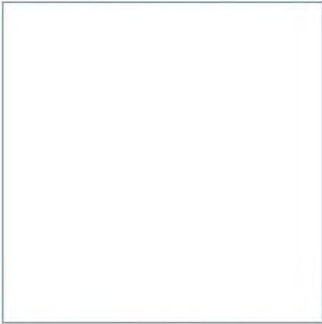
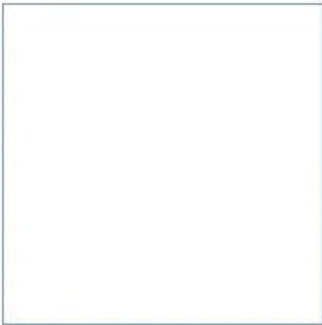


Peel Ports Group

Hunterston Construction Yard

Navigational Risk Assessment

May 2024



Innovative Thinking - Sustainable Solutions



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Hunterston Construction Yard

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Executive Summary

This Navigational Risk Assessment (NRA) has been produced as a technical appendix to an Environmental Impact Assessment Report for the Hunterston Construction Yard (HCY) proposed development. The NRA has been conducted by ABPmer for Clydeport Operations Limited (COL). This NRA has identified the hazards and assessed the associated risks for the construction and operational phase of the proposed development, in accordance with the Port Marine Safety Code (PMSC) and its Guide to Good Practice (GtGP) and procedures in place within COL's Marine Safety Management System (MSMS).

The NRA presents a baseline that includes marine traffic information, drawn from 14 days of data collected in the summer and 14 days of data collected in the winter, which characterise marine traffic for a busy and quiet period. The NRA also presents marine incidents, collated from COL, the Marine Accident Investigation Branch (MAIB) and the Royal National Lifeboat Institute (RNLI). Baseline information in the NRA provided context to the Hazard Identification (HAZID) workshop and risk assessment workshop.

This NRA has considered 15 hazard scenarios for the construction phase and 9 hazard scenarios for the operational phase. The NRA process included a HAZID workshop attended by local stakeholders and subject matter experts. After consideration of the 'most likely' and 'worst credible' hazard scenario descriptions, the causes and embedded controls have been assessed and the associated risk outcomes (scores) at the embedded stage (i.e., if the activities were to occur with no further controls) applied. In addition, attendees at the HAZID workshop were asked to suggest future controls which the Statutory Harbour Authority (SHA) could consider implementing if they considered that a risk was not already 'As Low As Reasonably Practicable' (ALARP).

Of the 24 hazards considered, one hazard was assessed to remain significant after the application of future controls. In accordance with the Peel Ports Group MSMS procedures, this hazard will require review and determination by the Group Harbour Master (GHM) before construction operations commence. The suggested future controls for this hazard are:

- Contractor Risk Assessment Method Statement (RAMS);
- Adherence to Construction (Design and Management) Regulations 2015;
- Project Liaison Officer and Marine Management Plan (MMP); and
- Safety boat (vessel capable of conducting a recovery from water, deployed in line with operational mitigation identified in contractor RAMS and MMP).

The 24 hazard scenarios within this NRA, following implementation of the identified potential future controls by COL as the SHA, can be deemed both tolerable and ALARP, as per the requirements the Peel Ports Group MSMS procedures.

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1 Introduction

1.1 About the Harbour Authority

Clydeport Operations Limited (COL), owned by the Peel Ports Group Limited (PPG), is the Statutory Harbour Authority (SHA) for an area of south-west Scotland covering some 1,165 square kilometres (450 square miles) from the west side of Albert Bridge in Glasgow, down river along the tidal River Clyde covering all areas into the Firth of Clyde including Loch Fyne. COL is also the Competent Harbour Authority (CHA) within the meaning of the Pilotage Act 1987; the area of the CHA is exactly the same as the SHA area, with compulsory pilotage operating through part of the CHA as defined in the COL's Pilotage Directions.

COL is the Local Lighthouse Authority (LLA) within the same area as its SHA, by virtue of Article 193 of the Merchant Shipping Act 1995; this gives COL the duty and powers to provide and maintain marking and lighting. PPG operates a Local Port Services (LPS) for the COL SHA area, the service is operated from Liverpool at the Group Port Control Centre (GPCC). The LPS maintains a 24-hour 'watch and advisory' service on Very High Frequency (VHF) Channels 16 and 12. The service is provided with data from vessel Automatic Identification System (AIS) and Closed-Circuit Television (CCTV). The LPS is the first line contact for emergency response within COL's SHA area of jurisdiction.

Within COL's SHA area of jurisdiction, there are a large number of other SHAs including that of Ardrossan Harbour Company Limited (AHCL), which is also owned by PPG. A number of the SHAs are located within and adjacent to COL's jurisdiction area. These include ports and harbours with separate jurisdictional boundaries established by local Acts and Orders, managed by Organisations including Caledonian Maritime Assets Ltd (CMAL), Argyll and Bute Council and North Ayrshire Council. In addition, the area also includes the Clyde Dockyard Port of Gareloch and Loch Long, which is managed by the Ministry of Defence (MoD) and operationally run by the King's Harbour Master (KHM) at Faslane.

1.2 Project background

The Hunterston Construction Yard (HCY) is located in the Firth of Clyde, approximately 2 km from the village of Fairlie. The islands of Great Cumbrae and Little Cumbrae are approximately 1.5 km to the northwest/southwest respectively, with the Hunterston Power Station approximately 1 km to the south. The HCY is being developed, with the intent to provide a marine facility that can support the offshore wind industry and including the assembly of components used in the construction of offshore wind farms and other renewables projects. The area of COL's SHA relevant to this study, is shown in Figure 1.

The HCY has one of the deepest sea entrances on the Firth of Clyde and can accommodate deep draughted and large capacity vessels. Developing the HCY will involve the redevelopment of the existing quay and dry dock structures and will require capital dredging. The proposed development comprises the construction of a new quay and associated quayside infrastructure to berth vessels.

The proposed development has different design options which include the following:

- The consideration of a 250 m, 450 m, and a 450 m quay wall with an additional 150 m long quay wall either to the east or southwest of the main quay wall.
- A Roll-on, Roll-off (RO-RO) facility.
- A grounding pad (not exceeding 250 m x 250 m) as a temporary fixed gravel platform for grounding two barges.

- A series of dolphins (3-5) for berthing / mooring of barges.
- A catwalk for access to the berthed barges.

COL submitted a Scoping Report on the 22 November 2023 inviting comments from a range of statutory and non-statutory consultees with respects to a proposed development at the HCY. The consultees responding to the Scoping Report included:

- Historic Environment Scotland;
- Marine Analytical Unit;
- Marine Invasive Species Team;
- Maritime and Coastguard Agency;
- Ministry of Defence (MoD) - Defence Infrastructure Organisation,
- NatureScot;
- Northern Lighthouse Board;
- North Ayrshire Council;
- Office for Nuclear Regulation;
- Peel Ports Group Ltd.;
- Royal Society for the Protection of Birds (RSPB) Scotland;
- Royal Yacht Association (RYA) Scotland;
- Scottish Environment Protection Agency (SEPA);
- Scottish Fishermen's Federation; and
- Transport Scotland.

Several respondents acknowledged the intention of COL to undertake a Navigational Risk Assessment (NRA). The Maritime Coastguard Agency (MCA) stated their expectation that the NRA would be produced in accordance with the Port Marine Safety Code (PMSC) (DfT, 2016) and its Guide to Good Practice (GtGP) (DfT, 2018) and recommended that COL undertake a Hazard Identification (HAZID) workshop. Following the receipt of the Scoping Opinion, COL commissioned an NRA which is provided by this document.

1.3 Scope of work

This NRA assesses the potential outcome of marine incidents resulting from marine operations and navigation activities associated with the proposed HCY development. To do so, the potential hazards of the proposed development will be considered in the following phases:

- Construction: construction craft and activities, including any dredging during development of infrastructure. Plus capital dredge to create operational access to the proposed infrastructure.
- Operation: change to the study area's vessel movements including any maintenance dredging as a result of the proposed development.

The NRA follows the five stages identified in the Code's GtGP (DfT, 2018) and is further detailed in Section 4 of this document.

1. Data gathering and vessel traffic analysis;
2. Hazard identification;
3. Risk analysis;
4. Assessment of existing measures; and
5. Recommendations for risk controls.

1.3.1 Study area

HCY is located in the Hunterston Channel to the east of Great Cumbrae Island and Little Cumbrae Island providing access for deeper draughted vessels to the Hunterston Ore and Coal Terminal. The study area for the purpose of the NRA includes the Hunterston Channel and Firth of Clyde Channel up to Gourock and including the approaches to Holy Loch and Loch Long in the north. The whole of the study area is within COL’s SHA area.

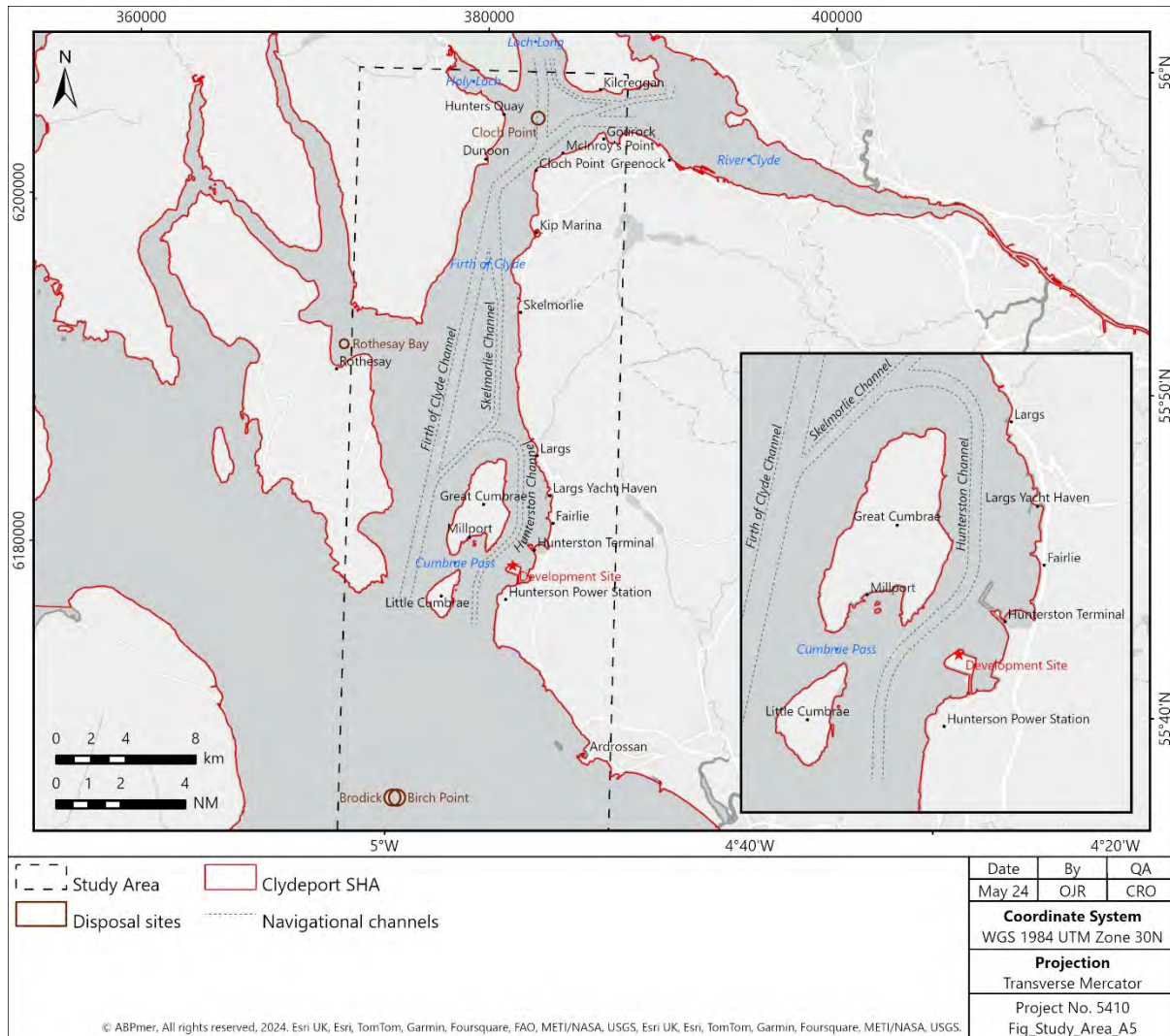


Figure 1. Study area

In the south, the study area includes the proposed dredge disposal sites at Brodick, Birch Point and to the north, the disposal site at Cloch in the Firth of Clyde (see Figure 1). Hunterston B Power Station is located in Hunterston Channel, to the south of HCY. The power plant is commencing a decommissioning phase. Within the Hunterston Channel there are also two recreational facilities, one at Fairlie Quay and the other at Largs Yacht Haven. A further Marina is located in the study area, operating as Kip Marina which is located south of Cloch Point. CalMac Ferries Limited (CFL) operate scheduled ferry services between Largs and Great Cumbrae Island, with a ferry terminal in the north and Millport town in the south.

1.4 Policy and guidance

1.4.1 National standard for port marine safety

The UK national standard for safe and efficient port and maritime facility operation is the PMSC (DfT, 2016) and its accompanying guidance document GtGP (DfT, 2018). This NRA has been produced in compliance with the requirements of the Code and its GtGP. Additionally, principles from the International Maritime Organization (IMO) Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule making process (IMO, 2018) has provided supplementary information with regards to navigational risk. It should be noted that the IMO's FSA provides a wide range of guidance advice for marine activities, not all of which is applicable to the port marine context in the UK.

This NRA assesses navigational risk by utilising a matrix approach using the four base receptors identified in the PMSC (DfT, 2016) and Chapter 4 of the GtGP (DfT, 2018). These receptors include human life, the environment, port/port user operations and port/shipping infrastructure damage. These receptors are further refined to encompass the 'PEAR' criteria of People, Assets, Environment and Reputation detailed in the PPG Standard System Procedure (SSP) number 012. It is this SSP that is used by COL, as the SHA for determination of risk acceptability.

1.4.2 ALARP and tolerability principles

ALARP: The PMSC defines the term 'ALARP' as being 'as low as reasonably practicable', (DfT, 2016). ALARP is an industry-wide standard, applying to both health and safety and port marine safety.

Reasonably practicable: Central to this standard is the term 'reasonably practicable'. To meet this standard, the NRA has to balance risk against the effort, time and money required to control the risk. The PMSC (DfT, 2016) specifically references ALARP as an underpinning rationale for Marine Safety Management Systems and marine risk assessments.

Risk assessment is based on a comprehensive and formal assessment of hazards and risks with a view, following assessment and mitigation of the more severe scenarios either to eliminating the hazards and risks or to reducing them to the lowest possible state, as far as is reasonably practicable. Where a project is proposed which may alter the navigable environment, the promoter of the scheme should consult with those likely to be involved in or affected by such alterations, and responsible for managing the risks. The overriding aim is to ensure that any consequential risk is reduced to meet the standard of as low as reasonably practicable.

The Code's GtGP states that the:

"Judgement of risk should be an objective one, without being influenced by the financial position of the authority. The degree of risk in a particular activity or environment can, however, be balanced on the following terms against the time, trouble, cost, and physical difficulty of taking measures that avoid the risk. If these are so disproportionate to the risk that it would be unreasonable for the people concerned to incur them, they are not obliged to do so. The greater the risk, the more likely it is that it is reasonable to go to very substantial expense, trouble, and invention to reduce it. But if the consequences and the extent of a risk are small, insistence on great expense would not be considered reasonable",

This means that every hazard scenario needs to be assessed and, regardless as to whether that scenario produces a minor or significant hazard, it needs to be taken into account so as to ensure that the risks overall are ALARP. Greater emphasis is placed on significant risks to ensure that the more significant risk outcomes are mitigated.

Tolerability: The concept of 'tolerability' seeks to define the point at which a risk has an unacceptable outcome (a function of likelihood and consequence) when measured against key criteria. Those criteria in respect of marine safety are defined in the GtGP as:

- Human life;
- The environment;
- Port/port user operations; and
- Port/shipping infrastructure damage.

Further, the GtGP states that:

"Risks may be identified which are intolerable. Measures must be taken to eliminate these so far as is practicable. This generally requires whatever is technically possible in the light of current knowledge, which the person concerned had or ought to have had at the time. The cost, time and trouble involved are not to be taken into account in deciding what measures are possible to eliminate intolerable risk. Risks may be identified which are intolerable. Measures must be taken to eliminate these so far as is practicable. This generally requires whatever is technically possible in the light of current knowledge, which the person concerned had or ought to have had at the time. The cost, time and trouble involved are not to be taken into account in deciding what measures are possible to eliminate intolerable risk",

Determining whether the predicted level of risk is acceptable requires a two-part test:

- Is the risk tolerable to the Organisation, and
- Is the risk mitigated to an 'ALARP' state.

This means that where risks are identified and assessed as being tolerable, they can be accepted, and the associated activity may proceed once a position of ALARP has been reached. However, if the assessed risk remains above the tolerability line or position, then all relevant controls must be applied to it or else the given activity cannot take place. Determining the risk tolerability, with respect to the proposed development is the responsibility of COL as SHA.

2 Navigation Baseline

2.1 Introduction

The following section presents the baseline information for commercial shipping, military or law enforcement, fishing vessels and recreational craft in the study area. Where relevant, factors relating to the proposed development and the subsequent operation have been highlighted. The following elements are considered in the baseline:

- Statutory responsibilities and management procedures;
- Vessel services;
- Aids to Navigation;
- MetOcean conditions;
- Marine traffic; and
- Marine incidents.

2.2 Statutory responsibilities and management procedures

The proposed development is located within COL's SHA limits. COL in its capacity as the SHA has a set of powers, duties and responsibilities which include ensuring and maintaining safe port marine operations and the regulatory control of navigational activities.

In this, COL has committed to meeting the requirements of the PMSC. The PMSC requires that Organisations operate an effective MSMS which is based on a set of comprehensive and regularly updated risk assessments and procedures. The MSMS for COL details how its statutory duties are met, through the implementation of plans, processes, and procedures (PPG, 2024a).

The CHA for the proposed development area is also COL. Pilotage Directions are in place identifying which vessels require a Pilot and in which circumstances, a Pilotage Exemption Certification (PEC) scheme is also in place for any *bona fide* ship's deck officer who demonstrates that they have the requisite skills, experience, and local knowledge to pilot their vessel. The COL Pilotage Area is split into two different areas, the Inner Pilotage and Outer Pilotage area (Shown in Figure 2). The whole area can be defined as the following:

- The SEAWARD LIMIT OF COMPULSORY PILOTAGE FOR ALL VESSELS means an imaginary line commencing at the intersection of the line of longitude 05° 06'W with the North shore of Loch Striven and then proceeding due South to the north shore of the Island of Bute and by the same line of longitude, from the South shore of the Island of Bute to the Latitude of Gull Point on Little Cumbrae Island; thence by a line proceeding in the direction 143° (T) for a distance of seven nautical miles; and thence by a line proceeding in the direction 053° (T) to the northern boundary of the Harbour of Saltcoats.*
- The LANDWARD LIMIT OF COMPULSORY PILOTAGE FOR ALL VESSELS means the west side of Albert Bridge in the City of Glasgow*

(PPG,2024b)

COL is the LLA for their area of jurisdiction by virtue of Section 193 of the Merchant Shipping Act 1995. This provides the responsibility for the maintenance of navigational marks and lights within the Authority's area. Approaches from seaward to the Firth of Clyde are managed by Northern Lighthouse Board (NLB) as the General Lighthouse Authority (GLA).

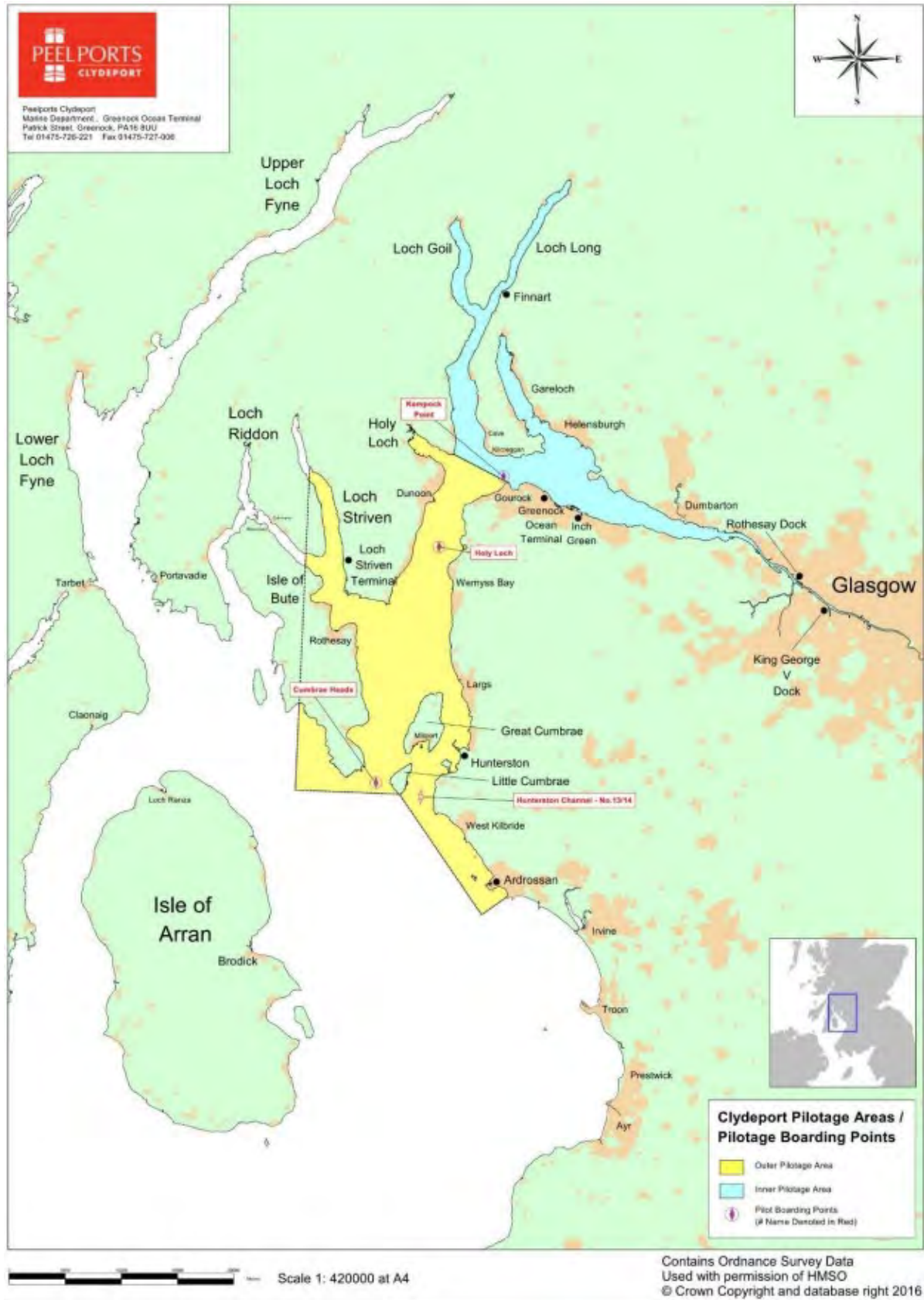


Figure 2. Compulsory pilotage areas

2.3 Vessel services

2.3.1 Pilotage

The COL Pilotage Directions (PPG,2024b) define the requirements for compulsory pilotage. The Pilotage Directions also specify the circumstances under which PECs are issued and administered in the area. Vessels subject to compulsory pilotage within the compulsory pilotage area include:

- Passenger vessels 25 m and over in length overall carrying in excess of 12 passengers and any vessel carrying passengers when navigating East of No1 Buoy.
- Passenger vessels proceeding to Loch Fyne or the Kyles of Bute.
- Any Vessel carrying passengers when navigating East of No1 Buoy.
- Timetabled ferry services operating within the Authority's area of jurisdiction.
- Vessels carrying dangerous substances in bulk as defined in the Dangerous Substances in Harbour Areas Regulations 1987 and all vessels which are not gas free. Also:
 - (i) Regardless of the vessel's LOA, all vessels carrying IMDG Class I goods require Pilotage from the Cumbrae Heads Pilot Station to the berth and *vice versa*.
 - (ii) Vessels carrying IMDG goods in bulk form require Pilotage from the Cumbrae Heads Pilot Station to the berth and *vice versa*.
 - (iii) Vessels carrying IMDG goods containerised, other than IMDG Class 1, require Pilotage.

In addition to these requirements the following instructions, shown in Table 1 also apply.

Table 1. Outer/Inner Pilotage area

Outer Pilotage Area (Length Overall and Above)		Inner Pilotage Area (Length Overall and Above)	
120 m	Transiting the Outer Pilotage Area	70 m	Proceeding to berths or anchorages within the Inner Pilotage Area
80 m	Proceeding to Hunterston, Loch Striven and other berths and anchorages within the Outer Pilotage Area	60 m	If proceeding into the River, East of No 1 Buoy
75 m	Proceeding to Holy Loch	45 m	If proceeding East of Shieldhall Riverside Berth (East End)
35 m	Vessels, dumb barges, etc when under tow East of No 1 Buoy	-	-

2.3.2 Towage

Tug services for the Firth of Clyde, River Clyde and the Dockyard Port are provided by three principal tug operators: Clyde Marine Services (CMS), Svitzer and Serco. The decision on tug use is based on, but not limited to, the characteristics of the vessel, the weather conditions expected and the state and height of tide. COL publishes Clydeport Towage Guidelines (PPG, 2020) and an associated Towage Matrix to identify the appropriate tug for the vessel's needs.

2.4 Aids to navigation

Within the study area there are a range of Aids to Navigation including channel lateral marks, cardinal buoys, special marks, and leading lights. Figure 3 identifies the Aids to Navigation in the vicinity of the proposed development site. The Aids to Navigation identify a clearly marked channel with port and Starboard lateral marks. There is also a Special mark to the south of the Proposed Development site which indicates an outfall pipe from the Hunterston Nuclear Power Station. The terminals and quays within the Hunterston Channel are marked with lateral marks. Leading lights are positioned on the south of Great Cumbrae Island for the approach to Millport.

