G' berthing at the Side Berth and Outer Berth accordingly.

On arrival at the Side Berth (Figure 9) it will be necessary to land the vessel lines prior to berthing. The vessel track depicts a route that cuts close to the Red Port Hand navigation marker in the main channel, with the vessel actively using bow thrusters and rudder to position the starboard shoulder of the vessel close to the pier development in order to transfer lines. Subsequently, the vessel needs to take all way (forward motion) off before berthing starboard side too. In adverse weather conditions, this has the potential to cause allision with the pier. On arrival at the Outer Berth (Figure 10) the vessel will turn to starboard, and use the wind and current to close with the berth. This again, has the potential to cause allision risk. Ultimately, any manoeuvre will be determined by the prevailing weather conditions and the suitability of the ship to make contact with the pier on berthing. A safeguard is the deep water channel, which allows the abort of a manoeuvre with the vessel transiting under the Skye Bridge, executing a turn in more sheltered water, and returning to berth at the pier.

Any allision has the potential to cause damage to a vessel which may lead to a pollution event and injuries to personnel. This risk will diminish with time as crew become familiar with the new berthing locations and the effects of wind and tidal flow at this location. This potential effect would have a medium level of sensitivity due to the strong tidal flow and shallow water. However, the low speed at which an approach to the berth is made means that there is adequate time to react to an allision situation by use of the vessel's engines, rudder and bow thruster. In addition, the potential impact is localised to the area of the marine facilities and will occur throughout the operational phase leading to a magnitude of medium negative and an overall ranking of moderate adverse.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer/Pier master – will promulgate safety information to vessels navigating in the area. They will be the Kyleakin Pier point of contact during an emergency situation.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Tidal flow atlas – provision of a tidal atlas for use on-board vessels, which provides tidal flow speed and direction through each hour of the tidal cycle.
- Oil spill contingency plans – to detail the response to any marine pollution event. As part of this plan training and exercise of personnel will be required.
- Dedicated VHF channel – to prevent over use of the main navigational channels, will require a licence from OFCOM.
- Communications equipment – marine personnel to monitor VHF channels 13 and 16.

Following the implementation of mitigation measures, specifically marine liaison officer/pier master and the port emergency plan, the magnitude is reduced to small negative and so the residual effect will be minor adverse.

8.3.2 Allision – With navigational buoy

The strong tidal flow on the approaches to Kyleakin increases the risk that a vessel will make contact (allision) with a navigational buoy, especially in periods of adverse weather conditions when wind activity has the potential to adversely affect vessel manoeuvring and potentially cause the buoy to be out of position. Any allision has the potential to cause damage to a vessel which may lead to a pollution event and injuries to personnel.

This potential effect would have a medium level of sensitivity due to the strong tidal flow in the area meaning vessels have reduced ability to adapt to the situation. In addition, the potential impact is localised to the approaches to the pier and will occur throughout the operational phase leading to a magnitude of medium negative and an overall ranking of **moderate adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer/Pier master – will promulgate safety information to vessels navigating in the area. They will be the Kyleakin Pier point of contact during an emergency situation.
- Tidal flow atlas – provision of a tidal atlas for use on-board vessels, which provides tidal flow speed and direction through each hour of the tidal cycle.
- Dedicated VHF channel – to prevent over use of the main navigational channels, will require a licence from OFCOM.

Following the implementation of mitigation measures, specifically marine liaison officer/pier master and the port emergency plan, the magnitude is reduced to small negative and so the residual effect will be minor adverse.

8.3.3 Allision – With Skye Bridge

A situation where a vessel is unable to berth/unberth at the pier during a strong ebb tide and/or wind conditions from the West through to North-West, has the potential for the vessel to drift towards the Skye Bridge and make contact (allision). This could also be caused through equipment failure, such as steering or engine failure. The factors that will have the largest effect on this impact are weather and tidal conditions. The conditions which will have the most adverse effect are a strong North-Westerly wind and a strong ebb tide, due to vessels needing to navigate with a faster speed over the ground in order to maintain steerage and if an incorrect assessment of the conditions is made, the vessel will be set towards the Skye Bridge. Any allision has the potential to cause damage to a vessel which may lead to a pollution event and injuries to personnel. This risk will diminish with time as crew become familiar with the new berthing locations and the effects of wind and tidal flow at this location.

This potential effect would have a high level of sensitivity due to the strong tidal flow in this area and the limited time available to correct any manoeuvre by use of the vessel's engines, rudder and bow thruster. In addition, the potential impact is localised to the area of the marine facilities and will occur throughout the operational phase leading to a magnitude of medium negative and an overall ranking of **major to moderate adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer/Pier master – will promulgate safety information to vessels navigating in the area. They will be the Kyleakin Pier point of contact during an emergency situation. The officer will monitor relevant VHF channels.
- Tidal flow atlas – provision of a tidal atlas for use on-board vessels, which provides tidal flow speed and direction through each hour of the tidal cycle.
- Dedicated VHF channel – to prevent over use of the main navigational channels, will require a licence from OFCOM.
- Communications equipment – marine personnel to monitor VHF channels 13 and 16.

Following the implementation of mitigation measures, specifically marine liaison officer/pier master, the magnitude is reduced to small negative and so the residual effect will be **minor adverse**.

8.3.4 Grounding – Vessel on approaches

During a vessel manoeuvre to or on departure from the pier, it is possible for a grounding incident to occur if the vessel's Master misjudges the prevailing conditions. This impact is most likely to happen on the side berth (Eastern berth) where there is shallow water in close proximity to the berth. Adverse weather conditions such as high wind and large waves together with strong tidal conditions has the potential to negatively impact vessel manoeuvring with a strong north-westerly wind and ebb tide presenting the conditions when grounding is most likely to occur.

This potential effect will have a high level of sensitivity due to the safety implications of hull damage and injury associated with a grounding event. A vessel approaching the Side Berth will have limited ability to adapt to the situation as the slow speed required for berthing means that the vessel will quickly drift as the result of a miscalculation of wind and tide. The potential impact is localised to the area of the marine facilities and will occur throughout the operational phase leading to a magnitude of medium negative and an overall ranking of **major to moderate adverse**.

- Marine liaison officer/Pier master – will promulgate safety information to vessels navigating in the area. They will be the Kyleakin Pier point of contact during an emergency situation.
- Dredging programme – the approaches to the berths will be dredged as part of the construction phase. Surveying completed during the operational phase will determine the need for maintenance dredging.
- Hydrographic surveying – scheduled surveys should be completed in line with PMSC requirements.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Tidal flow atlas – provision of a tidal atlas for use on-board vessels, which provides tidal flow speed and direction through each hour of the tidal cycle.
- Oil spill contingency plan – to detail the response to any marine pollution event. As part of this plan training and exercise of personnel will be required.
- Availability of latest hydrographic information – results of the hydrographic surveys should be provided to the UKHO so that navigational charts for the area can be updated.
- Marine safety management system – the MSMS should detail the procedures for promulgating weather information and requirements of marine personnel.
- PMSC compliance - ensures all risk is reduced to as low as reasonably practicable (ALARP) by risk assessment and subsequent mitigation.
- Sectored light – this should be used for vessels approaching the side berth. A sectored light consists of at least 2 lights, red and white. When the vessel is in the white sector of the light the navigator can be confident that they are in safe water. If the vessel is in the red sector of the light, it indicates that the vessel should change its course and is outside of the dredged approach area to the berth, see Figure 9 and 10 for the proposed sector light location. Any Aid to Navigation lighting is subject to approval of the NLB prior to installation.
- Safe allocation of berths – berths should have adequate depth, suitable mooring systems and be available for use.

Following the implementation of mitigation measures, specifically the aids to navigation and dredging programme, sensitivity will be reduced to low and so the residual effect will be **minor adverse**.

8.3.5 Ranging – Adverse weather conditions affecting moored vessels

Potential adverse weather conditions, especially strong wind blowing vessels off berth will put increased strain on mooring equipment that can lead to mooring lines parting or mooring bollards

failing. These consequences can cause injury to personnel and result in the vessel drifting and subsequently being involved in an allision, collision or grounding incident. If the mooring lines hold, the movement of the vessel on the berth can lead to damage of the berth and vessel.

This potential impact will have a high sensitivity due to the limited ability to react to adverse weather conditions; a vessel has limited ability to reduce the risk of mooring failure. The potential effect will be localised to the harbour area and will be present on a permanent basis. The impact also has the potential to occur frequently throughout the operational phase, which leads to an assessed magnitude of medium negative and an overall ranking of **major to moderate adverse**.

The following further mitigation measures provide risk reduction towards a point which is ALARP:

- Marine liaison officer/Pier master - To provide safety information and Metocean information to vessels using the Kyleakin pier.
- Marine safety management system - the MSMS should detail the procedures for promulgating weather information and requirements of marine personnel.
- PMSC compliance - Ensures all risk is reduced to as low as reasonably practicable (ALARP) by risk assessment and subsequent mitigation.

Following the implementation of mitigation measures, specifically the Harbour Authority Powers reduce the sensitivity to low as this will provide an LPS which will broadcast weather conditions via VHF to vessels. The mooring plans and studies will reduce the magnitude to small negative vessel will be kept alongside up to the design limits after which it will proceed to anchor until conditions improve. This leads to a residual effect of **insignificant**.

9 Cumulative Impacts

In order that other project proposals in the vicinity of the Kyleakin Pier Development are considered cumulatively, relevant projects have been listed in Table 21. These projects have been considered in relation to commercial shipping and recreational navigation cumulative/in-combination with the proposed pier development. The comments section of Table 21 identifies the likely outcome from cumulative/in-combination effects.

Table 21. In-combination activities and projects

Applicant	Description of Works	Marine Licence Application/ Licence Ref.	Comments
Kishorn Port Ltd	Regeneration of Kishorn Yard, Dry Dock and Quays, Wester Ross	Construction licence - 05003/13/0 Mooring licence - 05074/14/0	Works not yet commenced. Construction licence valid until 2019. This will increase the level of vessel traffic to the north of the study area and so **increase the likelihood** of marine incidents. The vessels using this facility are unlikely to transit close to the Kyleakin Pier Development site, so the project is unlikely to have an in-combination effect on vessels navigating in the area.
Marine Harvest	Installation of a raft, Loch Na Beiste, Loch Alsh	Application - 05529	**Not considered.** There will be no interaction between vessels involved with the Loch Na Beiste, Loch Alsh raft installation, and the Kyleakin Pier Development.
Kyle & Lochalsh Community Trust	Installation of 10 moorings on trots, Kyle of Lochalsh	Mooring licence - 05436/15/0	Vessels transiting to the new moorings may pass the Kyleakin Pier Development. This means that there will be a **minimal increase in likelihood** of a marine incident.

10 Mitigation Measures Summary

The following section summarises existing industry standard risk controls and project specific mitigation measures identified in Section 8. The NRA process has recognised both existing industry standard risk controls and project specific mitigation; to view mitigation and controls assigned to individual NRAs, see Appendix D and Appendix E. Embedded risk controls are listed in Table 11.

10.1 Project specific mitigation measures

Project specific mitigation has been summarised against the two phases of the proposed development.

10.1.1 Construction phase

The following 11 project specific mitigation measures were identified through the NRA process as appropriate risk management controls during the during the Marine Works phase:

- AIS coverage - all dredge/construction vessels, including barges to carry AIS (A or B).
- Contractor risk assessment method statement (RAMS) – reviewed and agreed prior to use.
- Dedicated VHF channel - for use by dredge/construction vessels working on the project. This will require a licence from OFCOM.
- Marine liaison officer – provides a point of contact for the marine works, will provide safety information to vessels navigating in the area and coordinate with local authorities during emergency situations.
- Marine safety management system - prior to commencement of marine operations, consideration and creation of a Marine-SMS which details the marine side operations and how these will be managed. Detailed Safety Operating Instructions (SOPs) may also be established to compliment the Marine-SMS.
- Notices to mariners – Issued by Kyle of Lochalsh Harbour Authority to inform vessels of the towage activities.
- Navigational lights – marine works to be lit. Caissons to be lit as per COLREGS, anchored caissons to display lighting agreed with NLB.
- Oil Spill Contingency Plan – the MCA require an oil spill contingency plan to be in place before the commencement of marine works. As part of this plan training and exercise of personnel will be required.
- PMSC compliance – the application of a Marine-SMS, which recognises the need for contractors' RAMS to be agreed in advance of marine works.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities. As part of this plan training and exercise of personnel will be required.
- Shore side facility maintenance programme – to ensure that all machinery is inspected and maintained.

10.1.2 Operational phase

The following 13 project specific mitigation measures were identified through the NRA process as appropriate risk management controls during the Operational phase:

- Availability of latest hydrographic information – results of the hydrographic surveys should be provided to the UKHO so that navigational charts for the area can be updated.

- Communications equipment – marine personnel to monitor VHF channels 13 and 16.
- Dedicated VHF channel – to prevent over use of the main navigational channels, will require a licence from OFCOM.
- Dredging programme – the approaches to the berths will be dredged as part of the construction phase. Surveying completed during the operational phase will determine the need for maintenance dredging.
- Hydrographic surveying – scheduled surveys should be completed in line with PMSC requirements.
- Marine liaison officer/Pier master – will promulgate safety information to vessels navigating in the area. They will be the Kyleakin Pier point of contact during an emergency situation.
- Marine safety management system – the MSMS should detail the procedures for promulgating weather information and requirements of marine personnel.
- Oil spill contingency plans – to detail the response to any marine pollution event.
- PMSC compliance - ensures all risk is reduced to as low as reasonably practicable (ALARP) by risk assessment and subsequent mitigation.
- Port emergency plan – will detail responses to emergency situations, along with contact details for local authorities.
- Sectored light – this should be used for vessels approaching the side berth. A sectored light consists of at least 2 lights, red and white. When the vessel is in the white sector of the light the navigator can be confident that they are in safe water. If the vessel is in the red sector of the light, it indicates that the vessel should change its course and is outside of the dredged approach area to the berth. Any Aid to Navigation lighting is subject to approval of the NLB prior to installation.
- Safe allocation of berths – berths should have adequate depth, suitable mooring systems and be available for use.
- Tidal flow atlas – provision of a tidal atlas for use on-board vessels, which provides tidal flow speed and direction through each hour of the tidal cycle.

11 Summary

These NRAs detail the risk generated by the Construction (marine works and dredging) and Operational phases of the proposed development. In total, 29 hazard scenarios were identified and assessed. A total of 14 hazard scenarios were identified for the construction phase and 15 hazard scenarios for the operational phase.

Through analysis of the causes and embedded mitigation, the hazard scenarios were scored and the 13 assessments that were classified as medium risk or above were brought forward into the formal safety assessment.

From the NRA process, 24 mitigation measures were identified, split between the Construction and Operational phases of the proposed development. Following implementation of appropriate mitigation, marine risk to navigational receptors can be maintained within a level that is 'as low as reasonably practicable'.

12 References

British Standards Institution. BS EN 1991-1-4:2005+A1:2010 Eurocode 1. Actions on structures. General actions. Wind actions.

DfT/MCA, 2013. Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations (OREI). Department for Transport and Maritime and Coastguard Agency.

Department for Transport (DfT), 2016. Port Marine Safety Code, published November 2016.

HM Government, 2011. The UK Marine Policy Statement (2011)

IMO, 2013. Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule making process. International Maritime Organization.

IMO, 1972. International Regulations for Preventing Collisions at Sea, 1972. International Maritime Organization.

International COLREGS 1972. The International Regulations for Preventing Collisions at Sea 1972 (COLREGS) published by the International Maritime Organization (IMO)

MCA, 2016. Marine Guidance Note 543 (MGN 543 Merchant + Fishing) Safety of Navigation: Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response. Maritime and Coastguard Agency.

RPS, 2016. Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling. RPS Group Plc.

RYA, 2016. UK Coastal Atlas of Recreational Boating 2.0. User Guide. September 2016

13 Abbreviations/Acronyms

AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
ALRS	Admiralty List of Radio Signals
BS	British Standards
BUTEC	British Underwater Test and Evaluation Centre
COLREGS	International Regulations for Preventing Collisions at Sea 1972 (as amended)
DfT	Department for Transport
ECMWF	European Centre for Medium-Range Weather Forecasts
EN	English
ES	Environmental Statement
FSA	Formal Safety Assessment
GPS	Global Positioning System
GT	Gross Tonnage
HM	Her Majesty's
HSE	Health and Safety Executive
ID	Identity
IMO	International Maritime Organization
LLA	Local Lighthouse Authority
LOHI	Loss of Hull Integrity
LNG	Liquefied Natural Gas
MAIB	Marine Accident Investigation Branch
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
M+F	Merchant + Fishing
MGN	Marine Guidance Note
MoB	Man Overboard
MoD	Ministry of Defence
MMO	Marine Management Organisation
MSMS	Marine Safety Management System
NLB	Northern Lighthouse Board
NRA	Navigational Risk Assessment
OFCOM	Office of Communications
OPRC	International Convention on Oil Pollution Preparedness
OREI	Offshore Renewable Energy Installation
PEXA	Practice and Exercise Areas
PMSC	Port Marine Safety Code
Q	Quarter (of year - e.g. Q1, Q2 of 2016)
RAMS	Risk Assessment Method Statement
RNLI	Royal National Lifeboat Institution
RPS	RPS Group Plc
RYA	Royal Yachting Association
TSHD	Trailing Suction Hopper Dredger
SAR	Search and Rescue
SHA	Statutory Harbour Authority
SMS	Safety Management System
SOP	Standard Operating Procedures
STCW	Standards of Training, Certification and Watchkeeping for Seafarers
UK	United Kingdom

UKHO	UK Hydrographic Office
UNCLOS	United Nations Convention on the Law of the Sea
VHF	Very High Frequency
VTS	Vessel Traffic Service

