Associated British Ports

Immingham Eastern Ro-Ro Terminal

Preliminary Environmental Information:
Appendix 10.1: Preliminary Navigational Risk Assessment

January 2022





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Document Information

Document History and Authorisation	
Title	Immingham Eastern Ro-Ro Terminal
	Preliminary Environmental Information: Appendix 10.1: Preliminary Navigational Risk Assessment
Commissioned by	Associated British Ports
Issue date	January 2022
Document ref	R.3828
Project no	R/5035/5

Date	Version	Revision Details
14/01/2022	1	Issued for client use

Suggested Citation

ABPmer, (2022). Immingham Eastern Ro-Ro Terminal, Preliminary Environmental Information: Appendix 10.1: Preliminary Navigational Risk Assessment, ABPmer Report No. R.3828. A report produced by ABPmer for Associated British Ports, January 2022.

Authors

ABPmer

ABPmer
Quayside Suite, Medina Chambers, Town Quay, Southampton, Hampshire SO14 2AQ
T: +44 (0) 2380 711844 W: http://www.abpmer.co.uk/

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1 Introduction

1.1 Project Background

1.1.1 Associated British Ports (ABP), the owner and operator of the Port of Immingham is proposing to construct a new roll-on/roll-off (Ro-Ro) facility within the Port. The site for the proposed new Terminal, lies within the eastern sector of the Port. The landside works fall within the administrative boundary of North East Lincolnshire Council whilst that part of the Project which extends seaward and falls beyond the local authority's boundary will take place in the bed of the Humber Estuary which is owned by the Crown Estate and over which ABP in its capacity as the Humber Conservancy Commissioner has the benefit of a long lease.

1.1.2 It is anticipated that the marine works will comprise a number of distinct components, which in brief will comprise:

- An approach jetty from the shore;
- A linkspan with bankseat;
- Two floating pontoons with guide piles or articulated restraint arms;
- Two separate finger piers with two berths each, one either side with the stern ramps of the ships resting upon two floating pontoons;
- A capital dredge of the new berth pocket; and
- Disposal of dredged material at sea.

1.1.3 In order for this new marine work to receive the proposed vessels there is a requirement for a capital dredge deepening the berth pockets to 9 m and to 5 m under the floating pontoons. Subject to no appropriate alternative use being identified for the dredge material, it is anticipated that any requirement for disposal of dredged material at sea associated with the proposed development would be fulfilled at licensed disposal sites HU056 and HU060.

1.1.4 Following the construction of the jetty there will be changes to the navigational environment which would include increased vessel activity in the area and potentially increased maintenance dredge activity for the proposed area. A slight change in vessel routeing is also anticipated with Ro-Ro vessels manoeuvring around the Immingham mooring terminal.

1.2 Scope of work

1.2.1 This preliminary Navigational Risk Assessment (NRA) considers the marine aspects of the construction and use of the new Ro-Ro terminal with regards to the effects on vessel navigation during the construction and operational phases. The scope of this assessment includes vessel activity associated with the installation of new infrastructure, capital and maintenance dredging of a pocket adjacent for the four new berths. The effect of the works on future marine traffic is assessed with regards to any additional hazards, the current mitigation measures in place, change in current risk and proposed future mitigation measures.

1.3 Study area

1.3.1 The study area for the assessment comprises a section of the Humber Estuary from the Humber Sea Terminal in the North to Burcom Shoal in the South. The area selected covers principal marine traffic patterns and activities associated with the wider area that impact on the facility and planned works. The study area, therefore, encompasses the dredge disposal site in proximity to Holme Channel and Clay Huts on the northern side of the main channel. The wider area incorporates typical traffic and marine activities which take place within Humber Estuary. Figure 1 shows the study area and identifies Clay Huts, Holme Channel, Immingham Dock, Immingham Oil Terminal (IOT) and Immingham Outer Harbour (IOH).

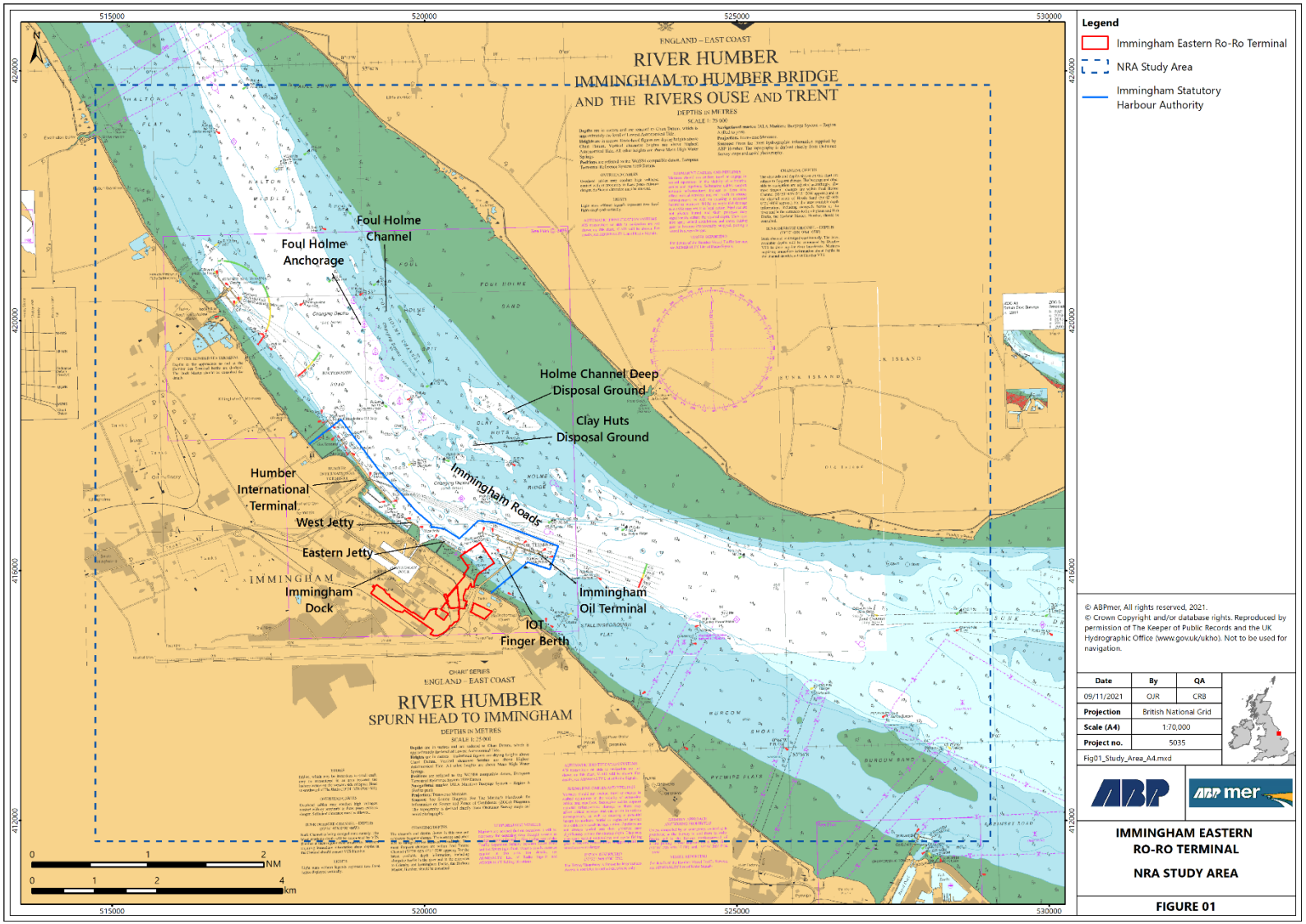

Figure 1 Study area

1.4 Legislation, policy and guidance

Primary legislation

1.4.1 The National Policy Statement for Ports (NPSfP) published in 2012 provides the overarching policy against which the Immingham Eastern Ro-Ro Terminal project is determined. Paragraph 5.6.2 recognises that there could be an increased risk of spills and leaks of pollutants as a result of infrastructure development. It recommends that the ES should describe the existing physical characteristics of the water environment affected by the proposed development and any impact of physical modification to these characteristics. Furthermore, the NPSfP recognises that the risks of impacts to the water environment can be reduced through the careful design to facilitate adherence to good pollution control practice.