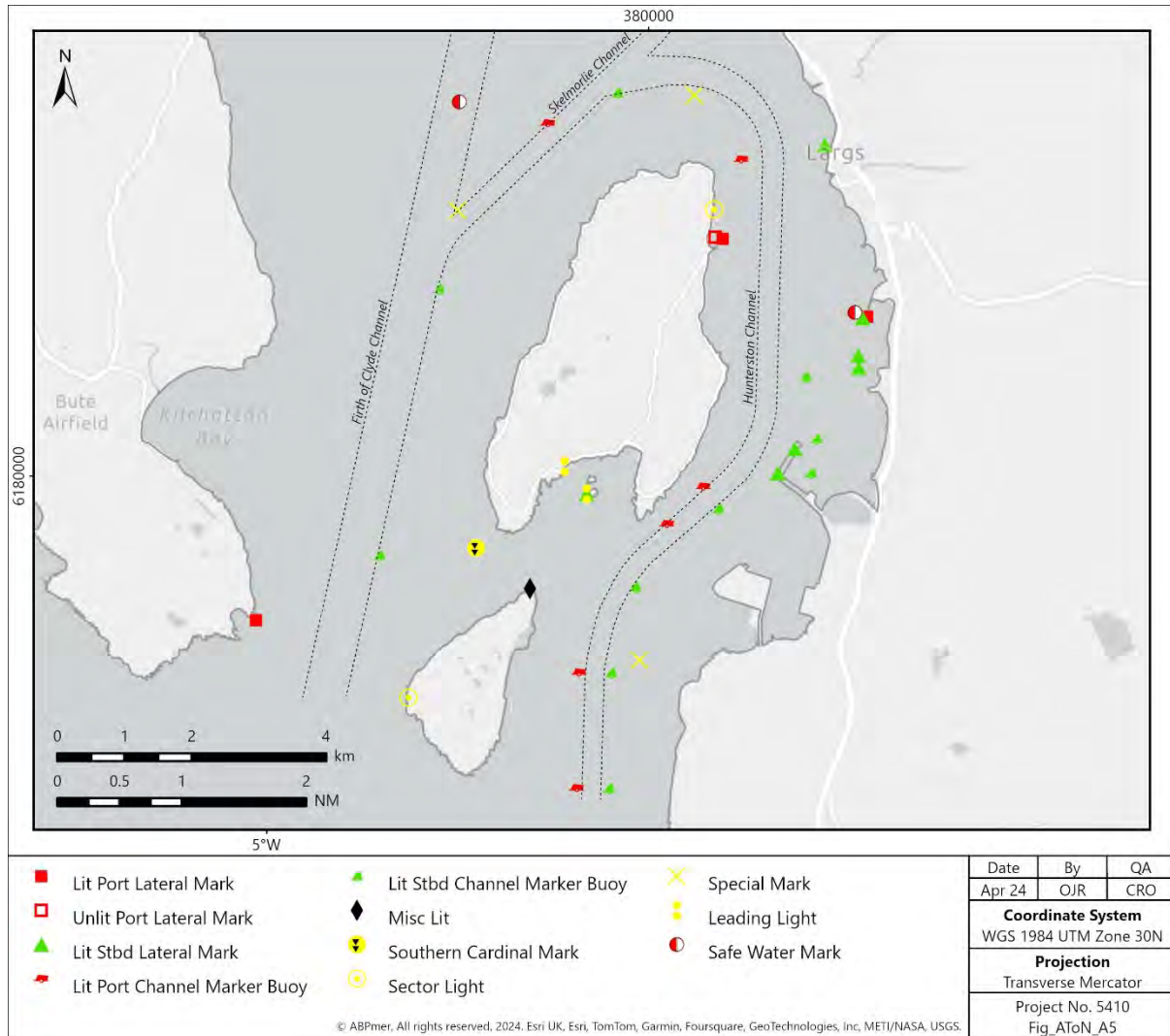


Figure 3. Aids to Navigation: Hunterston

2.5 MetOcean conditions

This section details the wind and wave characteristics from a position within the Firth of Clyde which is representative of the study area.

2.5.1 Waves

Figure 4 shows a wave rose diagram for the area immediately south of Little Cumbrae Island where the Firth of Clyde Channel and Hunterston Channel begin (inbound). This provides a suitable indication of significant wave height for the vessels navigating in the study area for the proposed development site.

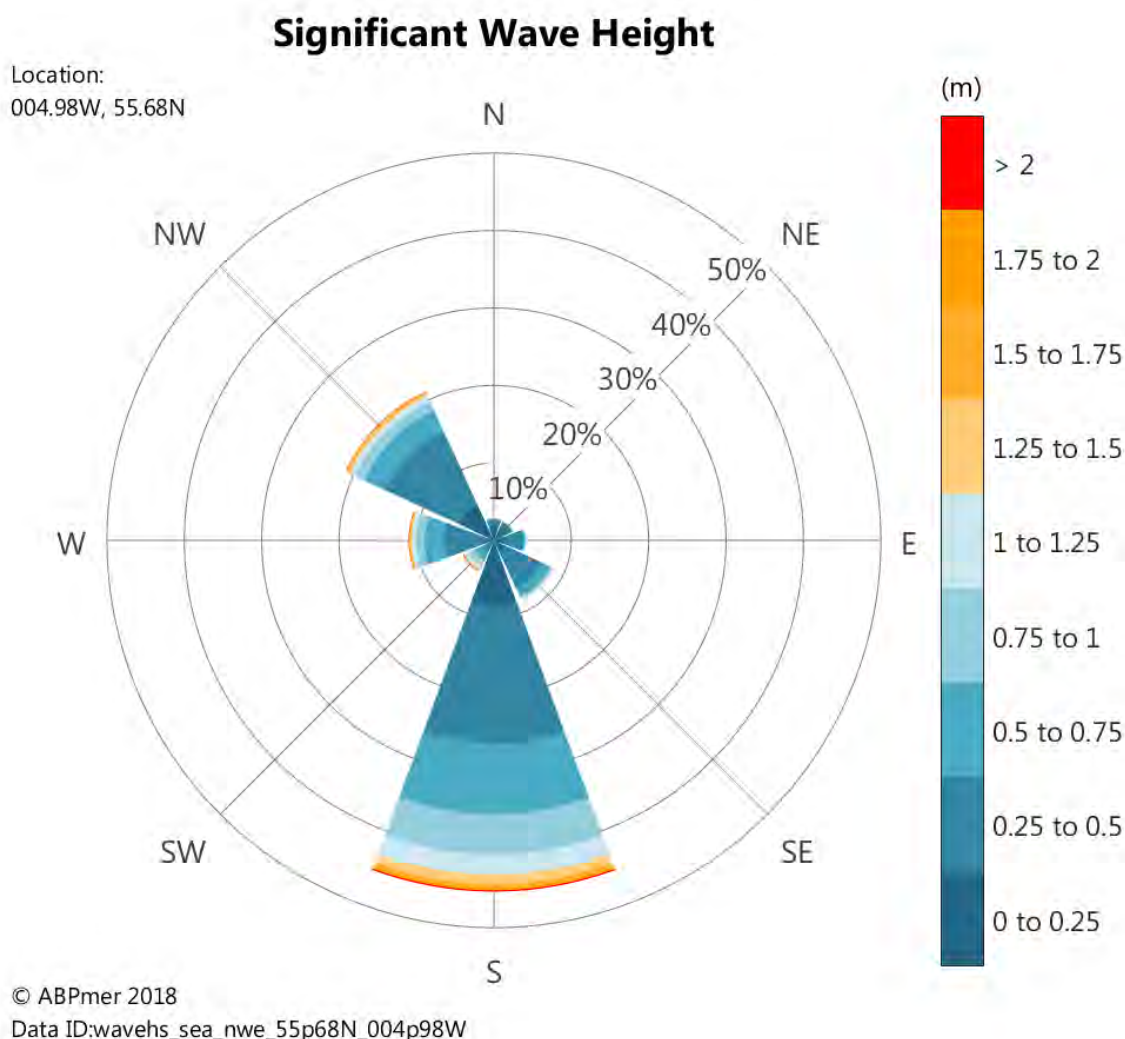


Figure 4. Significant Height Wave rose for Hunterston Channel

It can be seen from Figure 4 that waves are experienced from the south 45% of the time and the west and northwest, approximately 35% of the time with waves from other directions occurring much less frequently. The significant majority of the waves are modelled to be between 0.25 m to 0.75 m in height. The most significant waves modelled (greater than 2.0 m) account for approximately 3-5% of all waves and originate either from the south or west/northwest. This indicates that there is good shelter at the proposed development site against the prevailing weather conditions. .

2.5.2 Wind

Figure 5 shows a wind rose diagram for the Hunterston Terminal which provides wind data in closer proximity to the proposed development site. This provides an indication of prevailing wind conditions for the study area of the proposed development.

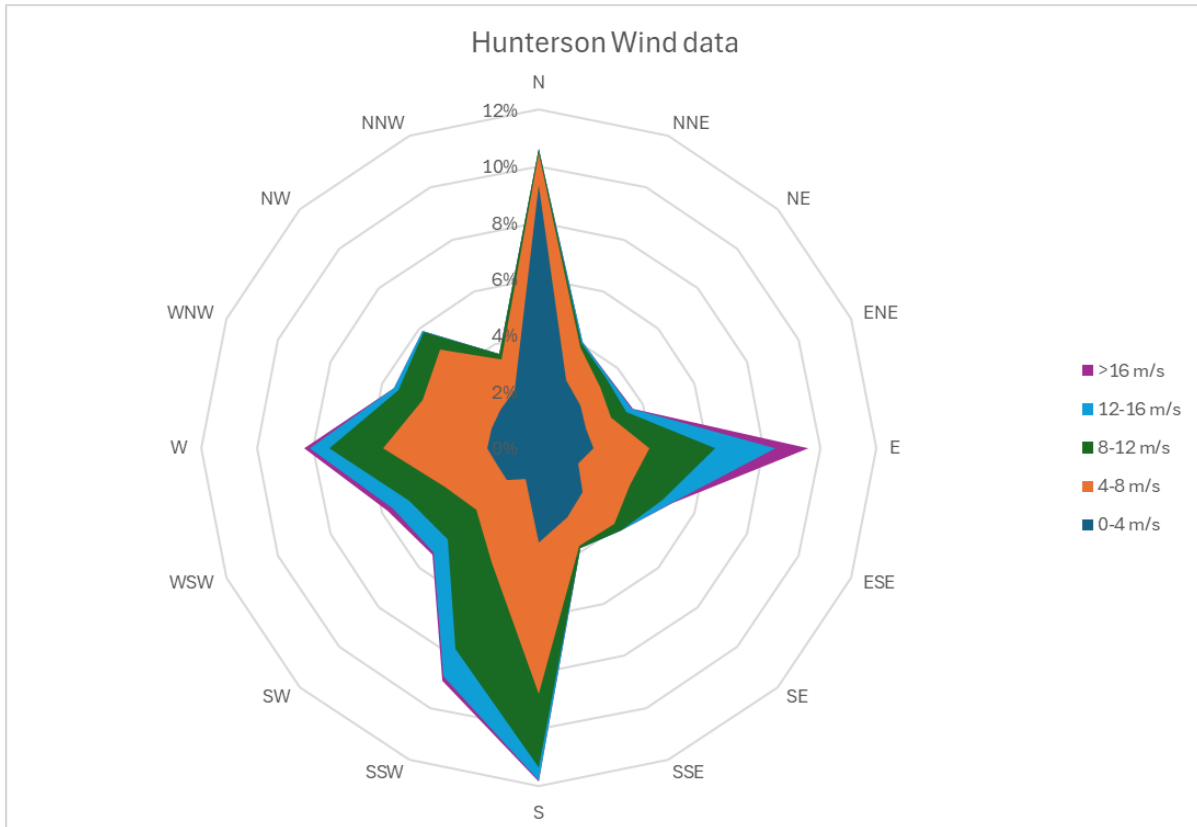


Figure 5 Wind rose for for Hunterston Terminal

Figure 6 identifies that the wind is predominantly from the south through to the northwest, and to a marginally lesser extent from the southeast/east. The strongest winds of greater than 16 m/s (Beaufort Wind Force 7) are also predominantly from the west and south-west and occur relatively infrequently (approximately 1-2% of the time). The Isle of Arran and other nearby features (West Kintyre and Cairnryan) provide shelter from the most frequent and severe wind conditions, significantly reducing the potential of this wind to cause significant swell, than might otherwise be experienced, due to a shortened fetch.

Figure 5 identifies that wind at the Hunterston Terminal is predominantly from the south through west. However, the strongest winds of greater than 16 m/s (Beaufort Wind Force 7) are predominantly from the east and occur relatively infrequently (approximately 1-2% of the time).

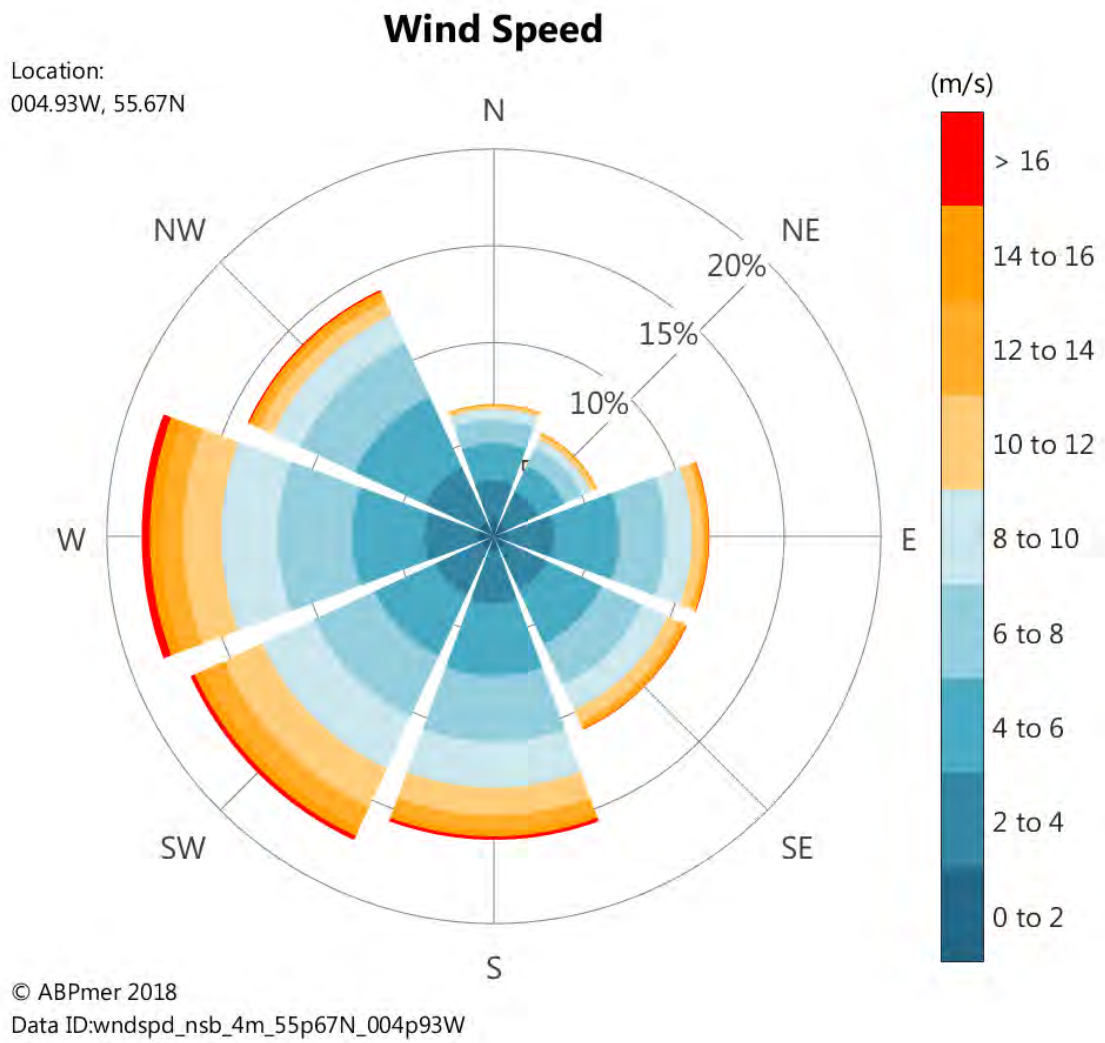


Figure 6. Wind rose for for Hunterston Channel

2.6 Marine traffic

This NRA has used the AIS data provided by a commercial supplier to conduct its marine traffic analysis and to help determine any potential challenges that may arise due to marine traffic within the study area. The AIS data captures vessel movements within COL's SHA across two separate periods to ensure coverage of both a quiet (winter) period and a busier (summer) period. The winter data was captured from 18- 31 December 2023 which represents 14 days of continuous AIS coverage. The summer data was captured between 18-31 July 2023. Table 2 displays the count of AIS movements captured in both periods.

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, all passenger ships regardless of size, fishing vessels 15 m or more in length overall (operating within UK waters) and certain categories of workboats. The use of AIS-B is not compulsory but may be carried by other vessels, including smaller commercial craft, the fishing sector, and recreational vessels. Both AIS-A and AIS-B data have been classified into the following eleven vessel categories, which are taken directly from the AIS data transmissions:

- Non-Port Service Craft,
- Port Service Craft,
- Dredging and Underwater Operations,
- High-speed craft,
- Military / Law Enforcement vessels,
- Passenger ships,
- Cargo ships,
- Tanker or bunker vessels,
- Fishing vessels, and
- Recreational craft.

Table 2. AIS Vessel Movement Count, whole study area (2023)

AIS Movements - 14 Day Period, Per Vessel Type	Winter	Summer	Total
1 – Non-Port Service Craft	2	40	42
2 – Port Service Craft	288	213	501
3 - Dredging and Underwater Operations	132	20	152
4 - High speed craft	0	0	0
5 - Military / Law Enforcement vessels	7	34	41
6 - Passenger ships	2,349	3,918	6,267
7 - Cargo ships	59	60	119
8 - Tanker ships	23	19	42
9 - Fishing vessels	47	116	163
10 - Recreational craft	16	792	808
Total	2,923	5,212	8,135

Table 3. shows the count of AIS vessel movements captured in both periods for Hunterston Channel. This identifies all vessel traffic which transits in proximity to the proposed site, see Figure 7 to Figure 12 for the vessel transect lines.

Table 3. Vessel AIS Movement Count, Hunterston Channel (2023)

AIS movements - 14 day period, per vessel type	Winter	Summer	Total
1 - Non-Port Service Craft	4	0	4
2 - Port Service Craft	39	69	108
3 - Dredging and Underwater Operations	2	20	22
4 - High speed craft		0	0
5 - Military / Law Enforcement vessels	1	0	1
6 - Passenger ships	7	1	8
7 - Cargo ships	1	7	8
8 - Tanker ships	0	0	0
9 - Fishing vessels	1	0	1
10 - Recreational craft	169	6	175
Total	224	103	327

2.6.1 Port service craft, non-port service craft, dredging and underwater operations, military / law enforcement vessels and fishing vessels

Figure 7 and Figure 8 identify the Non port Service craft, Port Service Craft, Dredging and Underwater Operations vessels, Military/Law Enforcement Vessels, and Fishing vessels.

Figure 7 identifies transits in the summer (busier) period with Port Service craft and Non-Port Service craft transiting the Hunterston Channel with greater frequency. Port Service craft would consist of Tugs, Pilot boats and port work craft. These vessels can be seen transiting through the Hunterston Channel from the north, south and through Cumbrae Pass, whilst in Hunterston Channel they are seen visiting Largs Yacht Haven and Largs. Non-Port Service Craft include search and rescue craft which are observed transiting similar routes to the Port-Service craft. Both vessel types transit the main Firth of Clyde Channel to Holy Loch, Loch Long and past Greenock towards River Clyde.

Fishing vessels as identified in Figure 7 transit with greater density between Largs and Rothesay predominantly transiting to the north of Great Cumbrae with a number of vessels manoeuvring through Skelmorlie Channel. A number of fishing vessels navigate in the vicinity of Cloch Point showing greater density around Gourock. Military and Law Enforcement vessels and Dredging and Underwater Operation Vessels are both observed conducting similar transit routes from Largs Yacht Haven, north through the Hunterston Channel and Skelmorlie Channel toward Gourock and the River Clyde as well as navigating through the Firth of Clyde Channel to the west of Great Cumbrae and Little Cumbrae.

Figure 8 identifies transits for the vessels in the winter (quieter) period. Port Service Craft are observed making similar transits to the summer period where a number of movements have been made from Largs utilising the north and south approaches to the Hunterston Channel, as well as Great Cumbrae Pass and also a greater density of transits from River Clyde to Loch Long with fewer vessels transiting Firth of the Clyde and Skelmorlie Channel. There are Considerably fewer Non-Port Service Craft and Military or Law Enforcement vessels which can only be observed transiting the Firth of Clyde. Fishing vessels follow similar routes as the summer transits however in a small volume. Dredging and Underwater Operations Vessels are observed making a number of trips between Largs Yacht Haven and Millport.

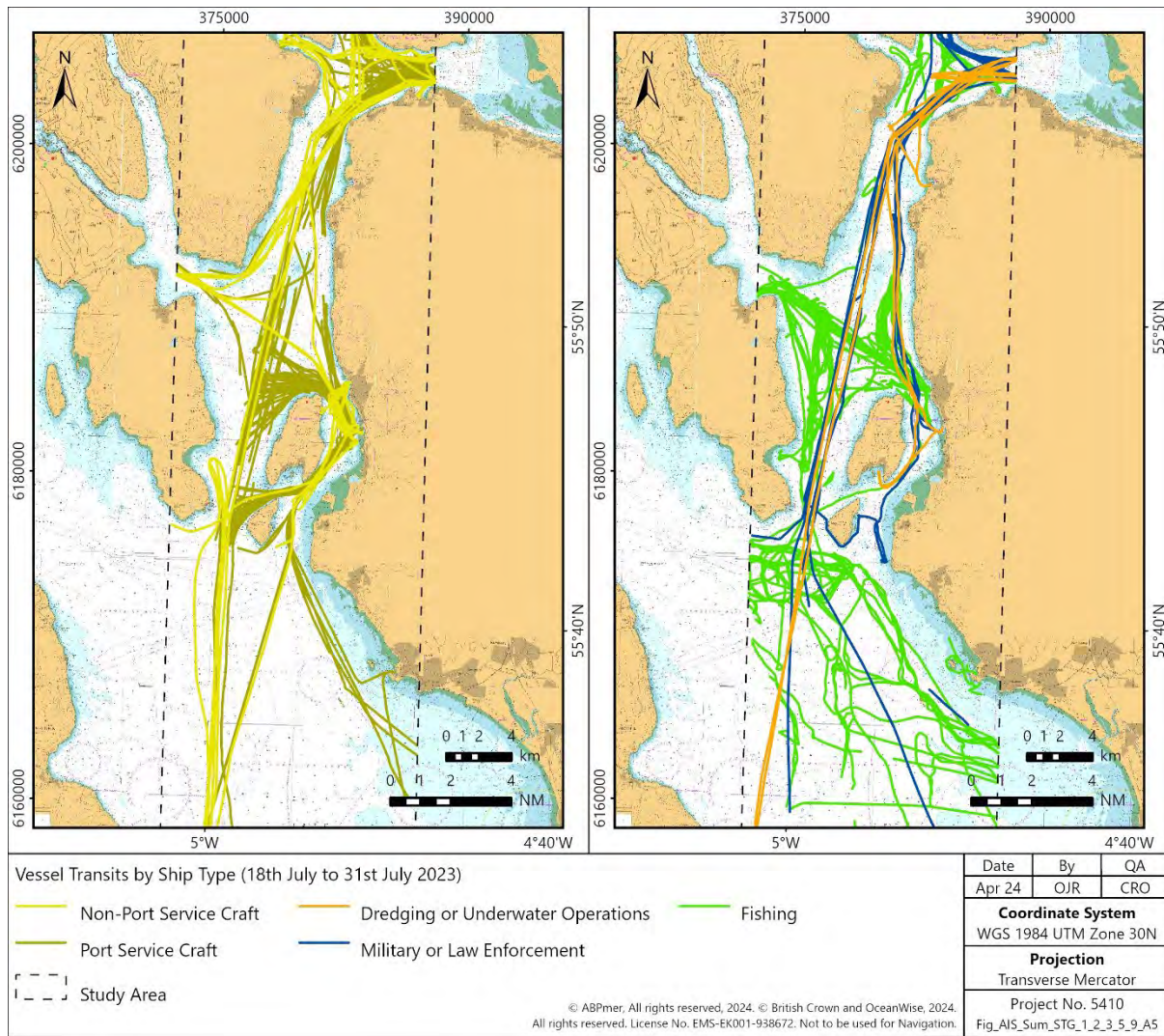


Figure 7. Summer AIS Transits – Non-Port Service Craft, Port Service Craft, Dredging or Underwater Operations, Fishing and Military or Law Enforcement vessels

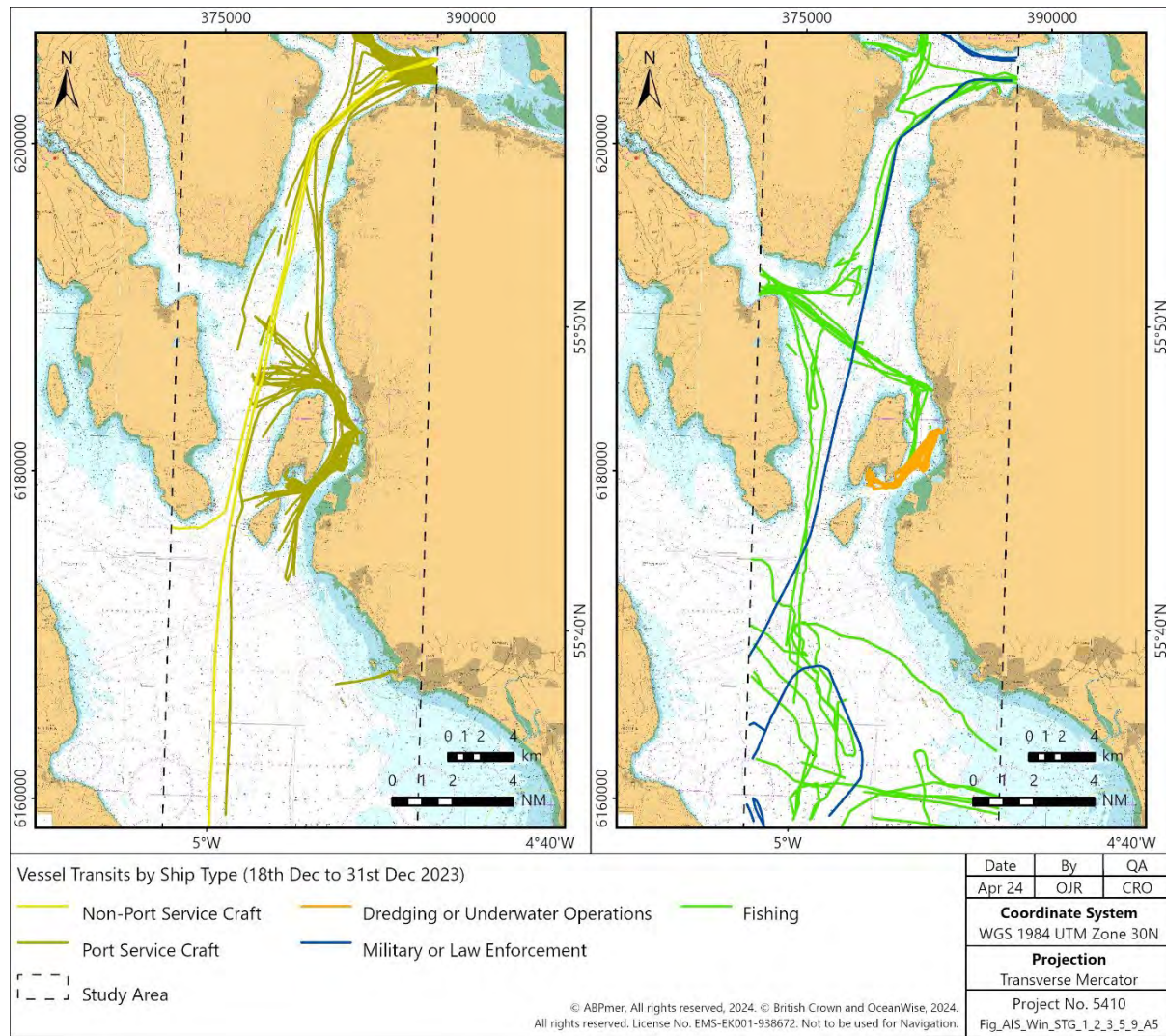


Figure 8. Winter AIS Transits – Non-Port Service Craft, Port Service Craft, Dredging or Underwater Operations, Fishing and Military or Law Enforcement vessels

2.6.2 Passenger and recreation AIS transits

Figure 9 and Figure 10 identify Passenger and Recreational vessel transits for summer (busier) and winter (quieter) periods, respectively. Passenger vessels are observed transiting a number of routes in the summer period, regular routes observed include Largs to Great Cumbrae Slip, Largs to Rothesay, Skelmorlie to Rothesay Gourock to Dunoon and Kilcreggan and McInroy Point to Hunters Quay. In addition to these regular routes, Passenger craft are observed transiting around the SHA using main navigable channels with a small number of vessels transiting through Hunterston Channel and Cumbrae Pass. In the Winter period Passenger vessels transit the main routes mentioned above with considerably reduced frequency and very little transits outside of these main ferry routes.