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Figures

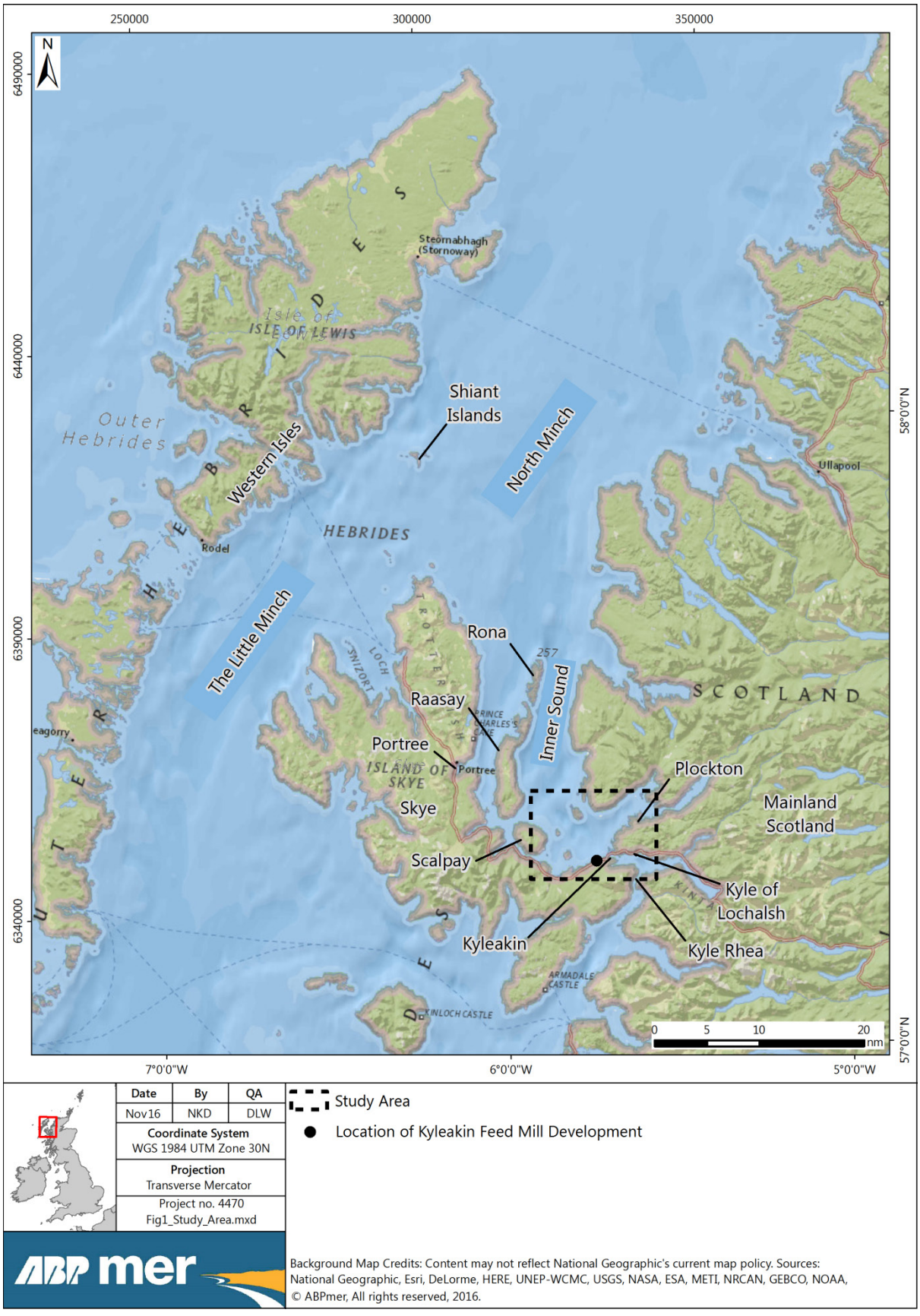


Figure 1. Location Map

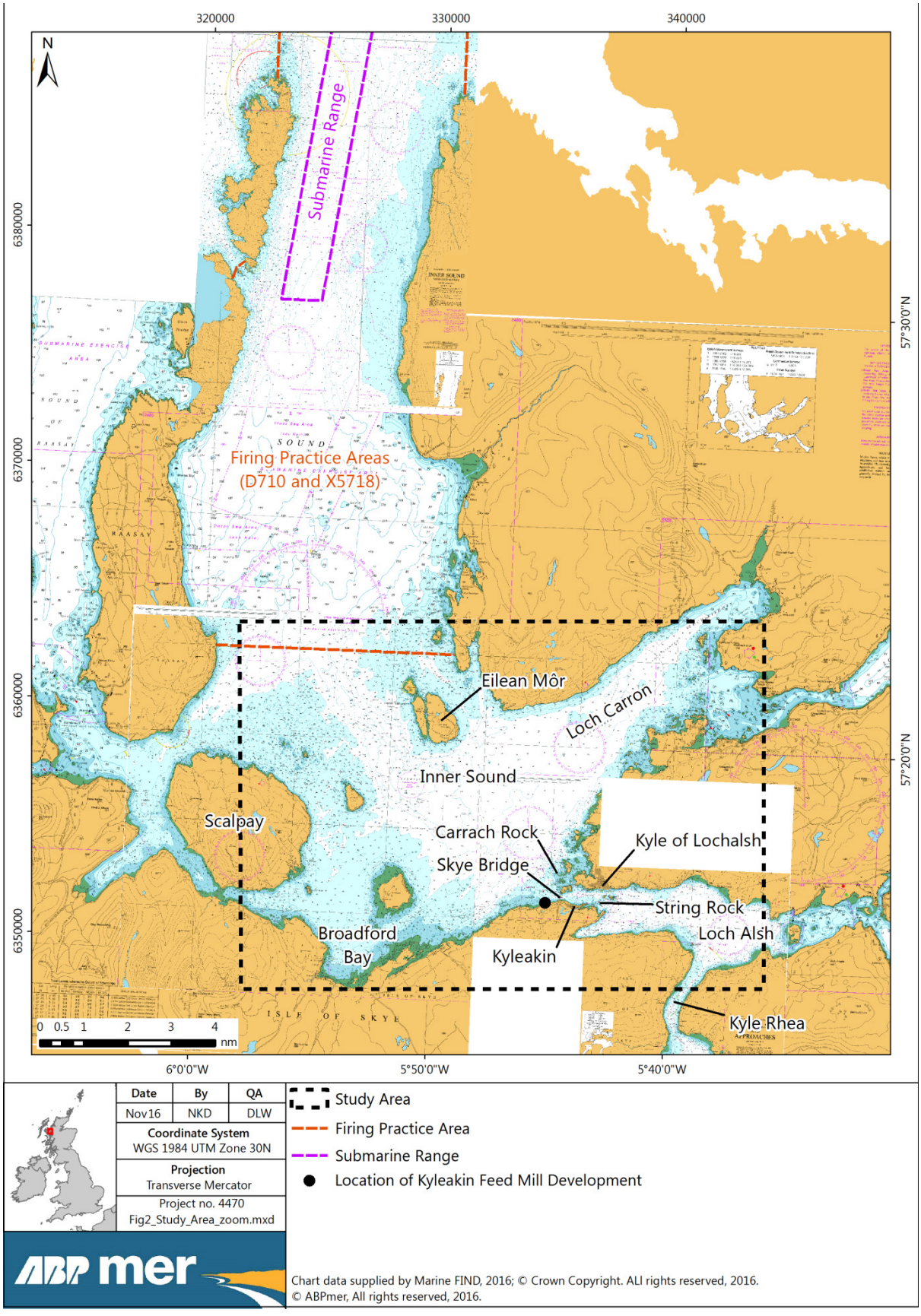


Figure 2. Wider and Detailed Study Area

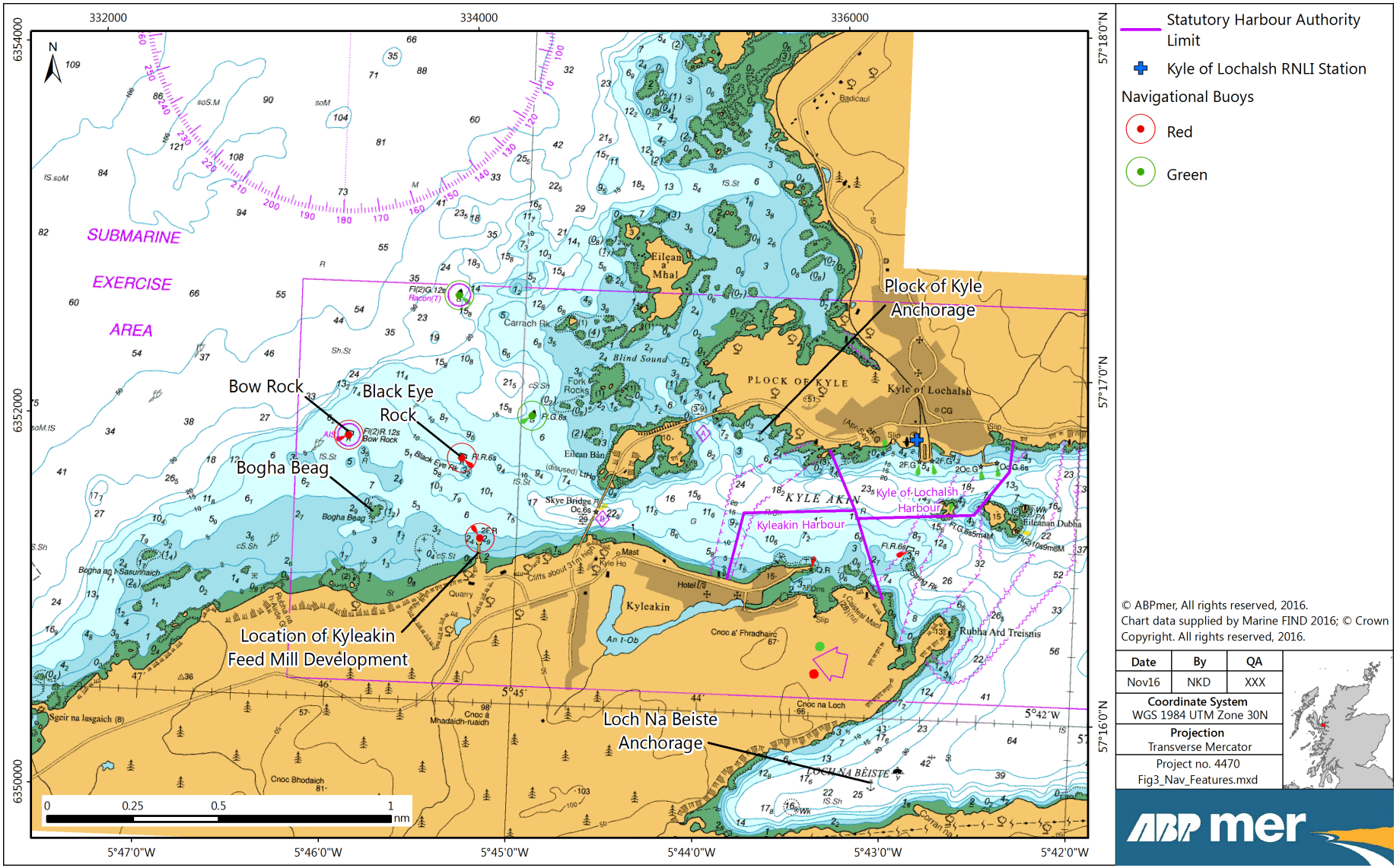


Figure 3. Navigational Features

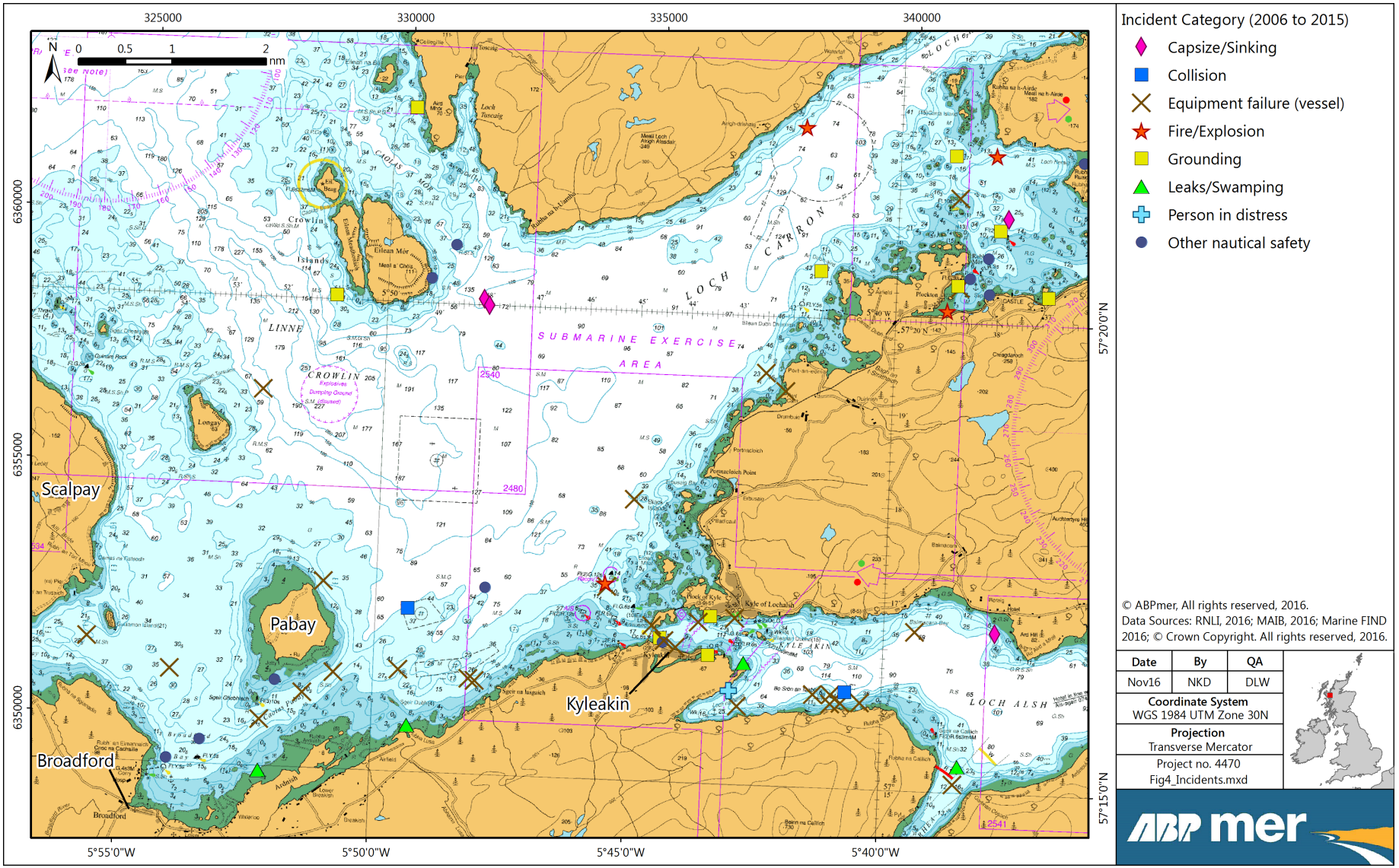


Figure 4. Accident-Incident Locations

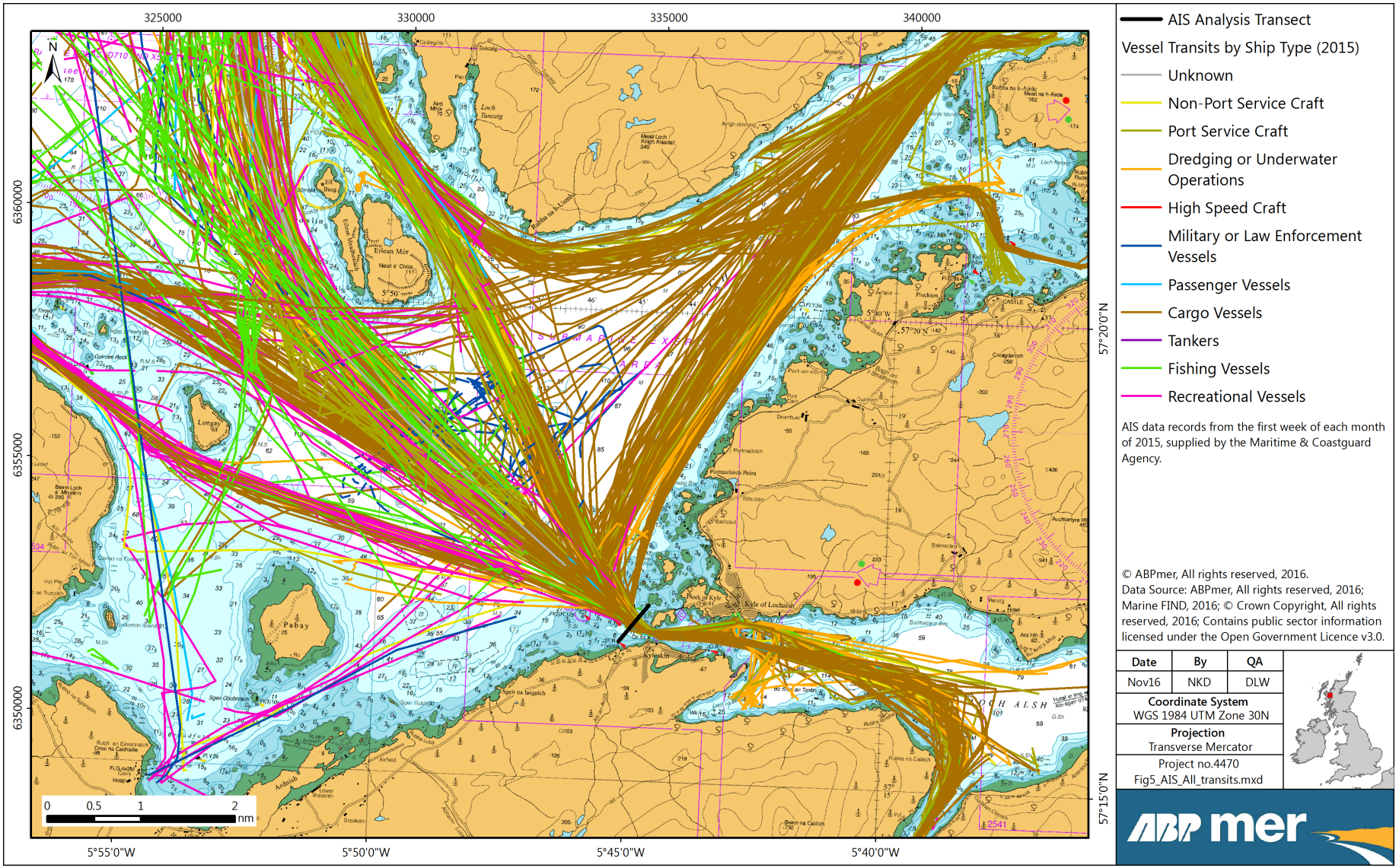


Figure 5. AIS Vessel Transits (2015)

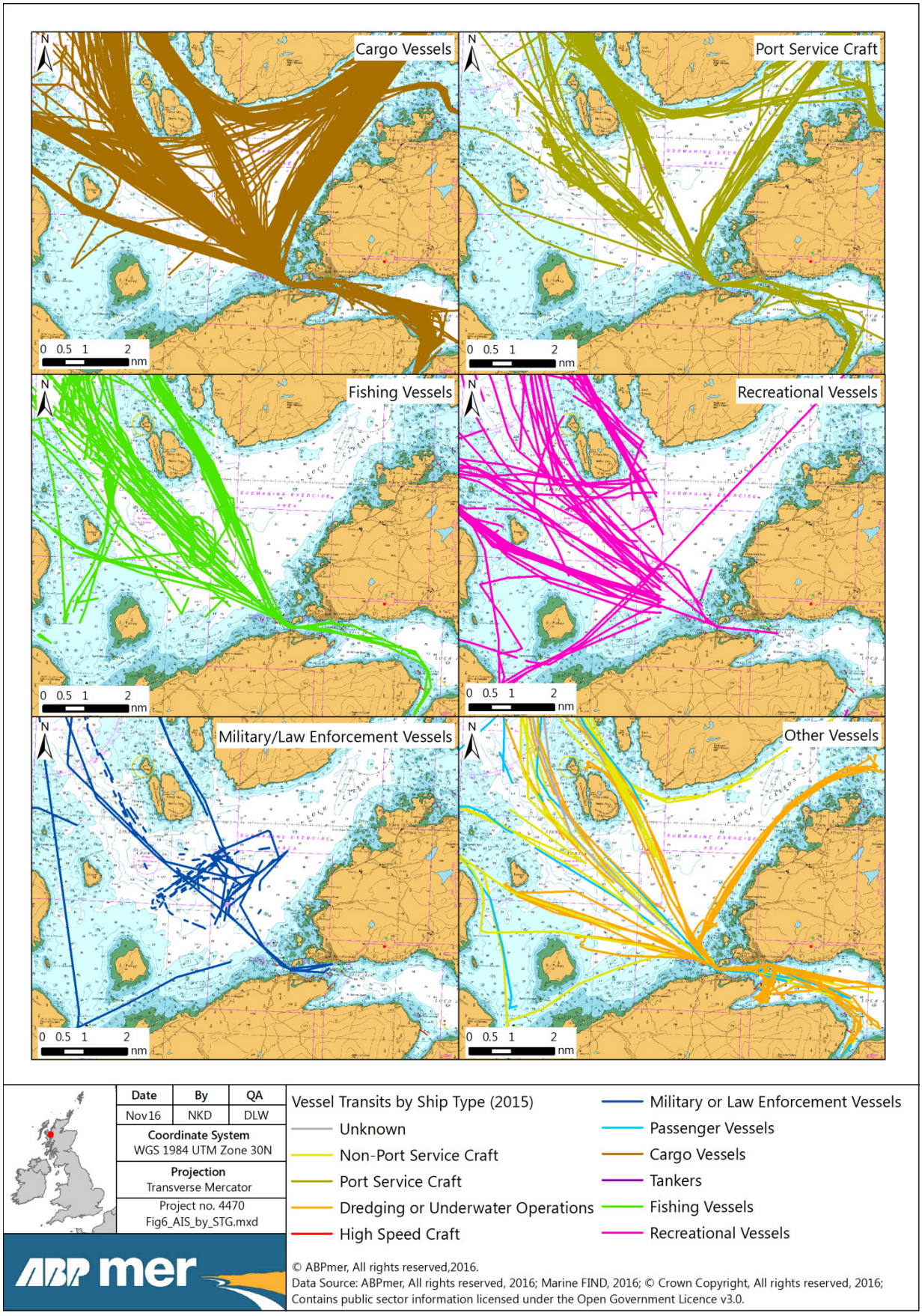


Figure 6. AIS Vessel Transits (2015) By Ship Type

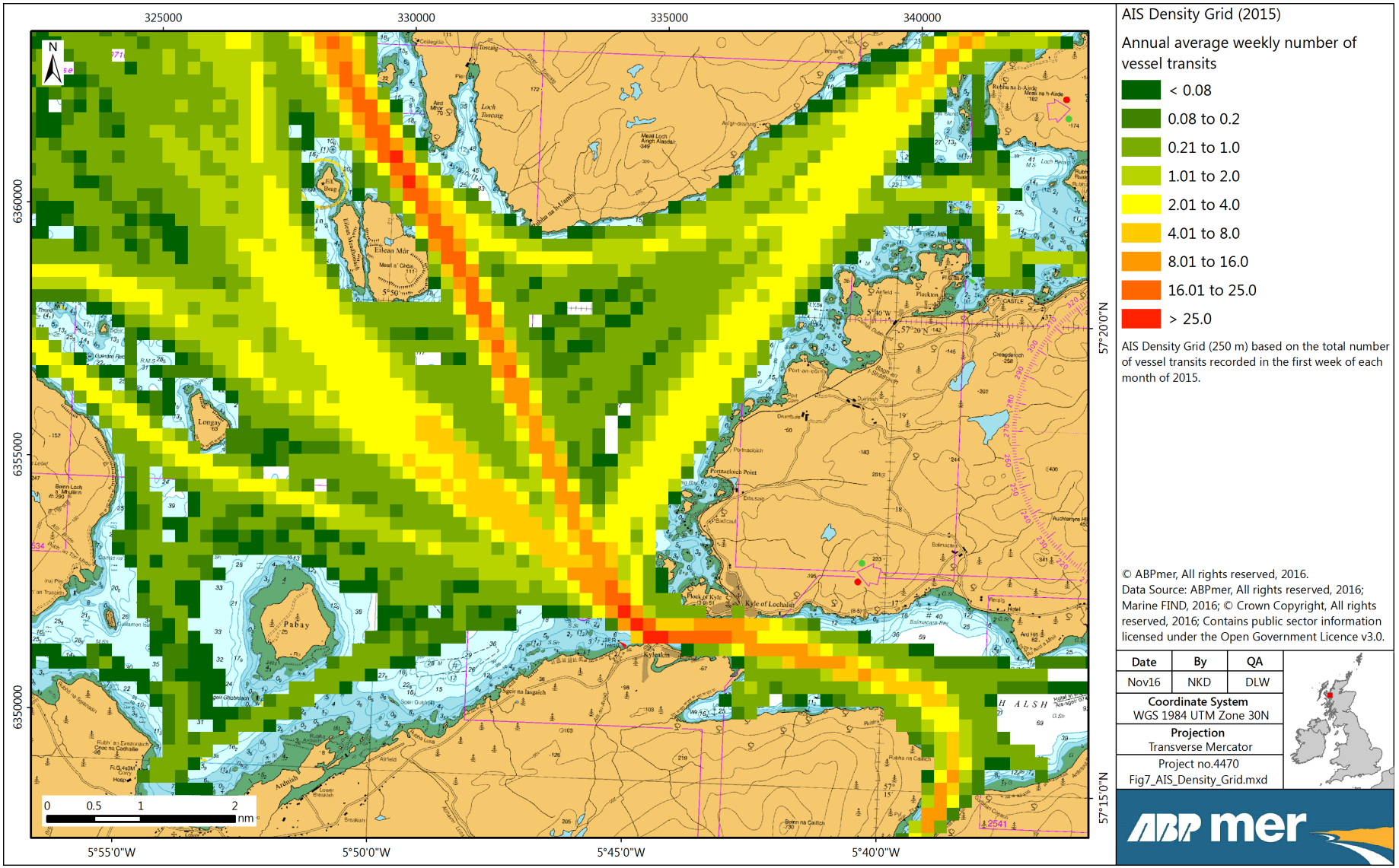


Figure 7. AIS Vessel Density Grid (2015)