1.4.2 Sea ports and harbours provide the interface between the land, near shore and open sea. The UK Marine Policy Statement (2011) in paragraph 3.4.7 identifies in relation to port developments and marine safety that:

1.4.3 "Marine plan authorities and decision makers should take into account and seek to minimise any negative impacts on shipping activity, freedom of navigation and navigational safety; and ensure that their decisions are in compliance with international maritime law".

1.4.4 The majority of port operations are administered by a Statutory Harbour Authority (SHA). Every SHA is self-governed with specific legislation (normally Acts of Parliament) creating the SHA as an entity, with further powers and amendments (Special Acts) made over time in response to the changing scope and remit of the SHA. Underpinning the powers of a SHA is a range of national legislation providing the Harbour Master with powers to issue directions to ensure navigation and safety within the harbour limits. Under such legislation, the Harbour Master may issue specific directions to control movements of vessels within their SHA area in order to ensure safety. Harbour Authorities who have the power to issue Work Orders under provisions in their Special Acts and Orders may choose to apply conditions including the completion of an NRA for developments within their SHA areas. This is the case for the ABP Immingham in its capacity as SHA who evaluate marine developments that have the potential to affect marine safety within the SHA area

Secondary guidance

1.4.5 In the absence of specific government guidance relating to navigational risk for developments in port areas, the following documents have been considered in the preparation of the NRA for the Immingham Eastern Ro-Ro Terminal project. These documents provide information regarding the issues that should be taken into consideration when assessing the effect on navigational safety:

- International Maritime Organization (IMO) Revised Guidelines for Formal Safety Assessment (FSA) for use in the IMO rule making process (IMO, 2018);
- Marine Guidance Note (MGN 654) Offshore Renewable Energy Installations (OREI) safety response. Incorporating: Annex 1 Methodology for assessing marine navigational safety and emergency response risks of OREIs. Maritime and Coastguard Agency (MCA), published 28 April 2021(MCA, 2021);
- DfT Port Marine Safety Code (DfT, 2016); and
- A Guide to Good Practice on Port Marine Operations (DfT, 2019).

ALARP principal

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

2 Data Sources

2.1.1 The following section details the origin of the data used to create the baseline information and inform the NRA.

2.2 Automatic identification system data

2.2.1 This NRA has utilised the most recent national dataset of Automatic Identification System (AIS) data for the year 2019. The data have been decoded to create a geodatabase of anonymised vessel transits. Data was taken from a quiet period (January 2019) and from a busier period (July 2019) to provide a representative set of vessel traffic information that would take seasonal variations into account. The full data set is comprised of the first 14 days for each month of 2019 to make a 168-day dataset.

2.2.2 AIS signals are broadly classified as 'Class A' and 'Class B', where AIS-A is carried by international voyaging ships with Gross Tonnage (GT) of 300 or more tonnes, and all passenger ships regardless of size. AIS-B is carried by smaller vessels and is aimed at smaller commercial craft, the fishing sector and recreational vessel users. However, the use of AIS-B is not compulsory. Both AIS-A and AIS-B data have been used within this study. The AIS data have been analysed and classified into the following vessel categories, which are taken directly from the AIS data transmissions:

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

2.3 Recreational activity

2.3.1 Information on recreational activity in the study area has been collated using a variety of methods. Quantitative data has been derived from AIS-B records although it is recognised that only a small percentage of recreational craft carry AIS transceivers, since the use of AIS-B is not mandatory. Therefore, patterns of activity related to recreational craft have also been collected from anecdotal sources, including port staff, recreational users and yachting guides.

2.4 Port statistics

2.4.1 Statistics for port freight and vessel movements at major ports is recorded by the Department for Transport (DfT). This data is collected by annual returns provided by the ports and made available online (DfT, 2021). The method used for collation of vessel movements at major ports was altered in 2017, resulting in comparison with previous years becoming untenable.

2.5 Navigational features

2.5.1 Navigational features have been considered in this assessment and have been identified using information from UK Hydrographic Office (UKHO) Admiralty Chart 3497 and 1188. This chart is used by mariners as part of the passage planning process and to plot progress during a passage and so contains all relevant navigational information.

2.6 Maritime incidents

2.6.1 To characterise maritime incidents occurring within the study area, available data has been pooled from two sources. These included records held by the Royal National Lifeboat Institution (RNLI) call out data and data from the local marine accident incident reporting database (MarNIS). Data from the RNLI callout database and the MarNIS database has been obtained for the following timescales:

- MarNIS: information includes all marine accidents/incidents reported to the Port of Immingham and Humber Estuary Services. This data set covers the period of 2011 to 2020 inclusive.
- RNLI: complete dataset of all callouts from 2011 to 2020 inclusive.

3 Navigational Baseline Information

3.1.1 The following sections review the baseline information for commercial shipping, and recreational craft, within the study area. Where relevant, factors relating to the proposed marine works, and the subsequent operational phase, have been highlighted. The following elements are covered in the baseline:

- Statutory responsibilities and management procedures;
- Visual aids to navigation;
- Vessel services;
- Vessel traffic management;
- Marine traffic analysis; and
- Marine accidents and incidents.

3.2 Statutory responsibilities and management procedures

3.2.1 Immingham Eastern Ro-Ro Terminal is located fully within the Port of Immingham SHA area where ABP is the SHA. In this capacity, ABP is charged with a set of powers and duties which include the management and regulation of the safety of navigation and marine operations in its SHA area.

3.2.2 ABP Humber Estuary Services (HES) is the Competent Harbour Authority (CHA) with respect to pilotage for the Humber Estuary and the ABP docks within. As the CHA, HES has the power to issue Pilotage Directions that prescribe which vessels require a Pilot or Pilot Exemption Certificate (PEC) holder when navigating within the CHA area.

3.2.3 A Vessel Traffic Service (VTS) within the meaning of MGN 401 is provided for the Humber Estuary. Humber VTS maintains a vessel traffic picture through the Automatic Identification System (AIS) and Radar providing information on weather, vessel movements and marine safety to vessels navigating in the VTS area. All sea-going vessels are required to report to Humber VTS when entering the VTS area and at designated reporting points identified on navigational charts.

3.2.4 ABP is also the Local Lighthouse Authority (LLA) for the Port of Immingham's SHA area by virtue of the Merchant Shipping Act 1995. As LLA, ABP is responsible for the provision and maintenance of Aids to Navigation (AtoN). ABP is required to report any defects to AtoN and consult on any proposed changes, additions or removal of AtoN with Trinity House Lighthouse Authority as the General Lighthouse Authority for England and Wales.

3.2.5 Both the Port of Immingham and HES have committed to meeting the requirements of the PMSC. The PMSC requires that ports operate a Marine Safety Management System (MSMS) which is based on comprehensive and continuously updated set of risk assessments. The MSMS details how the ports fulfil their duties as SHAs and meet the marine safety requirements prescribed by the PMSC.

3.3 Visual aids to navigation

3.3.1 Visual aids to navigation within the study area conform to the standards of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA).

3.3.2 Lateral markers are used to denote the navigable section of the estuary, the main navigable channel, and smaller channel, Foul Holme Channel. Leading lights are positioned on the Immingham Bulk Terminal identifying the main channel for transiting vessels.

3.3.3 A number of aids to navigation are surrounding the facilities nearby which include channel lights denoting the terminals and edge of the channel particularly noticeable on the Oil Terminal and Immingham Bulk Terminal.

3.4 Vessel services

3.4.1 Pilotage in the Humber Estuary and the Port of Immingham is provided by Humber Estuary Services. The ABP 'Pilotage Directions for ships to be navigated within the Humber pilotage area' (ABP, 2016) defines the Humber Pilotage Area and the requirements for compulsory pilotage within it. The directions also lay down regulations under which Pilotage Exemption Certificates (PECs) are issued and administered in the area.