Recreational craft are observed using almost all navigable water in the summer period utilising all approaches to Largs Yacht Haven and Millport transiting through Cumbrae pass and using both north and south approaches to Hunterston Channel, this is shown more easily within the density grid (see Figure 13 and Figure 14). These craft are observed leaving space around the proposed development area possibly due to available water depths. In the winter period there is very little recreational activity. These transits navigate from Largs Yacht Haven Kip Marina, Millport, and Rothesay. Recreational craft sailing from Largs Yacht Haven are observed circumnavigating Great Cumbrae and Little Cumbrae.

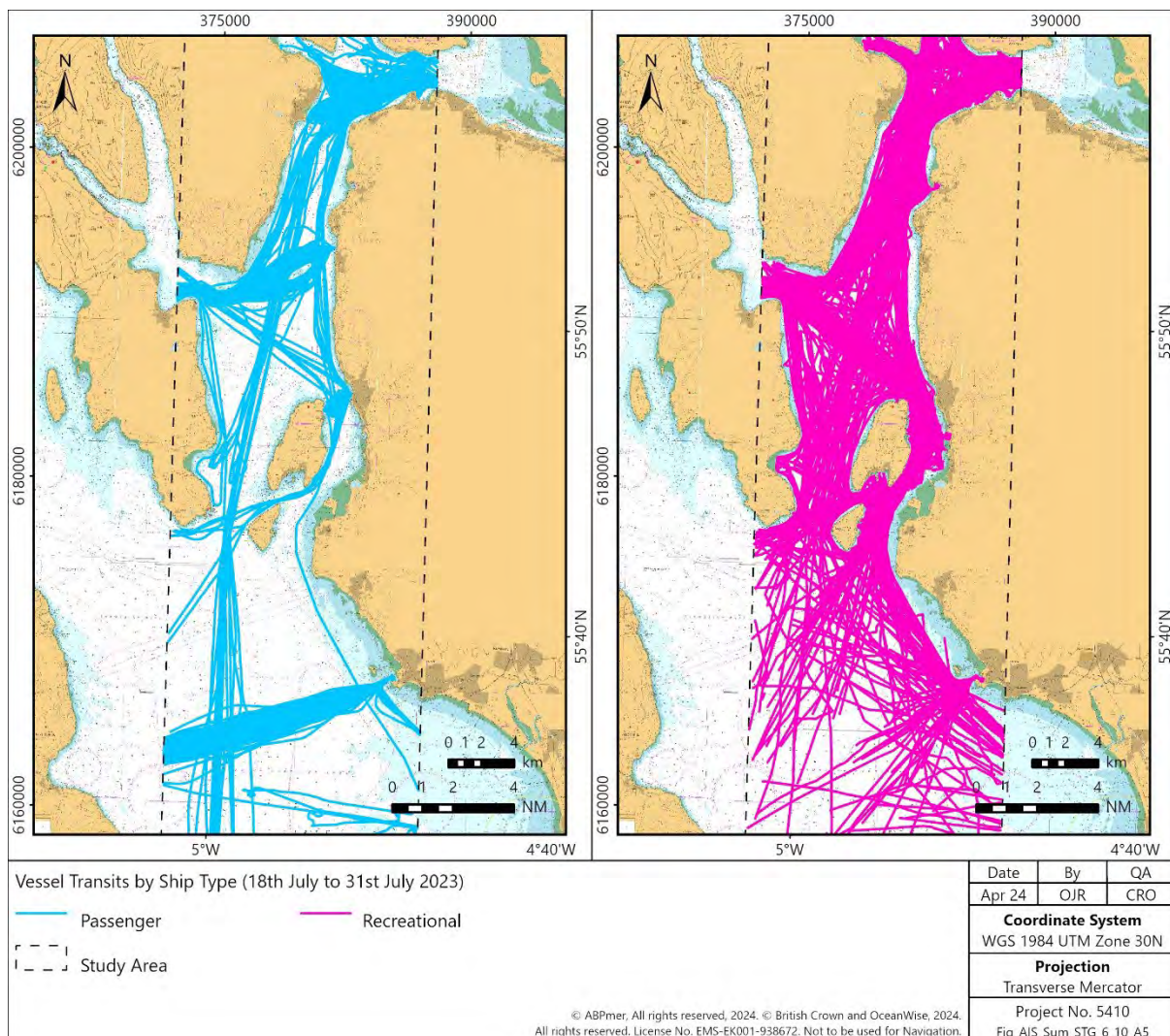


Figure 9. Summer AIS Transits – Passenger and Recreational vessels

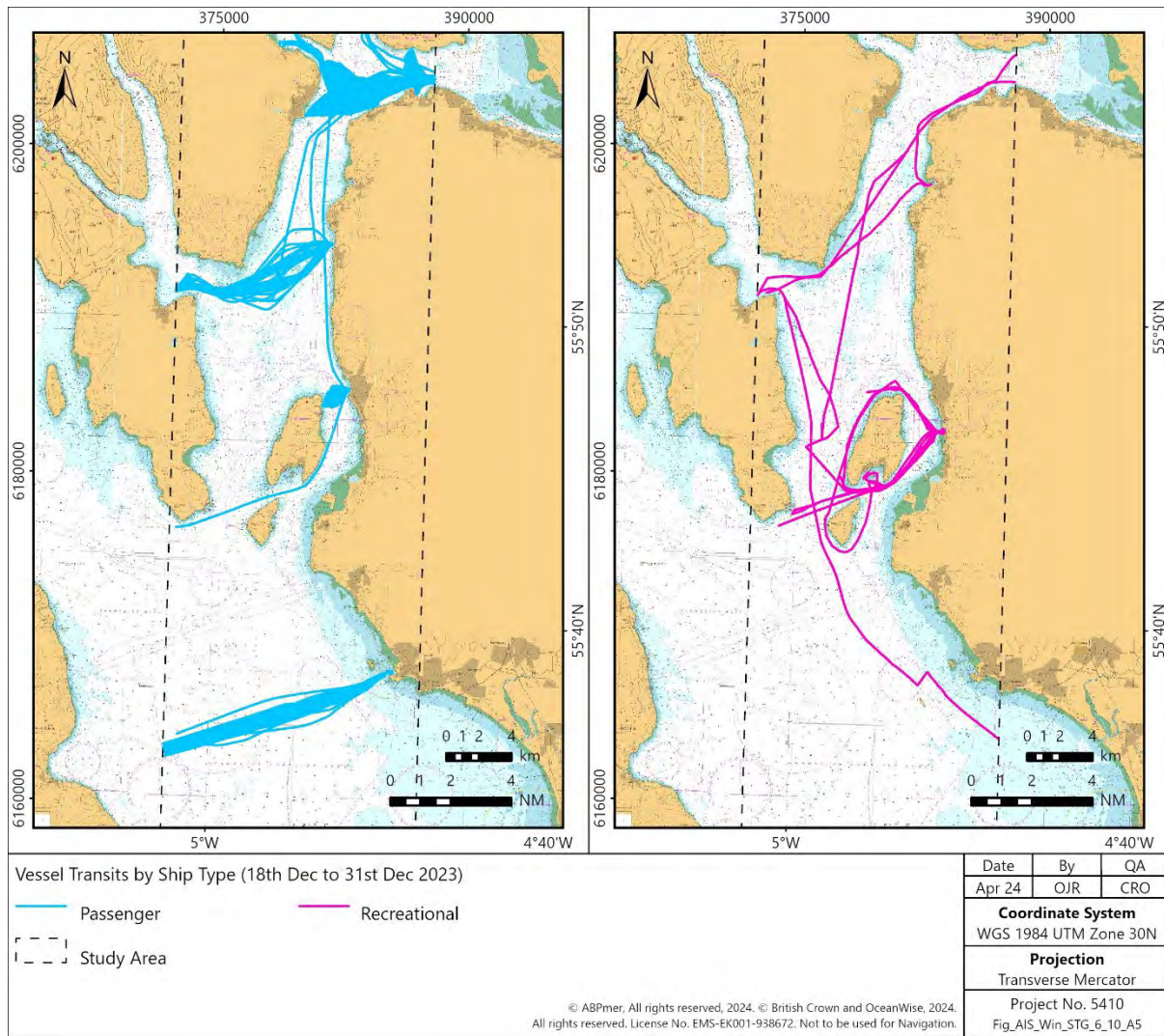


Figure 10. Winter AIS Transits – Passenger and Recreational Vessels

2.6.3 Cargo ships and tanker vessel AIS transits

Figure 11 and Figure 12 identify Cargo and Tanker vessel transits for the summer (busier) and winter (quieter) periods respectively. In the summer period, cargo vessels are observed transiting to Fairlie Quay and Hunterston Quay via the north and south approaches of the Hunterston Channel. The majority of cargo vessel transits are through the Firth of Clyde Channel towards the River Clyde and Rothesay, while a smaller number proceed to Ardnadam Bay in Holy Loch. The cargo vessel transits observed in the winter period follow similar routes to the summer period transits with increased visits to Fairlie Quay and Hunterston Quay via the Hunterston Channel, additionally a small number of vessels navigate towards Loch Long.

Tanker transits in the summer and the winter periods are similar with all vessels navigating via the Firth of Clyde Channel to the River Clyde or Loch Long.

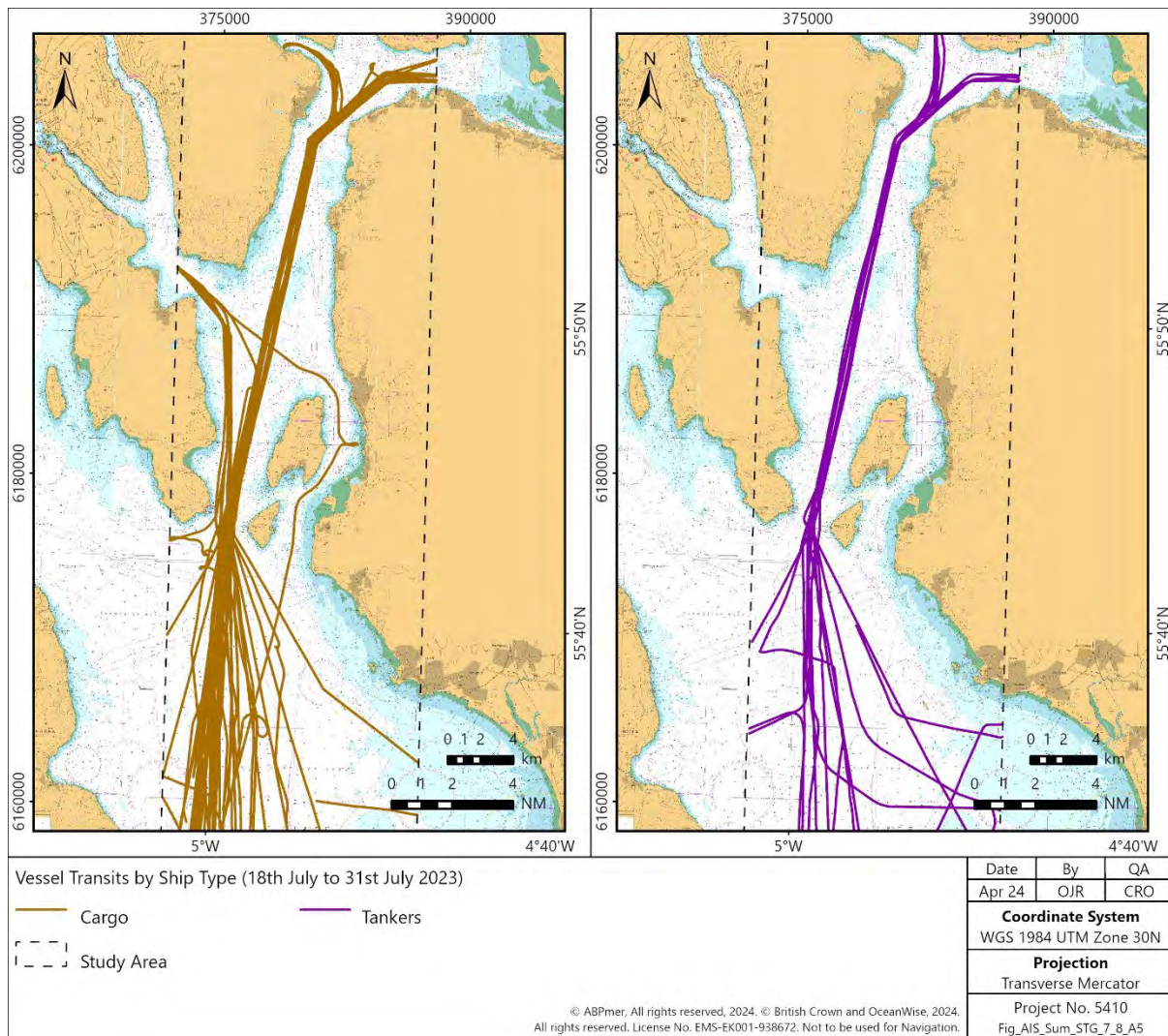


Figure 11. Summer AIS Transits – Cargo and Tanker Vessels

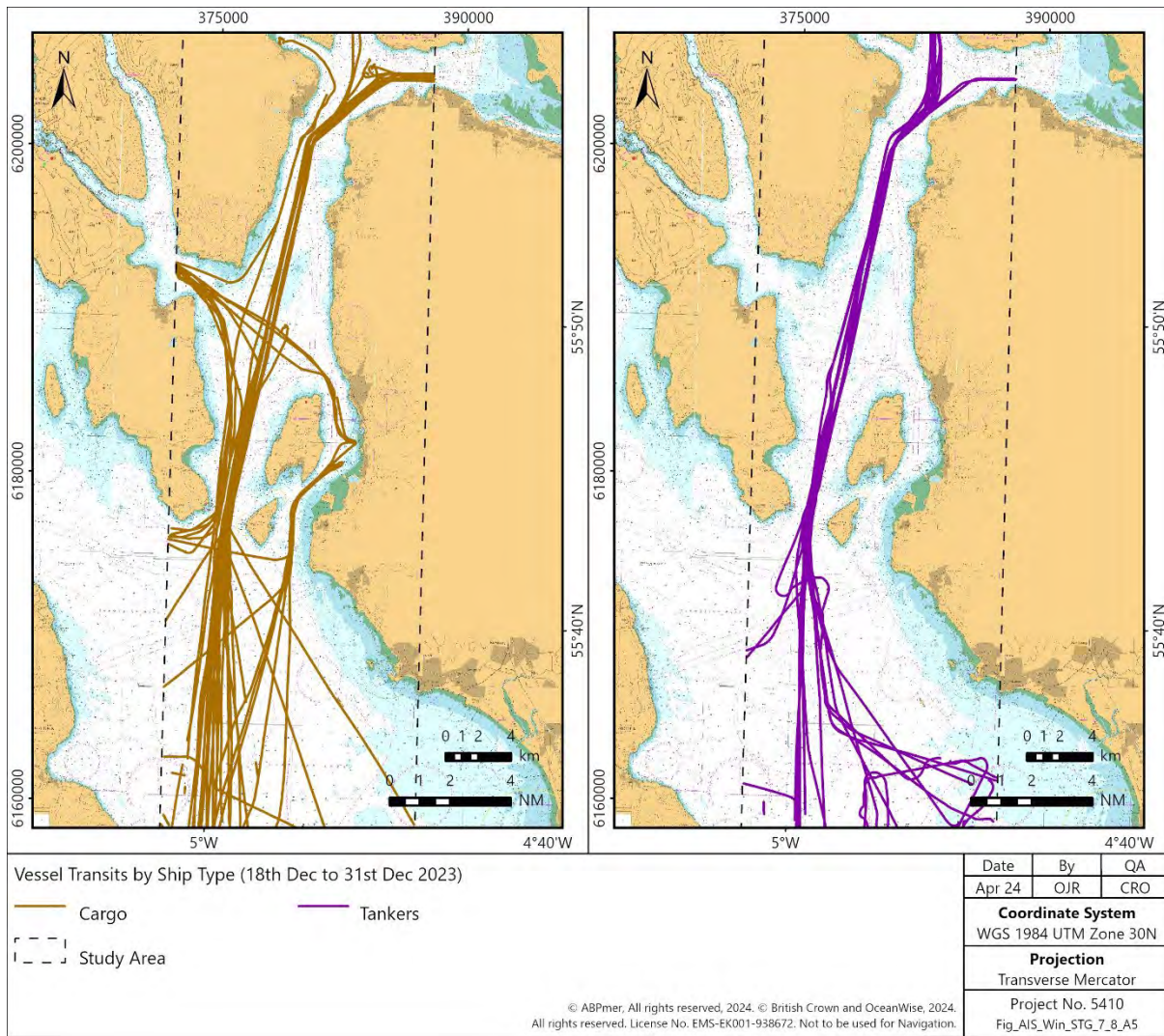


Figure 12. Winter AIS Transits – Cargo and Tanker Vessels

2.6.4 Traffic density

Traffic density plots (Figure 13 and Figure 14) indicate areas and routes with the greatest number of vessel movements, for the summer (busier) and winter (quieter) periods, respectively. The area has been divided into grid cells, of 50m², with the density grid identifying the number of movement (transits) per grid over the respective 14 day survey periods. Where two areas or routes of dense vessel traffic meet a greater amount of vessel interaction can be expected.

Traffic density plots show multiple high-density traffic routes which are mostly associated with passenger traffic and recreational traffic. The area with most noticeable traffic interaction comprises of the regular ferry routes across the Firth of Clyde and Hunterston Channel, additionally regular movements from the local marinas can be observed. The main channel clearly identifies two lanes of traffic in and out of Clydeport through the Firth of Clyde Channel.

Traffic density plots for all vessels for both the summer and winter periods (see Figure 13) show more active use of the area outside of the main navigation channels during the summer, this is associate mainly with recreational use (see Figure 14) and increased passenger vessel activity.

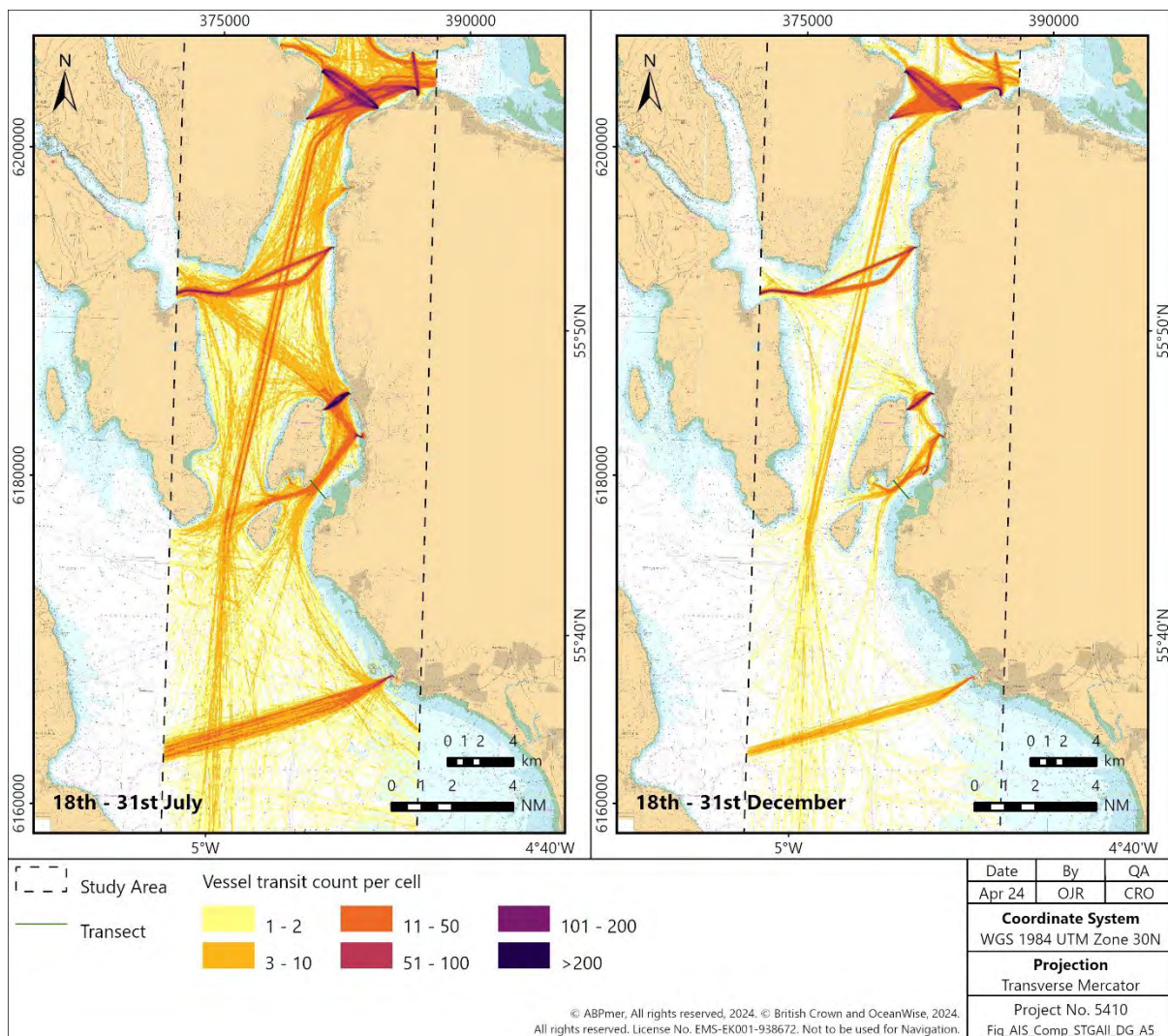


Figure 13. Traffic Density All Vessels

Figure 14 identifies traffic density for recreational craft only, to highlight areas of intensity. There is a marked difference summer to winter, with very limited use in the winter period. During the summer, recreational vessels actively use the Hunterston Channel. Recreational craft transit on a number of identifiable tracks, including routes from Rothesay, Kip Marina, Holy Loch, Largs, Largs Yacht Haven, Fairlie Quay Marina, and routes running north/south along the shoreline. In the winter (quieter) period, there is significantly lower activity around Great Cumbrae and Little Cumbrae and minimal activity in the Firth of Clyde Channel.