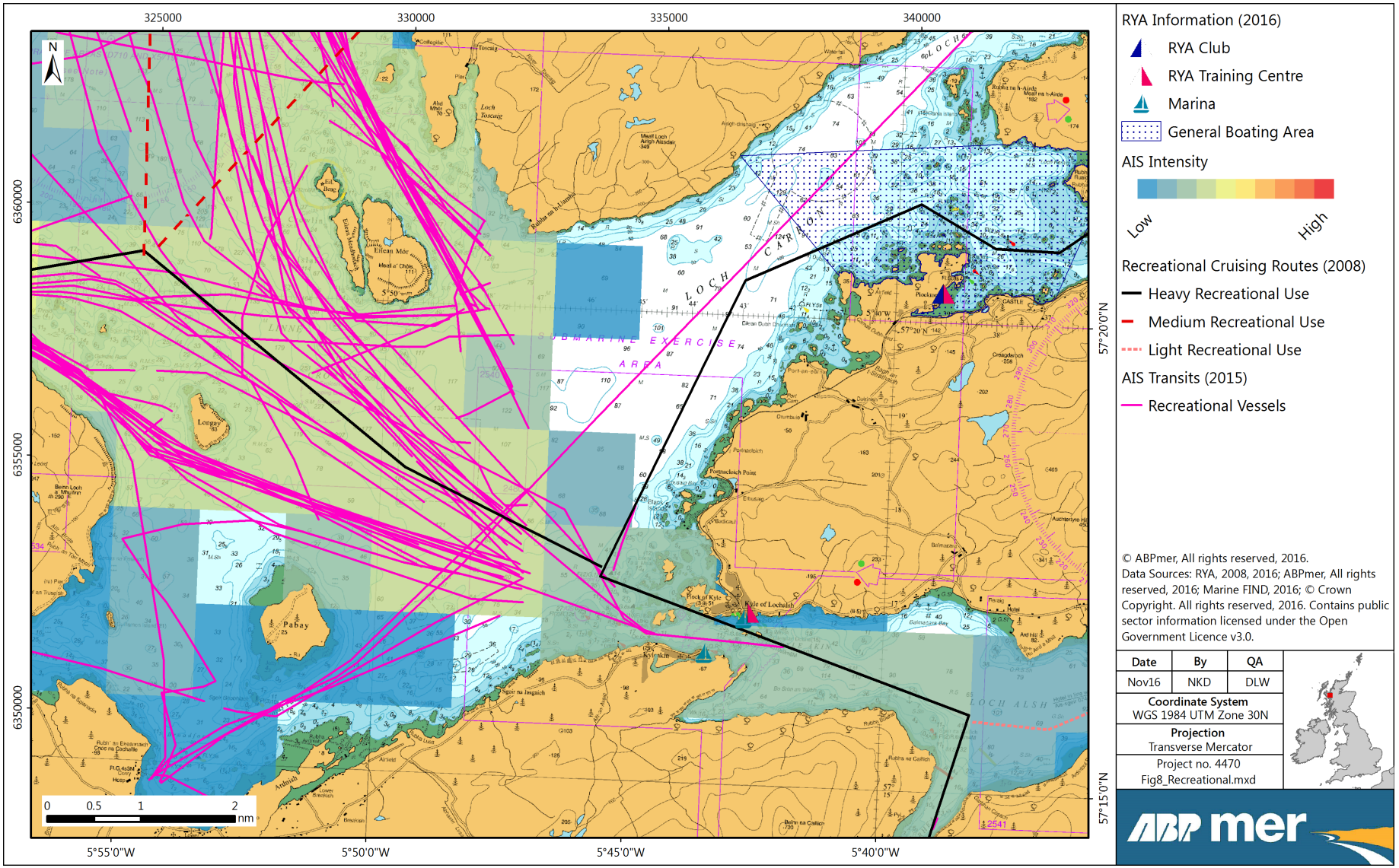


Figure 8. Recreational Vessel Transits and Sea Area Use

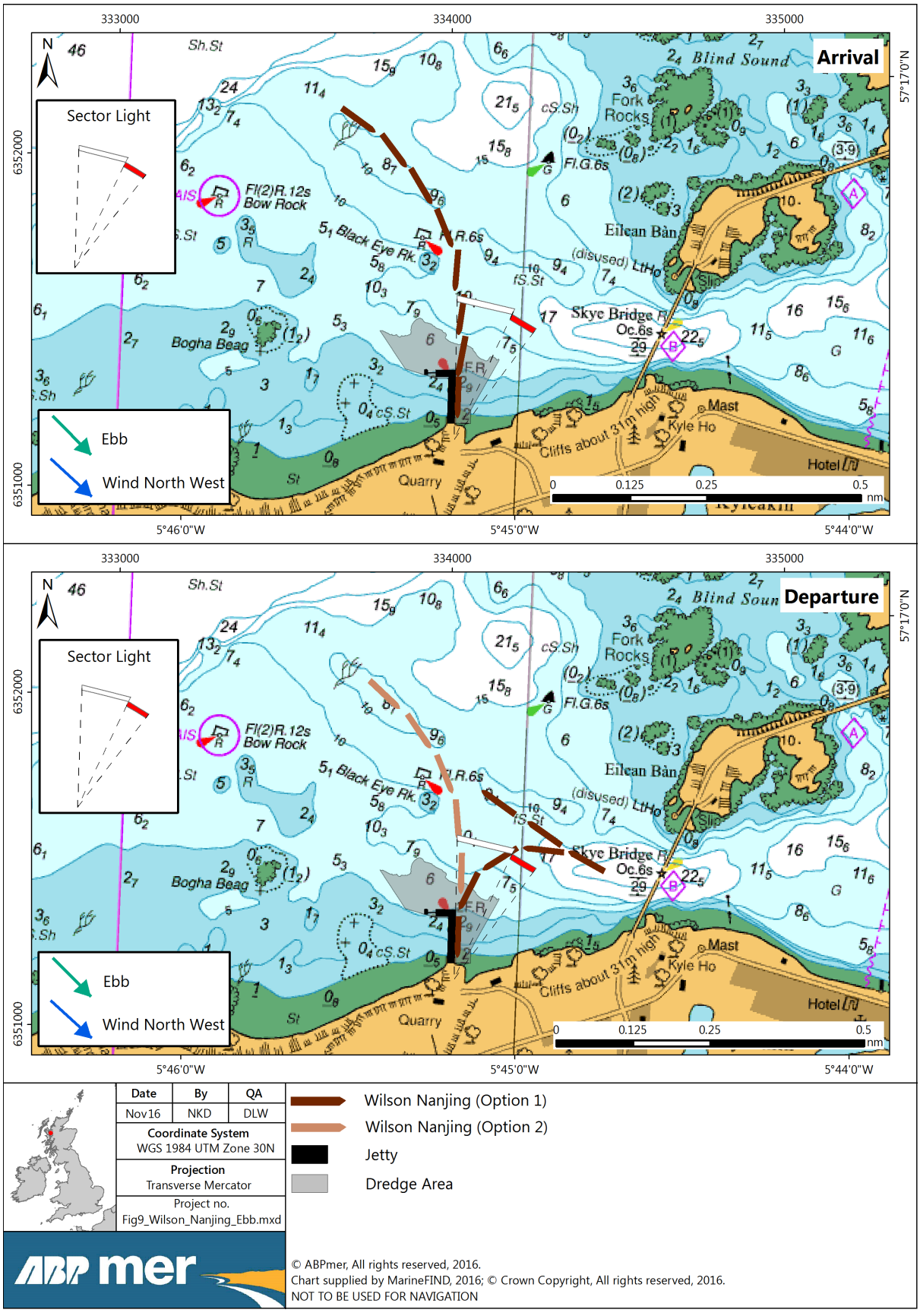


Figure 9. **Side Berth – Arrival and Departure Options**

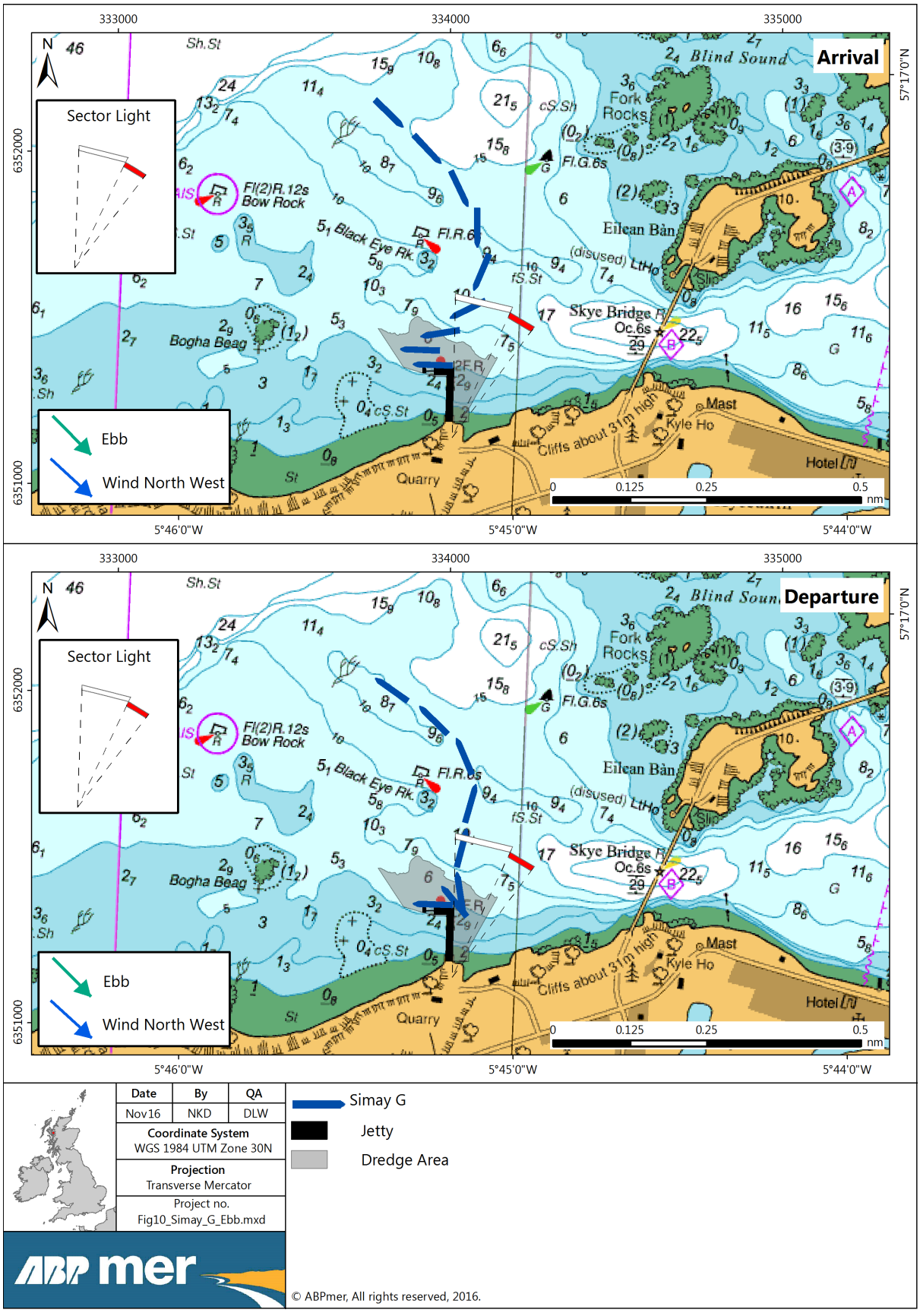


Figure 10. Outer Berth – Arrival and Departure Options

Appendices

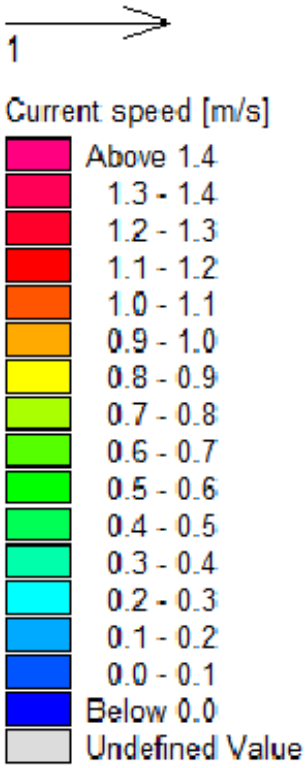
A Accident Incident Table

Data Source	Year	Vessel Type	Incident Type	Latitude	Longitude
RNLI	2006	MoD (not navy)	Equipment failure (vessel)	57.2666	-5.6891
MAIB	2006	Recreational craft	Equipment failure (vessel)	57.265	-5.68333
RNLI	2006	Inflatable dinghy	Other nautical safety	57.2832	-5.7977
MAIB	2006	Cargo ship	Grounding	57.277	-5.74
RNLI	2006	Sail yacht with aux engine	Other nautical safety	57.2543	-5.8893
RNLI	2006	Object	Fire/Explosion	57.3672	-5.6981
RNLI	2006	Small open powered boat	Equipment failure (vessel)	57.2634	-5.8563
RNLI	2006	Sail yacht with aux engine	Grounding	57.2797	-5.7236
RNLI	2006	Tender (pleasure craft)	Equipment failure (vessel)	57.3396	-5.6459
RNLI	2006	Jet ski	Capsize/Sinking	57.2785	-5.6302
RNLI	2006	Sail yacht with aux engine	Equipment failure (vessel)	57.3169	-5.873
RNLI	2006	Large powered boat with cabin	Leaks/Swamping	57.2492	-5.8697
RNLI	2007	Small open powered boat	Equipment failure (vessel)	57.2672	-5.8464
RNLI	2007	Inflatable dinghy	Other nautical safety	57.2748	-5.7389
RNLI	2007	Diving boat	Equipment failure (vessel)	57.264	-5.7138
MAIB	2007	Recreational craft	Equipment failure (vessel)	57.26667	-5.68333
RNLI	2007	Sail yacht with aux engine	Grounding	57.3341	-5.8501
RNLI	2007	Sail yacht with aux engine	Grounding	57.3341	-5.8501
RNLI	2007	Fishing vessel (small)	Fire/Explosion	57.3633	-5.6353
RNLI	2008	Fishing Vessel	Capsize/Sinking	57.3344	-5.8016
MAIB	2008	Fishing vessel	Capsize/Sinking	57.33333	-5.8
RNLI	2008	Military vessel	Equipment failure (vessel)	57.2719	-5.9275
RNLI	2008	Powered boat	Equipment failure (vessel)	57.2751	-5.7384
RNLI	2009	Yacht with engine	Equipment failure (vessel)	57.2843	-5.7578
MAIB	2009	Recreational craft	Grounding	57.35	-5.63333
RNLI	2009	Yacht with engine	Fire/Explosion	57.2849	-5.7585
RNLI	2009	Yacht with engine	Equipment failure (vessel)	57.3555	-5.6469
RNLI	2009	Sailing Dinghy	Capsize/Sinking	57.3521	-5.6307
RNLI	2009	Fishing Vessel	Equipment failure (vessel)	57.267	-5.8021
MAIB	2009	Fishing vessel	Equipment failure (vessel)	57.26667	-5.8
RNLI	2009	Yacht with engine	Other nautical safety	57.3386	-5.6362
RNLI	2010	Powered boat	Other nautical safety	57.2654	-5.8655
RNLI	2010	Fishing Vessel	Equipment failure (vessel)	57.2654	-5.6736
RNLI	2010	Fishing Vessel	Equipment failure (vessel)	57.2786	-5.7274
RNLI	2010	Yacht with engine	Equipment failure (vessel)	57.2777	-5.7427
RNLI	2010	Yacht with engine	Other nautical safety	57.345	-5.6369
RNLI	2011	Yacht with engine	Grounding	57.3679	-5.8264
RNLI	2011	Yacht with engine	Other nautical safety	57.3438	-5.8115
RNLI	2011	Powered boat	Equipment failure (vessel)	57.2681	-5.8251
RNLI	2011	Yacht with engine	Other nautical safety	57.3377	-5.8192
MAIB	2011	Passenger ship	Grounding	57.33333	-5.61667
MAIB	2011	Service ship	Equipment failure (vessel)	57.2675	-5.73433
RNLI	2012	Fishing Vessel	Equipment failure (vessel)	57.2833	-5.8507
MAIB	2012	Inland waterway vessel	Fire/Explosion	57.33333	-5.65

Data Source	Year	Vessel Type	Incident Type	Latitude	Longitude
RNLI	2012	Fishing Vessel	Leaks/Swamping	57.2717	-5.7122
RNLI	2012	Fishing Vessel	Equipment failure (vessel)	57.32	-5.7
RNLI	2012	Yacht with engine	Other nautical safety	57.2508	-5.9
MAIB	2012	Passenger ship	Grounding	57.34	-5.64667
MAIB	2012	Service ship	Equipment failure (vessel)	57.28333	-5.71667
RNLI	2013	Powered boat	Equipment failure (vessel)	57.2652	-5.68
RNLI	2013	Yacht with engine	Leaks/Swamping	57.2547	-5.641
RNLI	2013	Yacht with engine	Grounding	57.3417	-5.6917
RNLI	2013	Fishing Vessel	Leaks/Swamping	57.2583	-5.8217
RNLI	2014	Fishing Vessel	Equipment failure (vessel)	57.3233	-5.7083
RNLI	2014	Rowing Boat	Other nautical safety	57.3625	-5.6067
RNLI	2014	Fishing Vessel (Leisure)	Equipment failure (vessel)	57.2667	-5.9
RNLI	2014	Powered boat	Collision	57.2672	-5.6787
RNLI	2014	Yacht with engine	Equipment failure (vessel)	57.2783	-5.6565
RNLI	2014	Yacht with engine	Grounding	57.2728	-5.724
RNLI	2014	Yacht with engine	Other nautical safety	57.3413	-5.6427
MAIB	2015	Service ship	Equipment failure (vessel)	57.3	-5.75
MAIB	2015	Recreational craft	Person in distress	57.26667	-5.71667
MAIB	2015	Recreational craft	Collision	57.279	-5.82283
RNLI	2015	Yacht with engine	Equipment failure (vessel)	57.3865	-5.614
RNLI	2015	Fishing Vessel	Equipment failure (vessel)	57.2515	-5.6423
RNLI	2015	Powered boat	Equipment failure (vessel)	57.2583	-5.87
MAIB	2015	Fishing vessel	Grounding	57.363	-5.64867

B Tidal Flow Atlas

B.1 Figure Legend

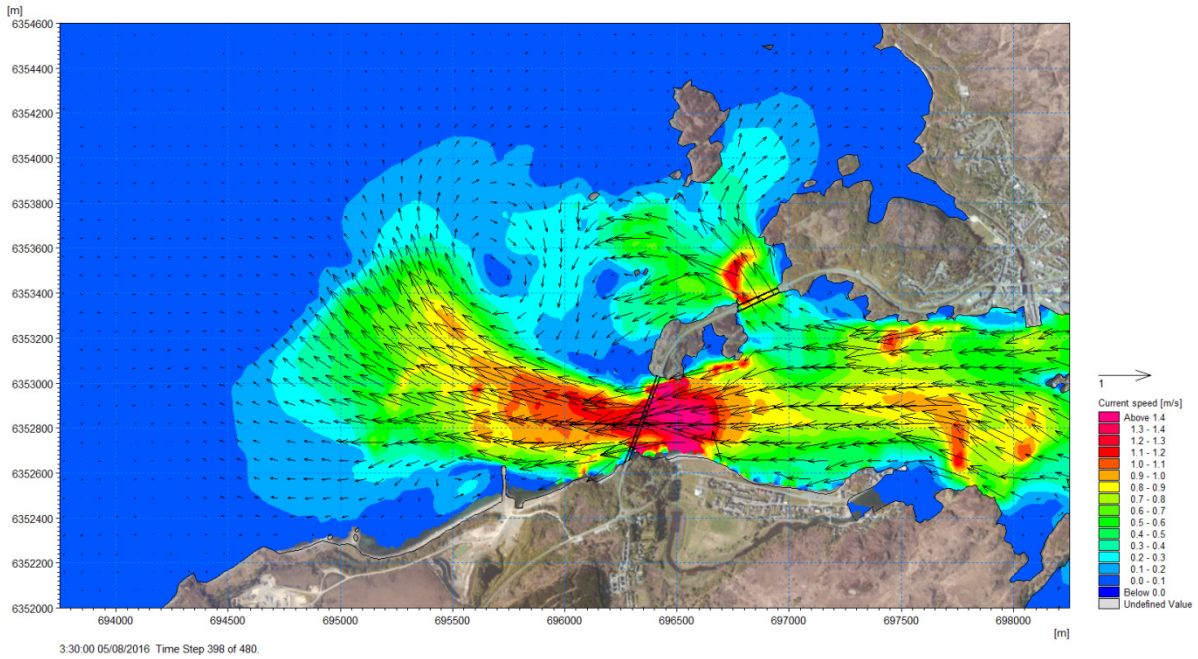


1 m/s = 1.94384 Knots

(as a rule of thumb, 1 m/s = 2 knots)