3.4.2 Vessels subject to compulsory pilotage within the compulsory pilotage area include:

- All vessel of greater than 60 metres length shall;
- Any vessel less than 60 meters carrying a bulk cargo of dangerous substances as defined and categorised in the Dangerous Substances in Harbour Areas Regulations 1987; and
- Vessels over 100m moving between tidal estuary berths which includes the moving of mooring lines.

3.4.3 Towage is provided by a range of service providers with the main companies being SMS towage and Svitzer who offer a range of tugs with different bollard pull capacities.

3.4.4 The vessel's size, type and draught dictate the minimum tugs that are required. Of particular note for the study area, all tankers visiting IOT up to 150,000 DWT and gas tankers over 20,000 DWT require two tugs from the sunk spit buoy for the passage to the berth.

3.4.5 Tankers up to 50,000 DWT require three tugs for berthing, four tugs are required for berthing tankers 50,000 to 150,000 DWT and five for any vessels greater than 150,000 DWT.

3.4.6 Vessels visiting the IOT Finger Pier shall be accompanied by the tug which is on standby at the pier.

3.5 Vessel traffic management

3.5.1 A Vessel Traffic Service (VTS) is in operation for the area designated Humber VTS which manages vessel traffic in the Humber Estuary. This service operates as a Traffic Organisation Service (TOS) and an Information Service (INS).

3.5.2 The service provides AIS coverage throughout the VTS area and radar tracking within a large portion of the VTS area. Communications are provided over three Very High Frequency (VHF) radio channels which consist of:

- VHF channel 14 is the main operational working channel for the Humber approaches through to the meridian of longitude passing through the no.4A Clee Ness light float;
- VHF channel 12 is the main operational channel for the middle Humber up estuary of the meridian of longitude which passes through the no. 4a Clee Ness light float to the Humber bridge; and
- VHF channel 15 is the main operational channel for the upper Humber up estuary of the Humber bridge and includes those areas of the estuary Ouse and estuary.

3.5.3 In addition, every 2 hours the VTS service broadcasts information to mariners regarding the weather, tidal information and navigational warnings.

3.6 Marine traffic analysis

Commercial navigation

3.6.1 Figure 2 to Figure 12 identify the vessel movements in the study area and around the proposed development.

3.6.2 It can be seen that the proposed development area is actively used by port service craft (tugs, pilot boats, survey, line handling vessels etc.), tankers, high speed craft and vessels engaged in dredging or underwater operations. A large number of vessel transits are to/from the Finger berth at IOT which is used regularly by tankers. There is also a significant number of vessel transits shown at the East Jetty which is regularly used as a tug berth and also has infrastructure for product tankers to load/discharge.

3.6.3 The wider study area high quantities of vessel movements for all commercial vessel types showing the complexity of the vessel activity in the Humber Estuary.

3.6.4 There is limited fishing and non-port service craft transits in the vicinity of the proposed development during the AIS data survey period. The fishing vessels can be seen transiting the study area utilising the Immingham Roads and the Foul Holme Channel.