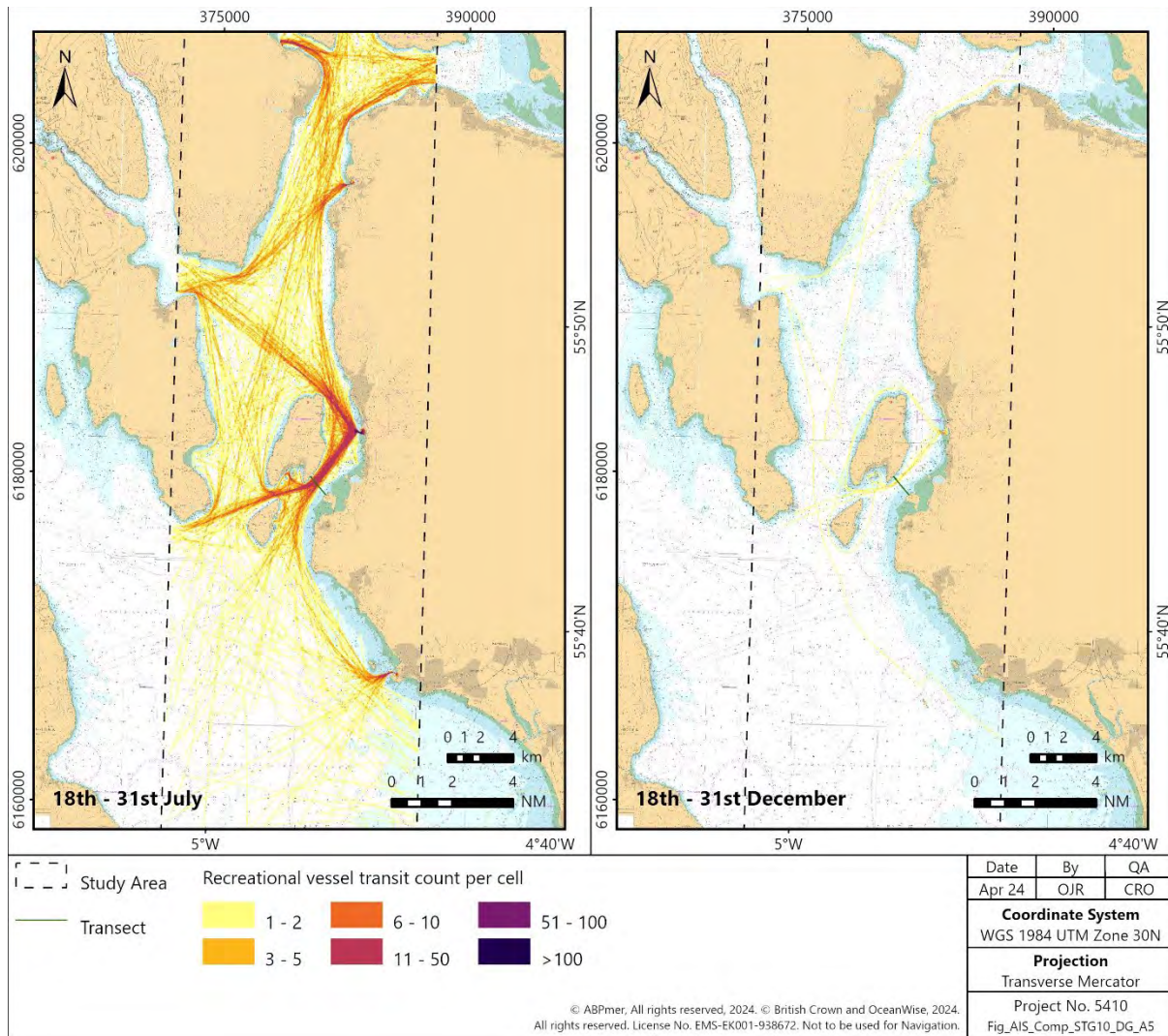


Figure 14. Recreational Traffic Density

2.6.5 Royal Yachting Association (RYA) information

The RYA has provided a set of resources that can be used in technical work, such as an NRA to further understand its members activity. The following sections present a summary of this information for the study area. Figure 15 presents the RYA Coastal atlas of recreational boating.

Yachting covers a variety of boating activities, which for the purposes of this NRA include motor boating, keelboat cruising and racing. The northern section of the Hunterston Channel includes the Largs Yacht Haven which is a significant centre for recreational boating with 730 full tide pontoon and space for 230 boats ashore (Yacht Havens Group, 2024).

The RYA Coastal atlas of recreational boating in Figure 15 identifies high level of recreational boating within the Hunterston channel originating from Largs Yacht Haven and Fairlie Quay Marina. The boating from here can be seen in greatest density transiting up to Rothesay and through East Kyle Loch. There is also moderate density observed around Gourock and Greenock.

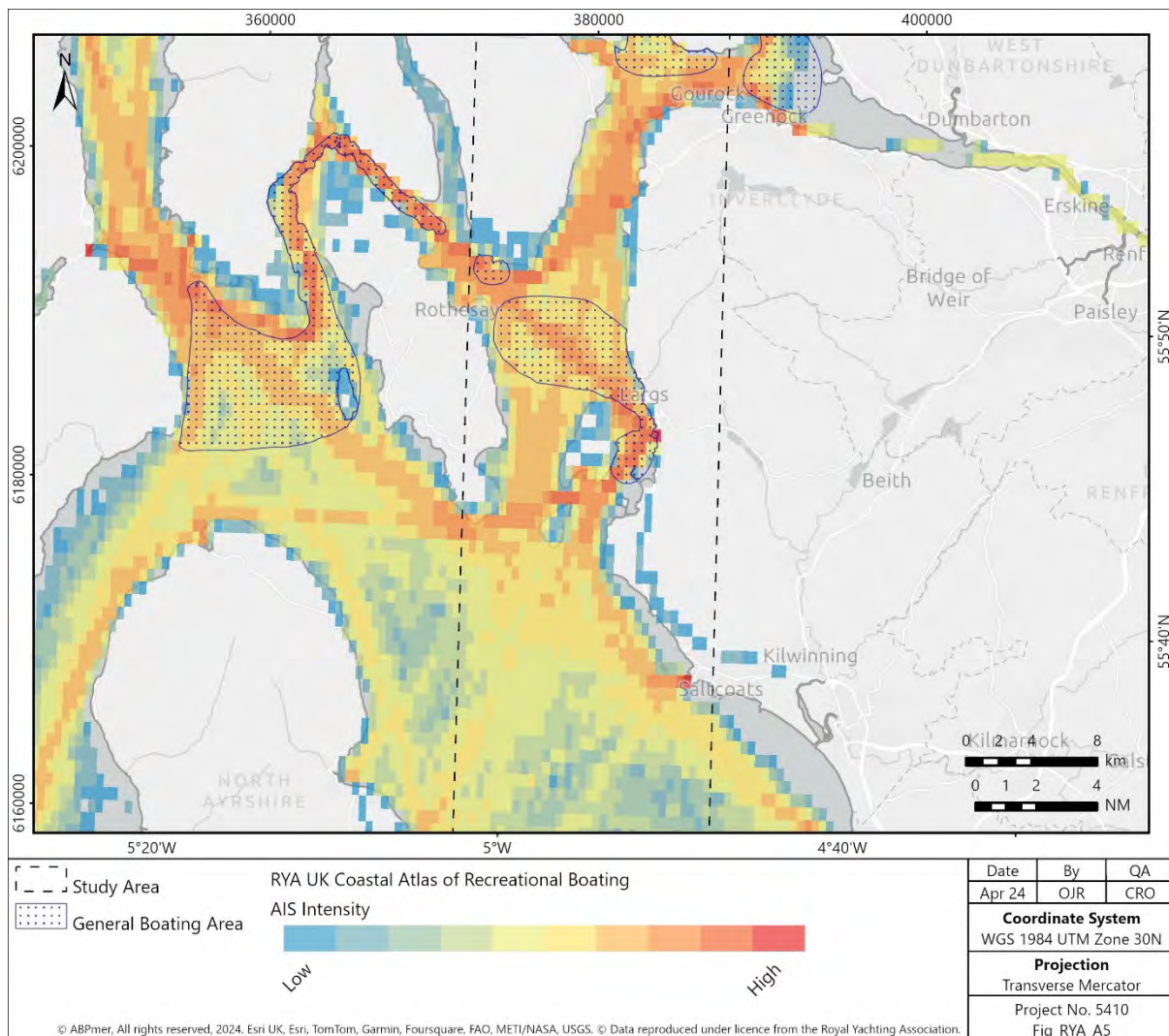


Figure 15. RYA Density Atlas

2.6.6 Fishing VMS information

Vessel Monitoring Systems (VMS) are satellite-based tracking tools used in the commercial fishing industry to ensure compliance with regulations and promote sustainable fisheries management. These systems automatically collect data on a vessel’s location, speed, and course, which helps authorities monitor fishing activities and enforce fishing zones. VMS also records time and date stamps, type of fishing gear used, and catch details, enabling comprehensive oversight of fishing operations. This data is crucial for preventing illegal fishing, managing fish stocks, and protecting marine environments.

Figure 16 shows total hours fished by vessels greater than 15 m and has been obtained from the Marine Management Organisation. The information shows some activity in the Hunterston Channel with 30 to 120 hours of utilisation in 2020, but there is significant activity within the northwest section of the Firth of Clyde. Low levels of activity have been recorded North of the Cumbrae Island.

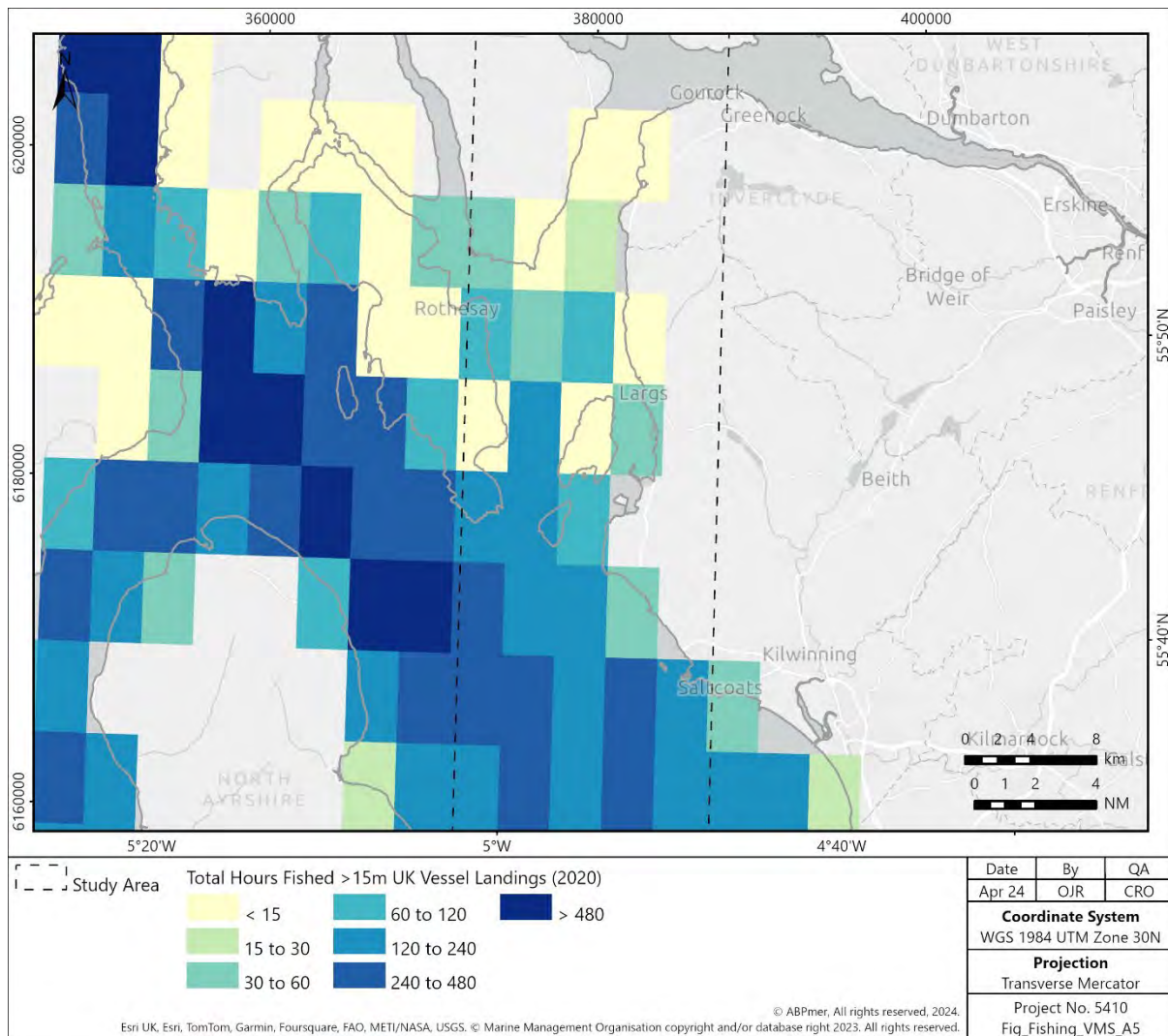


Figure 16. VMS Fishing information

2.7 Marine incidents

This section analyses the marine incidents that have been reported within the study area over a period of 10 years between 01 January 2013 and 31 December 2022. Data has been collected from three sources, namely:

- Maritime Accident and Investigation Branch (MAIB);
- Royal National Lifeboat Institution (RNLI) call out data; and
- COL's Incident Data (eight years of data available).

These datasets hold the details of all reported marine safety incidents and other occurrences which have potential significance to navigational safety. The reported incidents have been mapped onto a study area chart and colour coded as per their category to help identify areas where certain incidents are more likely to occur (see Figure 17 and Figure 18).

Table 4 presents MAIB incident records and the location of MAIB accident/incident reports are shown at Figure 17. It identifies there were 107 incidents between 2013 and 2022. This equates to an average annual frequency of 10.7 reportable MAIB incidents per year, in the study area. Harbour Authorities, marine facility owners and vessels operators are required to report certain incidents to the MAIB. These tend to be incidents which are more serious in nature or significant near misses. The most frequently reported incident type was 'Person in Distress' which occurred 34 times over the 10-year period. The next most frequently reported category was 'Other nautical safety' with a total of 14 reports. The closest incidents to the proposed development site were two groundings which both occurred to recreational craft.

Table 4. MAIB Marine Incident Summary for the Study Area (2013 to 2022)

Incident Category	Year											Annual Frequency
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total	
Collision	1	1	0	4	2	0	0	0	1	1	10	1
Equipment failure (vessel)	2	1	1	2	0	3	2	3	4	2	20	2
Fire/Explosion	0	1	3	0	0	0	1	1	2	0	8	0.8
Grounding	1	2	0	0	0	2	1	2	1	3	12	1.2
Impact with structure	0	2	0	0	0	0	1	1	1	1	6	0.6
Other nautical safety	0	2	0	0	1	2	2	4	2	1	14	1.4
Person in Distress	1	4	3	4	5	3	4	3	1	6	34	3.4
Person(s) in the water	2	0	0	0	1	0	0	0	0	0	3	0.3
Grand Total	7	13	7	10	9	10	11	14	12	14	107	10.7

Table 5 presents RNLI national dataset incidents, and their locations are displayed at Figure 18. The table and figures shows there were 439 incidents recorded in the 10-year period. For the RNLI dataset, the most frequent type of incident was 'Other nautical safety' with 216 incidents and making up 49% of the total incidents. While there are a number of these incidents spread across the study area, it can be seen in Figure 18, that there is a significant majority which occur in the vicinity of the east coast of the Firth of Clyde and within the Hunterston Channel. The incident locations indicate proximity to the main marinas including Largs Yacht Haven and Kip Marina. The incidents in these areas are largely associated with Equipment failure (vessel) and Other nautical safety. The closest incidents to the proposed development site include an equipment failure and a grounding which both occurred at the south edge of the proposed development site.

Table 5. RNLI Marine Incident Summary for the Study Area (2013 to 2022)

Incident Category	Year											Annual Frequency
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total	
Capsize/Sinking	3	0	2	2	5	2	6	0	0	0	20	2
Collision	0	0	0	0	0	0	0	0	0	2	2	0.2
Equipment failure (vessel)	10	13	15	18	12	10	10	9	12	7	116	11.6
Grounding	4	6	4	2	3	2	3	1	4	5	34	3.4
Impact with Structure	0	0	0	0	0	1	0	0	0	0	1	0.1
Leaks/Swamping	2	1	0	0	0	0	0	0	0	0	3	0.3
Other nautical safety	7	14	5	11	20	26	47	28	35	23	216	21.6
Person in Distress	6	3	5	2	1	7	2	2	2	0	30	3
Person(s) in the Water	1	4	6	4	0	1	1	0	0	0	17	1.7
Grand Total	33	41	37	39	41	49	69	40	53	37	439	43.9

Table 6 presents COL's local dataset of incidents covering an eight year period. Due to the method used to hold the data, it is not possible to spatially represent this information. However, three incidents have been associated with the Hunterston area. The data shows there were 79 incidents recorded in the 8-year period. For the COL dataset, the most frequent type of incident was 'Other Onboard Incident' with 20 incidents. The second most common incident type is 'Close Quarters Situation' with 18 incidents.

Table 6. COL's Marine Incident (2017 to 2022)

Incident Category	Year									Annual Frequency
	2017	2018	2019	2020	2021	2022	2023	2024	Total	
Close Quarters Situation	2	1	3	2	0	3	7	0	18	2.25
Collision (Another Vessel)	0	1	1	0	0	0	0	0	2	0.25
Collision (any fixed object)	0	0	0	0	0	1	1	1	3	0.38
Grounding	0	0	0	1	0	2	1	0	4	0.50
Lost Tow / Failed Line	0	0	0	0	0	0	0	1	1	0.13
Mooring Line / Bollard Failure	0	0	0	2	1	0	1	0	4	0.50
Non-Conformity to Port Regulations	0	0	0	0	0	1	0	0	1	0.13
Onboard Machinery / Hull Failure	0	2	0	2	1	0	2	1	8	1.00
Other Incident (Not Onboard)	0	2	2	2	3	0	0	1	10	1.25
Other Onboard Event	0	2	0	0	0	0	0	0	2	0.25
Other Onboard Incident	1	2	12	3	1	0	1	0	20	2.50
Pollution	0	0	0	0	0	1	0	0	1	0.13
Sinking / Capsizing / Listing	0	1	0	2	0	0	1	0	4	0.50
Weather	0	0	0	0	0	0	1	0	1	0.13
Grand Total	3	11	18	14	6	8	15	4	79	9.88

From a review of incident meta-data, three incidents were associated with the Hunterston area including a grounding of a recreational vessels and two Mooring line/Bollard failures at the Hunterston Terminal.

Some incidents will be duplicated across the three datasets due to the way in which they are recorded and stored. As a result, it should be noted that it is not possible to definitively remove duplicates. This means that the true total incident rates will be less frequent than stated in this report, as incidents classified as 'MAIB' have also been reported to the RNLI and reported to the COL. For this reason, all incident datasets have been considered individually within this NRA.

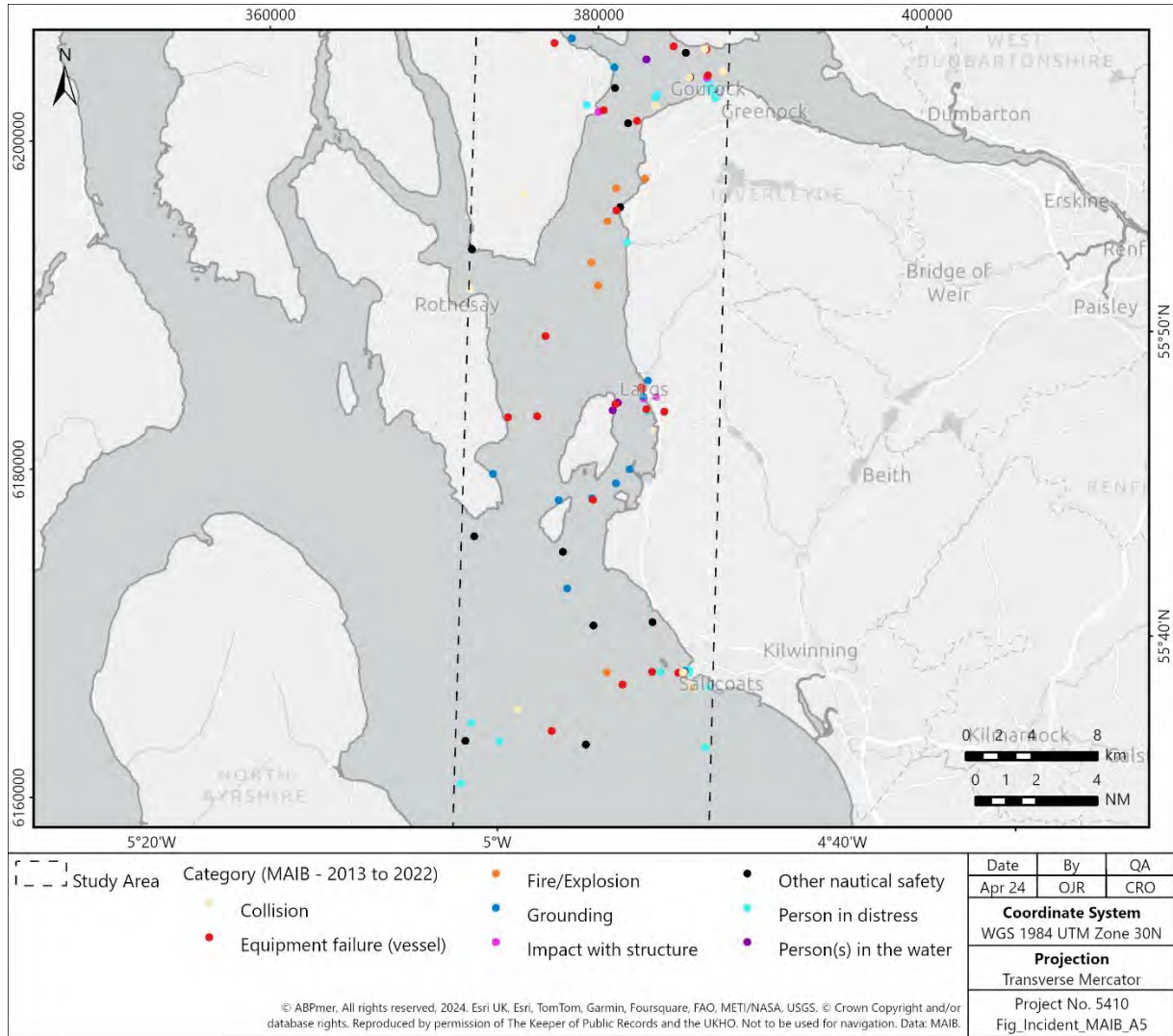


Figure 17. MAIB Accidents/ Incidents

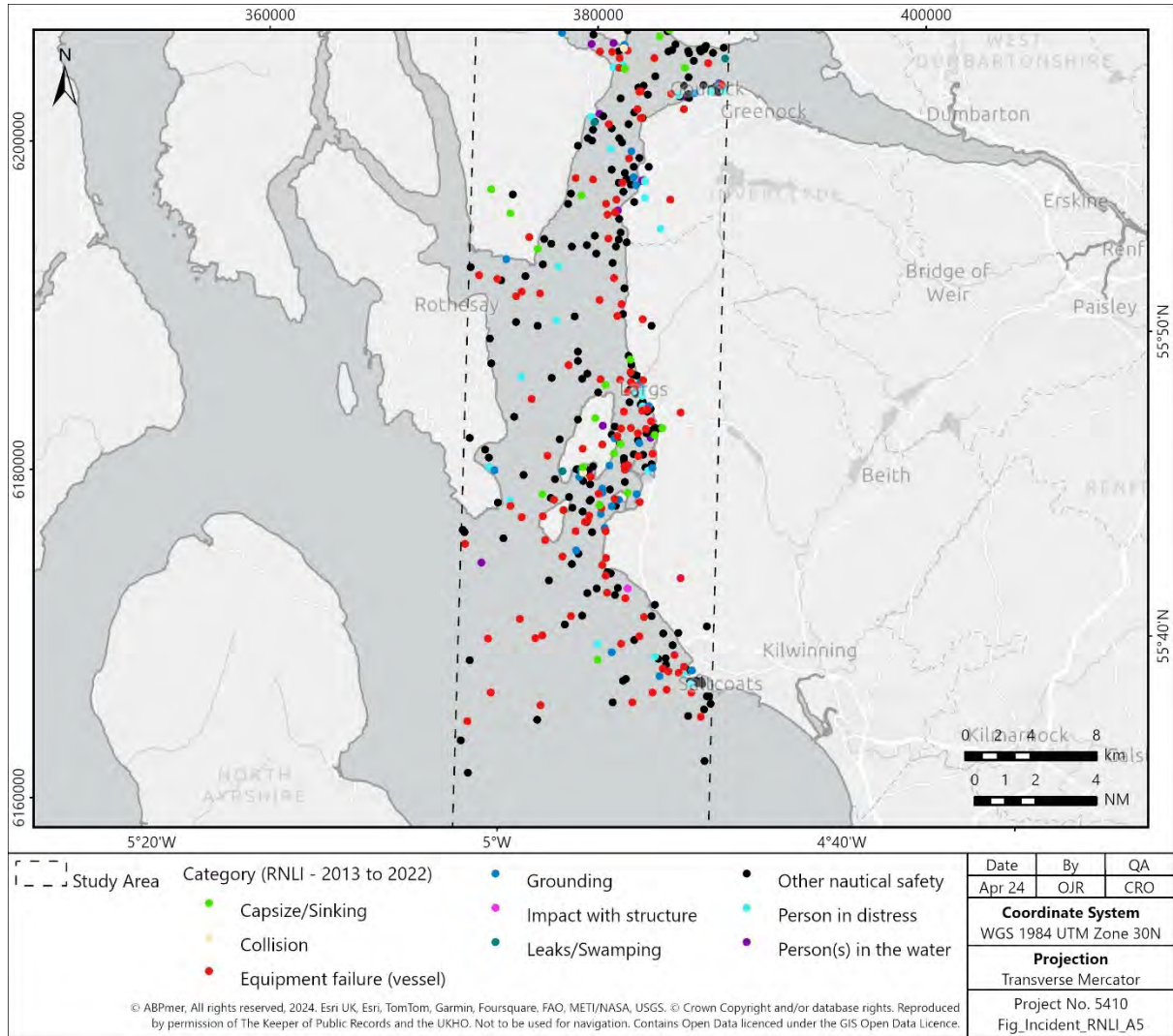


Figure 18. RNLi Accidents/ Incidents

3 Proposed Development Details

The proposed development has different design options which include the following:

- The consideration of a 250 m, 450 m, and a 450 m quay wall with an additional 150 m long quay wall either to the east or southwest of the main quay wall.
- A RO-RO facility.
- A grounding pad (not exceeding 250 m x 250 m) as a temporary fixed gravel platform for grounding two barges.
- A series of dolphins (3-5) for berthing / mooring of barges.
- A catwalk for access to the berthed barges.

Formation of new quay walls will likely involve driving tubular piles into the existing seabed which may require securing to the rock substructure using rock sockets, affixing sheet piles between the tubular piles, secured to existing quay structure and a reinforced concrete capping beam to encompass the existing quay structure. The proposal comprises of the construction of a new quay and associated quayside infrastructure to berth vessels.