B.2 High Water - 5

B.2.1 Spring



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

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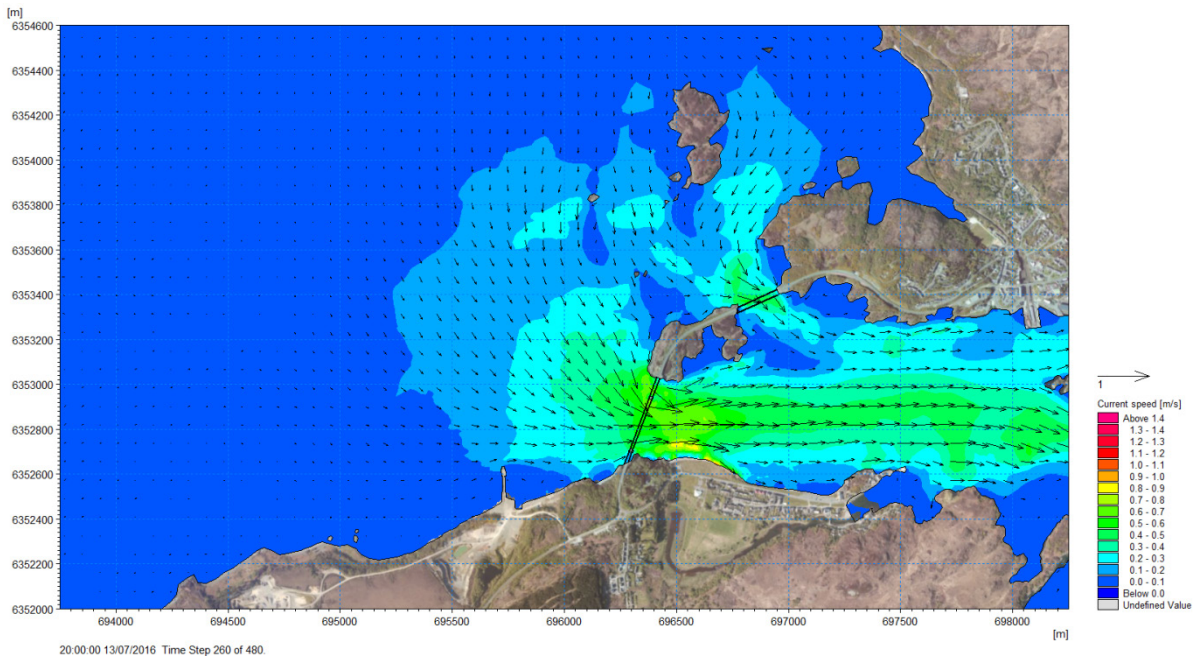
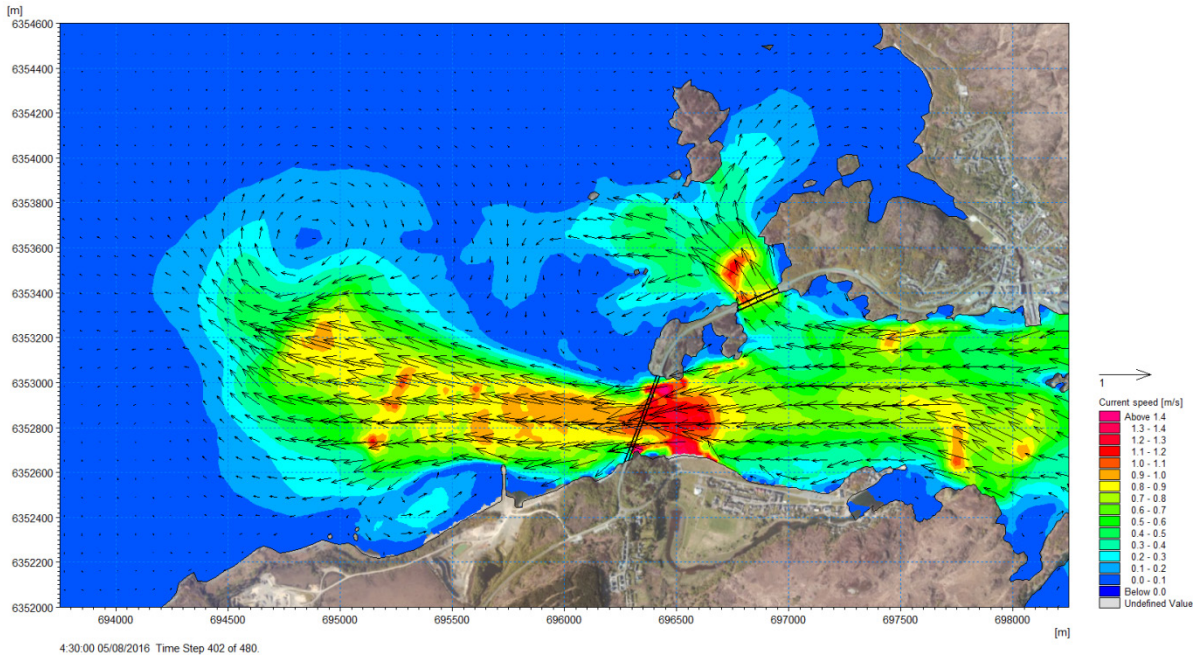


Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

B.3 High Water - 4

B.3.1 Spring



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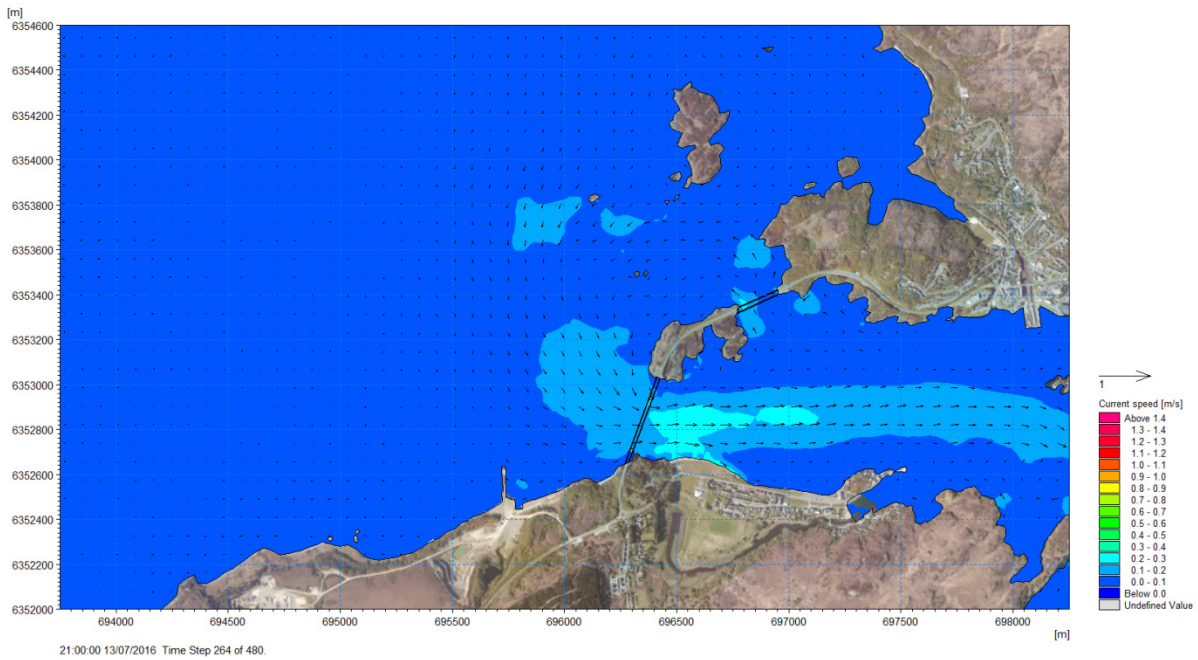
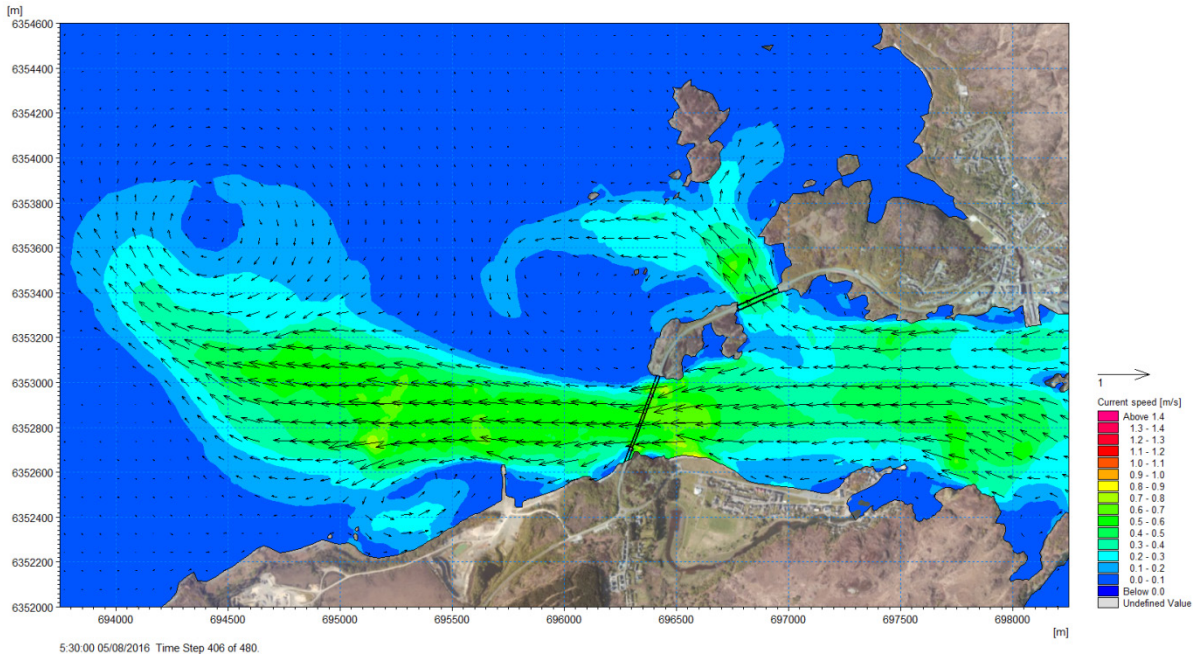


Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

B.4 High Water - 3

B.4.1 Spring



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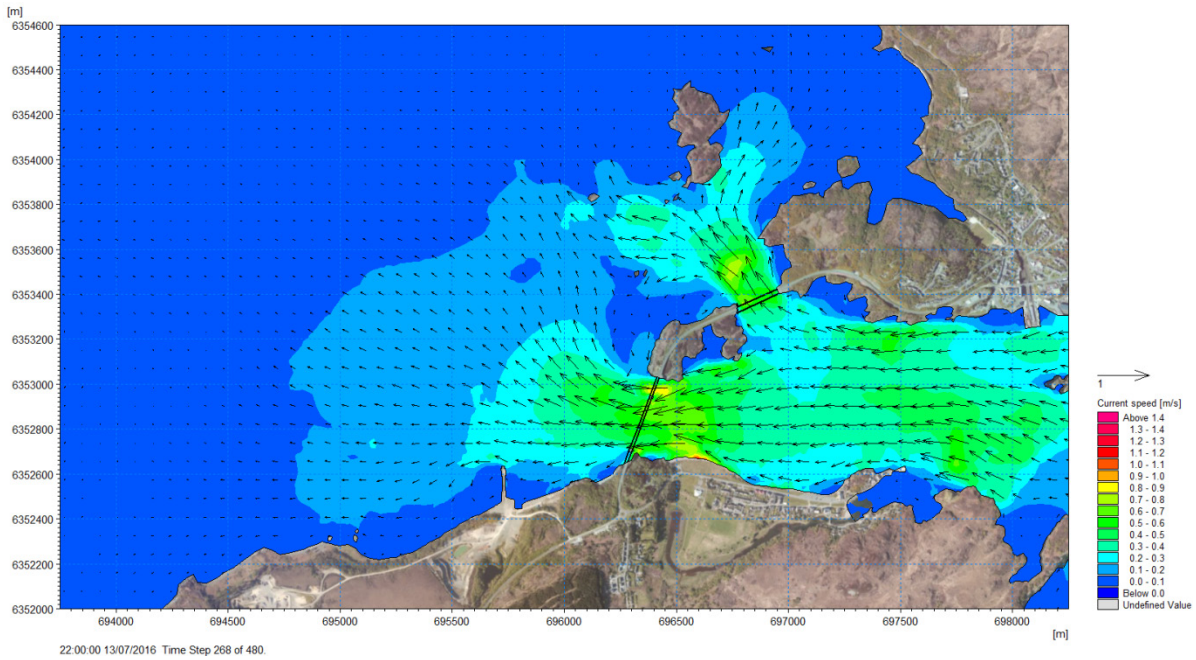

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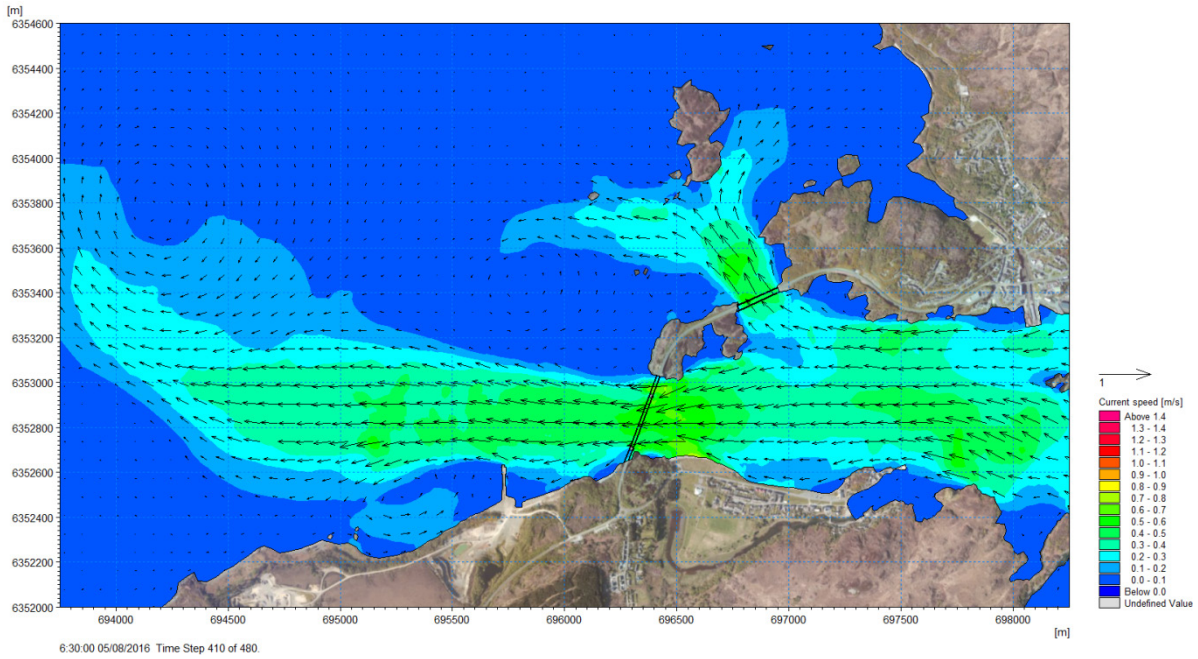
B.5 High Water - 2

B.5.1 Spring



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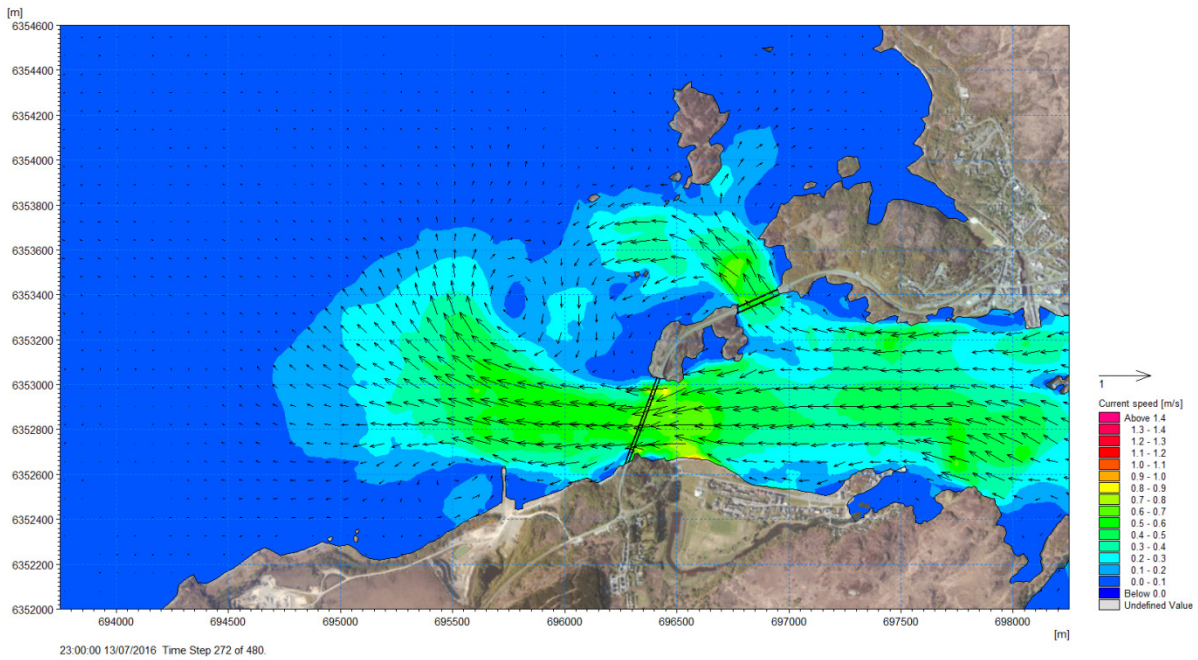

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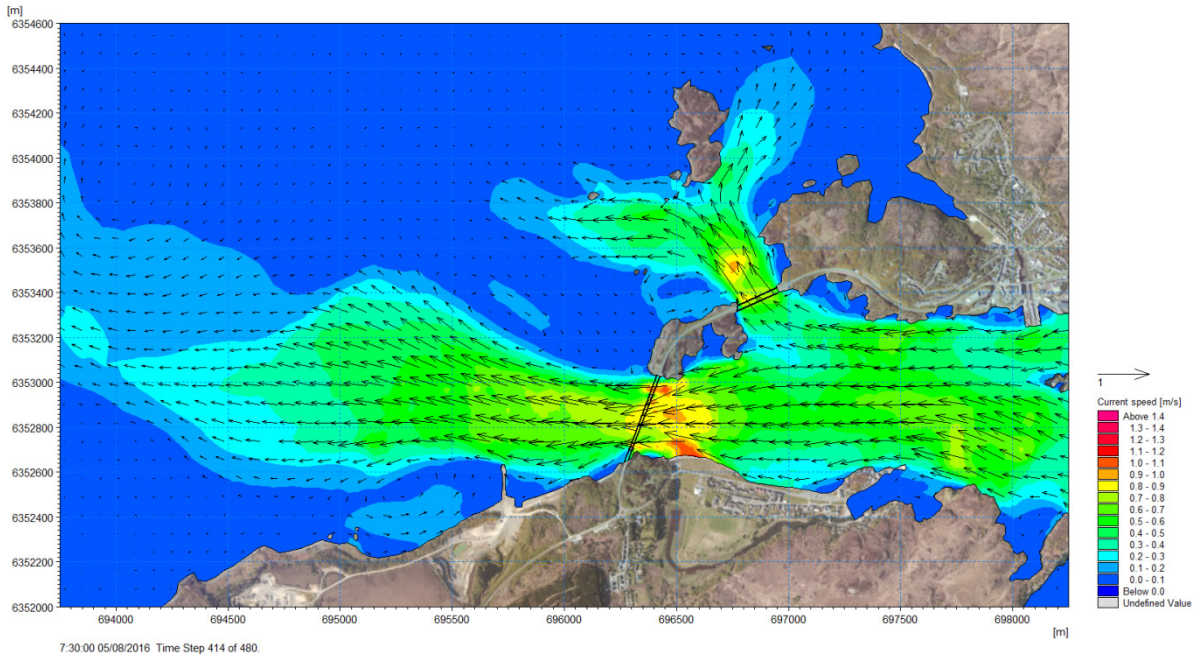
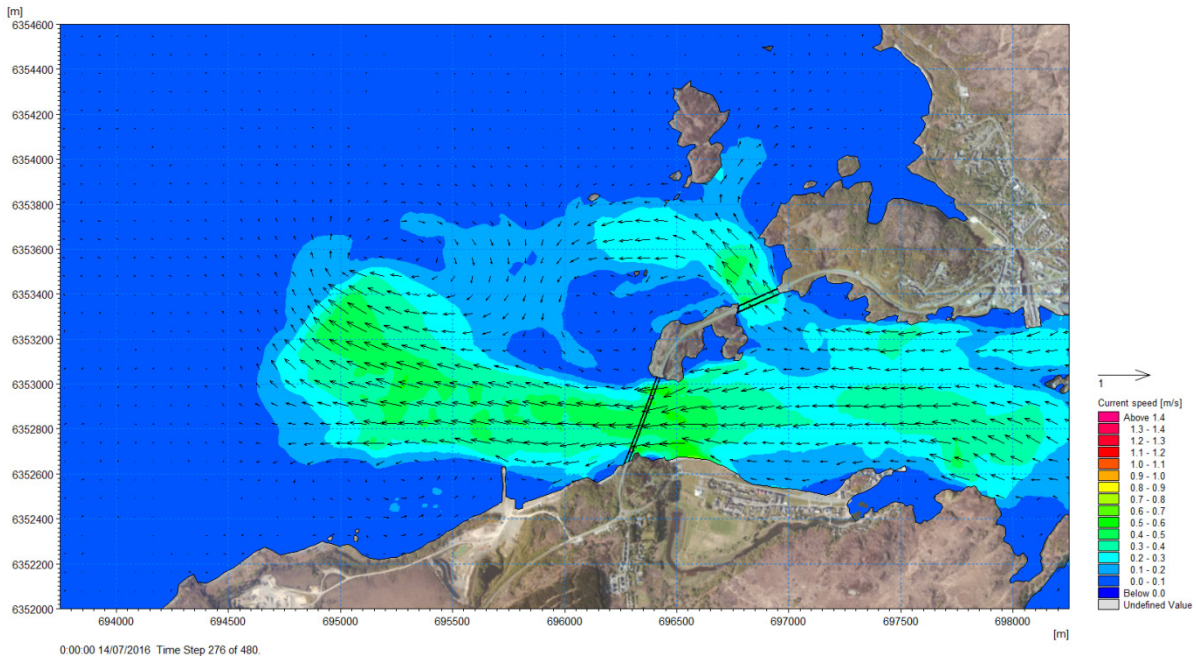
B.6 High Water - 1