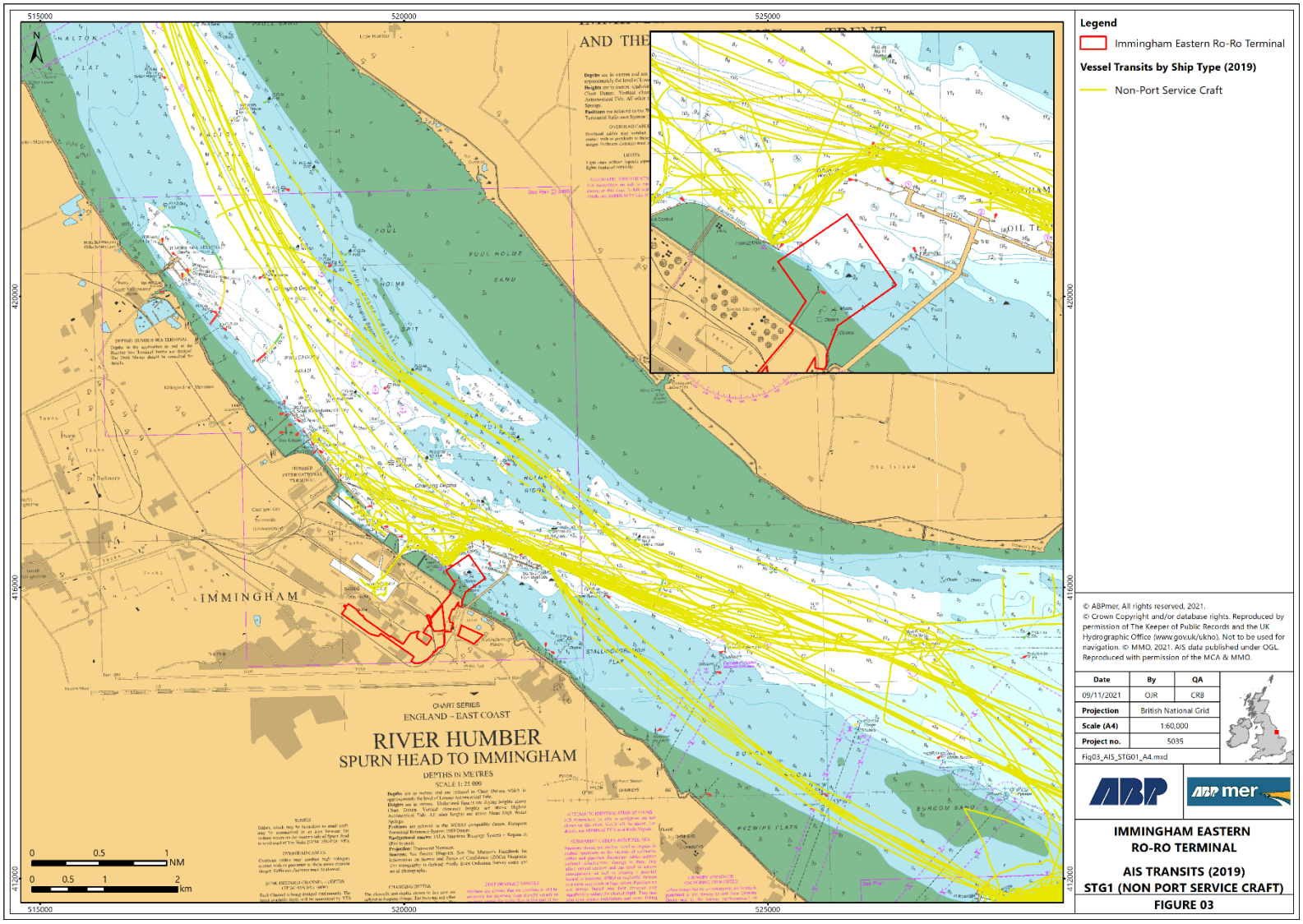

Figure 2 Vesssel transits – Non-port service craft

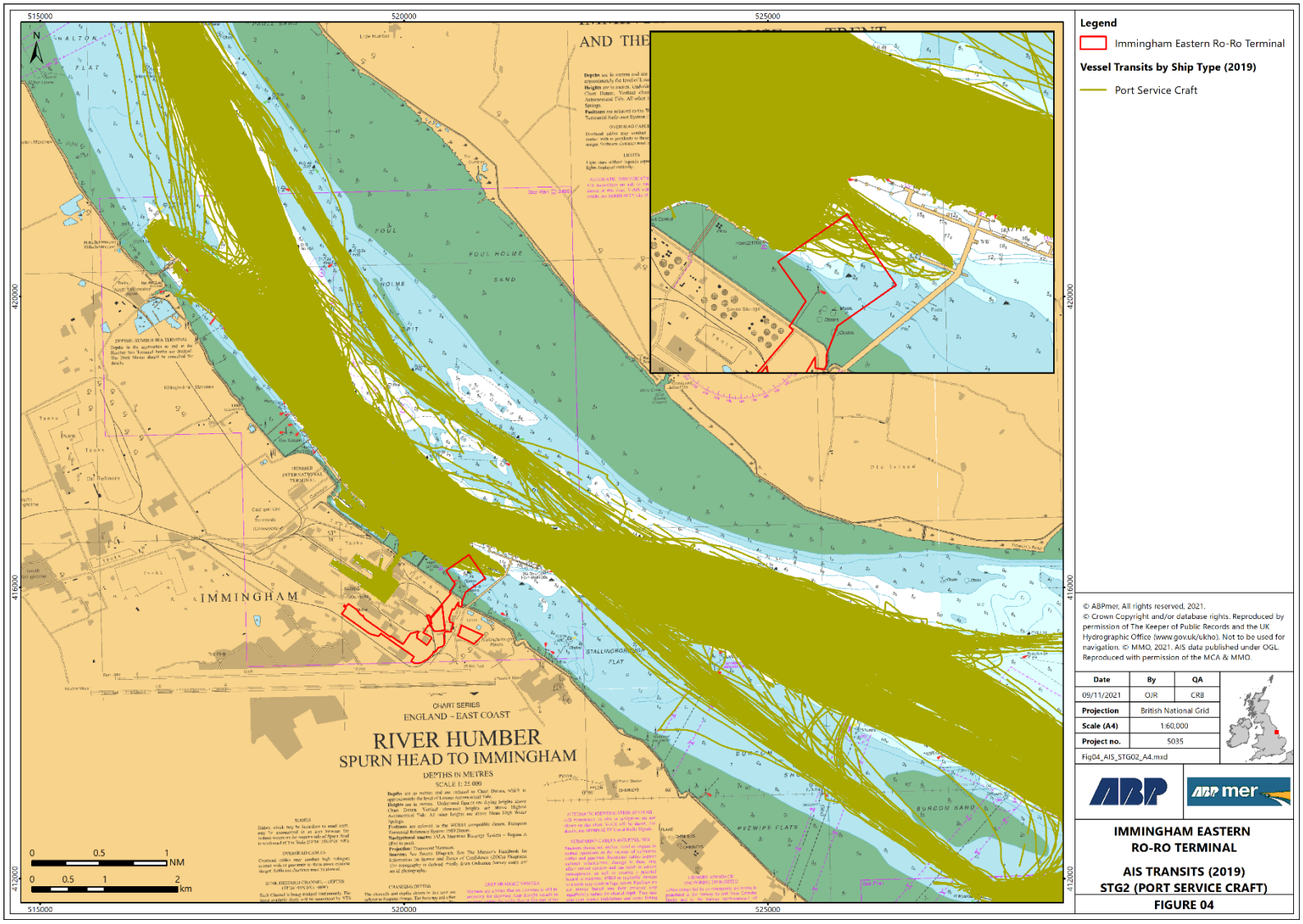

Figure 3 Vessel transits – Port service craft

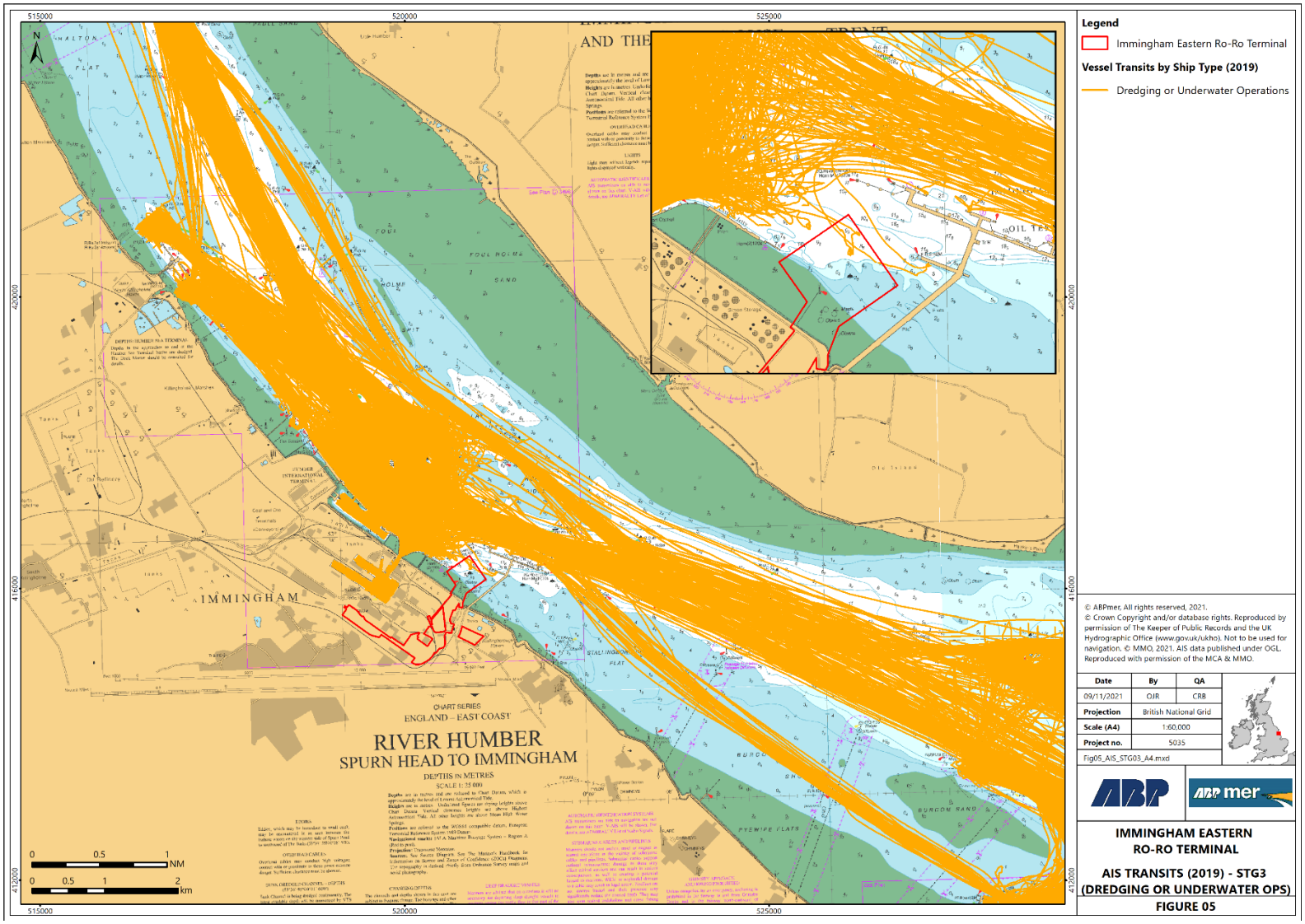

Figure 4 Vessel transits – Dredging or underwater operations

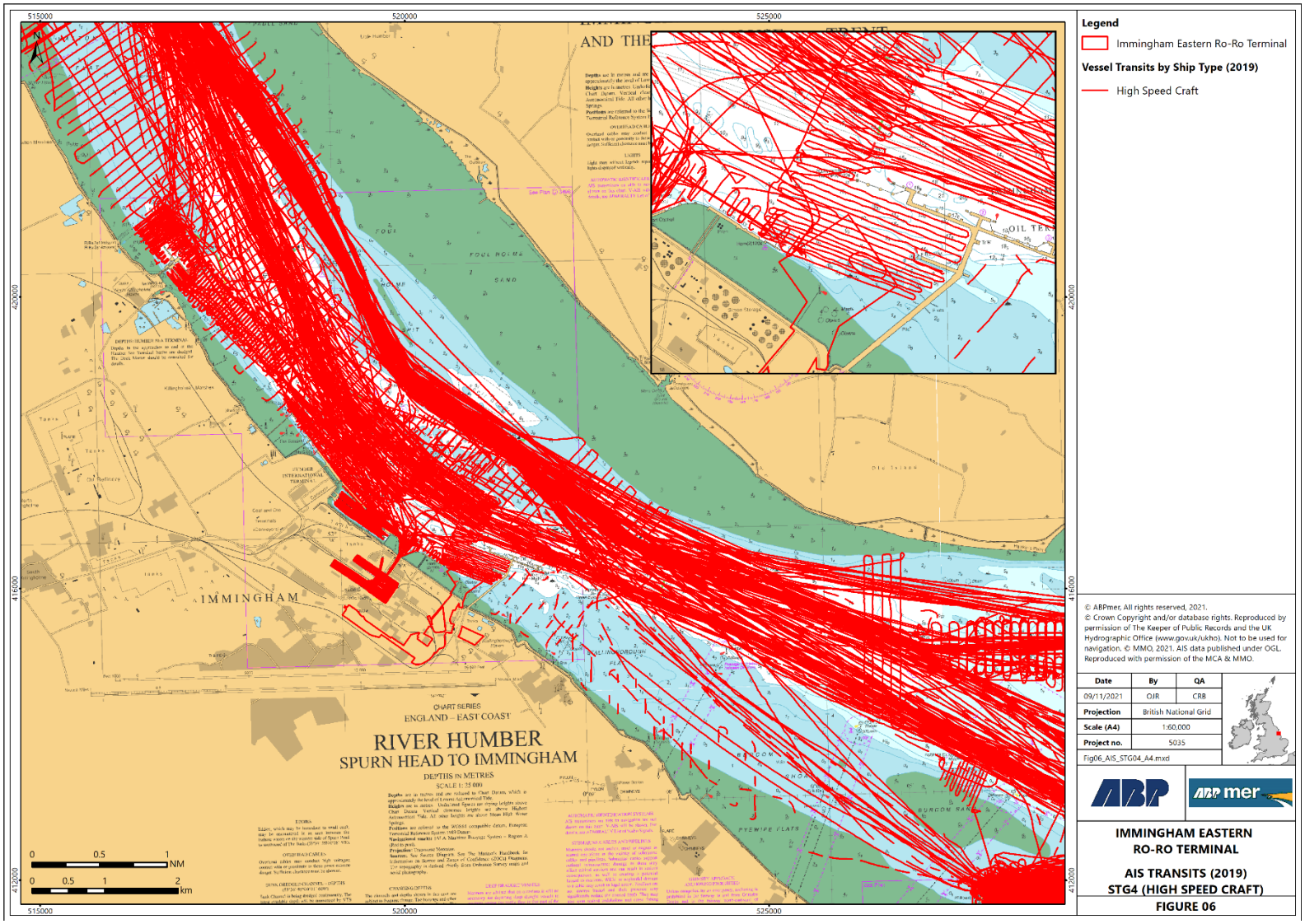

Figure 5 Vessel transits – High speed craft

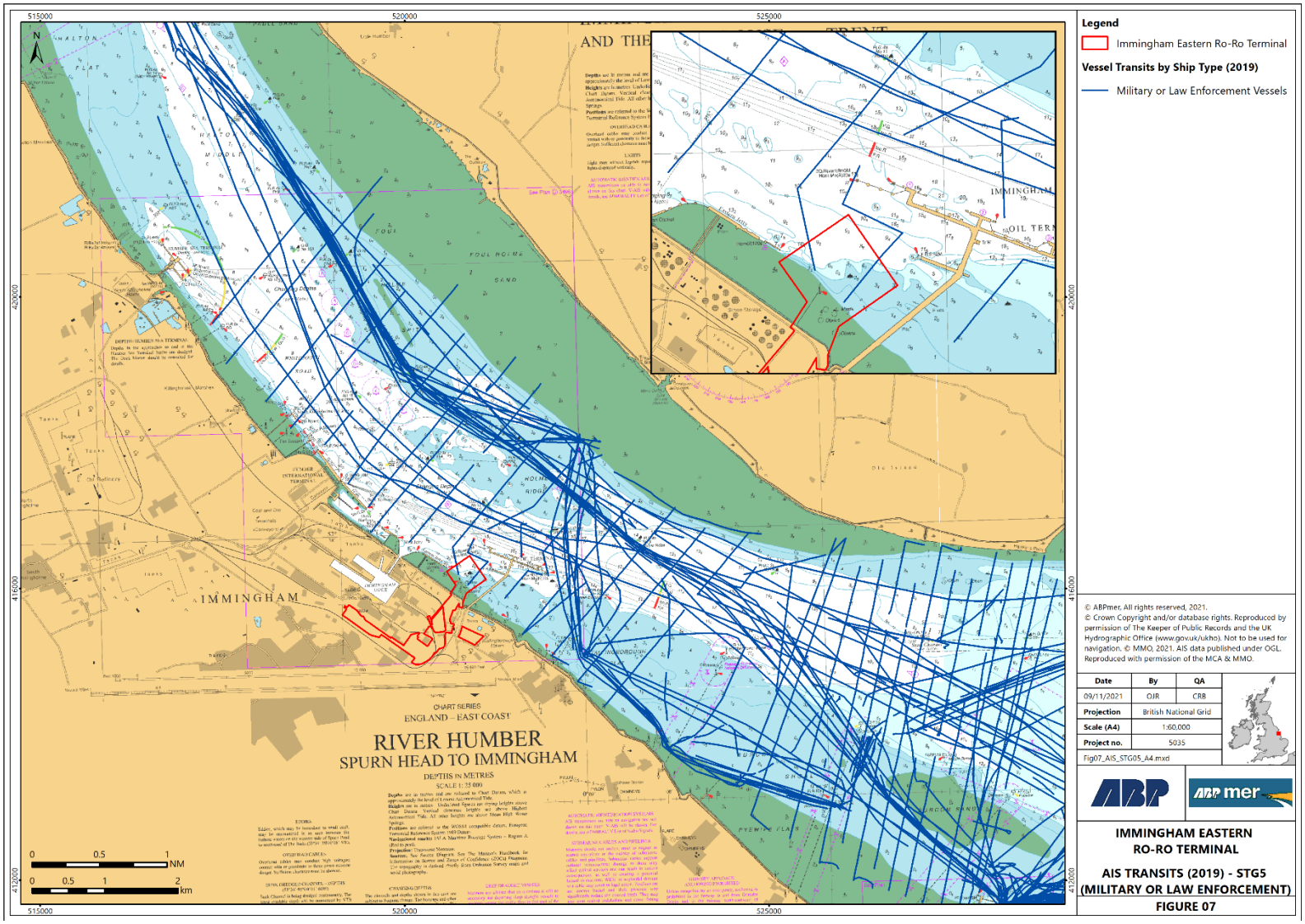

Figure 6 Vessel transits – Military or law enforcement

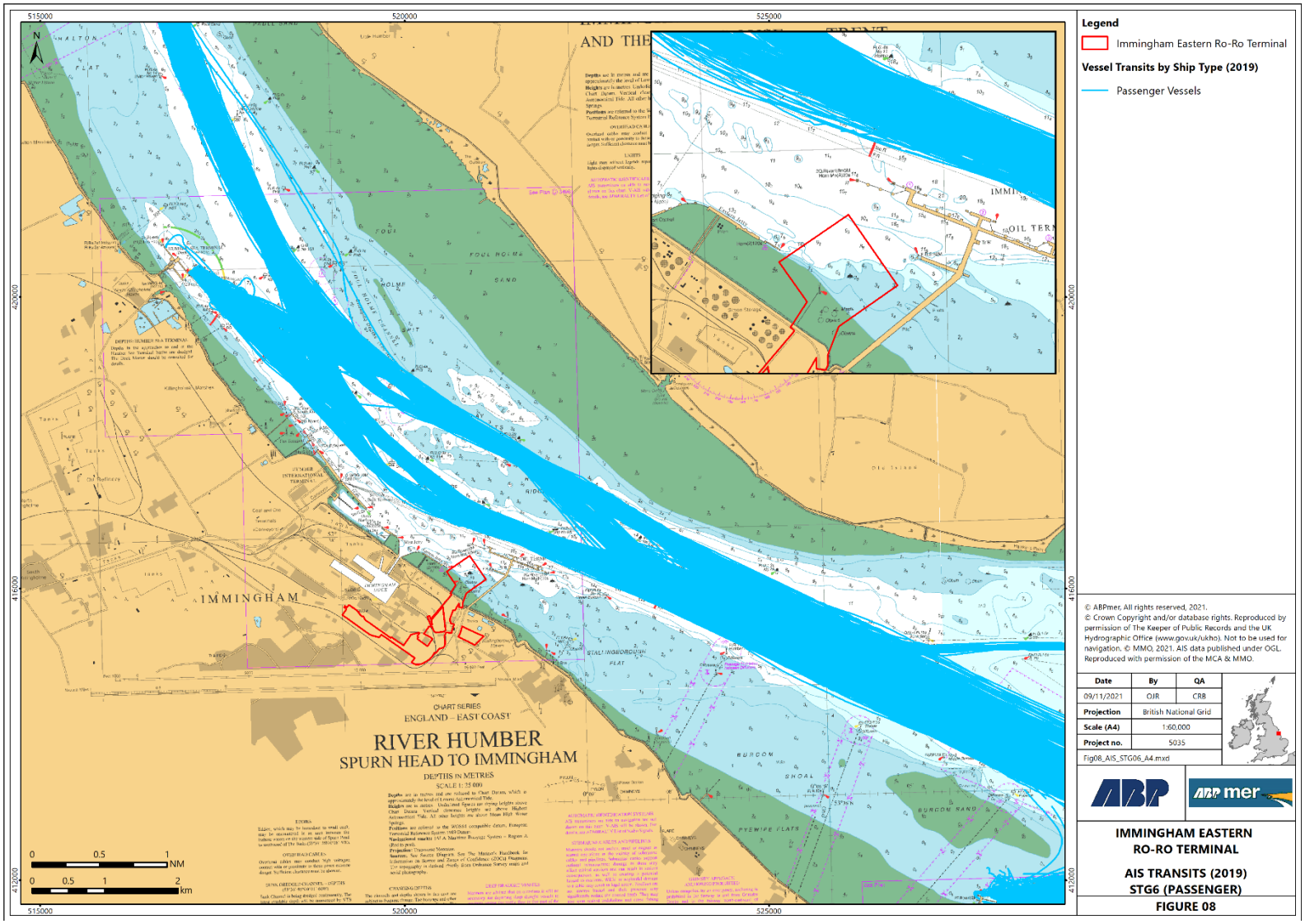

Figure 7 Vessel transits – Passenger

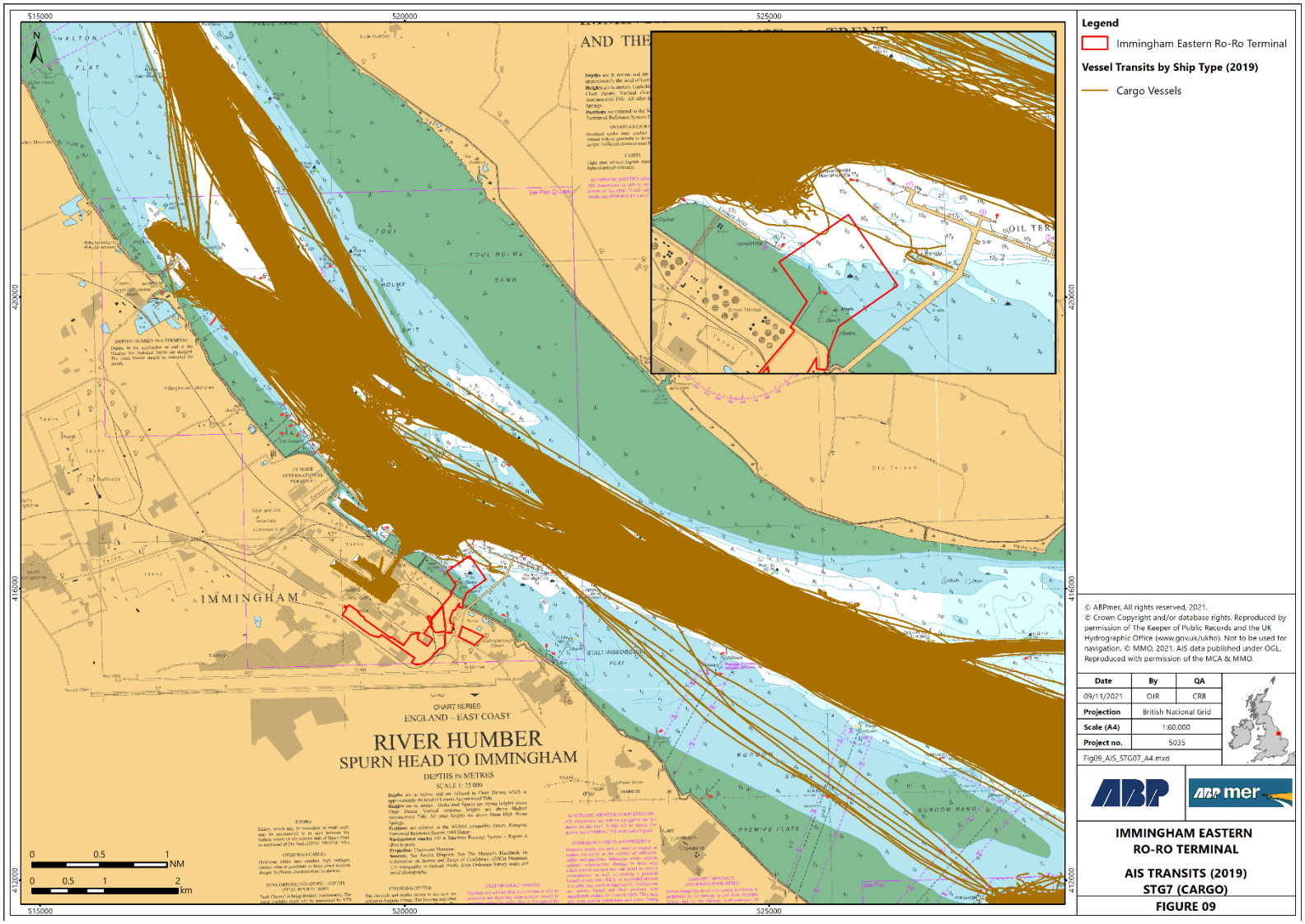

Figure 8 Vessel transits – Cargo

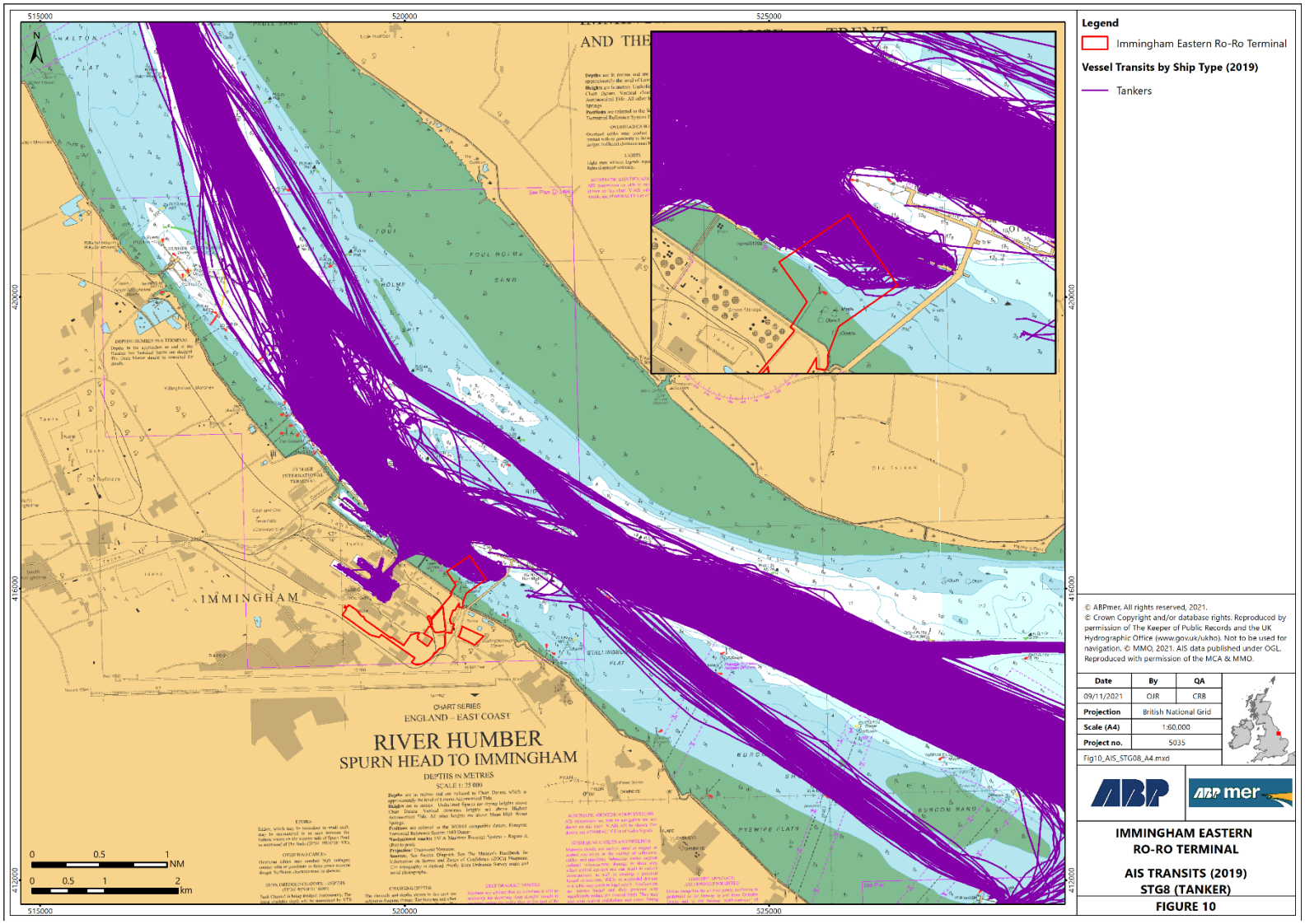

Figure 9 Vessel transits – Tankers