The proposed development also includes the capital dredging of the quay approaches with the dredged material potentially being repurposed, to infill the existing dry dock, this is dependent on quantity and quality of dredged material.

Options for the capital dredge include:

- a) Dredged area based upon an overall width of 250 m of constructed harbour wall. Dredged area will extend northwest from the constructed harbour wall, extending out to the -12m Admiralty Chart Datum (ACD) contour. The area is approximately 90,539 square metres (m²) this is shown in Figure 19 as Option A.
- b) Dredged area based upon an overall width of 450 m of constructed harbour wall. Dredged area will extend northwest from the constructed harbour wall, extending out to the -12m ACD contour. The area is approximately 191,500 m², this is shown in Figure 20 as Option B.
- c) Dredge area based upon a 450 m quay wall with an additional 150 m Quay wall to the south west of the proposed development site. Dredged area will extend northwest from the constructed harbour wall, extending out to the -12m ACD contour. The area is approximately 247,200 m², this is shown in Figure 21 as Option C.

As part of the proposed development, the PPG intends to redevelop the existing dry dock. It is anticipated that this will involve the removal of the concrete base from the dry dock and infilling with dredge materials or materials from other sources if the dredge materials are not considered suitable. In addition, to reinforcement of the dock using tubular piles driven vertically into the existing strata. The tubular piles may require affixing to the existing rockhead utilising rock sockets, these may consist of poured concrete. To provide stability and reinforcement to the structure; sheet piles will be installed vertically between the previously installed steel piles and using anchor piles and horizontal, or inclined tie rods. The quay wall will be capped using concrete reinforced beams and tying it into the existing quay wall.

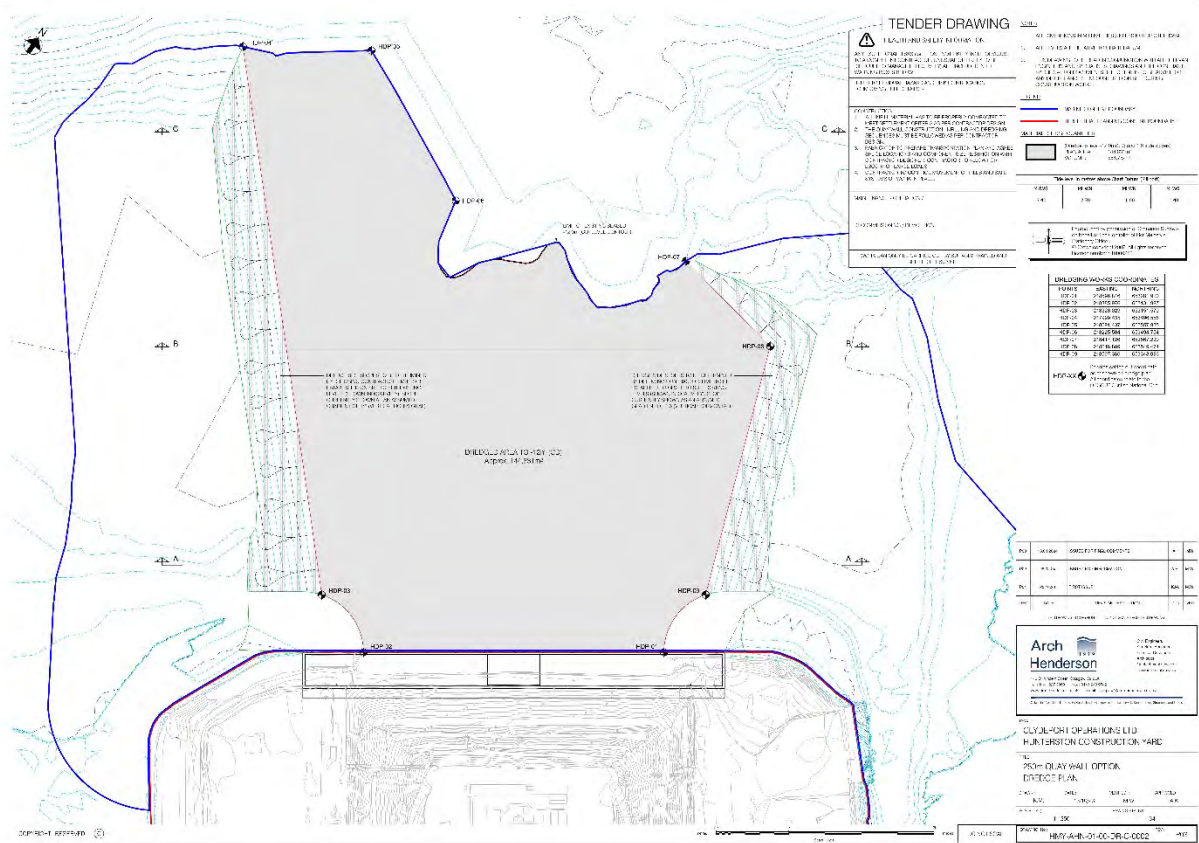


Figure 19. Option A

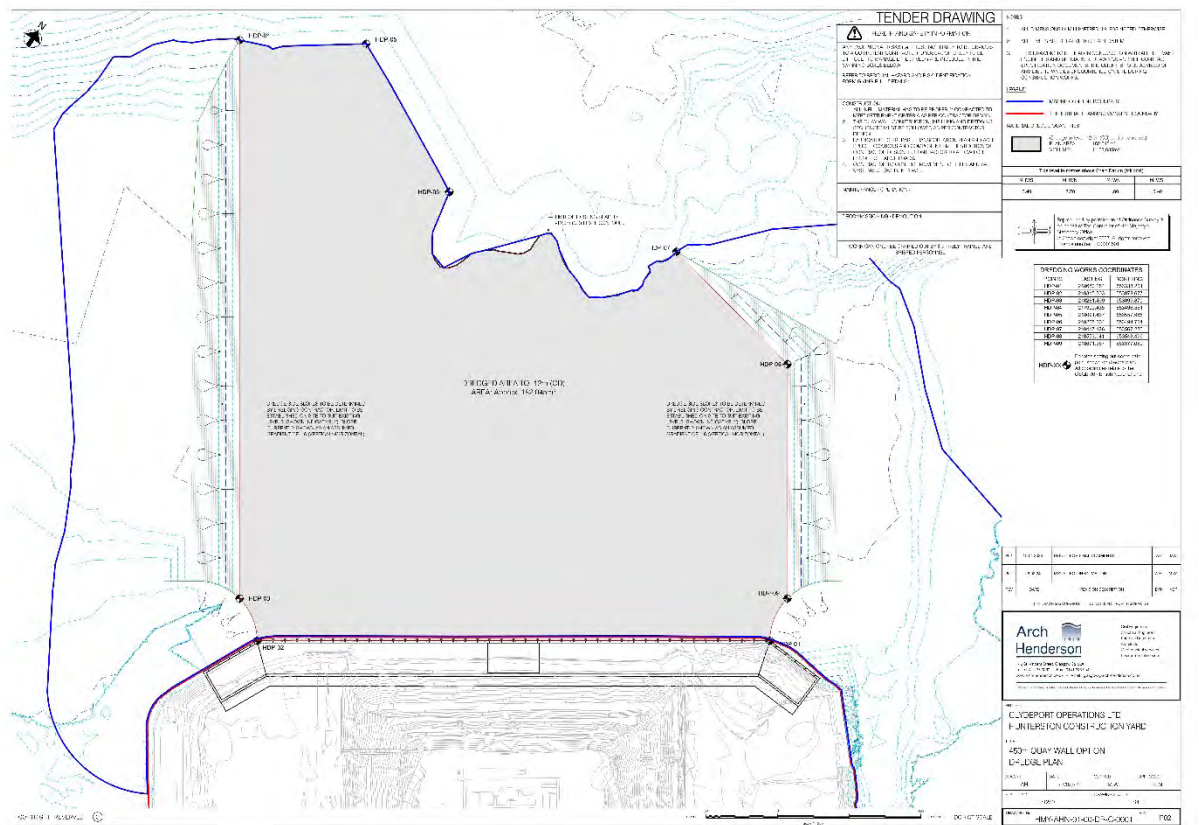


Figure 20. Option B

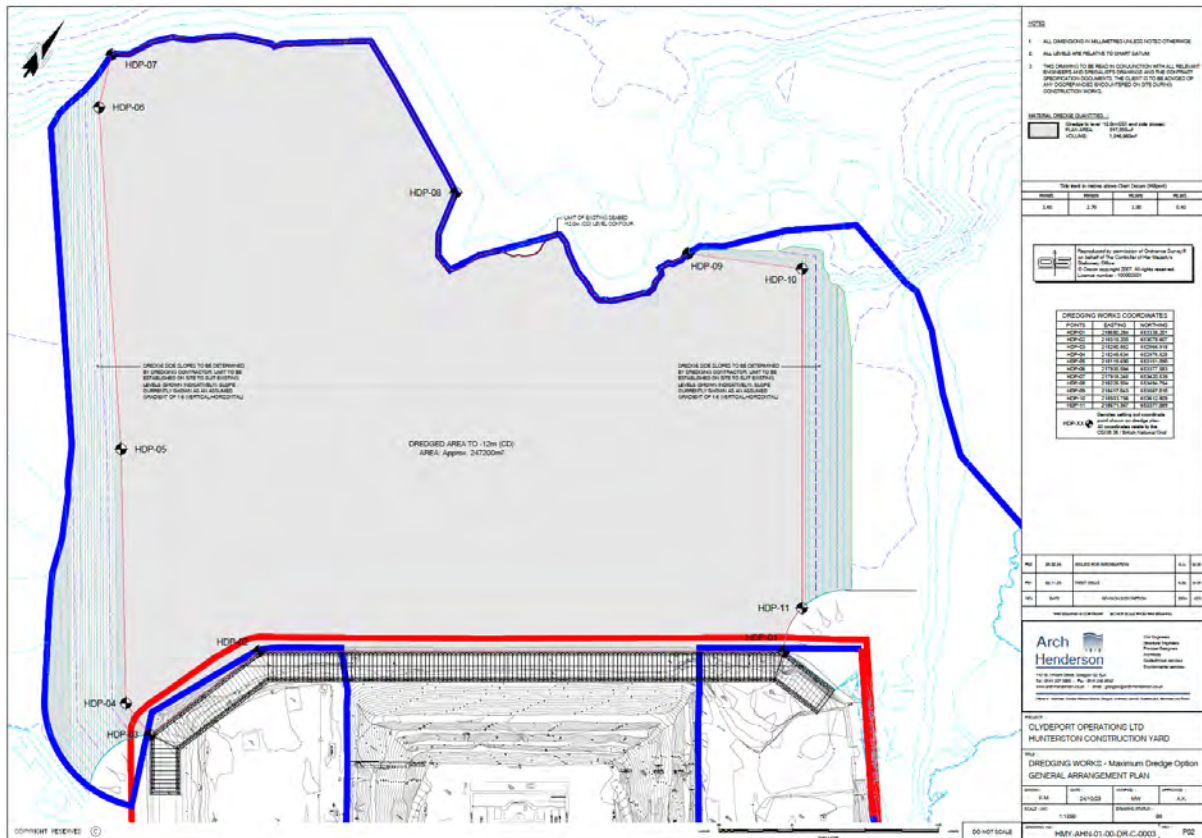


Figure 21. Option C

Approximately 1.3 million cubic metres (m³) of fill material is required for the dry dock infill (of which 1.1m³ is proposed to be made up of dredge arisings). If the dredge of the quay area does not yield sufficient quantities of material, additional dredged material could be utilised from other routine maintenance dredge activities within the River Clyde. It is anticipated that materials would be transported to site via barge. The PPG has indicated that the proposed development will take up to two years to complete with the aspects below Mean High Water Springs (MHWS) and dry dock infill estimated to take up to one year to complete.

3.1 Construction traffic

Table 7 identifies the estimated vessel moves over the construction period, it is predicted that vessels will be making between one and two movements a day and that the dredge period will likely last for 130 days working 24 hours a day.

Table 7. Construction Vessel Movements

Construction	Quantity m ³	Vessel Capacity m ³	Est. Vessel Moves
Dredge Option A	854,752	6,000	143
Dredge Option B	1,162,035	6,000	193
Dredge Option C	1,546,660	6,000	258
Dry Dock Infill – Dredge Arisings	1,100,000	4,000	275

The infill material will likely be provided by dredge programmes underway within the SHA, further research will determine whether this dredge material is appropriate for the infill of the dock. It should

be noted that Table 7 represents the higher end of potential construction phase vessel movements. The actual amount of construction vessel movements will be dependent on the suitability and volume of dredged materials used for infill.

3.2 Disposal sites

The Proposed Development identifies a number of appropriate disposal sites within the study area which could be used to dispose of dredge material these are identified in Table 8 and Figure 1.

Table 8. Active Licensed Marine Spoil Disposal Sites

ID	Name	OSGB36		Direction From Site	Approx. Distance From Site (km)
		Latitude	Longitude		
MA017	Brodick	55.61666	-4.99488	South west	15
MA019	Birch Point	55.61666	-4.99068	south west	15
MA021	Cloch Point	55.96912	-4.87871	North	26

The preferred disposal sites for the marine dredge and disposal application are Brodick and Birch Point disposal grounds. Dredging duration is estimated to take 130 days. Due to the nature of dredging operations, it will be a 24 hour, 7 day a week operation.

3.3 Proposed development site operations

For the operational phase, the expected site activities are related to the site continuing in use as an operational port facility. The initial use of the proposed development is expected to be used for offshore wind farm operations, this could include the storage and movement of wind farm components. The first campaign would likely involve the storage and movement of two to four wind turbine bases a day over a three-month period in the summer for two years. These movements would likely use Heavy Lift vessels with greater draught and beam than other vessels which regularly navigate the area at present. Any subsequent future operation which introduces new operational elements that differ from those detailed above will be subject to their own risk assessment, planning, consenting, and permitting requirements.

3.4 Future traffic baseline

The proposed development is intended to increase the operational space available to PPG and create an area appropriate to new and future trade. The proposed development would alter traffic patterns in the immediate locality to the works. Following construction, as a result of the new traffic there would likely be times where current traffic is displaced whilst vessels arrive and depart the new berth, however there is minimal anticipated change to vessel transits in general. Recreational users of the area is anticipated to alter during the construction of the proposed development and may be temporarily displaced during times of operations. Other than the dredging works which increases water depth in the vicinity of the proposed development there will be no change to the navigable environment.

The proposed development could provide for additional projects to be undertaken at the newly developed facility. Future vessel movements in the operational phase cannot be predicted past the first project as it may change depending on the client needs. It is envisaged that the initial project would allow for the shipping and storage of offshore wind farm bases. This operation would see one to two vessel movements a day over a three-month period in the summer and would be over a two-year period. This equates to a maximum of 180 additional vessel moves each year for COL.

4 Navigation Risk Assessment Approach

This NRA has been undertaken to assess the marine risks associated with the proposed HCY development. The NRA process follows the guidance from the PMSC (DfT, 2016) and the associated GtGP (DfT, 2018) as advised by the MCA and Scottish Ministers in their Scoping Opinion.

The following identifies the stages used in the NRA process:

1. **Data gathering and vessel traffic analysis:** the NRA has been informed by data gathering and vessel traffic analysis based on a minimum of 28-days, split into 14-days from a busy period and 14-days from a quiet period.
2. **Hazard identification:** identification Potential marine hazard scenarios, describing hazard descriptions and outcomes, was carried out as a workshop with stakeholders.
3. **Risk analysis:** determination of likelihood and consequence for each hazard scenario.
4. **Assessment of existing measures:** consideration of embedded controls, which either reduce the likelihood or mitigate the severity (or both) and potential future controls, which are not currently in place or not fully in place currently but could be used to further reduce or eliminate risk.
5. **Recommendations for risk controls:** final decisions in determining risk mitigation needs to be made by the appropriate organisation, which in the case of the proposed development is COL as the SHA.

4.1 Data gathering and vessel traffic analysis

To inform the NRA, marine traffic information was collected and analysed. To ensure a representative sample is obtained, a minimum of 14-days of data was obtained during a busy (summer) period and 14-days during a quiet (winter) period. Stakeholder consultation was used to assist validation and any anecdotal information on routeing and study area use by vessel traffic. The primary source of data to undertake a quantitative assessment of vessel traffic was therefore the AIS data. The analysis of up-to-date AIS data in the Navigation Baseline (Section 2) established:

- Numbers, types, and sizes of vessels presently transiting the study area;
- Non-transit uses of the areas, e.g., fishing, recreational activities, dredging; and
- Traffic densities within the study area.

Marine accident and incident records were also sourced from COL as the SHA, the MAIB, and the RNLI. Additionally, data from the RYA coastal Atlas of Recreational Boating and the IMO Fishing VMS information was used to provide more detail in respect to Recreational craft and Fishing vessels. Vessel density has been calculated from vessel transits (movements) using the total number of transits intersecting with each grid cell, calculated as a total, and then resolved to an average weekly density. Traffic and incident data has been presented in tabular and figure format in the Navigation Baseline (Section 2).

4.2 Hazard identification

Information relating to incidents that have occurred in the past provide valuable input to the hazard identification and risk assessment process as part of the Navigation Baseline (Section 2) and provided context for attendees at the HAZID and Risk Analysis workshop. Consultation conducted with these stakeholders informed the basis of the Hazard Logs which in turn and in consideration of the baseline data and scheme description, informed the NRA conclusions. Records of Stakeholders consulted as part

of the NRA and the minutes of the stakeholder meetings are attached at Appendix C and Appendix D, respectively. Subject matter experts and local port users in attendance at the HAZID and Risk Analysis workshop identified causes, embedded controls, potential future controls, and perceived risk outcomes for each of the four receptors (people, environment, assets, reputation). The workshop was facilitated by Maritime Consultants from ABPmer.

4.3 Risk analysis

The likelihood and consequence descriptors used to inform the assignment of risk outcomes to the hazard scenarios within the Hazard Log were derived from the PPG MSMS (PPG, 2022). That is, descriptors were arranged and agreed with the SHA to ensure the risk assessments are aligned with current PPG practices. Figure 22 shows the flow per hazard scenario used in the hazard identification and risk analysis process.

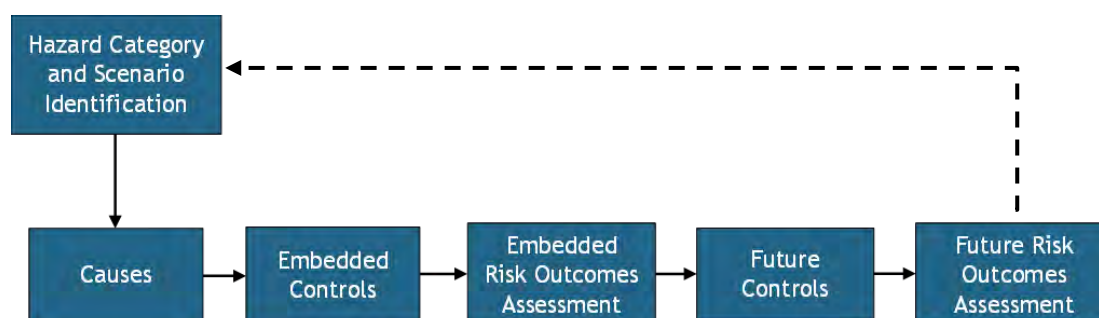


Figure 22. Hazard Identification and Risk Analysis Process

4.3.1 Consequence descriptors

The consequence descriptors, as defined by PPG in its MSMS were used to inform the assignment of consequence values to the hazard scenarios within the Hazard Log. The associated descriptions detailed below in Table 9 were used with the intention that outcomes are applied consistently.

Table 9. Consequence Descriptors

Descriptor	Score
Consequence Descriptors: People	
Near-miss, no injury, no treatment required, or; minor injury, may require first aid, but no time lost from work.	Low (1)
Non-reportable lost time injury (between 1 and 6 days lost from work), minor short term health problems.	Minor (2)
Reportable lost time injury, medical treatment by a doctor, paramedic or hospital, mid-term health problems.	Moderate (3)
Major injury (MAIB) or injury leading to disability, long term ability to work. Major long term or permanent health problems.	Major (4)
Loss of life (IMO). Fatality or multiple fatalities or total disability. Acute or developing terminal illness.	Critical/ Catastrophic (5)
Consequence Descriptors: Environment	
Small area of sheen <10msq. Small gas release. No clean up required. No action by workforce.	Low (1)

Descriptor	Score
Area of metallic appearance <50msq. Tier 2 responders called or dealt with by Tier 1 equipment on site. Terminal workforce in containment area onsite.	Minor (2)
Discontinuous true colour >50msq. Tier 2 called out. Terminal workforce in containment area offsite.	Moderate (3)
Serious pollution (IMO). Tier 2 responders called out. Local evacuation.	Major (4)
Severe pollution (IMO). Tier 3 responders called out. Large scale evacuation. Activation of National Contingency Plan.	Critical/ Catastrophic (5)
Consequence Descriptors: Infrastructure (Assets)	
Cosmetic damage. Vessel drags anchor but is under control. Vessel sustains major system failure (engines etc.)	Low (1)
Loss of timbers from fendering. Bent ladders, coping stones cracked. Bent rails. Denting to hull.	Minor (2)
Bollards broken. Restricted use of berth. Mooring line part. Tow lines part. Vessel grounds, in collision, or floods. Minor damage to hull, cargo gear or accommodation. Temporary restricted use of navigational channel(s). Vessel fails to respond to VTS instructions.	Moderate (3)
Fender system compromised & requires repair before use. Pipeline damage. Structural damage rendering ship unseaworthy (IMO). Prolonged restricted use of navigational channel(s). Break-down requires towage. V/I drags anchor over pipeline.	Major (4)
Berth closed for rebuild. Navigational channel(s) closed for ongoing restricted use. Pipeline breach. Total loss of vessel. Vessel sunk on berth.	Critical/ Catastrophic (5)
Consequence Descriptors: Reputation	
Accident closes port or part of the port for up to 1 hour. Vessel(s) delayed for a period up to 6 hours. Accident results in small item on local news. Social media interest. Improvement notice.	Low (1)
Accident closes port or part of the port for up to 3 hours. Vessel(s) delayed for a period up to 18 hours. Regional news with press statement required. Social media interest. Prohibition notice or injunction.	Minor (2)
Accident closes port or part of the port for up to 6 hours. Vessel(s) delayed for up to 36 hours. National news, journalists attend. Interviews required. Prosecution with fine or sued by third party.	Moderate (3)
Accident closes port or part of a port for up to 24 hours. National and international media attend. Management of media required. 24 hour response may be required. Personnel charged, public enquiry, compensation claims exceeding £1 million.	Major (4)
Accident closes port for more than 24 hours. World agencies require 24 hour information for a prolonged period. Management of media required. Conviction. Compensation payment exceeding £2 million.	Critical/ Catastrophic (5)

4.3.2 Likelihood descriptors

The likelihood descriptors, as defined by PPG in its MSMS were used to inform the assignment of likelihood values to the hazard scenarios within the Hazard Log. The associated descriptions detailed below in Table 10 were used with the intention that likelihood is applied consistently.

Table 10. Likelihood Descriptors

Descriptor	Years	Likelihood
This will probably never happen	1 per 50 years	Rare (1)
Do not expect it to happen/ recur but it is possible it may do so	1 per 25 years	Unlikely (2)
Might happen or recur occasionally	1 per 10 years	Possible (3)
Will probably happen/ recur but it is not a persisting issue	1 per 5 years	Likely (4)
Will undoubtedly happen/ recur, possibly frequently	>1 per year	Almost Certain (5)

4.3.3 Risk evaluation

The risk classification associated with each of the hazard scenarios is then assessed to a pre-defined scale shown in Table 11.

Table 11. Risk Classification

Classification	SAP Assessor
Green indicates that the risk score is acceptable and that the control measures can be inherently well implemented by the Senior Manager Marine Operations (SMMO) without onerous levels of intervention.	SMMO
The risk score is acceptable provided that the port is content that procedures are in place to ensure that the control measures identified are implemented with suitable checks and verifications. By the SMMO	SMMO
Amber may indicate that the risk score is ALARP but outside the boundaries of the SMMO approving so must be authorised by the Group Harbour Master (GHM).	GHM
The risk score is unacceptable and the hazard category or activity which generates the hazard should not be permitted or the control measures should be enhanced sufficiently to reduce the risk score to the requirements of the Duty Holder.	Duty Holder

All identified controls which could contribute to reducing or eliminating risk were considered, irrespective of the initial risk outcome, for example, a hazard scenario with a baseline or existing risk score of yellow or green would still be taken forward for risk reduction to satisfy the requirement of the 'as low as reasonably practicable' principle. The categories are shown in the risk matrix provided in Table 12.

This risk matrix in combination with the consequence and likelihood descriptors (Table 9 and Table 10), was used to assess outcomes for the receptors of People, Environment, Assets, and Reputation (port/ shipping). The risk outcomes were considered in context of PPG risk tolerability is set out in Table 11. Any risks in the red zone were considered as intolerable unless sufficient control measures are able to be identified so as to reduce consequence and likelihood to a position that is tolerable and ALARP.

Table 12. PPG Risk Matrix

Consequence Likelihood	1 Negligible	2 Minor	3 Moderate	4 Major	5 Catastrophic
5 - Almost Certain	5	10	15	20	25
4 - Likely	4	8	12	16	20
3 - Possible	3	6	9	12	15
2 - Unlikely	2	4	6	8	10
1 - Rare	1	2	3	4	5

4.4 Assessment of existing measures (control options)

Following the HAZID and Risk Analysis, the NRA process then considered assessment of existing and potential future control options. This step allows a broader view of controls, some of which may not have been considered at the HAZID and Risk Analysis workshop. This stage also included a review of existing hazards and their associated risk control measures. As a result, new potential future risk control measures (or changes to existing risk control measures) were identified for consideration.

4.5 Recommendations for risk controls

Recommendations for risk controls were considered against the status of the risk and whether it is both tolerable and ALARP. Where potential future controls were identified, consideration was given to the Code’s guidance on Risk Control Hierarchy (DfT, 2018) which aims to:

- Eliminate risks: by avoiding a hazardous procedure or substituting a less dangerous one.
- Combat risks: by taking protective measures to prevent risk.
- Minimise risk: by suitable systems of working. If a range of procedures is available, the relative costs need to be weighed against the degree of control provided, both in the short and long term.