B.6.1 Spring



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

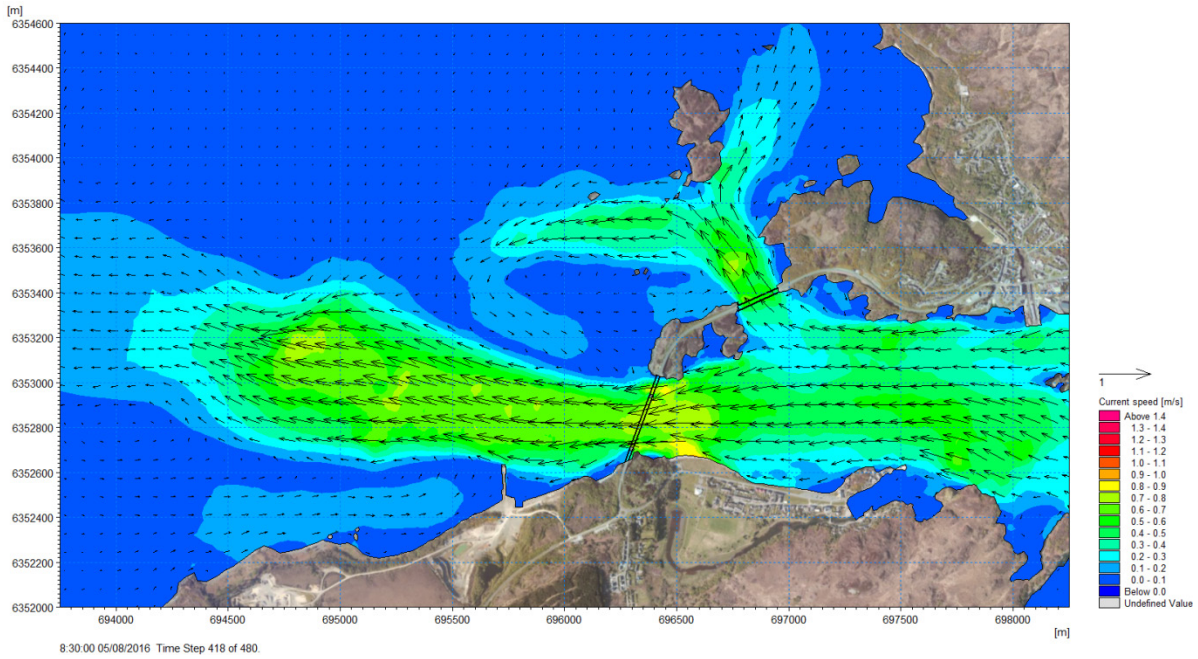
B.6.2 Neap



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

B.7 High Water

B.7.1 Spring



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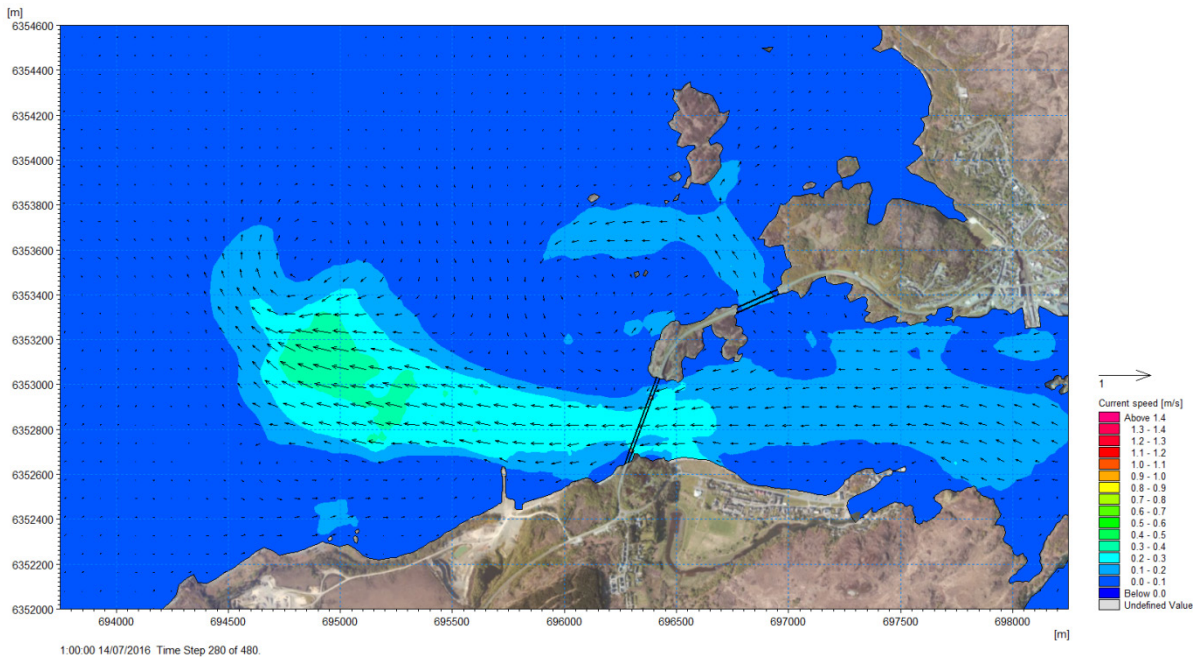

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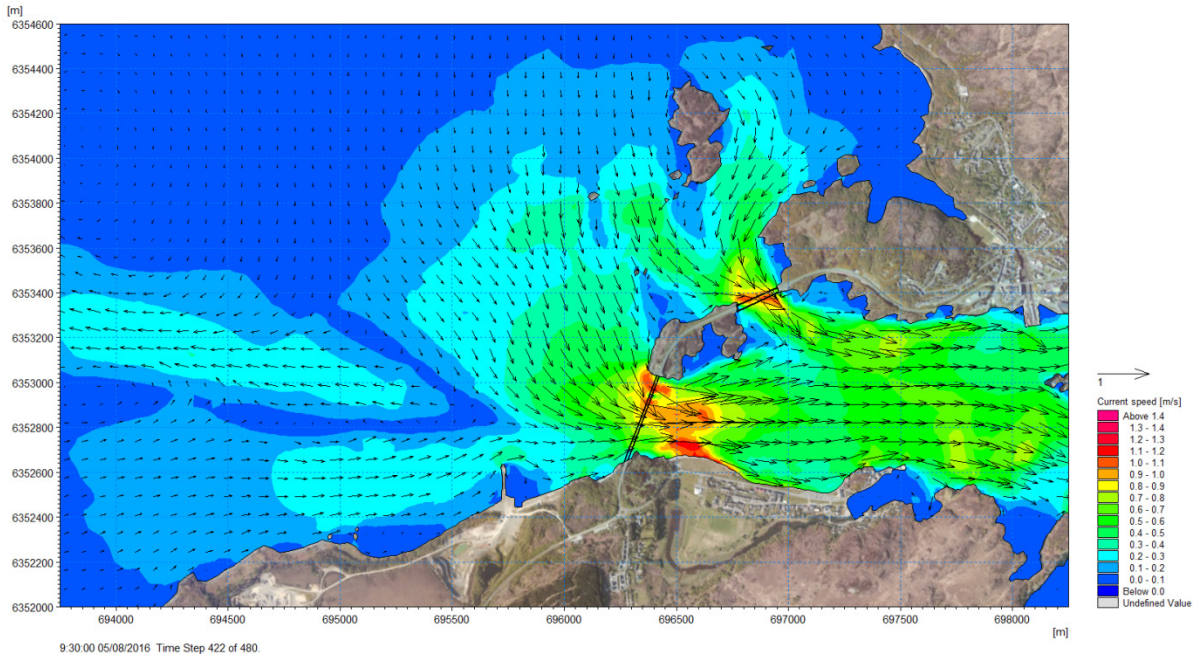
B.8 High Water + 1

B.8.1 Spring



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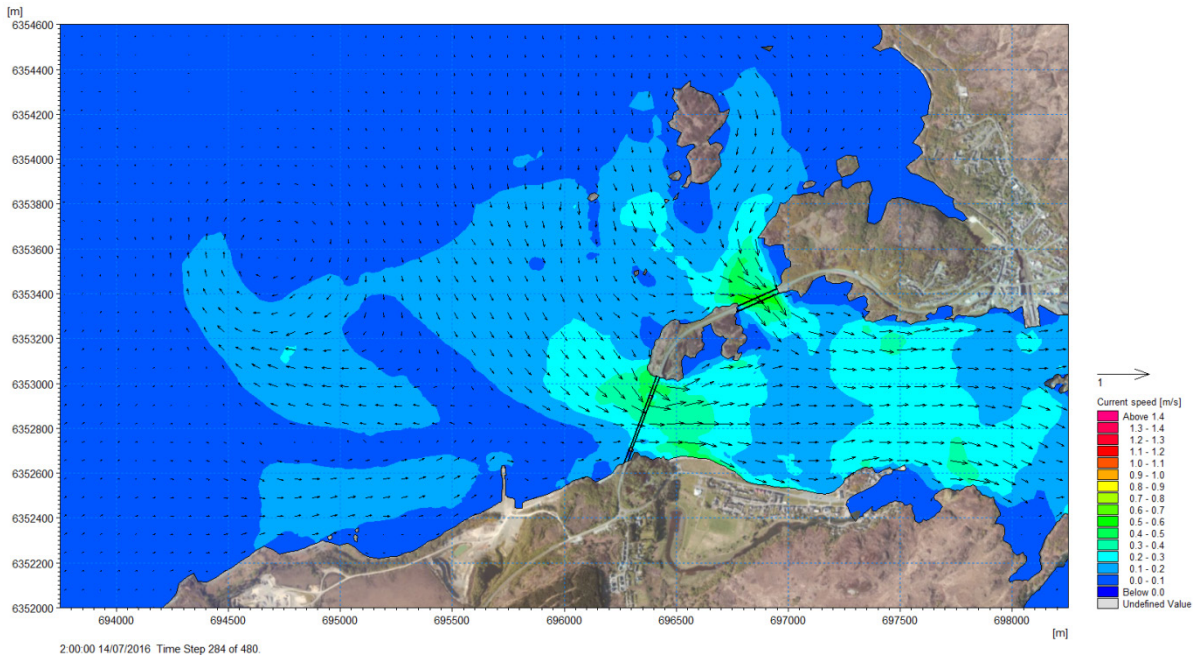
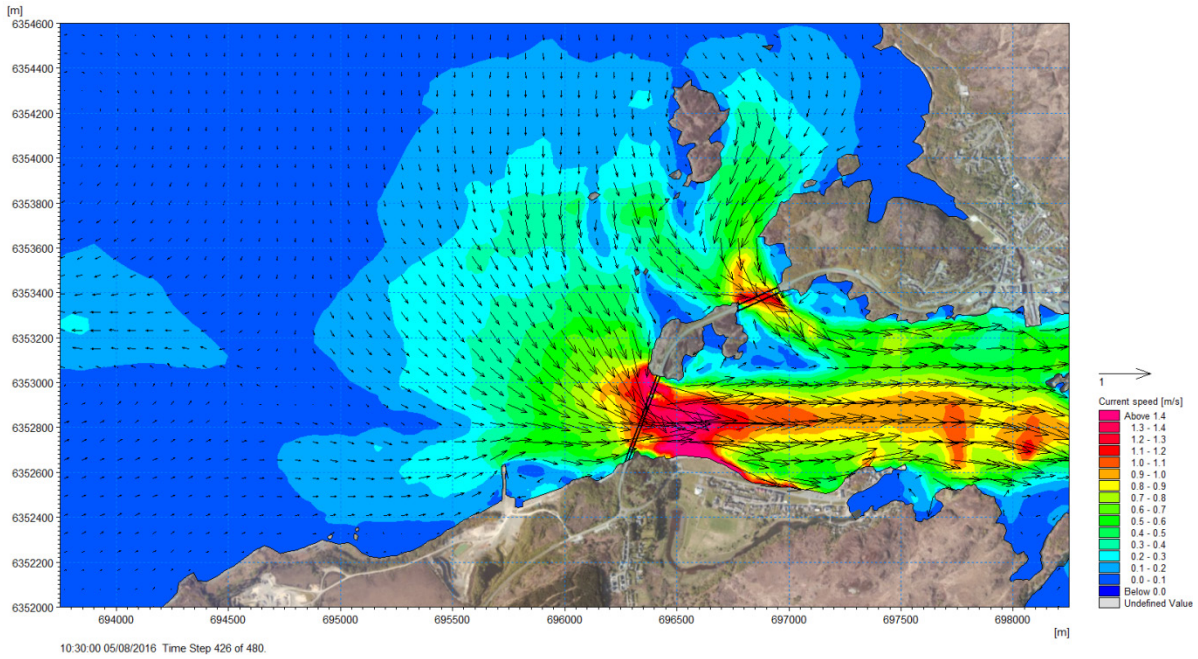
B.8.2 Neap