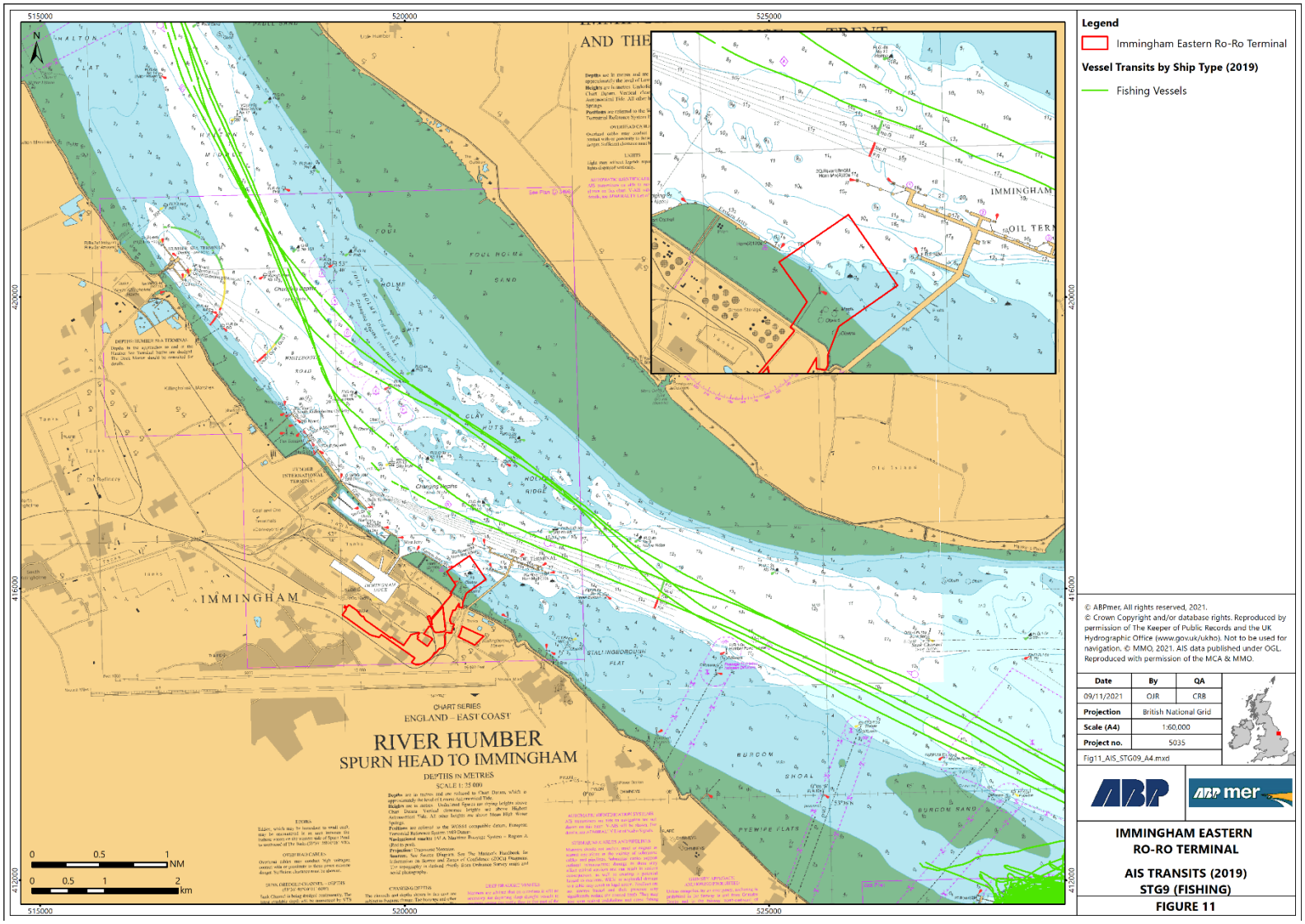

Figure 10 Vessel transits – Fishing

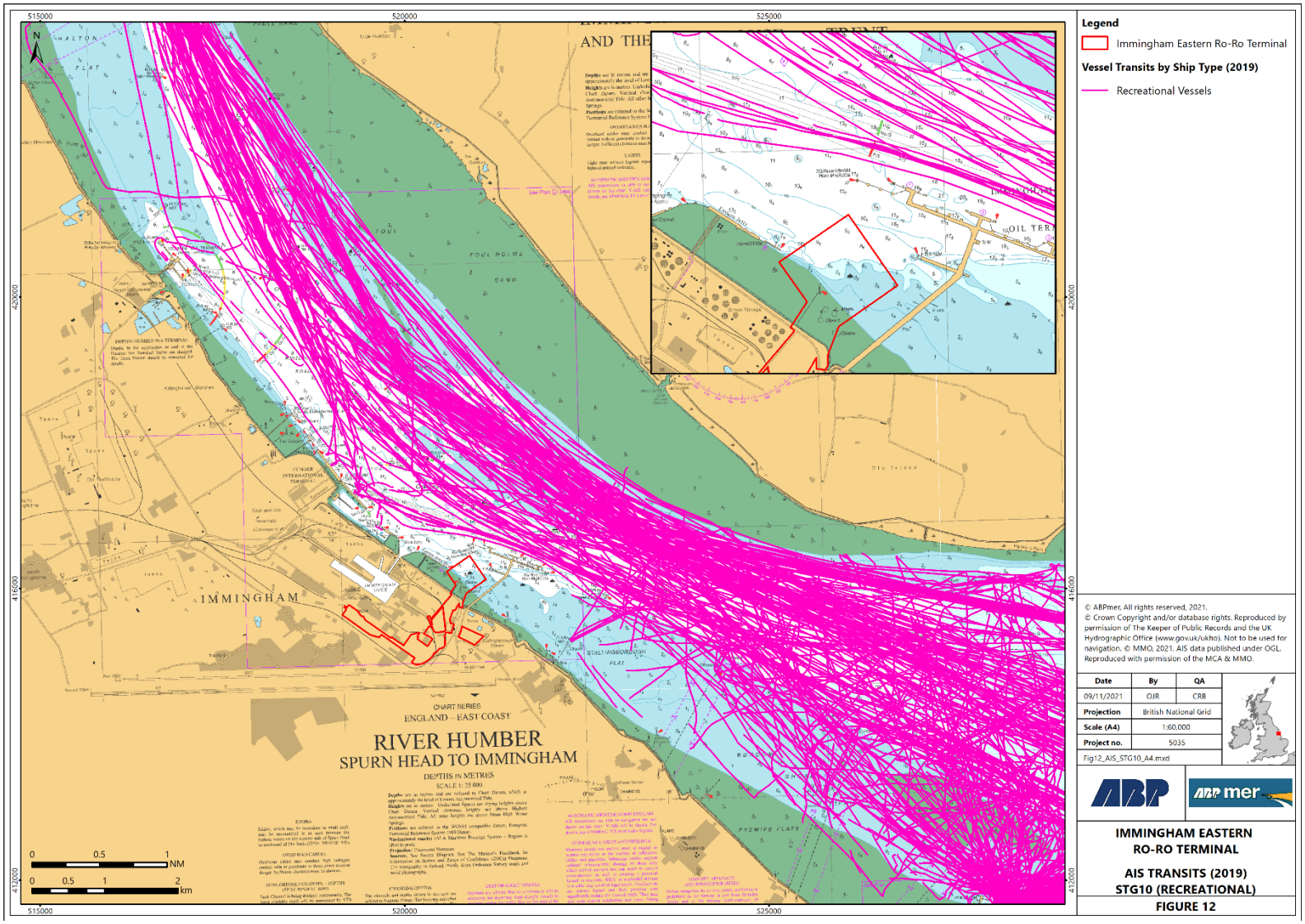

Figure 11 Vessel transits – Recreational

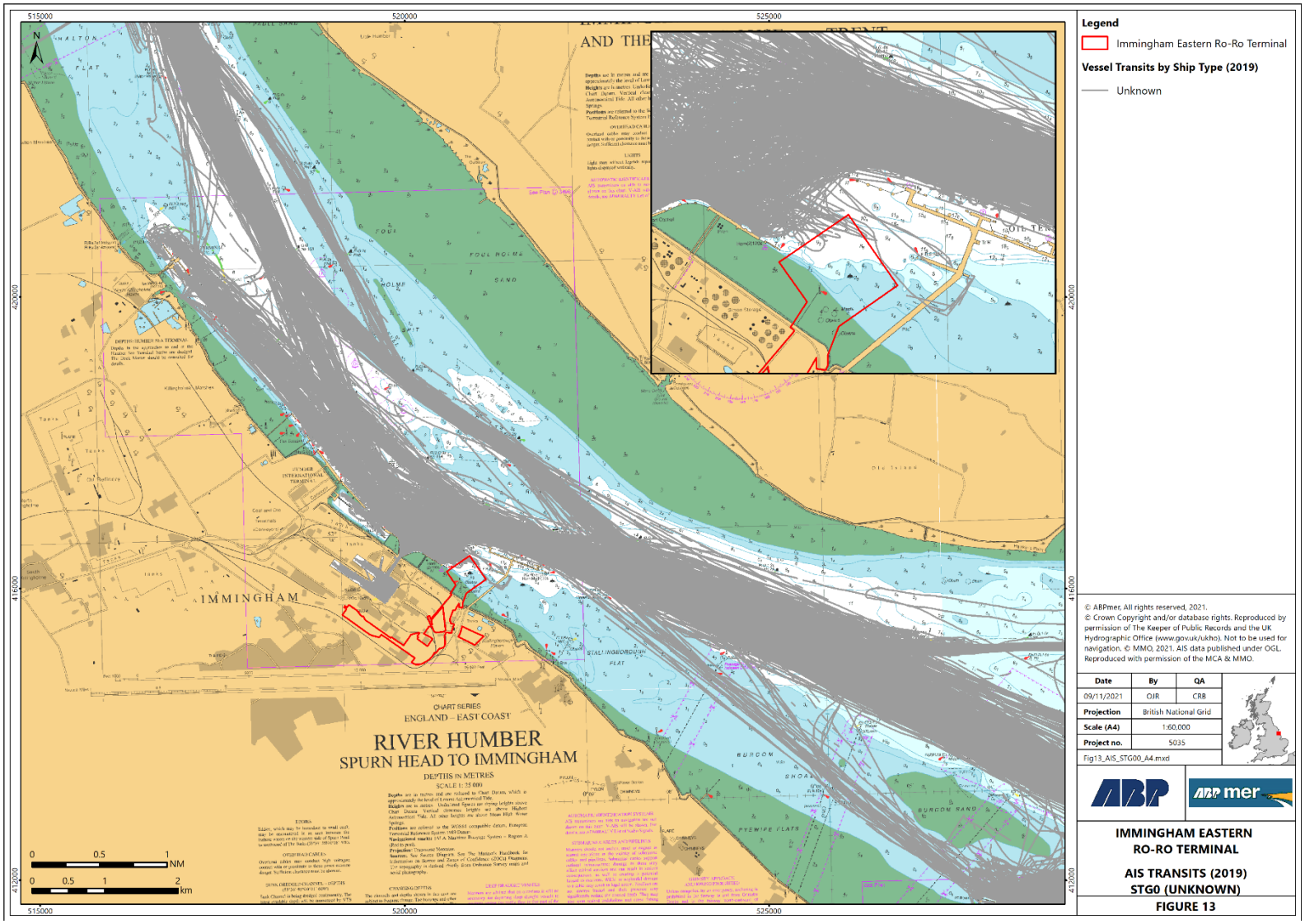

Figure 12 Vessel transits – Unknown

3.6.5 Other transits within the study area relate to military and law enforcement vessels can be seen making more erratic movements some of which can be associated with surveying activities. The main area of operation can be seen along the Foul Holme channel to Holme Ridge.

3.6.6 Table 1 shows a count of the AIS transits by vessel type through the study area. The count is for the dataset of 168 days comprising the first two weeks of each month for the year 2019. The count has also