5 HAZID and Risk Analysis Workshop

A HAZID and Risk Analysis workshop with the stakeholders set out as attendees in Table 13 was held on 11 April 2024. The overall aim of the workshop was to involve stakeholders and collate stakeholder views in the identification of navigational hazards potentially introduced by the proposed development and to consider views that feed into the assessment of Navigational risks. The workshop included a review of navigation baseline data and anecdotal information regarding marine use within the study area.

Table 13. Hazard Identification and Risk Analysis workshop attendees

Organisation	Attendee
ABPmer	Timothy Aldridge
ABPmer	Harry Aitchison
Bidwells	John Kent
PPG, Head of Engineering	Mark Sinnamon
COL, Head of Marine	Alex McIntosh
COL, Marine Compliance Officer	Caroline Baxter
COL, Pilot	Ross MacAulay
Fairlie Quay	Kevin Blamire
Largs Yacht Haven	Dave Hewitt
North Ayrshire Council	Kathleen Dow
North Ayrshire Council	Bruce McClure
PPG, Deputy Group Harbour Master	Nicole Read
PPG, Project Manager	Gary McCann
PPG	Matthew Hill
RYA (Scotland)	Clive Reeves
Svitzer Marine	Stephen Morgan
Svitzer Marine	Marshall Mercer
Organisation	Apologies
Clyde Marine Services	Hamish Munro
HM Coastguard	Paul Renfrew
HM Coastguard	Steve Muldoon
Coastworks	Brian Young
EDF Hunterston	Len Astell
Largs Yacht Haven	Carolyn Elder
Marine Directorate	Peter Sparrow
North Ayrshire Council	Martin Miller
Northern Lighthouse Board	Gillian Burns
Paddle Scotland	Unidentified Representative
PPG, Group Harbour Master	Gary Doyle
RYA (Scotland)	Graham Russell

Following discussion of the identified hazards, their causes and embedded controls, potential future control measures were then discussed with a view to reducing any risks associated with the proposed HCY development to tolerable levels aligned with the PPG Risk matrix as set out at Table 11 and an ALARP state.

6 Hazard Scenarios

6.1 Introduction

Prior to the HAZID and Risk Analysis Workshop a series of potential hazard scenarios were distributed for discussion. Stakeholders had the option to review the identified hazard scenarios and propose further hazard scenarios during this time. The following section identifies the hazard scenarios identified from the HAZID process that are additional and separate to the ordinary operation of the port.

6.2 Hazard categories

Six hazard categories were identified as detailed in Table 14 along with descriptions relating to them. These hazard categories were made available in the HAZID and Risk Analysis Workshop attendees.

Table 14. Hazard Categories

Hazard Category	Descriptors
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.
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.
Contact/ Allision	Contact is defined as a vessel striking, or being struck, by an external object that is not another vessel or the sea bottom. Sometimes referred to as Impact. Allision is defined as a violent 'contact' between a vessel and a fixed structure.
Fire/ Explosion	Fire is defined as the uncontrolled process of combustion characterised by heat or smoke or flame or any combination of these. An explosion is defined as an uncontrolled release of energy which causes a pressure discontinuity or blast wave.
Grounding/ Stranding	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 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).
Mooring Failure	The movement of a vessel relative to its berth, due to disturbance cause by environmental conditions and/or a passing vessel, or inadequate moorings.
Payload Related Accident	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.

6.3 Hazard scenarios

The hazard scenarios identified below in Table 15 and Table 16 have each been considered according to their 'Most Likely' and 'Worst Credible' outcomes. This provides the option to consider very serious outcomes which could credibly occur (i.e., worst credible), together with outcomes that are potentially less serious but could occur on a more frequent basis (i.e., most likely) to consider a hazard category more completely. Complete detail, descriptions, and evaluations for each hazard scenario are presented as a Hazard Log, in table format, in Appendices A, and B for construction and operation, respectively.

Table 15. Construction Hazards

ID	Category	Construction Hazard Scenarios
C1	Collision	Commercial vessel with capital dredge plant
C2	Collision	Recreational vessel with capital dredge plant
C3	Collision	Barge/ suction hopper dredger with another vessel during movements to/ from disposal site
C4	Collision	Displaced traffic (Recreational)
C5	Collision	Commercial vessel delivering infrastructure/development components with another commercial vessel.
C6	Contact/ Allision	Work craft with proposed development
C7	Contact/ Allision	Commercial vessel with jack up barge (JUB)
C8	Contact/ Allision	Recreational vessel with jack up barge (JUB)
C9	Grounding/ Stranding	Work craft manoeuvring for construction activities
C10	Grounding/ Stranding	Displaced traffic (Recreational)
C11	Fire/ Explosion	Fire breaks out on work craft
C12	Accidents to Personnel	Person in the water/ Man overboard
C13	Accidents to Personnel	Diving incident (e.g., cathodic protection installation/ pile inspection)
C14	Mooring Failure	Jack up barge (JUB) spud leg failure
C15	Mooring Failure	Barge breaks out of mooring

Table 16. Operation Hazards

ID	Hazard Category	Operation Hazard Scenarios
O1	Collision	Commercial vessel with maintenance dredger
O2	Collision	Commercial component delivery to/from development (wind)
O3	Collision	Recreational vessel with maintenance dredger
O4	Contact/ Allision	Commercial vessel with development
O5	Contact/ Allision	Recreational vessel with development
O6	Grounding/ Stranding	Commercial vessel in Hunterston Channel
O7	Payload Related Accident	Loading/ unloading of component (wind)
O8	Accidents to Personnel	Person in the water/ Man overboard
O9	Mooring Failure	Mooring break out

7 Hazard Log Assessment

7.1 Introduction

This section provides summarised information from the navigational risk assessments. In total, there are 15 construction Hazard Scenarios and 9 operation Hazard Scenarios. Each Hazard Scenario is detailed in the Hazard Logs, provided in Appendices A and B. The Hazard scenarios from the HAZID and Risk Analysis Workshop were thoroughly discussed by the stakeholders and have then been subject to further review by study team. From this process, causes, embedded controls, and future controls along with risk outcome is summarised and presented in the following sections.

7.2 Causes

The possible causes leading to each of the identified hazard scenarios have been considered as part of the risk assessment process. Table 17 and

Table 18 present a compiled list of causes. These causes, and the hazards to which they apply can be found in the risk assessments contained within the Hazard Logs provided at Appendices A and B.

Table 17. Hazard Scenario Causes - Construction

Causes	Count (max 15)
Adverse weather	14
Human error	14
Machinery failure	12
Mooring failure (equipment or plan)	12
Failure to follow passage plan	10
Lack of situational awareness	10
Communication failure	9
Restricted/ poor visibility	9
Failure to follow Byelaws, Directions, Notice to Mariners	8
Failure of AtoN	7
Inadequate/ failure of towage	7
Failure to follow COLREGS	5
Inadequate procedures	4
Interaction	4
Contact/ Allision/ Collision	3
Drugs and alcohol	3
Excessive vessel speed	3
Infrastructure failure	3
Lack of competence	3
Malicious action	3
Vessel overhang	3
Climate change (extreme weather)	2
Hydrographic survey not conducted/ inaccurate	2
Inaccurate draught	2
Inadequate crewing	2

Causes	Count (max 15)
Lack of local knowledge	2
Language barrier	2
Restricted viability	2
Traffic density	2
Unexpected shoaling	2
Access / egress	1
Battery failure	1
Build-up of gasses	1
Combustible material	1
Cooking	1
Displaced traffic	1
Electrical faults	1
Failure to comply with safe systems of work	1
Flag 'A' not flying/ observed	1
High traffic density	1
Hydraulic failure	1
Inadequate training	1
Incorrect storage of dangerous goods	1
Incorrect weather forecast	1
Inexperienced/ untrained personnel	1
Leaks – oils/ chemicals/ spills	1
Medical incident	1
Personnel transfer	1
Poor plant maintenance	1
Slips, trip, and falls	1
Unexpected seabed composition	1
Vessel 'notice to move'	1

Table 18. Hazard Scenario Causes - Operation

Causes	Count (max 9)
Adverse weather	9
Human error	9
Machinery failure	7
Failure of mooring equipment (bollards etc)	6
Failure to follow passage plan	6
Lack of situational awareness	6
Restricted/ poor visibility	6
Communication failure	5
Failure to follow Byelaws, Directions, Notice to Mariners	5
Inadequate/ failure of towage	5
Failure of AtoN	4
Failure to follow COLREGS	3
Interaction	3
Drugs and alcohol	2
Excessive vessel speed	2

Causes	Count (max 9)
Inadequate crewing	2
Inadequate procedures	2
Infrastructure failure	2
Lack of competence	2
Language barrier	2
Malicious action	2
Access / egress	1
Climate change (extreme weather)	1
Contact/ Allision/ Collision	1
Failure of cold storage procedures	1
Failure to follow loading plans	1
Failure to follow mooring plan	1
Hydrographic survey not conducted/ inaccurate	1
Inaccurate draught	1
Inadequate training	1
Inappropriate vessel	1
Incorrect weather forecast	1
Inexperienced personnel	1
Lack of local knowledge	1
Lifting and securing equipment failure	1
Medical incident	1
Personnel transfer	1
Poor quayside design	1
Slips, trip, and falls	1
Traffic density	1
Unexpected shoaling	1
Vessel movement alongside	1

In consideration of the most frequent of these causes across the individual hazards:

Adverse weather: this includes storm conditions, high winds and heavy precipitation which can impair vessel stability and navigation, increasing the likelihood of accidents.

Human Error: may be a judgment or a mistake in a repetitive task, which can apply to PPG contracted vessel crew, PPG owned craft, third party vessel crew, and port operatives.

Failure of mooring equipment (bollards etc): this cause describes a failure, partial or complete, of the mooring system associated with barges or vessels. This can range from one or many broken mooring lines or the failure of a bollard or other key mooring fixture.

Restricted/ poor visibility: in accordance with the 'Convention on the International Regulations for Preventing Collisions at Sea' (COLREGs), restricted visibility means any condition in which visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms, or any other similar causes.

Machinery failure: machinery failure was noted to be a highly recurring causal factor, for example, malfunctioning propulsion systems, navigation instruments, or onboard machinery.

Failure to follow passage plan: a passage plan helps to guide ships into a harbour and/or operate within its waters safely. Failure to adhere to the advice within this document can result in vessels intentions and movements not being well understood.

Communication failure: failure of equipment or poor communication among crew members, port authorities, or other stakeholders.

Inadequate/ failure of towage: this cause describes a situation whereby the towage provided is not sufficient for the situation. This can be due to a wide range of root-causes such as deteriorating weather conditions, size of incoming vessel, or mechanical failure of a tug.

Failure to follow Byelaws, Directions, Notice to Mariners: relevant legislation, policies, and notices help maintain safe navigation within the SHA area.

Failure of Aid to Navigation: Aids to Navigation are a key risk mitigation assisting vessels in their arrivals/departures from a harbour.

Lack of situational awareness: a reduction in situational awareness can apply to subject vessel crew, third party vessel crew, and port operatives.

7.3 Embedded controls

During the risk analysis, each hazard scenario was considered in the context of the embedded risk controls in place at COL relating to each hazard scenario. Embedded risk controls relate to processes, practices and available safety resources that are in existence with the aim to mitigate the consequence or likelihood of an incident occurring during marine operations. Table 19 and Table 20 present the embedded risk controls for the construction and operation phases, with an occurrence count for each.

Table 19. Embedded Controls – Construction

Embedded Control	Count (max 15)
Local Port Services	13
Weather limits	11
Pilotage service	8
Towage	8
Passage planning	7
AIS	6
Mooring guidelines	6
Defect reporting	5
Emergency procedures	5
Hydrographic survey	5
Port working channel	5
PPG publications	5
Secondary communication	5
Planned maintenance	4
Berth allocation	3
Berthing procedure	3
Leisure event calendar	3
AtoN	2

Embedded Control	Count (max 15)
AtoN defect reporting	2
Echo sounder	2
Fenders	2
Management of fairway/ channel	2
Notice to Mariners	2
PPG SOPs	2
Clean/ clear working area	1
Clyde Leisure Navigation Guide	1
Coded vessel	1
COL quayside audit	1
COLREGs	1
Communication equipment and standards	1
Contactors safety audits	1
Diving at Work Regulations 1997 compliance	1
Emergency services equipment	1
Fatigue management	1
Fire detection/ suppression systems	1
Firefighting equipment	1
Flag Alpha displayed during operations	1
Guidance for small craft	1
Hunterston emergency site procedures	1
Hunterston site inductions	1
International Maritime Dangerous Goods (IMDG) code	1
Master pilot exchange	1
Port emergency plan	1
Personal Protective Equipment (PPE)	1
PPG drug and alcohol policies	1
PPG quayside safety	1
Safe haven for Jack up barge	1
Safe Systems Of Work (H&S)	1
Seabed sampling	1
Training	1
Vessel fire drills	1
Vessel's own safety procedures	1
Visual check of draught	1
Weather monitoring	1

Table 20. Embedded Controls - Operation

Embedded Control	Count (max 9)
Local Port Services	8
Weather limits	6
Pilotage service	5
Towage	5
Emergency procedures	4
Aids to Navigation (AtoN)	3
Defect reporting	3
Planned maintenance	3
Port working channel	3
Secondary communication	3
Fenders	2
Mooring guidelines	2
Notice to Mariners	2
PPG mooring guidelines	2
PPG publications	2
Portable Pilotage Units (PPUs)	2
Qualified personnel	2
AtoN defect reporting	1
Berth allocation	1
Berthing procedures	1
Clean/ clear working area	1
Drug and alcohol policy	1
Echo sounder	1
Hydrographic survey	1
Loading guidelines	1
Management of fairway/ channel	1
On-call engineers	1
Passage planning	1
PPE	1
PPG golden rules	1
PPG quayside audit	1
PPG quayside safety	1
Quayside lighting	1
Safety lines	1
Site inductions	1
Toolbox talk	1
Training	1
Vessel stability calculation	1
Visual check of draught	1
Weather monitoring	1

The most frequent controls are expanded on below:

Local Port Services: provision of LPS is designed to improve port safety and co-ordination of port services within the port community by dissemination of port information to vessels, berth, and terminal operators.

Weather limits: limits or provisions based on weather conditions help to ensure that operations are conducted in consideration of the prevailing conditions.

Adequate training: training standards help to establish that relevant personnel possess the necessary skills, knowledge, and competency to perform their duties safely and effectively. These standards are a requirement of an MSMS and for commercial vessels using the 'International Convention on Standards of Training, Certification and Watchkeeping for Seafarers' (STCW).

Drug and alcohol policies: drug and alcohol policies help prevent and deter situations where personnel could be operating above policy determined levels of intoxicating substances.

Emergency procedures: emergency procedures include the provision of Port Emergency Plans, contingencies in Construction Marine Management Plans and vessels own emergency procedures. In place for people to follow if an incident occurs. By identifying actions that will help to rectify a situation, personnel are better able to respond and reduce the severity/consequence of an emergency.

Fatigue management: a documented procedure intended to ensure that personnel are adequately rested. Applicable to vessels, and port personnel as defined by the applicable legislation.

Mooring guidelines: mooring guidelines are a set of procedures and standards designed to enhance the safety and efficiency of mooring operations in maritime navigation. They encompass the selection, inspection, and maintenance of mooring equipment.

Pilotage: pilotage is a high value risk mitigation for which the circumstances of its application are determined by the CHA based on risk assessment.

Planned maintenance: a systematic approach to the upkeep of equipment and systems applicable to vessels and port infrastructure.

7.4 Risk assessment: Embedded risk outcomes

Table 20 shows the risk outcomes for the hazard scenarios at the embedded stage. The risks are ranked in accordance with the Code (DfT, 2016) and PPG's Standard System Procedures, SSP 012. This ranking is based on 'risk score' which is calculated by averaging the likelihood and highest consequence of each scenario (worst credible and most likely) for an identified hazard.

Table 21. Construction Hazard Scenarios Ranked by Embedded Risk Outcomes

Construction				Embedded Risk Outcomes				Score
Risk ID.	Hazard Category	Hazard Scenario		People	Environment	Asset	Reputation	
C2	Collision	Recreational vessel with capital dredge plant	WC	15	6	15	12	13.5
			ML	12	4	4	4	
C12	Accidents to Personnel	Person in the water/ Man overboard	WC	15	3	3	12	13.5
			ML	12	4	4	4	
C9	Grounding/ Stranding	Work craft manoeuvring for construction activities	WC	12	9	12	12	12
			ML	4	4	12	8	
C14	Mooring Failure	Jack up barge spud leg failure	WC	5	2	5	4	10.5
			ML	4	8	16	1	
C15	Mooring Failure	Barge breaks out of mooring	WC	8	4	6	8	10
			ML	4	4	12	12	
C13	Accidents to Personnel	Diving incident (e.g., cathodic protection installation/ pile inspection)	WC	10	2	2	8	9.5
			ML	9	3	3	3	
C3	Collision	Barge/ suction hopper dredger with another vessel during movements to/ from disposal site	WC	10	10	10	10	9.5
			ML	9	3	6	3	
C4	Collision	Displaced traffic (Recreational)	WC	10	4	10	10	9.5
			ML	9	3	6	6	
C8	Contact/ Allision	Recreational vessel with jack up barge	WC	10	4	10	10	9.5
			ML	9	3	6	6	
C10	Grounding/ Stranding	Displaced traffic (Recreational)	WC	8	4	10	8	9
			ML	8	4	8	8	
C1	Collision	Commercial vessel with capital dredge plant	WC	10	8	10	10	9
			ML	8	4	8	4	
C7	Contact/ Allision	Commercial vessel with jack up barge	WC	5	4	5	5	7
			ML	9	3	6	6	
C11	Fire/ Explosion	Fire breaks out on work craft	WC	5	5	5	5	5.5
			ML	3	3	6	3	
C5	Collision	Commercial vessel delivery of infrastructure/development components with another commercial vessel	WC	5	3	5	5	5.5
			ML	6	1	4	4	
C6	Contact/ Allision	Work craft with proposed development	WC	5	4	5	5	3.5
			ML	1	1	2	1	

WC: Worst Credible
ML: Most Likely

Table 22. Operation Hazard Scenarios Ranked by Embedded Risk Outcomes

Operation				Embedded Risk Outcomes				Score
Risk ID.	Hazard Category	Hazard Scenario		People	Environment	Asset	Reputation	
O3	Collision	Recreational vessel with maintenance dredger	WC	15	6	15	12	13.5
			ML	12	4	4	4	
O8	Accidents to Personnel	Person in the water/ Man overboard	WC	15	5	5	12	13.5
			ML	12	4	4	4	
O7	Payload Related Accident	Loading/ unloading of component (wind)	WC	10	4	10	8	9.5
			ML	3	3	9	6	
O6	Grounding/ Stranding	Commercial vessel in Hunterston Channel	WC	8	6	8	8	8.5
			ML	6	6	6	9	
O9	Mooring Failure	Mooring break out	WC	5	5	5	5	8.5
			ML	4	4	12	12	
O1	Collision	Commercial vessel with maintenance dredger	WC	10	6	10	8	8
			ML	6	3	6	3	
O4	Contact/ Allision	Commercial vessel with development	WC	5	4	5	5	7.5
			ML	5	5	10	5	
O5	Contact/ Allision	Recreational vessel with development	WC	5	2	5	4	5.5
			ML	6	3	6	6	
O2	Collision	Commercial component delivery to/from development (wind)	WC	5	3	5	4	5.5
			ML	2	2	6	6	
WC: Worst Credible								
ML: Most Likely								

7.5 Future controls

Table 23 and Table 24 set out the identified future controls for construction and operation of the proposed HCY development respectively along with an occurrence count to aid understanding of the controls with the widest application. The count associated with each future control should not be interpreted as a measure of an individual control's significance in reducing risk.

Table 23. Future Risk Controls – Construction

Future Risk Control	Count (max 15)
Project Liaison Officer and Marine Management Plan	14
Contractor Risk Assessment Method Statement (RAMS)	13
Vessel Traffic Management review	11
AtoN review	5
Education	5
Clyde Leisure Navigation Guide	4
Leisure vessel recommended routes	4
Safety boat	3
Adherence to CDM	2
Review COL towage guidelines and pilotage directions	2
Notice to Mariners	1

Table 24. Future Risk Controls - Operation

Future Risk Control	Count (max 9)
Vessel Traffic Management review	6
Clyde Leisure Navigation Guide	2
Education	2
Flow monitoring	2
Notice to Mariners	2
Prior notice of dredge campaign	2
Simulation	2
Review COL towage guidelines and pilotage directions	2
Emergency (controlled) vessel departure	1
Port emergency plan	1
PPG quayside audits and inspections	1
Review mooring and berthing guidelines	1
Safety area	1
Storm moorings	1

The most frequent future controls are expanded on below:

Contractor Risk Assessment Method Statements (RAMS): Although discussed as a potential future control at the HAZID and Risk Assessment Workshop, this control may also be considered as embedded as it is a requirement of 'Construction, Design and Management (CDM) Regulations. The future component of this control is that the specific RAMS are not yet in place for construction/dredging activity for the proposed HCY development but will be developed at the appropriate time and subject to review and approval by COL as the SHA.

Project Liaison Officer (Marine Management Plan): the appointment of an authority officer to act as liaison with the construction contractors, responsible for the development and adherence to a marine Management Plan. The premise of the plan is that it outlines the procedures in place for each organisation and how those procedures interface and deconflict. The intended outcome is shared understanding. Typically, the plan will include procedures for communications, agreed parameters for specific operations and contingencies to respond to reasonably foreseeable situations.

Vessel Traffic Management Review: PPG to review provision of VTM, specifically LPS resource delivered by GPCC, to monitor marine construction/dredge craft and vessel movements during the operational phase.

Safety boat: the provision of a boat to be on station during specified operations to undertake functions appropriate to the circumstances and to provide an element of response for specific operations, as necessary. This boat is to be crewed by trained personnel with exercises and drills for recovery of persons from the water.

Education: engagement with recreational users through local clubs, to aid understanding of users who navigate in the area with respect to awareness of the risks and how best avoided.

Clyde Leisure Navigation Guide: review and update of the PPG leisure guidance

Aids to Navigation Review: review aids to navigation in consideration of adjustments or additional buoyage to mark specific construction hazards or safe routes.

Review towage guidelines and pilotage directions: alignment of these services with any additional or changed risks introduced as a result of the proposed development and operation.

7.6 Risk assessment: Future risk outcomes

Table 25 sets out the future risk outcome for the hazard scenarios assuming the implementation of the future control options identified in this NRA. The future risk outcomes consider the potential likelihood reduction and consequence reduction (as mitigation) from each future risk control considered. In some instances, the risk ratings remain the same after the future controls are applied. This is because although the controls proposed are beneficial to the degree of risk, the control has not created sufficient change to move the risk outcome to the next category (e.g., 1/25 years to 1/50 years).

Table 25. Construction Hazard Scenarios Ranked by Future Risk Outcomes

Construction			Future Risk Outcomes				Score	
Risk ID.	Hazard Category	Hazard Scenario	People	Environment	Asset	Reputation		
C12	Accidents to Personnel	Person in the water/ Man overboard	WC	8	2	2	4	10
			ML	12	3	3	3	
C2	Collision	Recreational vessel with capital dredge plant	WC	10	4	10	8	9.5
			ML	9	3	3	3	
C9	Grounding/ Stranding	Work craft manoeuvring for construction activities	WC	8	6	8	8	8.5
			ML	4	4	9	8	
C14	Mooring Failure	Jack up barge spud leg failure	WC	5	2	5	4	8.5
			ML	4	8	12	4	
C15	Mooring Failure	Barge breaks out of mooring	WC	4	2	3	4	6.5
			ML	3	3	9	9	
C13	Accidents to Personnel	Diving incident (e.g., cathodic protection installation/ pile inspection)	WC	5	1	1	4	5.5
			ML	6	2	2	2	
C11	Fire/ Explosion	Fire breaks out on work craft	WC	5	5	5	5	5.5
			ML	3	3	6	3	
C4	Collision	Displaced traffic (Recreational)	WC	5	2	5	5	5.5
			ML	6	2	4	4	
C8	Contact/ Allision	Recreational vessel with jack up barge	WC	5	2	5	5	5.5
			ML	6	2	4	4	
C10	Grounding/ Stranding	Displaced traffic (Recreational)	WC	4	2	5	3	5.5
			ML	6	3	6	6	
C1	Collision	Commercial vessel with capital dredge plant	WC	5	4	5	5	5.5
			ML	6	3	6	3	
C7	Contact/ Allision	Commercial vessel with jack up barge	WC	3	4	3	4	5
			ML	6	3	4	4	
C6	Contact/ Allision	Work craft with proposed development	WC	3	4	3	4	5
			ML	3	3	6	3	
C3	Collision	Barge/ suction hopper dredger with another vessel during movements to/ from disposal site	WC	5	5	5	5	4.5
			ML	4	2	4	2	
C5	Collision	Delivery of infrastructure/development components	WC	5	3	5	5	4
			ML	3	1	2	2	

WC: Worst Credible
ML: Most Likely

Table 26. Operation Hazard Scenarios Ranked by Future Risk Outcomes

Operation				Future Risk Outcomes				Score
Risk ID.	Hazard Category	Hazard Scenario		People	Environment	Asset	Reputation	
O3	Collision	Recreational vessel with maintenance dredger	WC	10	4	10	8	9.5
			ML	9	3	3	3	
O7	Payload Related Accident	Loading/ unloading of component (wind)	WC	10	4	10	8	9.5
			ML	3	3	9	6	
O8	Accidents to Personnel	Person in the water/ Man overboard	WC	8	2	2	4	8.5
			ML	9	3	3	3	
O4	Contact/ Allision	Commercial vessel with development	WC	3	4	3	4	7
			ML	5	5	10	5	
O9	Mooring Failure	Mooring break out	WC	4	4	3	4	6.5
			ML	3	3	9	9	
O6	Grounding/ Stranding	Commercial vessel in Hunterston Channel	WC	4	3	4	4	5
			ML	4	2	4	6	
O2	Collision	Commercial component delivery to/ from development (wind)	WC	4	3	4	3	5
			ML	2	2	6	6	
O1	Collision	Commercial vessel with maintenance dredger	WC	5	3	5	4	4.5
			ML	4	2	4	2	
O5	Contact/ Allision	Recreational vessel with development	WC	4	2	5	3	4.5
			ML	4	2	4	2	
WC: Worst Credible								
ML: Most Likely								

8 Recommendations for Risk Controls

In considering the embedded risk outcomes in Table 21 and Table 22 against the future risk outcomes in Table 25 and Table 26, COL as the SHA can benefit from the total level of risk reduction if all 20 of the future controls are applied. The outcome from Table 25 and Table 26 identify that for the 15 Construction and 9 Operational Hazard Scenarios, all were tolerable and ALARP with the addition of risk controls, one of these required risk determination.