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

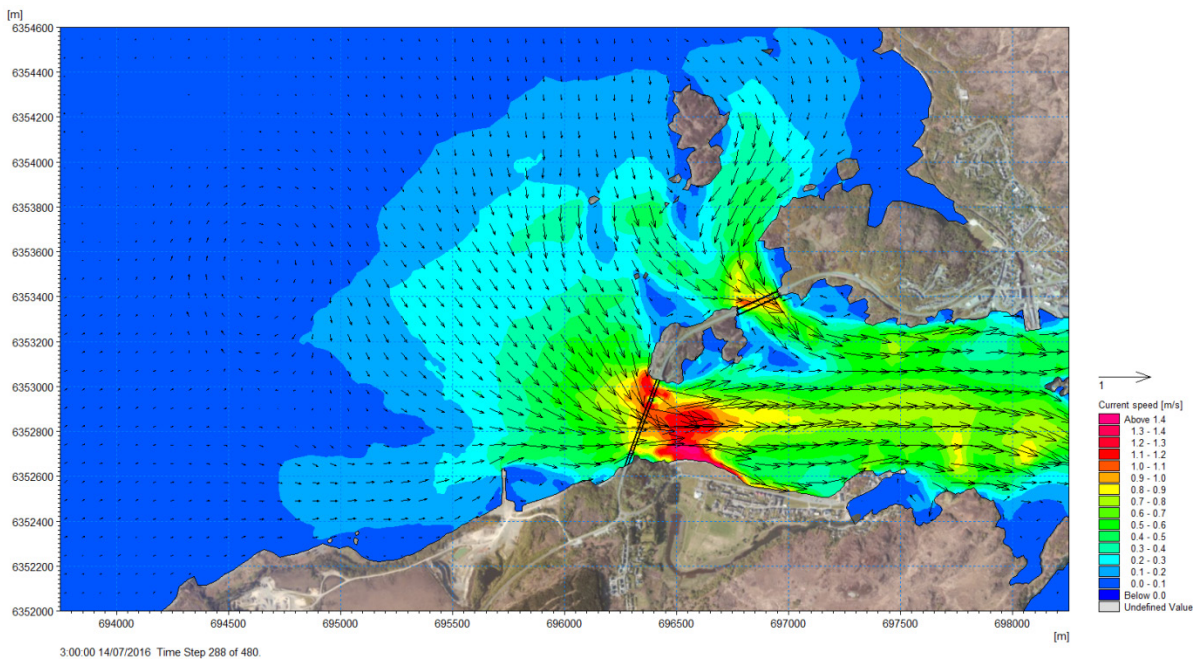
B.9 High Water + 2

B.9.1 Spring



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

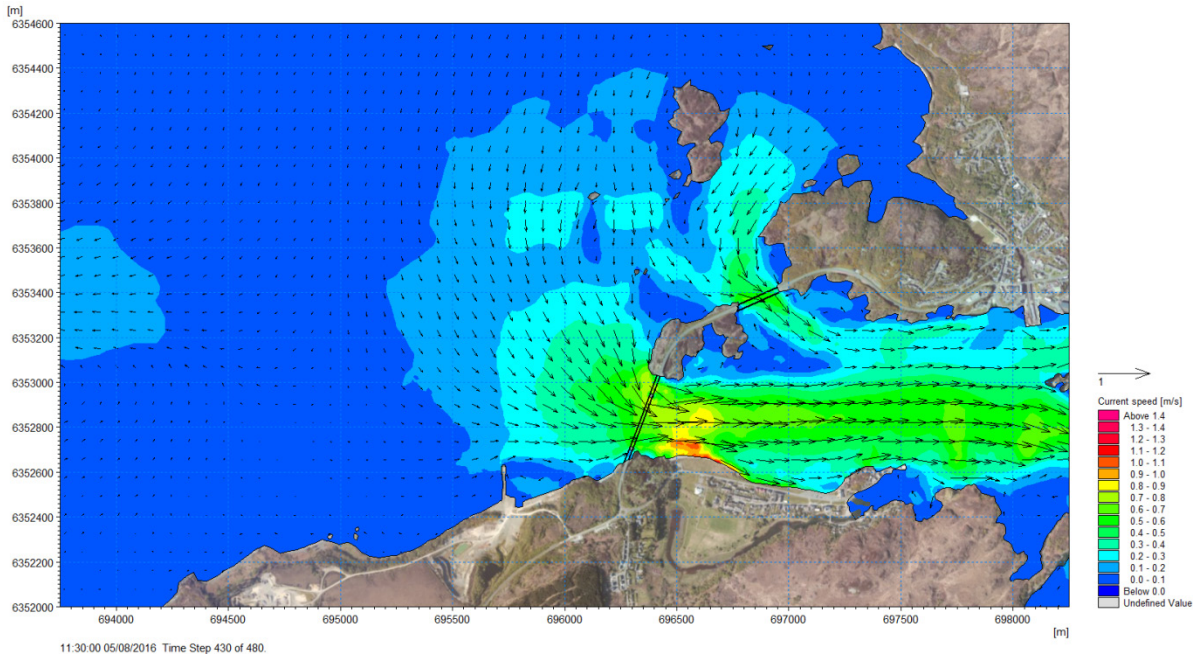
B.9.2 Neap



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

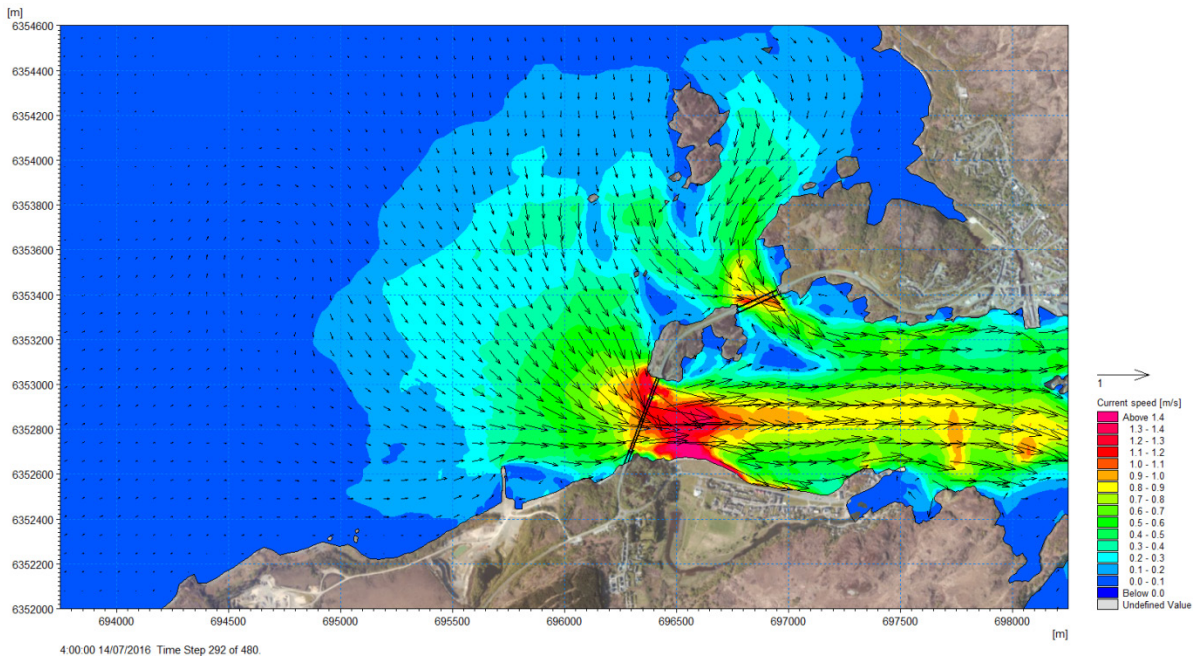
B.10 High Water + 3

B.10.1 Spring



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

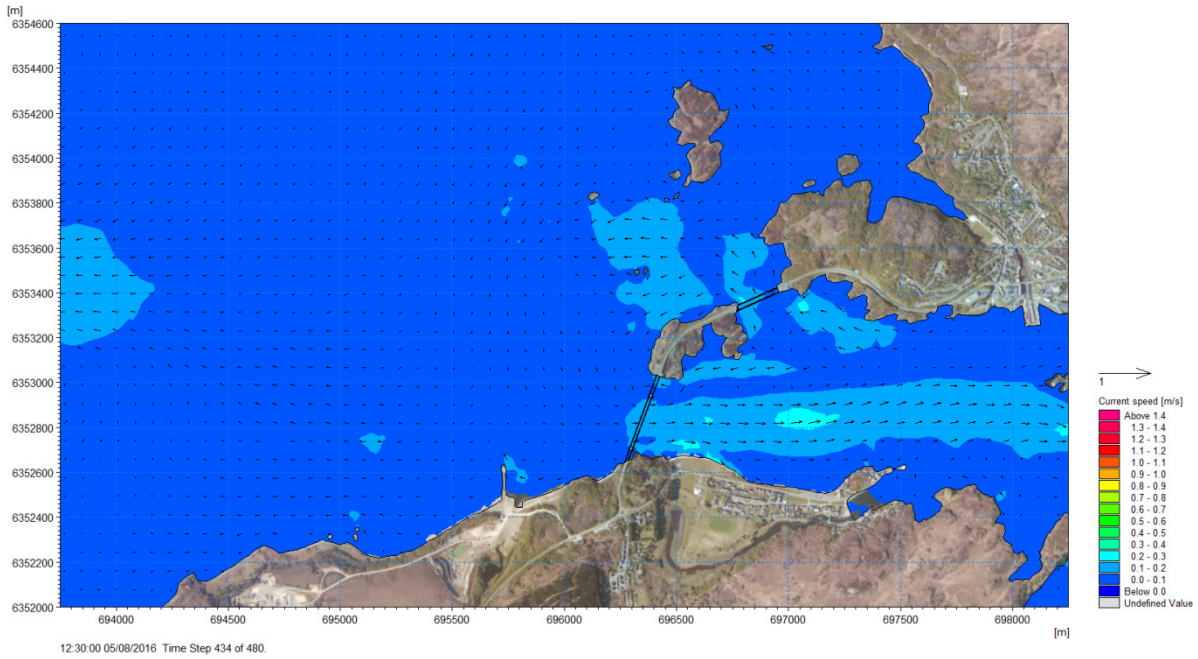
B.10.2 Neap



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

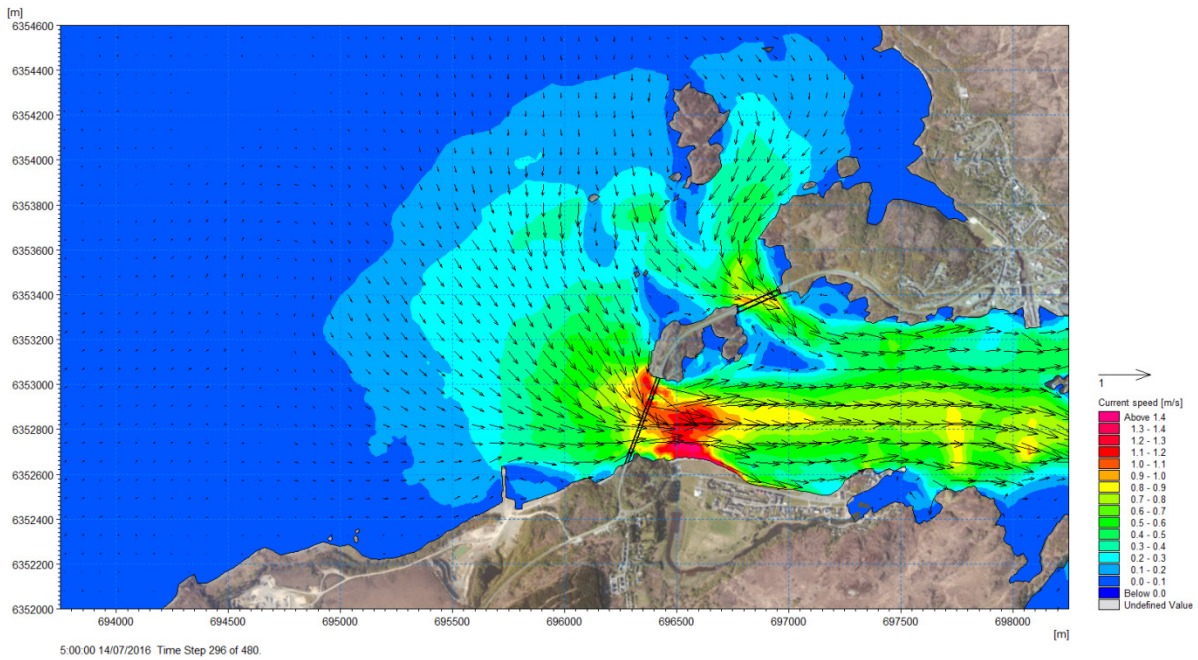
B.11 High Water + 4

B.11.1 Spring



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

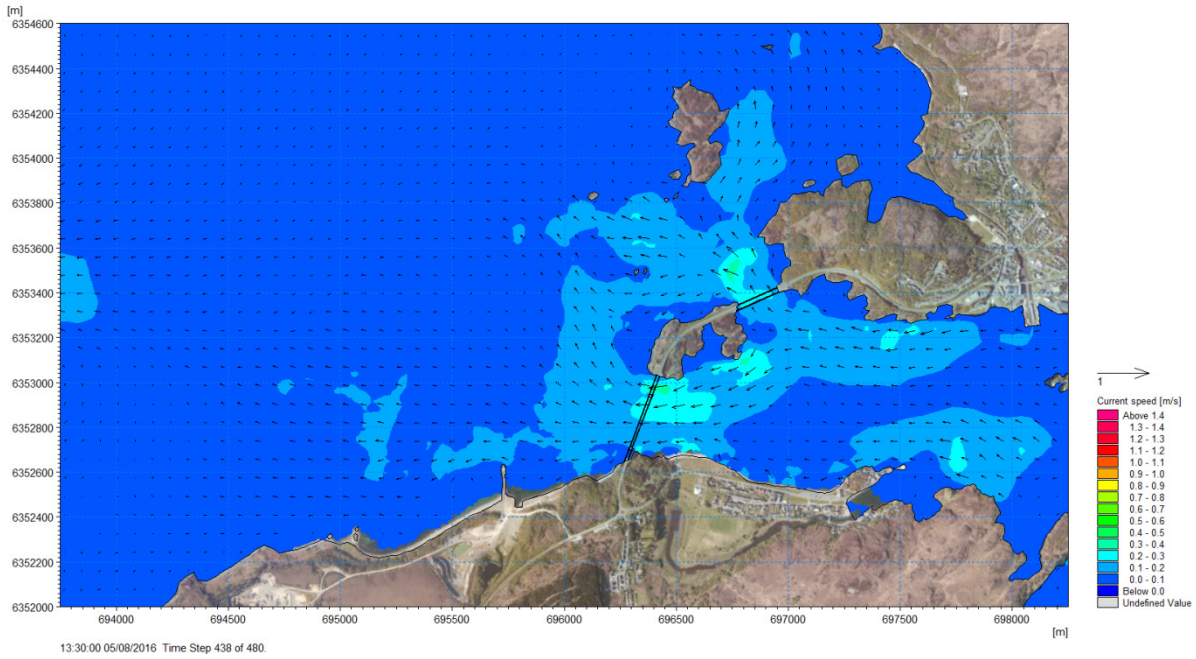
B.11.2 Neap



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

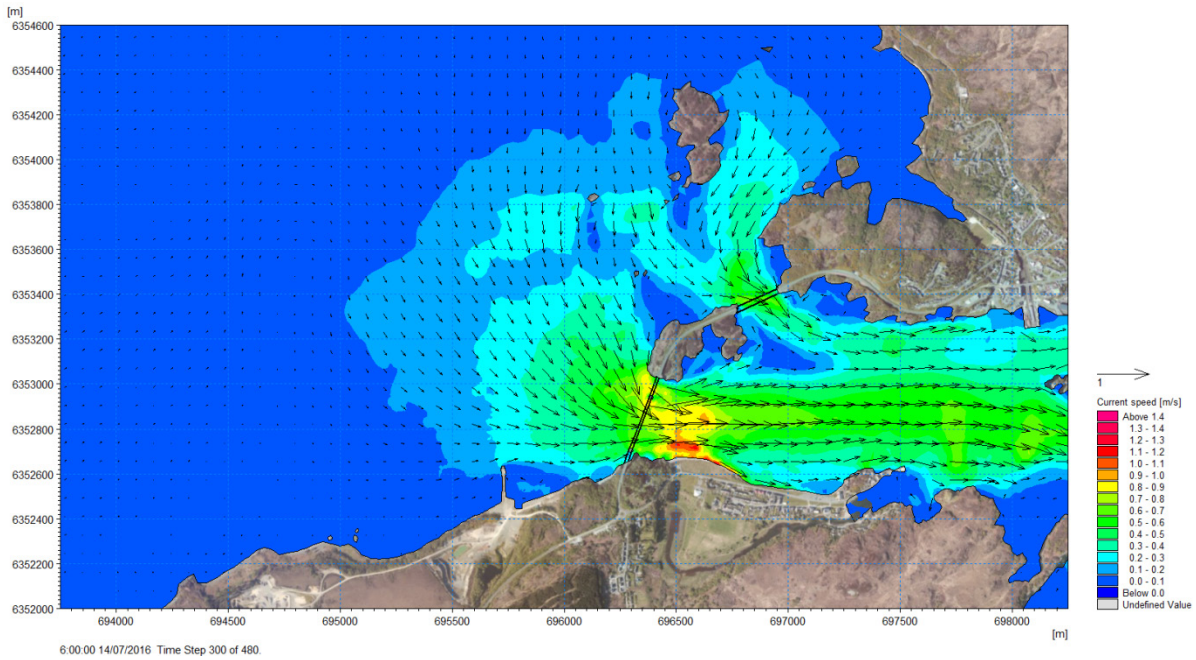
B.12 High Water + 5

B.12.1 Spring



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

B.12.2 Neap



Data Source: Kyleakin Pier Development – Coastal Processes and Hydraulic Modelling

C Design Vessels

C.1 Oil Tanker

Name of Ship:	Simay G
MMSI:	271043467
Ship Type:	Oil/chemical tanker
Deadweight:	6,913 t
Length:	119.1 m
Beam:	16.9 m
Draught:	6.76 m
Machinery Overview:	1 oil engine reduction geared to screw shaft driving 1 FP propeller at 140 rpm Total Power: Mcr 3,060 kW (4,160 hp) Max. Speed: 15.00 kts, Service Speed: 14.00 kts
Prime Mover Detail:	Design: MAN-B&W, Engine Builder: MAN Diesel A/S - Denmark 1 x 9L27/38, 4 Stroke, Single Acting, In-Line (Vertical) 9 Cy. 270 x 380, Mcr: 3,060 kW (4,160 hp) at 800 rpm
Auxiliary Engines:	N/A
Thrusters:	1 Tunnel thruster (f) 331 kW (450 bhp)

C.2 Cargo Carrier

Name of Ship:	With Harvest
MMSI:	257586000
Ship Type:	General Cargo
Deadweight:	3300 t
Length:	69.9 m
Beam:	17.2 m
Draught:	6.5 m

Machinery Overview: 1 oil engine reduction geared to screw shaft driving 1 CP propeller. Total Power: Mcr 2,360 kW (3,209 hp) Service Speed: 13.00 kts

Prime Mover Detail: Design: Bergens, Engine Builder: Rolls-Royce Marine AS - Norway
1 x C25:33L9P, 4 Stroke, Single Acting, In-Line (Vertical)
9 Cy. 250 x 330, Mcr: 2,360 kW (3,209 hp) at 1,000 rpm

Auxiliary Engines: Design: Scania, Engine Builder: Scania Cv Ab
2 x DI16M, Mcr: 570 kW

Thrusters: 1 Tunnel thruster (f) 800kW (1,088 bhp), 1 Tunnel thruster (a) 800kW(1,088 bhp)

C.3 Bulk Vessels

Name of Ship:	Wilson Nanjing
MMSI:	215061000
Ship Type:	Cargo
Deadweight:	8357 t
Length:	123.1 m
Beam:	16.5 m
Draught:	7.4 m
TEU:	60

Machinery Overview:	1 oil engine reduction geared to screw shaft driving 1 CP propeller at 134 rpm Total Power: Mcr 3,680 kW (5,003 hp) Service Speed: 12.50 kts
Prime Mover Detail:	Design: Wartsila, Engine Builder: Wartsila Finland Oy - Finland 1 x 8L32, 4 Stroke, Single Acting, In-Line (Vertical) 8 Cy. 320 x 400, Mcr: 3,680 kW (5,003 hp) at 750 rpm
Auxiliary Engines:	Design: Man, Engine Builder: Man 2 x D2840LE, 4 Stroke 10 Cy. 128 x 142, Mcr: 770 kW
Thrusters:	1 Tunnel thruster (f) 450 kW (612 bhp)

Name of Ship:	Wilson Weser
MMSI:	215061000
Ship Type:	Cargo
Deadweight:	2500 t
Length:	82.5 m
Beam:	10.9 m
Draught:	4.7 m
TEU:	86

Machinery Overview:	1 oil engine geared to screw shaft driving 1 FP propeller Total Power: Mcr 1,500 kW (2,039 hp) Service Speed: 12.00 kts
Prime Mover Detail:	Design: Deutz, Engine Builder: Deutz AG - Koeln 1 x SBV8M628, 4 Stroke, Single Acting, In-Line (Vertical) 8 Cy. 240 x 280, Mcr: 1,500 kW (2,039 hp) at 900 rpm
Auxiliary Engines:	Design: Man, Engine Builder: Man Nutzfahrzeuge Ag 2 x D2866TE, 4 Stroke 6 Cy. 128 x 155, Mcr: 176 kW
Thrusters:	1 Tunnel thruster (f) 140 kW (190 bhp)

C.4 LNG Vessel

Name of Ship:	Pioneer Knutsen
MMSI:	259393000
Ship Type:	LNG tanker
Deadweight:	817 t
Length:	69 m
Beam:	11.8 m
Draught:	3.5 m
Machinery Overview:	4 diesel electric oil engines driving 2 generators each 900 kW a.c. 2 generators each 640 kW a.c. connected to 2 electric motors of (900 kW) driving 2 Directional propellers Total Power: Mcr 3,100 kW (4,214 hp)Service Speed: 14.00 kts
Prime Mover Detail:	Design: Mitsubishi, Engine Builder: Mitsubishi Heavy Industries Ltd - Japan 2 x GS16R-MPTK, 4 Stroke, Single Acting, Vee 16 Cy. 170 x 180, Mcr: 910 kW (1,237 hp) at 1,500 rpm
Design:	Mitsubishi, Engine Builder: Mitsubishi Heavy Industries Ltd - Japan 2 x S6R2-MPTK2, 4 Stroke, Single Acting, In-Line (Vertical) 6 Cy. 170 x 220, Mcr: 640 kW (870 hp) at 1,500 rpm
Auxiliary Engines:	N/A
Thrusters:	1 Tunnel thruster (f) 200 kW (272 bhp)

D Construction Phase Navigational Risk Assessments

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
1	Accidents to personnel	Man overboard during dredge/construction works	Man overboard (MoB) during the dredge/construction works, MoB hits head on the vessel leading to drowning. No pollution, minor delay to construction works.	10	3	0	0	3	Man overboard (MoB) during the dredge/construction works, MoB recovered to shore and treated for cold water immersion. No pollution, minor delay to construction works.	1	1	0	0	1	4.50	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																16	Unplanned interaction with recreational/fishing craft
																20	Tug failure towing equipment
																23	Communication failure - Operational/procedural
																25	Communication failure - Personnel
																26	Adverse weather conditions
																27	Unexpected shoaling
																28	Restricted visibility
																37	Failure to comply with safe systems of work
																40	Failure of berth mooring systems
																42	Non-attendance of boatmen
																43	Malicious action by external parties
																48	Risk Assessment, Incomplete/not reviewed
																49	Loss of vessels stability (due to other than loss of watertight integrity)
																59	Inadequate procedures shoreside
																60	Protest by external parties
																63	Breach of security at berth/terminal/ship
																76	Inadequate training/competence - Others
																78	Ship/Tug/Launch failure
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
26	Communications equipment		5%	0%	4.47	2.77	19	Port Emergency Plan		0%	5%	2.60	1.39	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
44	Safe systems of work (HSE)		15%	0%	4.39		70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established.	5%	0%	2.59			
60	International COLREGS 1972 (as amended)		5%	0%	4.37		112	PMSC compliance	Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with Marine harvest in advance of marine works.	5%	0%	2.58			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	10%	2.98		136	Marine liaison officer	To provide safety information to vessels navigating in the area and to liaise with local authorities	0%	5%	2.41			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	5%	0%	2.96		140	Contractor risk assessment method statement (RAMS)	Agreed with the Client prior to commencement of works	10%	5%	2.21			
97	Visual observation (clear line of sight)		5%	0%	2.95		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	0%	5%	1.84			
130	Vessels own safety procedure	MoB drills and SOPs	5%	5%	2.77		142	Rescue craft	On site, appropriate for recovering a MoB and ready for immediate use	0%	20%	1.39			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
2	Accidents to personnel	Diving operations associated with the marine works	Dredge/construction vessel unaware of divers in the water. Diver caught in propellers or umbilical severed, loss of life, operations cease, national adverse publicity.	10	3	1	0	4	Dredge/Construction vessel approaches diving area and does not see 'A' flag. Vessel is warned of underwater operations and alters course. Divers taken out of water, disruption to activities.	1	0	0	0	1	4.56	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																23	Communication failure - Operational/procedural
																24	Communication failure - equipment
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																33	High traffic density
																37	Failure to comply with safe systems of work
																43	Malicious action by external parties
																48	Risk Assessment, Incomplete/not reviewed
																55	Incapacitated master (drinks/drugs)
																59	Inadequate procedures shoreside
																61	Incorrect assessment of tidal flow
																78	Ship/Tug/Launch failure
																80	Human error
																86	Competence
																102	Language problems
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
26	Communications equipment		10%	0%	4.51	3.22	19	Port Emergency Plan		0%	5%	3.08	2.72	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
41	Notices to mariners	Issued weekly by the Admiralty	5%	0%	4.49		22	Contingency plan exercises		0%	5%	2.95			
44	Safe systems of work (HSE)	Provided by contractors	15%	0%	4.42		33	Training of port marine/operations personnel		0%	5%	2.82			
60	International COLREGS 1972 (as amended)		10%	0%	4.37		41	Notices to mariners	Issued by Kyle of Lochalsh Harbour Authority	5%	0%	2.80			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	10%	3.26		70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established.	5%	0%	2.79			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	5%	0%	3.24		112	PMSC compliance	Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with Marine harvest in advance of marine works.	5%	0%	2.78			
97	Visual observation (clear line of sight)		5%	0%	3.23		136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	0%	2.75			
102	Shore side signage	A' flag displayed during operations	5%	0%	3.22		140	Contractor risk assessment method statement (RAMS)		10%	0%	2.73			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	2.72			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
3	Allision	Dredge/construction plant impact with marine works during construction phase	Dredge/construction vessel slow speed impact with structures during the marine works dredge/construction phase, leading to minor damage to vessel, serious injury to crew, minor pollution (Tier 1). Delay to marine works.	5	2	3	2	2	Dredge/Construction vessel slow speed impact with structures during the marine works dredge/construction phase, with no damage to vessel hull, minor injury to crew, no pollution. Minor delay to marine works.	1	1	1	0	1	5.94	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																16	Unplanned interaction with recreational/fishing craft
																20	Tug failure towing equipment
																22	Failure to comply with Towage guidelines
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																38	Shoreside light backscatter
																55	Incapacitated master (drinks/drugs)
																61	Incorrect assessment of tidal flow
																68	Interaction
																72	Failure to follow passage plan
																76	Inadequate training/competence - Others
																78	Ship/Tug/Launch failure
																80	Human error
																84	Inadequate number/type tugs
																86	Competence
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
26	Communications equipment		10%	0%	5.84	5.33	19	Port Emergency Plan		0%	5%	4.07	2.67	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
44	Safe systems of work (HSE)		10%	0%	5.73		21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	5%	3.87			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	10%	0%	5.63		33	Training of port marine/operations personnel		0%	5%	3.67			
97	Visual observation (clear line of sight)		10%	0%	5.53		36	Availability of pollution response equipment		0%	5%	3.48			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		20%	0%	5.33		57	Aids to navigation, Provision & maintenance of	All marine works are required to be lit	10%	0%	3.39			
							69	Training of pollution response personnel		0%	5%	3.20			
							70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established.	5%	0%	3.16			
							112	PMSC compliance	Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with Marine harvest in advance of marine works.	5%	0%	3.12			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	5%	2.84			
							140	Contractor risk assessment method statement (RAMS)		10%	0%	2.76			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	2.68			
							28	AIS coverage	All dredge/construction vessels, including barges to carry AIS (A or B).	10%	0%	2.67			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
4	Allision	Recreational or fishing vessel allision with dredge pipeline/buoy.	Recreational or fishing vessel transiting past the marine works at night, is in allision with the temporary dredge pipeline/buoy. Impact with pipeline causes vessel to broach, leading to serious injury to crew, damage to the pipeline causing a delay to the construction programme, and damage to the vessel. Limited pollution (Tier 1). marine works.	5	3	3	2	2	Recreational or fishing vessel transiting past the marine works at night, is in allision with the temporary dredge pipeline/buoy. Slow speed impact with pipeline causes vessel damage, leading to minor injury to crew, minor damage to the pipeline causing a delay to the construction programme, no pollution.	1	1	1	0	1	6.00	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																55	Incapacitated master (drinks/drugs)
																61	Incorrect assessment of tidal flow
																72	Failure to follow passage plan
																76	Inadequate training/competence - Others
																78	Ship/Tug/Launch failure
																80	Human error
																86	Competence
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
97	Visual observation (clear line of sight)		10%	0%	5.90	5.90	19	Port Emergency Plan		0%	5%	4.65	3.24	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
							21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	5%	4.44			
							22	Contingency plan exercises		0%	5%	4.24			
							36	Availability of pollution response equipment		0%	5%	4.04			
							41	Notices to mariners	Issued by Kyle of Lochalsh Harbour Authority	5%	0%	3.99			
							57	Aids to navigation, Provision & maintenance of	Buoy marking the end of the pipeline to be lit in agreement with NLB	10%	0%	3.91			
							69	Training of pollution response personnel		0%	5%	3.70			
							70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established.	5%	0%	3.66			
							112	PMSC compliance	Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with Marine harvest in advance of marine works.	5%	0%	3.62			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	5%	3.33			
							140	Contractor risk assessment method statement (RAMS)		10%	0%	3.24			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
5	Collision	Dredge/construction plant collision with recreational vessel	Collision of a recreational craft with a static dredge/construction vessel. Collision occurs at night, recreational vessel misunderstands or does not recognise navigational lights and shapes, or dredger and construction plant not correctly lit. Recreational vessel holed and sinks, loss of life, small scale pollution (Tier 1). Disruption to marine works and adverse publicity.	25	4	4	3	4	Collision of a recreational craft with dredge or construction plant. Collision occurs at night, recreational vessel misunderstands or does not recognised navigational lights and shapes. Recreational vessel receives minor contact damage, no damage to dredge or construction plant. Minor injury to recreational vessel crew, no pollution. No delay to dredge and marine works.	5	1	1	0	0	4.06	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																16	Unplanned interaction with recreational/fishing craft
																23	Communication failure - Operational/procedural
																24	Communication failure - equipment
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																33	High traffic density
																48	Risk Assessment, Incomplete/not reviewed
																55	Incapacitated master (drinks/drugs)
																56	COLREGS failure to comply
																61	Incorrect assessment of tidal flow
																68	Interaction
																72	Failure to follow passage plan
																76	Inadequate training/competence - Others
																80	Human error
																82	AIS failure
																86	Competence
																87	Notice to Mariners failure to observe
																102	Language problems
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning	All vessels should plan their passage	10%	0%	4.01	3.31	19	Port Emergency Plan		0%	5%	3.17	2.00	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
36	Availability of pollution response equipment	Provided by the contractors	0%	5%	3.48		21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	5%	3.04			
41	Notices to mariners	Issued weekly by the Admiralty	5%	0%	3.47		22	Contingency plan exercises		0%	5%	2.90			
60	International COLREGS 1972 (as amended)		5%	0%	3.46		33	Training of port marine/operations personnel		0%	5%	2.38			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	5%	5%	3.32		36	Availability of pollution response equipment		0%	5%	2.34			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	5%	0%	3.31		69	Training of pollution response personnel		0%	5%	2.18			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	3.31		70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established.	5%	0%	2.17			
							112	PMSC compliance	Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with Marine harvest in advance of marine works.	5%	0%	2.17			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	5%	2.01			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	10%	0%	2.01			
							28	AIS coverage	All dredge/construction vessels, including barges to carry AIS (A or B).	10%	0%	2.00			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	2.00			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
6	Collision	Tug and tow collision with recreational vessel	Tug and tow (transporting material by barge, or movement of the caissons) on transit to the Kyleakin pier in collision with recreational vessel. Recreational vessel holed and sinks in deep water. Loss of life, pollution (Tier 2). Disruption to marine works meaning temporary suspension of operations, and adverse publicity.	25	4	4	3	4	Collision occurs in deep water. Vessels make contact whilst taking avoiding action, glancing blow resulting in minor damage to both vessels. Vessels proceed to nearest suitable berth to assess damage. Minor injury to crew, no pollution, no disruption to operations.	5	1	1	0	1	4.25	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																16	Unplanned interaction with recreational/fishing craft
																20	Tug failure towing equipment
																23	Communication failure - Operational/procedural
																24	Communication failure - equipment
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																55	Incapacitated master (drinks/drugs)
																56	COLREGS failure to comply
																61	Incorrect assessment of tidal flow
																72	Failure to follow passage plan
																76	Inadequate training/competence - Others
																78	Ship/Tug/Launch failure
																80	Human error
																82	AIS failure
																86	Competence
																102	Language problems
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning	All vessels should plan their passage. Tug and tow passage subject to approval prior to operation.	10%	0%	4.19	3.43	28	AIS coverage	All dredge/construction vessels, including barges to carry AIS (A or B).	10%	0%	3.41	3.26	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
36	Availability of pollution response equipment		0%	5%	3.59		41	Notices to mariners	Issued by Kyle of Lochalsh Harbour Authority	5%	0%	3.40			
41	Notices to mariners	Issued weekly by the Admiralty	5%	0%	3.59		136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	5%	5%	3.26			
60	International COLREGS 1972 (as amended)		5%	0%	3.58										
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	5%	5%	3.43										
95	Standing Orders/SOPs	Provided by the vessels owners/operators	5%	0%	3.43										

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
7	Collision	Caissons temporarily anchored in study area presenting a risk of collision	Caissons being towed to Kyleakin pier, and/or anchored awaiting placement represent a collision risk due their size and mooring arrangement in an area with high traffic density. Vessel collision at night due to misunderstanding of navigational lights and shapes/lights not working. Smaller vessel holed and sinks in deep water. Loss of life, pollution (Tier 2). Disruption to marine works meaning temporary suspension of operations, and adverse publicity.	10	4	4	3	4	Vessel collision at night due to misunderstanding of navigational lights and shapes/lights not working. Vessels make contact whilst taking avoiding action, glancing blow resulting in minor damage. Minor hull damage, minor injuries, no pollution, adverse publicity.	5	1	1	0	1	4.75	1	Human error/fatigue - Ship Personnel
																11	Vessel breakdown or malfunction
																16	Unplanned interaction with recreational/fishing craft
																20	Tug failure towing equipment
																22	Failure to comply with Towage guidelines
																23	Communication failure - Operational/procedural
																24	Communication failure - equipment
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																33	High traffic density
																38	Shoreside light backscatter
																55	Incapacitated master (drinks/drugs)
																56	COLREGS failure to comply
																72	Failure to follow passage plan
																76	Inadequate training/competence - Others
																80	Human error
																82	AIS failure
																86	Competence
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning	All vessels should plan their passage. Tug and tow passage subject to approval prior to operation.	10%	0%	4.67	4.01	28	AIS coverage	Tugs to carry AIS (A or B) displaying correct information for the voyage	10%	0%	3.98	3.90	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
116	Weather forecasting		5%	0%	4.63		41	Notices to mariners	Issued by Kyle of Lochalsh Harbour Authority	5%	0%	3.96			
60	International COLREGS 1972 (as amended)		10%	0%	4.56		136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	0%	3.93			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	5%	4.08		143	Navigational lights	Caissons to be lit as per International COLREGS 1972 (as amended), anchored Caissons to display lighting in agreement with NLB	10%	0%	3.90			
95	Standing Orders/SOPs		5%	0%	4.06										
139	Places of refuge	Identified during passage planning	5%	0%	4.05										
41	Notices to mariners	Issued weekly by the Admiralty	10%	0%	4.01										

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
8	Fire/Explosion	Dredge/construction plant on-board fire	Fire on-board the dredge/construction vessel during the marine works dredge/construction phase. Fire makes the vessel inoperative, loss of life, minor pollution (Tier 1) from firefighting products and run off, vessel laid up or removed from service. Disruption to the marine works.	25	4	4	2	3	Fire on-board the dredge/construction vessel during the marine works dredge/construction phase. Fire is contained by ships crew, resulting in localised damage to vessel on-board equipment. Minor injury, no pollution, vessel operational capability unaffected. Minor disruption to the marine works.	5	1	1	0	2	5.00	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																19	Vessel fails to notify hazardous cargo
																48	Risk Assessment, Incomplete/not reviewed
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
44	Safe systems of work (HSE)	Provided by contractors after risk assessment	10%	0%	4.91	4.73	19	Port Emergency Plan	Response and actions for fire/explosion	0%	10%	4.08	2.72	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
95	Standing Orders/SOPs	Provided by the vessels owners/operators	10%	0%	4.82		21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	5%	3.91			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		10%	0%	4.73		22	Contingency plan exercises		0%	5%	3.74			
							33	Training of port marine/operations personnel		0%	5%	3.57			
							36	Availability of pollution response equipment		0%	5%	3.06			
							69	Training of pollution response personnel		0%	5%	2.99			
							70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established by the Harbour Authority.	5%	0%	2.97			
							112	PMSC compliance		5%	0%	2.94			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	0%	5%	2.74			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	2.72			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
9	Flooding	Dredger flooding whilst engaged in operations	Ingress of water due to weld failure, sea valve failure, hatches/ramps not secure, affects vessel stability leading to vessel sinking. Loss of life, pollution (Tier 2), navigation hazard disrupting operations, major adverse publicity	25	4	4	3	3	Ingress of water controlled before vessel stability affected. Operations delayed until investigation/repairs completed.	5	0	1	0	2	4.94	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																8	Fire/Explosion
																9	Loss of watertight integrity
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																25	Communication failure - Personnel
																26	Adverse weather conditions
																43	Malicious action by external parties
																57	Vessel Ramps or Hatches not secure
																59	Inadequate procedures shoreside
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
26	Communications equipment		5%	0%	4.89	2.63	19	Port Emergency Plan		0%	5%	2.45	0.33	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	10%	4.09		21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	5%	2.27			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	5%	5%	3.91		22	Contingency plan exercises		0%	5%	2.20			
110	Ramps/hatches closed when underway		15%	0%	3.84		33	Training of port marine/operations personnel		0%	5%	1.94			
118	Vessel maintenance	Maintenance schedule part of the vessel SMS	15%	10%	3.45		36	Availability of pollution response equipment		0%	5%	1.69			
119	Vessel inspection/survey	Port and flag state inspections and surveys by classification society	15%	10%	2.88		69	Training of pollution response personnel		0%	5%	1.34			
120	Vessel secured for sea		10%	5%	2.63		70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established by the Harbour Authority.	5%	5%	1.10			
							112	PMSC compliance	Harbour Authority Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with the Harbour Authority in advance of marine works.	5%	5%	0.65			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	0%	5%	0.49			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	0%	5%	0.33			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
10	Grounding	Dredger grounding whilst engaged in operations	Trailing suction hopper dredger (TSHD) grounds whilst carrying out dredge. Drag head and pipe damaged, hull holed causing ingress of water, major injuries from hot liquids aboard, pollution (Tier 2), disruption to marine works and adverse publicity.	10	4	4	3	3	TSHD grounds whilst dredging. Minor damage to drag head and pipe, plus vessel hull from rocks on seabed, minor injuries. Vessel requires hull survey causing delay to marine works.	1	1	2	0	1	6.63	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																9	Loss of watertight integrity
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																25	Communication failure - Personnel
																37	Failure to comply with safe systems of work
																43	Malicious action by external parties
																48	Risk Assessment, Incomplete/not reviewed
																60	Protest by external parties
																61	Incorrect assessment of tidal flow
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
12	Draught, Accurate, declared and within max limits		5%	0%	6.60	5.83	19	Port Emergency Plan		0%	5%	5.60	3.74	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
26	Communications equipment		5%	0%	6.57		21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	5%	5.38			
30	Accurate tidal measurements	Tide level observed on-site and made available to vessels	5%	0%	6.54		22	Contingency plan exercises		0%	5%	5.15			
31	Availability of latest hydrographic information	Survey provided in advance of the dredge	10%	0%	6.48		36	Availability of pollution response equipment	Shore side equipment provided by the Harbour Authority	5%	0%	5.13			
41	Notices to mariners	Issued weekly by the Admiralty	5%	0%	6.45		69	Training of pollution response personnel	Response by the Harbour Authority	5%	5%	4.80			
69	Training of pollution response personnel	Response by the vessels crews	0%	5%	6.17		112	PMSC compliance	Harbour Authority Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with the Harbour Authority in advance of marine works.	5%	5%	4.40			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	5%	5%	5.91		133	Tidal flow atlas	Covering each hour for spring and neap, scaled for the area of the marine works	15%	0%	4.33			
97	Visual observation (clear line of sight)		5%	0%	5.89		136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	5%	5%	4.03			
108	Requirement for notification of vessel defects		5%	0%	5.86		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	0%	5%	3.74			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	5.83										

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
11	Hazardous substance accidents	Accidental spill during marine works	Pollution from accidental spill during construction phase leading to Tier 2 response. For example from a marine incident, split hose or pipe. No effect to other nearby vessels.	5	0	0	3	3	Pollution from accidental spill during construction phase leading to Tier 1 response. For example, from refuelling machinery on marine plant such as generators, compressors or crainage. Contractors pollution response equipment deployed. No effect to other nearby vessels.	1	0	0	2	2	5.63	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																24	Communication failure - equipment
																25	Communication failure - Personnel
																26	Adverse weather conditions
																37	Failure to comply with safe systems of work
																48	Risk Assessment, Incomplete/not reviewed
																59	Inadequate procedures shoreside
																62	Illegal discharges into the water
																69	Port Equipment (inc. craft) mechanical breakdown/system malfunction
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																77	Port infrastructure failure
																78	Ship/Tug/Launch failure
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
21	Oil spill contingency plans	Vessels will have oil spill contingency plans that are specific to that vessel	0%	10%	5.36	4.17	21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	10%	3.72	0.90	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
22	Contingency plan exercises	Oil spill response drills run by vessels crew	0%	10%	5.10		22	Contingency plan exercises		0%	5%	2.38			
36	Availability of pollution response equipment	Vessels will have pollution response equipment	0%	10%	4.84		36	Availability of pollution response equipment	Shore side equipment provided by the Harbour Authority	0%	5%	2.16			
69	Training of pollution response personnel	crew of vessels are trained for oil spill response	0%	5%	4.67		69	Training of pollution response personnel		0%	5%	1.93			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	5%	4.17		70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established by the Harbour Authority.	5%	5%	1.35			
							112	PMSC compliance	Harbour Authority Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with the Harbour Authority in advance of marine works.	5%	5%	1.13			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	0%	1.13			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	0%	5%	0.90			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
12	Machinery related accidents	Heavy lift failure, or failure of lifting gear	Failure during unloading of vessels with load slung. Load released and lands on vessel deck causing major damage to vessel or failure during transfer of heavy cargo from vessel to quay. Loss of life, minor pollution (Tier 1), operations cease pending recovery and investigation.	10	4	3	2	3	Failure of lifting equipment causes automatic shutoff. Delay to operations while repairs are made.	1	0	0	0	2	5.69	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																20	Tug failure towing equipment
																23	Communication failure - Operational/procedural
																37	Failure to comply with safe systems of work
																69	Port Equipment (inc. craft) mechanical breakdown/system malfunction
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
26	Communications equipment		5%	5%	5.71	4.49	19	Port Emergency Plan		0%	5%	4.14	2.13	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
44	Safe systems of work (HSE)	Provided by contractors after risk assessment	10%	10%	5.26		21	Oil spill contingency plans	The MCA require an OPRC plan to be in place and approved by them prior to the commencement of marine works at the site.	0%	5%	3.90			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	5%	5.06		22	Contingency plan exercises		0%	5%	3.65			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	10%	10%	4.54		36	Availability of pollution response equipment		0%	5%	3.41			
116	Weather forecasting	Advance warning gained from available internet resources and metocean forecasts.	10%	0%	4.49		69	Training of pollution response personnel		0%	5%	2.13			
							70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established by the Harbour Authority.	5%	0%	2.13			
							112	PMSC compliance	Harbour Authority Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with the Harbour Authority in advance of marine works.	5%	0%	2.13			
							122	Shore side facility maintenance programme		15%	0%	2.13			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	10%	0%	2.13			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	2.13			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
13	Other	Vessel damage due to weather conditions.	Adverse weather conditions lead to construction vessel grounding/stranding/allision. Weather related effects include waves, high wind and reduced visibility. Vessel holed, takes on water and sinks. Loss of life, pollution (Tier 2), operations cease and adverse publicity.	10	4	4	3	4	Construction operations cease until weather conditions drop below the operating threshold(s). Disruption to operations.	1	0	0	0	2	5.94	26	Adverse weather conditions
																79	Weather & hydro failure - equipment

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
116	Weather forecasting	Advance warning gained from available internet resources and metocean forecasts.	20%	0%	5.84	5.84	70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established by the Harbour Authority.	5%	0%	5.82	5.05	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
							112	PMSC compliance	Harbour Authority Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with the Harbour Authority in advance of marine works.	5%	0%	5.79			
							21	Oil spill contingency plans		0%	5%	5.88			
							22	Contingency plan exercises		0%	5%	5.68			
							36	Availability of pollution response equipment		0%	5%	5.48			
							69	Training of pollution response personnel		0%	5%	5.28			
							136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	0%	5%	5.08			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	5.05			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
14	Payload related accidents	Incorrect payload distribution/loading affects vessel stability.	Barge taking material generated by the Backhoe dredger is loaded/unloaded incorrectly, causing instability and capsize of vessel. Loss of vessel, loss of life if barge manned, pollution (Tier 1), navigation hazard created by the sunk vessel, delays to marine construction programme.	10	3	3	2	3	Barge takes on list during unloading. Operations cease and barge unloaded causing delays.	1	0	1	0	2	5.75	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																22	Failure to comply with Towage guidelines
																24	Communication failure - equipment
																25	Communication failure - Personnel
																26	Adverse weather conditions
																37	Failure to comply with safe systems of work
																42	Non-attendance of boatmen
																48	Risk Assessment, Incomplete/not reviewed
																49	Loss of vessels stability (due to other than loss of watertight integrity)
																55	Incapacitated master (drinks/drugs)
																59	Inadequate procedures shoreside
																76	Inadequate training/competence - Others
																78	Ship/Tug/Launch failure
																80	Human error
																86	Competence
																102	Language problems

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
44	Safe systems of work (HSE)		10%	10%	5.28	3.37	19	Port Emergency Plan		5%	0%	3.36	1.89	01-Nov-16	Tom Rea - Wallace Stone Steven Driver - Northern Lighthouse Board Monty Smedley - ABPmer
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	10%	10%	4.74		22	Contingency plan exercises		0%	5%	3.19			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	10%	10%	4.21		33	Training of port marine/operations personnel		0%	5%	3.01			
108	Requirement for notification of vessel defects		5%	0%	4.18		70	Marine Safety Management System	Prior to commencement of marine operations, Marine-SMS established by the Harbour Authority.	5%	5%	2.07			
118	Vessel maintenance	Maintenance schedule part of the vessel SMS	10%	5%	3.61		112	PMSC compliance	Harbour Authority Marine-SMS applies, which recognises the need for contractors RAMS to be agreed with the Harbour Authority in advance of marine works.	5%	0%	2.07			
119	Vessel inspection/survey	Port and flag state inspections and surveys by classification society	10%	0%	3.58		136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	5%	5%	1.89			
120	Vessel secured for sea		0%	5%	3.41		140	Contractor risk assessment method statement (RAMS)	Method statement identifies unloading process for heavy loads to minimise vessel instability	10%	0%	1.89			
121	Loading/unloading plan	Provided by the vessels owners/operators	15%	0%	3.37		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	1.89			

E Operation Phase Navigational Risk Assessments

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
1	Accidents to personnel	Man Overboard	Man overboard (MoB) whilst alongside or approaching/departing the pier, MoB hits head on the vessel leading to drowning. No pollution, minor delay to operations.	5	3	0	0	3	Man overboard (MoB) whilst alongside or approaching/departing the pier, MoB recovered to shore and treated for cold water immersion. No pollution, minor delay to operations.	1	1	0	0	1	4.88	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																7	Inadequate procedures in place onboard vessel
																23	Communication failure - Operational/procedural
																24	Communication failure - equipment
																25	Communication failure - Personnel
																26	Adverse weather conditions
																37	Failure to comply with safe systems of work
																59	Inadequate procedures shoreside
																80	Human error

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
26	Communications equipment		0%	10%	4.54	2.49	19	Port Emergency Plan		10%	5%	2.29	1.30	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
30	Accurate tidal measurements	Tide level observed on-site and made available to vessels	0%	5%	4.37		22	Contingency plan exercises		0%	5%	2.12			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	10%	5%	3.38		44	Safe systems of work (HSE)	Based on risk assessment and industry best practice	0%	5%	1.95			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	0%	10%	3.04		70	Marine Safety Management System	Provides guidance and procedures based on risk assessments	10%	5%	1.74			
130	Vessels own safety procedure		10%	5%	2.49		112	PMSC compliance	Ensures all risk is reduced to as low as reasonably practicable (ALARP)	5%	5%	1.56			
							138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	6%	1.30			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
2	Allision	With navigational buoy	Vessel makes contact with navigational buoy on approach. Hull punctured leading to extensive flooding and vessel sinking, buoy is damaged and light inoperable. Loss of life, pollution (Tier 2), loss of cargo, national adverse publicity. Hazard to navigation until wreck cleared and buoy repaired causing financial losses and delay to operations.	10	4	4	3	3	Vessel makes light contact at slow speed causing damage to vessel hull and buoy. Minor injuries, no pollution, vessel out of service until survey and repairs made, buoy requires maintenance.	5	1	3	0	1	5.94	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																16	Unplanned interaction with recreational/fishing craft
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																31	Failure to observe standing notices
																36	Failure of Aid to Navigation (out of position/unlit)
																38	Shoreside light backscatter
																55	Incapacitated master (drinks/drugs)
																59	Inadequate procedures shoreside
																61	Incorrect assessment of tidal flow
																72	Failure to follow passage plan
																78	Ship/Tug/Launch failure
																80	Human error
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning	From berth to berth containing all relevant information on the area and contingency planning	5%	0%	5.90	5.30	26	Communications equipment	Marine personnel monitor VHF channels 13 and 16	5%	5%	5.04	4.53	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
13	Arrival/Departure, advance notice of		5%	0%	5.86		33	Training of port marine/operations personnel		5%	5%	4.77			
26	Communications equipment		5%	5%	5.76		138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	0%	4.63			
30	Accurate tidal measurements	Tide level observed on-site and made available to vessels	5%	0%	5.71		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	4.58			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	5%	5.50		133	Tidal flow atlas	Provision of a tidal atlas for use on-board vessels, which details tidal flow	5%	0%	4.53			
97	Visual observation (clear line of sight)		5%	0%	5.45										
108	Requirement for notification of vessel defects		5%	0%	5.40										
116	Weather forecasting	Advance warning gained from available internet resources and metocean forecasts	5%	0%	5.35										
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	5.30										