8.1 Risk determination

Following PPG's SSP 012 risk determination matrix (as shown in Table 11) the hazard scenarios requiring determination by the Group Harbour Master (GHM) totals once assessment, namely 'Accident to Personnel – Person in the water / Man Overboard'. This hazard scenario and its associated causes, embedded controls and potential future controls are detailed in the following section.

8.1.1 C12 – Accidents to personnel Person in the water/ Man overboard

This hazard considered the potential for a worker associated with the construction phase of the proposed development falling into the water. The worst credible scenario considered a worker incurring an impact which knocks them unconscious causing them to then fall into the water and the most likely scenario considered a worker misplacing their footing whilst engaged in the construction phase and subsequently falling into the water.

The causes considered in the potential for this risk were identified to be:

- Interaction;
- Adverse weather;
- Access/ egress;
- Inexperienced/ untrained personnel;
- Human error;
- Medical incident;
- Language barrier;
- Drugs and alcohol;
- Contact/ Allision/ Collision;
- Mooring failure (equipment or plan);
- Slips, trip, and falls; and
- Personnel transfer.

Embedded controls were identified to be:

- PPE (Life jackets, PLB);
- PPG quayside Safety (Adherence to ACOP Safety in Docks which includes lifebuoys, escape ladders, lighting, and defined walkways);
- Training (MOB exercises);
- Clean/ clear working area;
- Hunterston site induction;
- Hunterston emergency site procedures;
- PPG drug and alcohol policies, drug, and alcohol testing; and
- Weather limits.

In considering the causes identified and the mitigation potential of the embedded controls, the stakeholders and subject matter experts at the HAZID workshop considered that the worst credible scenario could occur every 10 years and result in a single fatality, no environment or infrastructure damage and national reputational damage. Whereas the most likely scenario could occur every year and result in moderate injury requiring medical treatment, no environmental or asset damage with no reputational damage.

This risk assessment resulted in the risk having an embedded risk outcome score of 13.5. A risk score between 10 and 16 falls within the 'Amber' section of PPG's risk framework and requires assessment by the Group Harbour Master for approval of the activity associated. In consideration of future controls including the views of the stakeholders and subject matter experts at the HAZID workshop, the following have been considered:

- Contractor Risk Assessment Method Statement (RAMS);
- Adherence to CDM Regulations;
- Project Liaison Officer and Marine Management Plan; and
- Safety boat (vessel capable of conducting a recovery from water, deployed in line with operational mitigation identified in contractor RAMS and MMP).

These future controls are considered to reduce the likelihood of this hazard from occurring and the potential consequence of the risk if it were to occur. As a result, it is considered that the likelihood for worst credible scenario to occur is reduced from once in every 10 years to once in every 25 years and that the risk of fatality could be reduced to a serious injury which in turn reduces the reputation damage from nationally significant to local. It is also anticipated that the controls are unlikely to mitigate the most likely scenario any further. This risk assessment resulted in the risk having a future risk outcome score of 10.0, assuming that all controls are implemented. Therefore, it is recommended that the GHM considers the application of the future controls prior to commencing the construction phase.

8.2 Additional future controls considerations

The risks resulting from the remaining 23 Hazard scenarios considered as part of this NRA have been assessed to fall within the 'Yellow' segment of the MSMS risk assessment procedure in place across PPG. Risks in this category are considered to be both tolerable and ALARP provided that the COL as the SHA is content that procedures are in place to ensure that the control measures identified are implemented with suitable checks and verifications.

9 References

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

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Peel Ports Group (PPG), 2020. Clydeport Towage Guidelines, Version 1: May 2020.

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Peel Ports Group PPG, 2024a. Port Marine Safety Code, Marine Safety Management system, Volume 1 – Policy. January 2024

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Yacht Havens Group. (2024) Largs Yacht Haven. Available at: <https://www.yachthavens.com/largs-yacht-haven> (Accessed: [01/02/2024])

10 Abbreviations/Acronyms

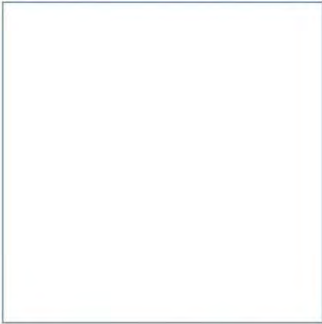
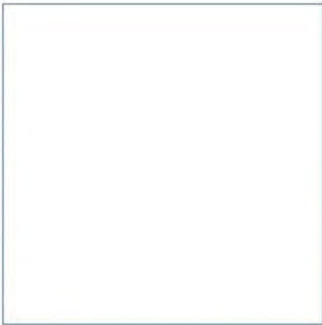
ACD	Admiralty Chart Datum
ACOP	Approved Code of Practice
AHCL	Ardrossan Harbour Company Limited
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AtoN	Aids to Navigation
CCTV	Closed-Circuit Television
CDM	Construction, Design and Management
CFL	CalMac Ferries Limited
CHA	Competent Harbour Authority
CMAL	Caledonian Maritime Assets Limited
CMS	Clyde Marine Services
COL	Clydeport Operations Limited
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea, 1972
DfT	Department for Transport
EDF	Électricité de France
FSA	Formal Safety Assessment
GHM	Group Harbour Master
GLA	General Lighthouse Authority
GPCC	Group Port Control Centre
GT	Gross Tonnage
GtGP	Guide to Good Practice
H&S	Health & Safety
HAZID	Hazard Identification
HCY	Hunterston Construction Yard
HM	His Majesty's
ID	Identity
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organization
JUB	Jack Up Barge
KHM	King's Harbour Master
LLA	Local Lighthouse Authority
LOA	Length Overall
LPS	Local Port Service
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MHWS	Mean High Water Spring Tides
ML	Most Likely
MMP	Materials Management Plan
MOB	Man Overboard
MoD	Ministry of Defence
MSMS	Marine Safety Management System
NLB	Northern Lighthouse Board
NRA	Navigation Risk Assessment
PARC	Port and Resource Campus
PEAR	People, Assets, Environment and Reputation
PEC	Pilotage Exemption Certification
PLB	Personal Locator Beacon

PMSC	Port Marine Safety Code
PPE	Personal Protective Equipment
PPG	Peel Ports Group Limited
PPUs	Portable Pilotage Units
RAMS	Risk Assessment Method Statement
RNLI	Royal National Lifeboat Institution
RO-RO	Roll On-Roll Off
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yacht Association
SAP	Standard Assessment Procedure
SEPA	Scottish Environment Protection Agency
SHA	Statutory Harbour Authority
SMMO	Senior Manager Marine Operations
SOP	Standard Operating Procedure
SSP	Standard System Procedure
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
TSHD	Trailing Suction HOPPER dredger
UK	United Kingdom
VHF	Very High Frequency
VMS	Vessel Monitoring Systems
VTM	Vessel Traffic Management
VTS	Vessel Traffic Service
WC	Worst Credible

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Appendices



Innovative Thinking - Sustainable Solutions

A Hazard Log: Construction

Table A1. Hazard Category: Collision; Hazard Scenario Title: Commercial vessel with capital dredge plant; Risk ID: C1

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Machinery failure	Local Port Services	Run from GPCC	Commercial vessel has significant collision with the capital dredge plant at the development site, resulting in multiple fatalities, tier 2 pollution, total loss of vessel and temporary port closure. Serious international reputational damage.	2	People	5	Commercial vessel has a minor collision, such as a glancing blow after taking avoiding action at the development site, resulting in minor injuries to personnel, no pollution, minor infrastructure damage, no reputational damage.	4	People	2
Adverse weather	Pilotage service	Including PEC provision			Environment	4			Environment	1
Restricted/ poor visibility	Passage planning				Assets	5			Assets	2
Human error	Secondary communication	Mobiles			Reputation	5			Reputation	1
Failure to follow passage plan	Port working channel	VHF		Unlikely	Likely					
Failure to follow COLREGS	PPG publications	PPG Website								
Communication failure	Towage	Application of COL Towage Guidelines								
Failure to follow Byelaws, Directions, Notice to Mariners	AIS	IMO Carriage Requirements								
Failure of AtoN	Weather limits	Restricted visibility parameters								
Inadequate/ failure of towage										
Mooring failure (equipment or plan)										
Lack of situational awareness										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
AtoN review	Review AtoN in consideration of adjustments or additional buoyage to mark specific construction hazards or safe routes	1	People	5	3	People	2
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft		Environment	4		Environment	1
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Assets	5		Assets	2
Safety boat	Used in conjunction with static dredge plant	Rare	Reputation	5	Possible	Reputation	1
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL						

Table A2. Hazard Category: Collision: Hazard Scenario Title: Recreational vessel with capital dredge plant: Risk ID: C2

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Environment			Assets	Reputation
Machinery failure	Weather limits		Recreational vessel has a significant high speed impact with the capital dredge plant, resulting in multiple fatalities onboard recreational craft, minor pollution damage, complete loss of recreational vessel and major reputational damage.	3	People	5	Recreational vessel has a minor low speed collision with the capital dredge plant, such as a glancing blow after taking avoiding action, resulting in moderate injury to personnel which require medical treatment, no environmental impact, minor cosmetic damage.	4	People	3
Adverse weather	Secondary communication	Mobiles			Environment	2			Environment	1
Restricted/ poor visibility	Port working channel	VHF			Assets	5			Assets	1
Human error	PPG publications	PPG Website			Reputation	4			Reputation	1
Failure to follow passage plan	Local Port Services	Run from GPCC		Possible	Likely					
Failure to follow COLREGS	Pilotage service	Including PEC provision								
Communication failure	Passage planning									
Failure to follow Byelaws, Directions, Notice to Mariners										
Failure of AtoN										
Mooring failure (equipment or plan)										
Lack of situational awareness										
Lack of local knowledge										
Lack of competence										
Drugs and alcohol										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
			People	Environment		Assets	Reputation
Clyde Leisure Navigation Guide	Updating leisure guidelines	2	People	5	3	People	3
Education	Proactive engagement with charters, clubs, and marinas		Environment	2		Environment	1
AtoN review	Review AtoN in consideration of adjustments or additional buoyage to mark specific construction hazards or safe routes		Assets	5		Assets	1
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	Unlikely	Reputation	4	Possible	Reputation	1
Leisure vessel recommended routes	Identification of recommended routes for leisure activity transiting the works and dredge area promulgated via leisure navigation guide and/ or Notice to Mariners	Unlikely					
Notice to Mariners	Key information promulgated by Notice to Mariners as appropriate to phase of works						

Table A3. Hazard Category: Collision: Hazard Scenario Title: Barge/ trailing suction hopper dredger (TSHD) with another vessel during movements to/ from disposal site: Risk ID: C3

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Machinery failure	Planned maintenance		A work craft (barge) has a significant collision with a ferry or tanker whilst transiting to/ from the development/ disposal site with dredge/ infill material, resulting in multiple fatalities, tier 3 pollution, potential loss of vessel and international reputational damage.	2 Unlikely	People	5	A work craft (barge) has a minor collision with another vessel whilst transiting to/ from the development/ disposal site with dredge/ infill material, resulting in moderate injuries requiring medical treatment, no pollution, minor infrastructure, and minor reputational damage.	3 Possible	People	3
Adverse weather	Defect reporting				Environment	5			Environment	1
Restricted/ poor visibility	Weather limits				Assets	5			Assets	2
Human error	Passage planning				Reputation	5			Reputation	1
Failure to follow passage plan	AIS	IMO Carriage Requirements								
Failure to follow COLREGS	Secondary communication	Mobiles								
Communication failure	Port working channel	VHF								
Failure to follow Byelaws, Directions, Notice to Mariners	PPG publications	PPG Website								
Failure of AtoN	Leisure event calendar									
Inadequate/ failure of towage	Local Port Services	Run from GPCC								
Mooring failure (equipment or plan)	Pilotage service	Including PEC provision								
Lack of situational awareness	Towage	Application of COL Towage Guidelines								

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Education	Proactive engagement with charters, clubs, and marinas	1	People	5	2	People	2
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft		Environment	5		Environment	1
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Assets	5		Assets	2
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	Rare	Reputation	5	Unlikely	Reputation	1

Table a4. Hazard Category: Collision: Hazard Scenario Title: Displaced traffic (Recreational): Risk ID: C4

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Machinery failure	Planned maintenance		Recreational vessel displaced from its normal navigation passage during the construction phase has a significant collision with a large commercial vessel, resulting in multiple fatalities, minor environmental damage, total loss of vessel and significant international reputational damage.	2	People	5	Recreational vessel displaced from its normal navigation passage during the construction phase has a minor collision with fishing vessel/ large commercial vessel, resulting in people in the water, quickly recovered requires medical treatment, no pollution, minor damage to recreational vessel. Local reputational damage.	3	People	3
Adverse weather	PPG publications	Website			Environment	2			Environment	1
Restricted/ poor visibility	Leisure event calendar				Assets	5			Assets	2
Human error	Local Port Services	Run from GPCC			Reputation	5			Reputation	2
Failure to follow passage plan	Secondary communication	Mobiles		Unlikely	Possible					
Failure to follow COLREGS	Port working channel	VHF								
Communication failure										
Failure to follow Byelaws, Directions, Notice to Mariners										
Failure of AtoN										
Lack of local knowledge										
Lack of competence										
Drugs and alcohol										
Lack of situational awareness										
Displaced traffic										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft	1	People	5	2	People	3
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Environment	2		Environment	1
AtoN review	Review AtoN in consideration of adjustments or additional buoyage to mark specific construction hazards or safe routes		Assets	5		Assets	2
Leisure vessel recommended routes	Identification of recommended routes for leisure activity transiting the works and dredge area, promulgated via leisure navigation guide and/ or Notice to Mariners	Rare	Reputation	5	Unlikely	Reputation	2
Clyde Leisure Navigation Guide	Updating leisure guidelines						
Education	Proactive engagement with charters, clubs, and marinas						

Table A5. Hazard Category: Collision: Hazard Scenario Title: Commercial vessel delivering infrastructure/development components collision with another commercial vessel or recreational vessel: Risk ID: C5

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	
Machinery failure	Planned maintenance		Commercial vessel delivery construction components (e.g., piles) has a significant collision on its passage to the berth with a commercial vessel, resulting in multiple fatalities, tier 2 pollution, loss of vessel and international reputation damage.	1	People	5	Commercial vessel delivering construction components (e.g., piles) has a minor collision on its passage to the berth with a recreational vessel, resulting in glancing blow with moderate injuries to people requiring medical treatment, minor environmental damage, negligible damage to vessels. Minor reputation damage.	2	People	3	
Adverse weather	Defect reporting				Environment	3			Environment	1	
Restricted/ poor visibility	Weather limits			Rare	Assets	5		Unlikely	Assets	2	
Human error	Secondary communication	Mobiles			Reputation	5			Reputation	2	
Failure to follow passage plan	Port working channel	VHF									
Failure to follow COLREGS	PPG publications	PPG Website									
Communication failure	Leisure event calendar										
Failure to follow Byelaws, Directions, Notice to Mariners	Local Port Services	Run from GPCC									
Failure of AtoN	Pilotage service	Including PEC provision									
Inadequate/ failure of towage	Passage planning										
Lack of situational awareness	AIS										
	Towage	Application of COL Towage Guidelines									

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Clyde Leisure Navigation Guide	Updating leisure guidelines	1	People	5	1	People	3
Project liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Environment	3		Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft		Assets	5		Assets	2
Education	Proactive engagement with charters, clubs, and marinas	Rare	Reputation	5	Rare	Reputation	2
AtoN review	Review AtoN in consideration of adjustments or additional buoyage to mark specific construction hazards or safe routes						
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL						

Table A6. Hazard Category: Contact/ Allision: Hazard Scenario Title: Work craft with proposed development: Risk ID: C6

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence	Most Likely Scenario	Likelihood	Consequence		
	Control	Comment						People	Assets	
Machinery failure	Pilotage service	Including PEC provision	A work craft associated with the construction phase has an allision with the delivery berth, resulting in multiple fatalities, debris in the water and punctured fuel tank causing tier 2 pollution. Berth significantly damaged and closed for inspection. International reputational damage.	1	People	A work craft associated with the construction phase makes minor contact with the development, resulting in no injuries, no environmental damage, minor damage to fenders.	5	People	1	
Adverse weather	Towage	Application of COL Towage Guidelines			Environment			4	Environment	1
Restricted/ poor visibility	Weather limits				Assets			5	Assets	2
Human error	Mooring guidelines	Application of COL Mooring Guidelines		Rare	Reputation			5	Reputation	1
Failure to follow passage plan	Fatigue management									
Malicious action	Berthing procedure									
Communication failure	Emergency procedures									
Failure to follow Byelaws, Directions, Notice to Mariners	Fenders									
Interaction	Berth allocation									
Inadequate/ failure of towage	Local Port Services	Run from GPCC, application of emergency response procedures								
Lack of situational awareness	Defect reporting									
Mooring failure (equipment or plan)	AIS	IMO Carriage Requirements								
Vessel overhang										
Excessive vessel speed										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence	Future Most Likely Likelihood	Future Most Likely Consequence		
Review COL towage guidelines and pilotage directions	Alignment of these services with any additional or changed risks introduced as a result of the proposed development and operation	1	People	3	People	1	
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL		Environment		4	Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/dredge craft		Assets		3	Assets	2
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA	Rare	Reputation	Possible	Reputation	1	

Table A7. Hazard Category: Contact/ Allision: Hazard Scenario Title: Commercial vessel with jack up barge: Risk ID: C7

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Machinery failure	Pilotage service	Including PEC provision	A commercial vessel has an allision with a jack up barge associated with the construction phase, resulting in multiple fatalities, debris in the water and punctured fuel tank causing tier 2 pollution. Berth significantly damaged and closed for inspection. International reputation damage.	1	People	5	A commercial vessel has makes minor contact with a jack up barge associated with the construction phase, resulting in glancing blow with moderate injuries requiring medical treatment, minor environmental damage, negligible damage to vessels. Minor reputation damage.	3	People	3
Adverse weather	Passage planning				Environment	4			Environment	1
Restricted/ poor visibility	Weather limits				Assets	5			Assets	2
Human error	Mooring guidelines				Reputation	5			Reputation	2
Failure to follow passage plan	Berthing procedure			Rare	Possible	Possible	Possible	Possible	Possible	Possible
Malicious action	Emergency procedures									
Communication failure	Fenders									
Failure to follow Byelaws, Directions, Notice to Mariners	Towage	Application of COL Towage Guidelines								
Interaction	AIS	IMO Carriage Requirements								
Inadequate/ failure of towage	Defect reporting									
Lack of situational awareness	Local Port Services	Run from GPCC								
Mooring failure (equipment or plan)	Berth allocation									
Vessel overhang										
Excessive vessel speed										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Review COL towage guidelines and pilotage directions	Alignment of these services with any additional or changed risks introduced as a result of the proposed development and operation	1	People	3	2	People	3
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft		Environment	4		Environment	1
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Assets	3		Assets	2
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	Rare	Reputation	4	Unlikely	Reputation	2

Table A8. Hazard Category: Contact/ Allision: Hazard Scenario Title: Recreational vessel with jack up barge: Risk ID: C8

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Machinery failure	Pilotage service	Including PEC provision	A recreational vessel has an allision with a jack up barge associated with the construction phase, resulting in multiple fatalities, minor environmental damage, total loss of vessel and will have significant international reputational damage.	2	People	5	A recreational vessel has makes minor contact with a jack up barge associated with the construction phase, resulting in people in the water, quickly recovered but require medical treatment, little to no pollution, cosmetic a damage to recreational damage or loss of mast. Local reputational damage.	3	People	3
Adverse weather	Local Port Services	Run from GPCC			Environment	2			Environment	1
Restricted/ poor visibility	Weather limits				Assets	5			Assets	2
Human error	Mooring guidelines				Reputation	5			Reputation	2
Failure to follow passage plan	Berth allocation			Unlikely	Possible					
Malicious action	Berthing procedure									
Communication failure	Emergency procedures									
Failure to follow Byelaws, Directions, Notice to Mariners	Towage	Application of COL Towage Guidelines								
Interaction	Defect reporting									
Inadequate/ failure of towage										
Lack of situational awareness										
Mooring failure (equipment or plan)										
Vessel overhang										
Excessive vessel speed										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Leisure vessel recommended routes	Identification of recommended routes for leisure activity transiting the works and dredge area, promulgated via leisure navigation guide and/ or Notice to Mariners	1	People	5	2	People	3
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Environment	2		Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft		Assets	5		Assets	2
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	Rare	Reputation	5	Unlikely	Reputation	2

Table A9. Hazard Category: Grounding/ Stranding: Hazard Scenario Title: Work craft manoeuvring for construction activities: Risk ID: C9

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	
Unexpected shoaling	AtoN		A work craft associated with the construction phase becomes stranded whilst maneuvering, resulting in serious injuries to crew, call out tier 2 providers to scene. Significant damage to vessel, national reputational damage.	3	People	4	A work craft associated with the construction phase temporarily grounds whilst maneuvering, resulting in minor injuries to people, no damage to environment, vessel requires inspection following grounding. Minor reputational damage.	4	People	1	
Machinery failure	Pilotage service	Including PEC			Environment	3			Environment	1	
Adverse weather	Hydrographic survey				Assets	4			Assets	3	
Failure of AtoN	Weather limits				Reputation	4			Reputation	2	
Human error	Hydrographic survey			Possible	Likely	Likely	Likely	Likely	Likely	Likely	Likely
Traffic density	Mooring guidelines										
Lack of situational awareness	Passage planning										
Failure to follow passage plan	Guidance for small craft										
Infrastructure failure	Master pilot exchange										
Hydrographic survey not conducted/ inaccurate	Local Port Services	Run from GPCC									
Restricted viability	Towage										
Mooring failure (equipment or plan)	Management of fairway/ channel										
Inaccurate draught	Echo sounder										
	AtoN defect reporting										
	Visual check of draught										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	2	People	4	3	People	1
Project Liaison Officer and Marine Management Plan	Regular promulgation of dredging progress		Environment	3		Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft		Assets	4		Assets	3
		Unlikely	Reputation	4	Possible	Reputation	2

Table A10. Hazard Category: Grounding/ Stranding: Hazard Scenario Title: Displaced traffic (Recreational): Risk ID: C10

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Unexpected shoaling	AtoN		Recreational vessel displaced from its normal navigation passage during the construction phase becomes stranded, resulting in serious injuries, minor environmental damage, total loss of vessel and will have moderate reputational damage.	2	People	4	Recreational vessel displaced from its normal navigation passage during the construction phase temporarily grounds, resulting in minor injuries, no pollution, minor asset damage, minor reputational damage.	4	People	2
Machinery failure	Echo sounder				Environment	2			Environment	1
Adverse weather	Hydrographic survey				Assets	5			Assets	2
Failure of AtoN	Weather limits				Reputation	4			Reputation	2
Human error	Hydrographic survey			Unlikely	Likely					
Traffic density	Mooring guidelines									
Lack of situational awareness	Passage planning									
Failure to follow passage plan	Clyde Leisure Navigation Guide									
Infrastructure failure	Management of fairway/channel									
Hydrographic survey not conducted/ inaccurate	AtoN defect reporting									
Restricted viability										
Mooring failure (equipment or plan)										
Inaccurate draught										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence		
Clyde Leisure Navigation Guide	Updating leisure guidelines	1	People	4	3	People	2	
Education	Proactive engagement with charters, clubs, and marinas		Environment	2		Environment	1	
AtoN review	Review AtoN in consideration of adjustments or additional buoyage to mark specific construction hazards or safe routes		Assets	5		Assets	2	
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA	Rare	Reputation	3	Possible	Reputation	2	
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft							
Leisure vessel recommended routes	Identification of recommended routes for leisure activity transiting the works and dredge area							

Table A11. Hazard Category: Fire/ Explosion: Hazard Scenario Title: Fire breaks out on work craft: Risk ID: C11

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Electrical faults	Vessel fire drills		A significant fire breaks out on a work craft associated with the construction phase, rendering in unable to continue to support the development, resulting in multiple fatalities, tier 3 pollution, loss of vessel. International reputation damage and potential for port to be closed.	1	People	5	A minor fire breaks out on a work craft associated with the construction phase, contained onboard resulting in no injuries, fire suppression system contains fire, no environmental damage, minor damage to vessel and no reputational damage.	3	People	1
Machinery failure	Coded vessel	Including electrical test			Environment	5			Environment	1
Incorrect storage of dangerous goods	Contact safety audits	COL audits of tugs and mooring companies		Assets	5	Assets		2		
Cooking	Vessel's own safety procedures			Rare	Reputation	5		Possible	Reputation	1
Battery failure	Planned maintenance									
Inadequate procedures	Fire detection/ suppression systems									
Leaks – oils/ chemicals/ spills	Firefighting equipment									
Inadequate training	Emergency procedures									
Contact/ Allision/ Collision	IMDG code	Storage and carry of dangerous goods								
Combustible material	Local Port Services	Run from GPCC Run from GPCC, application of emergency response procedures								
Build-up of gasses										
Human error										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	1	People	5	3	People	1
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Environment	5		Environment	1
			Assets	5		Assets	2
		Rare	Reputation	5	Possible	Reputation	1

Table A12. Hazard Category: Accidents to Personnel: Hazard Scenario Title: Person in the water/ Man overboard: Risk ID: C12

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Interaction	PPE	Life jackets, PLB	A worker associated with the construction phase falls from a vessel or construction area that knocks them unconscious, resulting in single fatality, no environment or infrastructure damage and national reputational damage.	3	People	5	A worker associated with the construction works falls into the water, resulting in moderate injury requiring medical treatment, no environmental or asset damage. No reputational damage.	4	People	3
Adverse weather	Weather limits				Environment	1			Environment	1
Access / egress	Training	MOB exercises		Possible	Assets	1		Likely	Assets	1
Inexperienced/ untrained personnel	Clean/ clear working area				Reputation	4			Reputation	1
Human error	Hunterston site inductions									
Medical incident	Hunterston emergency site procedures									
Language barrier	PPG drug and alcohol policies	Drug and alcohol testing								
Drugs and alcohol	PPG quayside safety	Adherence to ACOP Safety in Docks								
Contact/ Allision/ Collision										
Mooring failure (equipment or plan)										
Slips, trip, and falls										
Personnel transfer										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Safety boat	Vessel capable of conducting a recovery from water deployed in line with operational mitigation identified in contractor RAMS and MMP	2	People	4	4	People	3
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Environment	1		Environment	1
Adherence to CDM	Construction (Design and Management) Regulations 2015		Assets	1		Assets	1
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	Unlikely	Reputation	2	Likely	Reputation	1

Table A13. Hazard Category: Accidents to Personnel: Hazard Scenario Title: Diving incident (e.g. cathodic protection installation/ pile inspection): Risk ID: C13

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	
High traffic density	Communication equipment and standards		Divers installing cathodic protection are struck by a vessel whilst on/ near the water's surface, resulting in single fatality, no environment or infrastructure damage and national reputational damage.	2	People	5	Divers installing the cathodic protection on the piles have a minor fault on their equipment whilst conducting their diving activity, resulting in moderate injury requiring medical treatment, no environmental or asset damage no reputational damage.	3	People	3	
Failure to comply with safe systems of work	Notice to Mariners				Environment	1			Environment	1	
Flag 'A' not flying/ observed	Safe Systems Of Work (H&S)			Unlikely	Assets	1		Assets	1		
Restricted/ poor visibility	COLREGs				Reputation	4		Reputation	1		
Inadequate procedures	Emergency services equipment			Possible	Unlikely						
Communication failure	PPG SOPs	Application of Diving SOP requirements									
Adverse weather	Flag Alpha displayed during operations										
Human error	Port emergency plan										
	AIS	IMO Carriage Requirements									
	Local Port Services	Run from GPCC									
	Diving at Work Regulations 1997 compliance										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Safety boat	Vessel capable of conducting a recovery from water deployed in line with operational mitigation identified in contractor RAMS and MMP	1	People	5	2	People	3
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL, inclusive of CDM regulations		Environment	1		Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/ dredge craft		Assets	1		Assets	1
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA	Rare	Reputation	4	Unlikely	Reputation	1

Table A14. Hazard Category: Mooring Failure: Hazard Scenario Title: Jack up barge spud leg failure: Risk ID: C14

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	Reputation
Machinery failure	Hydrographic survey		A jack up barge's spud leg fails causing a significant shift of the barge's centre of gravity, resulting in potential for multiple fatalities, tier 2 environmental damage, total loss of barge, and significant national reputational damage.	1	People	5	A jack up barge's spud leg fails to extend/retract causing delays to the construction operation, resulting in no injury to personnel onboard, minor pollution, delays to operation and no reputational damage.	4	People	1	
Poor plant maintenance	Safe haven for Jack up barge				Environment	2			Environment	2	
Unexpected seabed composition	PPG SOPs			Rare	Assets	5			Assets	4	
Inadequate procedures	Notice to Mariners				Reputation	4			Reputation	1	
Hydraulic failure	Weather limits							Likely			
Contact/ Allision/ Collision	Local Port Services	Run from GPCC									
Adverse weather	Seabed sampling	Determining bottom composition to assist bedding down									
Climate change (extreme weather)											
Mooring failure (equipment or plan)											

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA	1	People	5	4	People	1
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL		Environment	2		Environment	2
Adherence to CDM	Construction (Design and Management) Regulations 2015		Assets	5		Assets	3
		Rare	Reputation	4	Likely	Reputation	1

Table A15. Hazard Category: Mooring Failure: Hazard Scenario Title: Barge breaks out of mooring : Risk ID: C15

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	
Adverse weather	Mooring guidelines	Checked by COL as the SHA	Barge associated with dredging or construction works has a complete mooring breakout and begins to drift, resulting in serious injuries, call out tier 2 providers. Significant damage to barge, national reputation damage.	2	People	4	Barge associated with the dredging has a partial mooring breakout from a snapped line, resulting in no injury, no environmental damage, moderate damage to infrastructure and moderate reputational damage	4	People	1	
Mooring failure (equipment or plan)	Local Port Services	Run from GPCC			Environment	2			Environment	1	
Inadequate crewing	COL quayside audit				Assets	3			Assets	3	
Vessel 'notice to move'	Emergency procedures	COL emergency plans and exercising			Reputation	4			Reputation	3	
Mooring failure (equipment or plan)	Towage	Routine towage provided by existing Clydeport towage contractors		Unlikely	Likely	People	4	Environment	2	Assets	3
Language barrier	Weather monitoring										
Incorrect weather forecast											
Inadequate/ failure of towage											
Inadequate procedures											
Inadequate crewing											
Infrastructure failure											
Human error											
Lack of competence											
Climate change (extreme weather)											

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Contractor Risk Assessment Method Statement (RAMS)	Reviewed and agreed by COL	1	People	4	3	People	1
Project Liaison Officer and Marine Management Plan	Promulgation of works programme, liaison with local port stakeholders, updated to LPS and COL as the SHA		Environment	2		Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine construction/dredge craft		Assets	3		Assets	3
		Rare	Reputation	4	Possible	Reputation	3

B Hazard Log: Operation

Table B1. Hazard Category: Collision: Hazard Scenario Title: Commercial vessel with maintenance dredger: Risk ID: O1

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence			
	Control	Comment			People	Assets			People	Assets		
Machinery failure	Local Port Services	Run by GPCC	A maintenance dredger has a significant collision with a commercial vessel, resulting in multiple fatalities, moderate environmental damage. Significant infrastructure damage with potential loss of ship and international reputational damage.	2	People	5	A maintenance dredger has a minor collision with a commercial vessel, such as a glancing blow after taking avoiding action, resulting in minor injuries to personnel, no pollution, minor infrastructure damage, little to no reputational damage.	3	People	2		
Adverse weather	Notice to Mariners				Environment	3			Environment	1		
Restricted/ poor visibility	Weather limits				Assets	5			Assets	2		
Human error	Secondary communication	Mobiles			Reputation	4			Reputation	1		
Failure to follow passage plan	Port working channel	VHF		Unlikely	Possible	People		2	Environment	1	Assets	2
Failure to follow COLREGS	PPUs											
Communication failure	Pilotage service	Including PEC provision										
Failure to follow Byelaws, Directions, Notice to Mariners	Towage	Application of COL Towage Guidelines										
Failure of AtoN												
Inadequate/ failure of towage												
Failure of mooring equipment (bollards etc)												
Lack of situational awareness												

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
			People	Assets		People	Assets
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine activity	1	People	5	2	People	2
Notice to Mariners	A condition of dredge disposal licence		Environment	3		Environment	1
Prior notice of dredge campaign	A condition of dredge disposal licence		Assets	5		Assets	2
		Rare	Reputation	4	Unlikely	Reputation	1

Table B2. Hazard Category: Collision: Hazard Scenario Title: Commercial component delivery to/ from development (wind): Risk ID: O2

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	Reputation
Machinery failure	Planned maintenance		During the operation of the terminal, a vessel carrying a wind turbine component has a significant collision, resulting in multiple fatalities, moderate environmental damage. Significant infrastructure damage with potential loss of ship and international reputational damage.	1	People	5	During the operation of the terminal, a vessel carrying a wind turbine component has a minor collision, such as a glancing blow after taking avoiding action, resulting in minor injuries to personnel, no environmental damage, moderate damage to assets and moderate reputational damage.	2	People	1	
Adverse weather	Defect reporting				Environment	3			Environment	1	
Restricted/ poor visibility	Weather limits				Assets	5			Assets	3	
Human error	Secondary communication	Mobiles			Rare	Reputation			4	Reputation	3
Failure to follow passage plan	Port working channel	VHF									
Failure to follow COLREGS	PPG publications	Website									
Communication failure	Pilotage service	Including PEC provision									
Failure to follow Byelaws, Directions, Notice to Mariners	Towage	Application of COL Towage Guidelines									
Failure of AtoN	PPUs										
Inadequate/ failure of towage	Qualified personnel										
Failure of mooring equipment (bollards etc)	Local Port Services	Run by GPCC									
Lack of situational awareness											

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Simulation	Rehearsal of manoeuvre if deemed to require a novel approach	1	People	4	2	People	1
Review COL towage guidelines and pilotage directions	Review pilotage directions considering the provision of additional pilotage assistance for new operation		Environment	3		Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine activity		Assets	4		Assets	3
			Rare	Reputation		3	Unlikely

Table B3. Hazard Category: Collision: Hazard Scenario Title: Recreational vessel with maintenance dredger: Risk ID: O3

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Machinery failure	Planned maintenance		A maintenance dredger has a significant collision with a recreational vessel, resulting in multiple fatalities onboard recreational craft, minor pollution, complete loss of recreational vessel and national reputational damage.	3	People	5	A maintenance dredger has a minor collision with a recreational vessel, such as a glancing blow after taking avoiding action, resulting in moderate injury to personnel, no environmental impacts, minor cosmetic damage.	4	People	3
Adverse weather	Defect reporting				Environment	2			Environment	1
Restricted/ poor visibility	Weather limits				Assets	5			Assets	1
Human error	Secondary communication	Mobiles			Reputation	4			Reputation	1
Failure to follow passage plan	Port working channel	VHF		Possible	Likely					
Failure to follow COLREGS	PPG publications	Website								
Communication failure	Notice to Mariners									
Failure to follow Byelaws, Directions, Notice to Mariners	AtoN									
Failure of AtoN	Local Port Services	Run by GPCC								
Lack of situational awareness	Pilotage service	Including PEC provision								
Lack of local knowledge										
Lack of competence										
Drugs and alcohol										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Clyde Leisure Navigation Guide	Updating leisure guidelines	2	People	5	3	People	3
Education	Proactive engagement with charters, clubs, and marinas		Environment	2		Environment	1
Notice to Mariners	A condition of dredge disposal licence		Assets	5		Assets	1
Prior notice of dredge campaign	A condition of dredge disposal licence	Unlikely	Reputation	4	Possible	Reputation	1

Table B4. Hazard Category: Contact/ Allision: Hazard Scenario Title: Commercial vessel with development: Risk ID: O4

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	
Machinery failure	Pilotage service	Including PEC provision	During the operation of the terminal, a commercial vessel associated with the operation has an allision with the development, resulting in multiple fatalities, debris in the water and punctured fuel tank causing tier 2 pollution. Berth significantly damaged and closed for inspection.	1	People	5	During the operation of the terminal, a commercial vessel associated with the operation makes contact (heavier than an ordinary berthing) with the development, resulting in no injury , no environmental damage, minor damage to fenders and bent ladders.	5	People	1	
Adverse weather	Towage				Environment	4			Environment	1	
Restricted/ poor visibility	Weather limits				Assets	5			Assets	2	
Human error	Mooring guidelines				Reputation	5			Reputation	1	
Failure to follow passage plan	Defect reporting			Rare	Very Likely						
Malicious action	Berthing procedures										
Communication failure	Emergency procedures										
Failure to follow Byelaws, Directions, Notice to Mariners	Fenders										
Interaction	Berth allocation										
Inadequate/ failure of towage	Qualified personnel										
Lack of situational awareness	Local Port Services	Run by GPCC									
Failure of mooring equipment (bollards etc.)											
Excessive vessel speed											

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Review COL towage guidelines and pilotage directions	Alignment of these services with any additional or changed risks introduced as a result of the proposed development and operation	1	People	3	5	People	1
Review mooring and berthing guidelines	Review mooring and berthing guidelines and linesmen procedures in consideration of additional identified risks associated with operation of the facility		Environment	4		Environment	1
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine activity		Assets	3		Assets	2
Flow monitoring	Consider the requirement for a hydrodynamic survey post-construction, to establish flow speeds and direction at the berth and through the dredge area	Rare	Reputation	4	Very Likely	Reputation	1

Table B5. Hazard Category: Contact/ Allision: Hazard Scenario Title: Recreational vessel with development: Risk ID: O5

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Machinery failure	Local Port Services	Run by GPCC	A recreational vessel has an allision with the development, resulting in multiple fatalities, minor environmental damage, total loss of vessel and will have national reputational damage.	1 Rare	People	5	A recreational vessel makes unintentional minor contact with the development, resulting in minor injuries, little to no pollution, cosmetic a damage to recreational damage. Local reputational damage.	3 Possible	People	2
Adverse weather	Emergency procedures				Environment	2			Environment	1
Restricted/ poor visibility	Fenders				Assets	5			Assets	2
Human error	AtoN				Reputation	4			Reputation	2
Failure to follow passage plan										
Malicious action										
Communication failure										
Failure to follow Byelaws, Directions, Notice to Mariners										
Interaction										
Inadequate/ failure of towage										
Lack of situational awareness										
Excessive vessel speed										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine activity	1 Rare	People	4	2 Unlikely	People	2
Education	Proactive engagement with charters, clubs, and marinas		Environment	2		Environment	1
Clyde Leisure Navigation Guide	Updating leisure guidelines		Assets	5		Assets	2
			Reputation	3		Reputation	1

Table B6. Hazard Category: Grounding/ Stranding: Hazard Scenario Title: Commercial vessel in Hunterston Channel: Risk ID: O6

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence		
	Control	Comment			People	Assets			People	Assets	
Unexpected shoaling	AtoN		During operation of the terminal, a commercial vessel approaching/ departing the development becomes stranded, resulting in serious injuries to crew, call tier 2 providers to scene. Significant damage to vessel, national reputation damage.	2	People	4	During operation of the terminal, a commercial vessel approaching/ departing the development temporarily grounds, resulting in minor injuries, no pollution, minor damage to the vessel and moderate reputational damage.	3	People	2	
Machinery failure	Pilotage service	Including PEC provision			Environment	3			Environment	1	
Adverse weather	Hydrographic survey				Assets	4			Assets	2	
Failure of AtoN	Weather limits				Reputation	4			Reputation	3	
Human error	AtoN defect reporting			Unlikely	Possible	People	2	Environment	1	Assets	2
Traffic density	Mooring guidelines										
Lack of situational awareness	Passage planning										
Failure to follow passage plan	Local Port Services	Run by GPCC									
Infrastructure failure	Visual check of draught										
Hydrographic survey not conducted/ inaccurate	Towage	Application of COL Towage Guidelines									
Failure of mooring equipment (bollards etc.)	Management of fairway/ channel										
Restricted/ poor visibility	Echo sounder										
Inaccurate draught											

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine activity	1	People	4	2	People	2
Simulation	Rehearsal of manoeuvre if deemed to require a novel approach		Environment	3		Environment	1
Flow monitoring	Consider the requirement for Conduct a hydrodynamic survey post-construction, to establish flow speeds and direction at the berth and through the dredge area		Assets	4		Assets	2
			Rare	Reputation		4	Unlikely

Table B7. Hazard Category: Payload Related Accident: Hazard Scenario Title: Loading/unloading of component (wind): Risk ID: O7

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Vessel movement alongside	Vessel stability calculation		A significant incident occurs during the transfer of a wind turbine component onto a vessel causing the loss of the component, resulting in multiple fatalities, minor damage to environment, loss off component, significant reputational damage.	2	People	5	A minor incident occurs during the transfer of a component onto a vessel that causes delays whilst remedial steps are actioned but not significant damage, resulting in no injury to personnel or environment, moderate damage to infrastructure and minor reputational damage.	3	People	1
Poor quayside design	On-call engineers	For crantage			Environment	2			Environment	1
Machinery failure	Quayside lighting				Assets	5			Assets	3
Inappropriate vessel	PPG quayside audit			Unlikely	Reputation	4		Possible	Reputation	2
Inadequate procedures	PPG golden rules	Lifting safety								
Adverse weather	Loading guidelines									
Failure to follow loading plans	Toolbox talk	Brief prior to lift								
Human error	PPG mooring guidelines									
Lifting and securing equipment failure	Planned maintenance									

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Port emergency plan	Updated to consider HCY Operations	2	People	5	3	People	1
			Environment	2		Environment	1
			Assets	5		Assets	3
		Unlikely	Reputation	4	Possible	Reputation	2

Table B8. Hazard Category: Accidents to Personnel: Hazard Scenario Title: Person in the water/ Man overboard: Risk ID: O8

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Interaction	PPE	Life jackets, PLB	An incident occurs which knocks a port worker unconscious and causes them to fall into the water, resulting in single fatality, no environment or infrastructure damage and national reputational damage.	3	People	5	A port worker misplaces their footing and falls into the water from the quayside, resulting in moderate injury requires medical treatment, no environmental or asset damage. No reputational damage.	4	People	3
Adverse weather	Safety lines				Environment	1			Environment	1
Access/ egress	Training	MOB exercise		Assets	1	Assets			1	
Inexperienced personnel	Clean/ clear working area			Reputation	4	Reputation			1	
Human error	Local Port Services	Run by GPCC		Possible	Likely	Likely	Likely	Likely	Likely	Likely
Inadequate training	Emergency procedures									
Language barrier	Drug and alcohol policy									
Drugs and alcohol	Weather limits									
Contact/ Allision/ Collision	Site inductions									
Failure of mooring equipment (bollards etc)	PPG quayside safety	Adherence to ACOP Safety in Docks								
Slips, trip, and falls										
Medical incident										
Personnel transfer										

Future Controls	Comment	Future Worst Credible Likelihood	Future Worst Credible Consequence		Future Most Likely Likelihood	Future Most Likely Consequence	
Safety area	2m line from quay edge, designated walk ways	2	People	4	3	People	3
PPG quayside audits and inspections	Include HCY in established quayside inspection program		Environment	1		Environment	1
			Assets	1		Assets	1
		Unlikely	Reputation	2	Possible	Reputation	1

Table B9. Hazard Category: Mooring Failure: Hazard Scenario Title: Mooring break out: Risk ID: O9

Causes	Embedded Controls		Worst Credible Scenario	Likelihood	Consequence		Most Likely Scenario	Likelihood	Consequence	
	Control	Comment			People	Assets			People	Assets
Adverse weather	PPG mooring guidelines		A vessel berthed at the development has a complete mooring breakout and begins to drift into shallow water, resulting in multiple fatalities, significant tier 3 pollution, complete loss of vessel and significant international reputational.	1	People	5	A vessel berthed at the development incurs a vessel surging away from quay and causing a partial or single snapped line, resulting in no injury, no environmental damage, moderate damage to infrastructure and moderate reputational damage.	4	People	1
Failure to follow mooring plan	Towage				Environment	5			Environment	1
Inadequate crewing	Emergency procedures				Assets	5			Assets	3
Failure of cold storage procedures	Weather monitoring	Site weather monitoring			Rare	Reputation			5	Likely
Failure of mooring equipment (bollards etc)	Local Port Services	Run from GPCC Run from GPCC, application of emergency response procedures								
Language barrier										
Incorrect weather forecast										
Inadequate/ failure of towage										
Inadequate procedures										
Inadequate crewing										
Infrastructure failure										
Human error										
Lack of competence										
Climate change (extreme weather)										

Future Controls		Future Worst Credible Likelihood	Future Worst Credible Consequence	Future Most Likely Likelihood	Future Most Likely Consequence
Storm moorings	Moorings appropriate to the conditions	1	People	3	People
Emergency (controlled) vessel departure	Leave berth and go to anchor/ to sea		Environment		Environment
Vessel Traffic Management review	GPCC to review provision of VTM, specifically LPS resource to monitor marine activity		Assets		Assets
			Rare		Reputation

C Minutes: Pre-HAZID Categories and Scenarios Discussion

Subject	Pre-HAZID Categories and Scenarios Discussion
Date meeting held	28/03/2024
Location	Microsoft Teams
ABPmer project no	R/5410/01/TJA
Project name	Hunterston Construction Yard
Prepared by	Timothy Aldridge
Attendees	Monty Smedley, Rod Lewis, Harry Aitchison, Timothy Aldridge

Subject: Pre-HAZID Categories and Scenarios Discussion

On 28 March 2024, the project team at ABPmer met to consider the proposed development at the Hunterston Construction Yard. The considerations specifically focused around identifying categories and general scenarios of potential hazards as part of the construction and operation of the proposed development.

The meeting identified 8 unique categories and 26 potential hazards for further assessment at the HAZID workshop, scheduled to take place on the 11 April 2024, in Hunterston. These items are listed below in Table 1 and Table 2.

Table 1. Construction Hazards

ID	Hazard Category	Operation Hazard Scenarios
C2	Collision	Recreational vessel with capital dredge plant
C3	Collision	Barge/ suction hopper dredger with another vessel during movements to/ from disposal site
C4	Collision	Displaced traffic (Recreational)
C5	Collision	Delivery of infrastructure/development components
C6	Contact/ Allision	Work craft with proposed development
C7	Contact/ Allision	Commercial vessel with jack up barge
C8	Contact/ Allision	Recreational vessel with jack up barge
C9	Grounding/ Stranding	Work craft manoeuvring for construction activities
C10	Grounding/ Stranding	Displaced traffic (Recreational)
C11	Marine Pollution	Accidental Spill
C12	Fire/ Explosion	Fire breaks out on work craft
C13	Accidents to Personnel	Person in the water/ Man overboard
C14	Accidents to Personnel	Diving incident (e.g. cathodic protection installation/ pile inspection)
C15	Mooring Failure	Jack up barge spud leg failure
C16	Mooring Failure	Barge breaks out of mooring

Table 2. Operational Hazards

ID	Hazard Category	Operation Hazard Scenarios
O1	Collision	Commercial vessel with maintenance dredger
O2	Collision	Commercial component delivery to/from development (wind)
O3	Collision	Recreational vessel with maintenance dredger
O4	Contact/ Allision	Commercial vessel with development
O5	Contact/ Allision	Recreational vessel with development
O6	Grounding/ Stranding	Commercial vessel in Hunterston Channel
O7	Marine Pollution	Accidental Spill
O8	Payload Related Accident	Loading/ unloading of component (wind)
O9	Accidents to Personnel	Person in the water/ Man overboard
O10	Mooring Failure	Mooring break out

Meeting Agenda

Table 3 outlines the meeting agenda and provides timings for each item discussed. All attendees were present throughout the meeting.

Table 3. Meeting Agenda

Time	Item
1230	Meeting commenced
1233	Brief on proposed development
1305	Pre-HAZID construction phase discussion
1340	Pre-HAZID operation phase discussion
1356	Plan for HAZID workshop
1400	Meeting closed

Post Script: Additional Note

At the HAZID attendees identified that the existing risk assessment in place under the Peel Port Group and Clydeport Operations Limited Marine Safety Management System for Marine Pollution was already addressed and in date. Further, it was pointed out that the construction of the proposed development and the operation of it would be covered under the current and in date risk assessments that the harbour authority has in place. For this reason, hazards C11 and O7, as per Tables 1 and 2, are not included within the Navigation Risk Assessment.

D Minutes: HAZID Workshop

Subject	HAZID Workshop – Hunterston Construction Yard
Date meeting held	11/04/2024
Location	Hunterston PARC
ABPmer project no	R/5410/01/TJA
Prepared by	Harry Aitchison

Agenda

Time	Item	Responsible
HAZID and Risk Analysis Workshop: 11 April 2024		
0900-0915	Workshop introduction	Tim Aldridge - ABPmer
0915-0945	Construction methods and operation plans	COL/ PPG
0945-1000	Navigation Baseline	Tim Aldridge - ABPmer
1000-1040	Workshop – Construction phase risks	Tim Aldridge - ABPmer
1040-1100	Comfort/Coffee Break	COL/ PPG
1100-1230	Workshop – Construction phase risks cont.	Tim Aldridge - ABPmer
1230-1310	Lunch	COL/ PPG
1310-1500	Workshop – Operation phase risks	Tim Aldridge - ABPmer
1500-1520	Comfort/Coffee Break	COL/ PPG
1520-1630	Workshop – Operation phase risks cont.	Tim Aldridge - ABPmer
1630-1700	Wrap up - Expected Timelines and Q&A	Tim Aldridge - ABPmer

Attendees

Attendee		Organisation
HAZID and Risk Analysis Workshop: 11 April 2024		
Timothy Aldridge	TA	ABPmer
Harry Aitchison	HA	ABPmer
John Kent	JK	Bidwells
Alex McIntosh	AM	Clydeport, Head of Marine
Caroline Baxter	CB	Clydeport, Marine Compliance Officer
Ross MacAulay	RM	Clydeport, Pilot
Kevin Blamire	KB	Fairlie Quay
Dave Hewitt	DH	Largs Yacht Haven
Kathleen Dow	KD	North Ayrshire Council
Bruce McClure	BM	North Ayrshire Council
Mark Sinnamon	MS	Peel Ports, Head of Engineering
Nicole Read	NR	Peel Ports, Deputy Group Harbour Master
Gary McCann	GM	Peel Ports, Project Manager
Matthew Hill	MH	Peel Ports
Clive Reeves	CR	RYA
Stephen Morgan	SM	Svitzer
Marshall Mercer	MM	Svitzer

Minutes

Item	
Introduction 09:00	Arrivals and introductions. Start of presentation. TA Explains purpose of the workshop and method we are using within the workshop.
Construction methods and operation plans 09:15	GM PPG: Introduces the proposed development and provides details about the development site. Questions on the development and types of vessel movements are expected for construction and operation.
Baseline NRA 09:45	TA Provides details of the current navigation environment. DH Suggested Wind data presented may not be accurate for the development site and additional data should be acquired. The strongest wind is regularly observed from the East with 70knots being observed in the past. AM Suggested to gather weather data from Peel weather station data. Question: KB: Will there be notifications about movements future movements with the development. CB: confirmed already there.
Start risk assessments 10:00	CR Suggestion for inclusion of a risk assessment for Regatta/ Evetts for both construction and Operational hazards. Recreational and construction craft discussion. Suggestion to take into account future increase of recreational usage in the area. CR RYA – pointed out reduction in people joining clubs' year on year.
11:30	Short comfort break.
11:45	Resume on Construction Risk 3. Question: Will a Barge or a dredger be transferring dredge material? GM PPG confirmed it will be suction hopper barge. Discussion about Bunker barge and how it will be conducted. CB Confirmed PPG procedure. Discussion of what VTS is compared to LPS. <i>Group consensus to complete construction risks for the day and share populated operations to be shared post work shop for stakeholder comments.</i>
12:30	Break for Lunch
13:20	Continued with Construction risks. TA Confirmed with group to complete one of each hazard category first and go back through. Discussion of regular survey.
15:00	Break for tea.
15:35	Suggestion for mooring failure of recreational vessel to drifting into sight. Completion of operational risks.
16:54	Risk assessment wrap-up and finish.

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