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
3	Allision	With Skye bridge	Vessel makes contact with Skye Bridge during adverse weather conditions. Hull punctured leading to extensive flooding and vessel sinking and blocking channel under the Skye Bridge, major damage to bridge supports. Loss of life, pollution (Tier 2), loss of cargo, national adverse publicity. Hazard to navigation until wreck cleared causing financial losses and delay to operations. Bridge closed to assess damage an make repairs.	25	4	4	3	3	Vessel makes light contact at slow speed causing damage to vessel hull and minor damage to bridge. Minor injuries, no pollution, vessel out of service until survey and repairs made. Bridge requires survey and repairs.	5	1	3	0	1	5.44	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																16	Unplanned interaction with recreational/fishing craft
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																31	Failure to observe standing notices
																36	Failure of Aid to Navigation (out of position/unlit)
																38	Shoreside light backscatter
																55	Incapacitated master (drinks/drugs)
																59	Inadequate procedures shoreside
																61	Incorrect assessment of tidal flow
																72	Failure to follow passage plan
																78	Ship/Tug/Launch failure
																80	Human error
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning	From berth to berth containing all relevant information on the area and contingency planning	5%	0%	5.41	4.80	26	Communications equipment	Marine personnel monitor VHF channels 13 and 16	5%	5%	4.56	4.14	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
13	Arrival/Departure, advance notice of		5%	0%	5.38		33	Training of port marine/operations personnel		5%	5%	4.33			
26	Communications equipment		5%	5%	5.19		138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	0%	4.21			
30	Accurate tidal measurements	Tide level observed on-site and made available to vessels	5%	0%	5.15		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	4.18			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	5%	4.95		133	Tidal flow atlas	Provision of a tidal atlas for use on-board vessels, which details tidal flow	5%	0%	4.14			
97	Visual observation (clear line of sight)		5%	0%	4.91										
108	Requirement for notification of vessel defects		5%	0%	4.88										
116	Weather forecasting	Advance warning gained from available internet resources and metocean forecasts	5%	0%	4.84										
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	4.80										

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
4	Allision	With pier structure	Contact with the pier leading to damage to vessel and pier. Major injuries to crew and marine personnel on pier, no pollution, berth unavailable until repairs made.	10	4	4	3	3	Contact made at slow speed causing minor damage to vessel and quay. Minor injuries to vessel crew, operations delayed as inspections carried out.	1	1	3	0	1	6.94	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																16	Unplanned interaction with recreational/fishing craft
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																31	Failure to observe standing notices
																36	Failure of Aid to Navigation (out of position/unlit)
																38	Shoreside light backscatter
																55	Incapacitated master (drinks/drugs)
																59	Inadequate procedures shoreside
																61	Incorrect assessment of tidal flow
																72	Failure to follow passage plan
																78	Ship/Tug/Launch failure
																80	Human error
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning	From berth to berth containing all relevant information on the area and contingency planning	5%	0%	6.91	6.01	19	Port Emergency Plan		0%	5%	5.83	4.31	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
13	Arrival/Departure, advance notice of		5%	0%	6.88		21	Oil spill contingency plans		0%	5%	5.65			
26	Communications equipment		5%	5%	6.31		22	Contingency plan exercises		0%	5%	5.48			
30	Accurate tidal measurements	Tide level observed on-site and made available to vessels	5%	0%	6.29		26	Communications equipment	Marine personnel monitor VHF channels 13 and 16	5%	5%	5.20			
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	5%	6.11		33	Training of port marine/operations personnel		5%	5%	5.09			
97	Visual observation (clear line of sight)		5%	0%	6.08		36	Availability of pollution response equipment		0%	5%	4.76			
108	Requirement for notification of vessel defects		5%	0%	6.06		69	Training of pollution response personnel		0%	5%	4.43			
116	Weather forecasting	Advance warning gained from available internet resources and metocean forecasts	5%	0%	6.03		138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	0%	4.36			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	6.01		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	4.33			
							133	Tidal flow atlas	Provision of a tidal atlas for use on-board vessels, which details tidal flow	5%	0%	4.31			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
5	Collision	Vessel transiting to/from Kyleakin with submarine	Submarine collides with and holes/sinks a vessel in poor visibility conditions. Loss of life, pollution (Tier 2), national adverse publicity. Cargo and wreck in navigational channel represents hazard to navigation.	50	4	4	4	3	Vessels take avoiding action resulting in a slow speed contact. Minor damage to both vessels, no injuries, no pollution, adverse publicity.	10	0	2	0	2	4.27	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																23	Communication failure - Operational/procedural
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																56	COLREGS failure to comply
																80	Human error
																102	Language problems
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
3	Communications - Traffic broadcast	Information promulgated by the Coastguard	5%	0%	4.24	3.62	26	Communications equipment	Marine personnel monitor VHF channels 13 and 16	5%	5%	3.47	3.22	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
10	Passage planning	From berth to berth containing all relevant information on the area and contingency planning	5%	0%	4.21		33	Training of port marine/operations personnel		5%	5%	3.32			
26	Communications equipment		5%	5%	3.68		135	Liaison with QinetiQ		10%	0%	3.29			
60	International COLREGS 1972 (as amended)		10%	0%	3.65		138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area	15%	0%	3.25			
97	Visual observation (clear line of sight)		5%	0%	3.63		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	3.23			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	3.62		133	Tidal flow atlas	Provision of a tidal atlas for use on-board vessels, which details tidal flow	5%	0%	3.22			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
6	Collision	Vessel transiting to/from Kyleakin with commercial vessel	Vessels make contact leading to hull being holed, flooding and loss of cargo. Major injuries, pollution (Tier 2), national adverse publicity. Cargo in navigational channel represents hazard to navigation. Vessels out of service until repairs complete.	50	4	4	3	3	Vessels take avoiding action resulting in a glancing blow. Minor damage to both vessels, no injuries, no pollution, adverse publicity.	10	1	2	0	2	4.33	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																23	Communication failure - Operational/procedural
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																56	COLREGS failure to comply
																80	Human error
																102	Language problems
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
3	Communications - Traffic broadcast	Information promulgated by the Coastguard	5%	0%	4.30	3.65	26	Communications equipment	Marine personnel monitor VHF channels 13 and 16	5%	5%	3.50	3.26	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
10	Passage planning	From berth to berth containing all relevant information on the area and contingency planning	5%	0%	4.28		33	Training of port marine/operations personnel		5%	5%	3.35			
26	Communications equipment		5%	5%	3.70		138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	10%	0%	3.33			
60	International COLREGS 1972 (as amended)		10%	0%	3.68		137	Consultation with local harbour authorities	To provide safety information to vessels navigating in the area	15%	0%	3.29			
97	Visual observation (clear line of sight)		5%	0%	3.66		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	3.28			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	3.65		133	Tidal flow atlas	Provision of a tidal atlas for use on-board vessels, which details tidal flow	5%	0%	3.26			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
7	Collision	Vessel transiting to/from Kyleakin with recreational vessel	Collision with contributory weather conditions (high winds or reduced visibility). Fully loaded vessel on transit to Kyleakin in collision with recreational vessel at manoeuvring speed. Two vessels are damaged, recreational vessel sinks with multiple fatalities. Pollution (Tier 2), operations immediately affected, damage to cargo, national adverse publicity.	25	4	4	3	3	Vessels make slow speed contact, damage to lighter vessel, minor injuries, no pollution, local adverse publicity.	5	0	1	0	1	4.00	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																23	Communication failure - Operational/procedural
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																56	COLREGS failure to comply
																80	Human error
																102	Language problems
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
3	Communications - Traffic broadcast	Information promulgated by the Coastguard	5%	0%	3.97	3.33	26	Communications equipment	Marine personnel monitor VHF channels 13 and 16	5%	5%	3.19	3.01	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
10	Passage planning	From berth to berth containing all relevant information on the area and contingency planning	5%	0%	3.95		33	Training of port marine/operations personnel		5%	5%	3.05			
26	Communications equipment		5%	5%	3.35		138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	10%	0%	3.04			
60	International COLREGS 1972 (as amended)		10%	0%	3.34		137	Consultation with local harbour authorities	To provide safety information to vessels navigating in the area	15%	0%	3.02			
97	Visual observation (clear line of sight)		5%	0%	3.33		141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	3.01			
125	Standards of Training, Certification and Watchkeeping for Seafarers (STCW)		5%	0%	3.33		133	Tidal flow atlas	Provision of a tidal atlas for use on-board vessels, which details tidal flow	5%	0%	3.01			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
8	Fire/Explosion	Alongside berth	Fire onboard vessel leads to explosion. Loss of life, major damage to berth, pollution (Tier 2)	50	4	4	3	3	Fire contained and extinguished by vessel crew. Minor injuries, damage to vessel, no pollution.	10	1	1	0	0	3.46	1	Human error/fatigue - Ship Personnel
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																37	Failure to comply with safe systems of work
																48	Risk Assessment, Incomplete/not reviewed
																75	Inadequate maintenance/inspection
																80	Human error
																86	Competence
																102	Language problems

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
15	Hazardous cargoes, advance notice of		5%	5%	3.23	2.96	19	Port Emergency Plan		0%	5%	2.83	1.94	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
62	Emergency services equipment - shore side	Mayday or Pan-Pan call to Coastguards	0%	5%	3.10		21	Oil spill contingency plans		0%	5%	2.69			
95	Standing Orders/SOPs	Provided by the vessels owners/operators	5%	5%	2.96		22	Contingency plan exercises		0%	5%	2.34			
							44	Safe systems of work (HSE)	Based on risk assessment and industry best practice	10%	5%	2.27			
							69	Training of pollution response personnel		0%	5%	2.12			
							70	Marine Safety Management System	Provides guidance and procedures based on risk assessments	5%	0%	2.11			
							112	PMSC compliance	Ensures all risk is reduced to as low as reasonably practicable (ALARP)	5%	0%	2.11			
							126	Dangerous substances in harbour areas 2016		5%	0%	2.10			
							138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	5%	1.94			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
9	Flooding	Vessel transiting to or from Kyleakin	Vessel has ingress of water and strands within approaches to Kyleakin pier blocking the navigation channel. Loss of life, pollution (Tier 2), loss of cargo, adverse publicity. Operations cease until wreck can be re-floated or removed.	25	4	4	3	4	Ingress of water is contained and vessel berthed safely, minor injuries. Vessel out of service as survey/repairs completed, delays to operations.	10	1	2	0	2	4.56	6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																9	Loss of watertight integrity
																11	Vessel breakdown or malfunction
																25	Communication failure - Personnel
																26	Adverse weather conditions
																43	Malicious action by external parties
																55	Incapacitated master (drinks/drugs)
																57	Vessel Ramps or Hatches not secure
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																78	Ship/Tug/Launch failure
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
118	Vessel maintenance	Maintenance schedule part of the vessel SMS	10%	10%	3.83	3.67	26	Communications equipment	Marine personnel monitor VHF channels 13 and 16	5%	5%	3.53	2.84	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
119	Vessel inspection/survey	Port and flag state inspections and surveys by classification society	10%	0%	3.81		33	Training of port marine/operations personnel		5%	5%	3.38			
120	Vessel secured for sea		0%	5%	3.67		70	Marine Safety Management System		5%	0%	3.37			
							112	PMSC compliance		5%	0%	3.36			
							136	Marine liaison officer		10%	0%	3.35			
							138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	5%	2.84			
							137	Consultation with local harbour authorities	To provide safety information to vessels navigating in the area	15%	0%	2.84			
							141	Dedicated VHF channel	Licence obtained from OFCOM, information updated in ALRS	5%	0%	2.84			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
10	Grounding	Vessel on approaches	Vessel grounds whilst manoeuvring to berth in adverse weather conditions. Hull punctured on rocky outcrop causing ingress of water. Vessel sinks causing navigational hazard. Loss of life, pollution (Tier 2), loss of cargo, operations cease until vessel re-floated/salvaged, national adverse publicity.	25	4	4	3	4	Vessel makes light contact with seabed, hull holed but flooding contained and vessel berthed safely. Minor injuries, pollution (Tier 1), adverse publicity. Vessel out of service until repairs complete.	5	1	2	2	2	5.75	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																9	Loss of watertight integrity
																10	Incorrect draught advised/promulgated
																11	Vessel breakdown or malfunction
																25	Communication failure - Personnel
																26	Adverse weather conditions
																28	Restricted visibility
																38	Shoreside light backscatter
																40	Failure of berth mooring systems
																43	Malicious action by external parties
																55	Incapacitated master (drinks/drugs)
																61	Incorrect assessment of tidal flow
																72	Failure to follow passage plan
																76	Inadequate training/competence - Others
																78	Ship/Tug/Launch failure
																80	Human error
																86	Competence
																102	Language problems
																103	Excessive vessel speed

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning	From berth to berth containing all relevant information on the area and contingency planning	10%	0%	5.64	5.31	11	Dredging programme	Informed by the results of hydrographic survey	10%	5%	4.71	2.70	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
12	Draught, Accurate, declared and within max limits		5%	0%	5.58		17	Hydrographic surveying program	Regular scheduled surveys in line with PMSC requirements	10%	0%	4.65			
13	Arrival/Departure, advance notice of	Tide level observed on-site and made available to vessels	5%	0%	5.53		18	Safe allocation of berths (depth, available, suitable)		10%	0%	4.59			
30	Accurate tidal measurements	Provided by the vessels owner/operator	10%	0%	5.42		19	Port Emergency Plan		0%	5%	4.40			
95	Standing Orders/SOPs		5%	0%	5.36		21	Oil spill contingency plans		0%	5%	4.21			
108	Requirement for notification of vessel defects		5%	0%	5.31		22	Contingency plan exercises		0%	5%	4.02			
							31	Availability of latest hydrographic information	Results of hydrographic survey provided to UKHO for update of navigation charts for the area	10%	0%	3.96			
							33	Training of port marine/operations personnel		0%	5%	3.77			
							36	Availability of pollution response equipment		0%	5%	3.26			
							69	Training of pollution response personnel		0%	5%	3.12			
							70	Marine Safety Management System	Provides guidance and procedures based on risk assessments	5%	0%	3.09			
							112	PMSC compliance	Ensures all risk is reduced to as low as reasonably practicable (ALARP)	5%	0%	3.06			
							138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	5%	2.73			
							144	Sectored light	To indicate whether a vessel is proceeding within safe water	15%	0%	2.70			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
11	Hazardous substance accidents	Fuel spillage into water	Pollutant/oil spill (Tier 2) from vessel/shore facility via pier. Local adverse publicity, no injuries, loss of revenue for local fish farms.	5	0	0	3	2	Small pollutant/oil spill from vessel/shore facility via pier reported to marine personnel. Spill contained and removed.	1	0	0	1	0	4.44	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																23	Communication failure - Operational/procedural
																25	Communication failure - Personnel
																31	Failure to observe standing notices
																37	Failure to comply with safe systems of work
																43	Malicious action by external parties
																59	Inadequate procedures shoreside
																62	Illegal discharges into the water
																69	Port Equipment (inc. craft) mechanical breakdown/system malfunction
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
15	Hazardous cargoes, advance notice of		5%	5%	3.56	3.56	21	Oil spill contingency plans		0%	5%	3.41	2.25	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
							22	Contingency plan exercises		0%	5%	3.26			
							33	Training of port marine/operations personnel		0%	5%	3.10			
							36	Availability of pollution response equipment		0%	5%	2.95			
							69	Training of pollution response personnel		0%	5%	2.80			
							70	Marine Safety Management System	Provides guidance and procedures based on risk assessments	5%	0%	2.76			
							112	PMSC compliance	Ensures all risk is reduced to as low as reasonably practicable (ALARP)	5%	0%	2.73			
							138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	5%	2.25			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
12	Hazardous substance accidents	Organic material into water	Large amount of organic matter enters water during marine incident. Local adverse publicity, operations stopped until clean-up complete. Testing of local water quality required.	10	0	0	2	2	Small amount of organic matter enters water, not reported to marine personnel. Continuous occurrences lead to water quality impacts, fish farm loss of revenue, local adverse publicity	5	0	0	1	0	2.44	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																23	Communication failure - Operational/procedural
																25	Communication failure - Personnel
																31	Failure to observe standing notices
																37	Failure to comply with safe systems of work
																43	Malicious action by external parties
																59	Inadequate procedures shoreside
																62	Illegal discharges into the water
																69	Port Equipment (inc. craft) mechanical breakdown/system malfunction
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																80	Human error
																86	Competence

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
134	Vessel MARPOL compliance		5%	5%	1.68	1.68	19	Port Emergency Plan		0%	5%	1.61	1.27	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
							22	Contingency plan exercises		0%	5%	1.54			
							33	Training of port marine/operations personnel		0%	5%	1.48			
							36	Availability of pollution response equipment		0%	5%	1.41			
							69	Training of pollution response personnel		0%	5%	1.34			
							70	Marine Safety Management System	Provides guidance and procedures based on risk assessments	5%	0%	1.34			
							112	PMSC compliance	Ensures all risk is reduced to as low as reasonably practicable (ALARP)	5%	0%	1.34			
							138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	15%	5%	1.27			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
13	Machinery related accident	Loss of power leading to collision/allision /grounding	Vessel loses steerage/propulsion leading to collision/allision/grounding at manoeuvring speed. Hull punctured leading to flooding/sinking of vessel. Vessel represents a navigational hazard, loss of life, pollution (Tier 2), adverse publicity.	10	4	4	3	3	Vessel loses steerage/propulsion. Emergency generator activates. Vessel berths safely and undergoes maintenance. No injuries, no pollution.	1	0	1	0	0	5.25	1	Human error/fatigue - Ship Personnel
																6	Inadequate bridge resource management
																7	Inadequate procedures in place onboard vessel
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																69	Port Equipment (inc. craft) mechanical breakdown/system malfunction
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
22	Contingency plan exercises		0%	10%	4.84	3.93	70	Marine Safety Management System	Provides guidance and procedures based on risk assessments	5%	5%	3.75	2.64	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
108	Requirement for notification of vessel defects		10%	0%	3.96		112	PMSC compliance	Ensures all risk is reduced to as low as reasonably practicable (ALARP)	5%	5%	3.58			
118	Vessel maintenance		10%	0%	3.93		136	Marine liaison officer	To provide safety information to vessels navigating in the area and to local authorities	0%	10%	3.18			
							138	Marine liaison officer/pier master		0%	10%	2.64			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
14	Payload related accident	Incorrect loading/unloading of vessel	Vessel stability compromised, large sheer forces and/or hogging/sagging cause loss of hull integrity. Ingress of water leads to vessel sinking alongside. Loss of life, pollution (Tier 2), adverse publicity.	25	4	4	3	4	Vessel takes on list. Operation stopped and list corrected with ballast or movement of cargo. Delay to operations, no injuries or pollution.	5	0	0	0	1	3.88	1	Human error/fatigue - Ship Personnel
																5	Human error/fatigue - Port/Marine Personnel
																7	Inadequate procedures in place onboard vessel
																8	Fire/Explosion
																9	Loss of watertight integrity
																11	Vessel breakdown or malfunction
																14	Vessel has unreported defect
																23	Communication failure - Operational/procedural
																25	Communication failure - Personnel
																26	Adverse weather conditions
																31	Failure to observe standing notices
																37	Failure to comply with safe systems of work
																49	Loss of vessels stability (due to other than loss of watertight integrity)
																59	Inadequate procedures shoreside
																69	Port Equipment (inc. craft) mechanical breakdown/system malfunction
																75	Inadequate maintenance/inspection
																76	Inadequate training/competence - Others
																80	Human error
																86	Competence
																105	Incorrect ballasting

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
15	Hazardous cargoes, advance notice of		0%	5%	3.72	2.82	19	Port Emergency Plan		0%	5%	2.29	1.71	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
18	Safe allocation of berths (depth, available, suitable)		0%	10%	3.42		21	Oil spill contingency plans		0%	5%	2.27			
95	Standing Orders/SOPs	Provided by the vessels owner/operator	5%	5%	2.98		22	Contingency plan exercises		0%	5%	2.11			
108	Requirement for notification of vessel defects		5%	0%	2.97		33	Training of port marine/operations personnel		0%	5%	1.94			
120	Vessel secured for sea		5%	5%	2.84		36	Availability of pollution response equipment		0%	5%	1.81			
121	Loading/unloading plan	Provided by the vessel using stability calculations and confirmed before operations proceed	15%	0%	2.82		44	Safe systems of work (HSE)	Based on risk assessment and industry best practice	5%	5%	1.97			
							69	Training of pollution response personnel		0%	5%	1.74			
							70	Marine Safety Management System	Provides guidance and procedures based on risk assessments	5%	0%	1.73			
							112	PMSC compliance	Ensures all risk is reduced to as low as reasonably practicable (ALARP)	5%	0%	1.73			
							138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	10%	0%	1.71			

Assessment Number	Hazard Category	Hazard Scenario	Worst Credible	Frequency (Years)	Consequence				Most Likely	Frequency (Years)	Consequence				Baseline Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port			
15	Ranging	Adverse weather conditions affecting moored vessels	High wind speed off berth causes vessels to range. Moorings break causing vessel to drift. Minor damage to vessel, bollards pulled from quay, major injuries from snap back and bollards. Vessel unable to return safely to berth goes to emergency anchor in harbour until engines started.	25	3	2	0	4	High wind speed off berth causes vessels to range. Moorings break causing vessel to drift. Minor damage to vessel, bollards pulled from quay, major injuries from snap back and bollards. Vessel unable to return safely to berth goes to emergency anchor in harbour until engines started.	1	0	1	0	1	4.63	1	Human error/fatigue - Ship Personnel
																7	Inadequate procedures in place onboard vessel
																26	Adverse weather conditions
																37	Failure to comply with safe systems of work
																48	Risk Assessment, Incomplete/not reviewed
																61	Incorrect assessment of tidal flow
																80	Human error

Control ID	Current Controls				Residual Risk	Current Risk	Control ID	Further Applicable Controls				Residual Risk	Final Risk	Date	Assessors
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction				
10	Passage planning		5%	0%	4.60	4.50	70	Marine Safety Management System		5%	0%	4.48	3.30	01-Nov-16	Chris Read - Marine Harvest Robert Thomson - Highland Council Jimmy Ferguson - QinetiQ
13	Arrival/Departure, advance notice of		5%	0%	4.58		112	PMSC compliance		5%	0%	4.46			
116	Weather forecasting	Advance warning gained from available internet resources and metocean forecasts.	20%	0%	4.50		138	Marine liaison officer/pier master	To provide safety information to vessels navigating in the area and to local authorities	5%	5%	3.30			

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