been uplifted to present an estimate for the annual vessel transits. Table 2 presents the vessel transits crossing a transect between the western extent of the IOT infrastructure and the eastern extent of the East Jetty.

Table 1 Transits in the Study area

Vessel Type	Transit Count	Yearly Uplift	Percentage
Non Port Service Craft	758	1,647	0.7%
Port Service Craft	41,929	91,096	36.8%
Dredging or Underwater Operations	7,027	15,267	6.2%
High Speed Craft	11,775	25,583	10.4%
Military or Law Enforcement	319	693	0.3%
Passenger	7,920	17,207	7.0%
Cargo	19,379	42,103	17.1%
Tanker	5,334	11,589	4.7%
Fishing	1,003	2,179	0.9%
Recreational	1,589	3,452	1.4%
Unknown	16,451	35,742	14.5%
Total	113,484	246,558	100%

Table 2 Transits between IOT and Eastern Jetty

Vessel Type	Transit Count	Yearly Uplift	Percentage
Non-Port Service Craft	3	7	0.4%
Port Service Craft	194	421	24.7%
Dredging or Underwater Operations	4	9	0.5%
High Speed Craft	13	28	1.7%
Military or Law Enforcement	2	4	0.3%
Cargo	3	7	0.4%
Tanker	548	1,191	69.8%
Unknown	17	37	2.2%
Total	784	1,703	100.0%

3.6.7 For the area in close proximity to the proposed terminal, Table 2 shows that the majority of transits are from tankers with 548 movements in the 168 day dataset. Given the location of the transect, it is likely that all of these transits are to/from the IOT Finger Pier. Other notable transits are from the port service craft which is likely to be associated with the tug berths on the eastern jetty or providing assistance to the tankers on passage to/from the IOT Finger Pier.

DFT vessel counts

3.6.8 The Humber Estuary is one of the busiest waterways in the UK. The Estuary handles around 40 thousand commercial shipping movements a year, bound for 27 principal dock, jetty, and estuary locations (including anchorages). The major Humber ports of Hull, Goole, Grimsby and Immingham account for the majority of cargo handled on the Humber Estuary, namely 9.2 million tonnes, 1.0 million tonnes and 45.6 million tonnes of cargo respectively in 2017 (DfT, 2021).

Recreational navigation

3.6.9 The Humber Estuary has approximately 1,000 permanent berths and 120 visitor's berths for recreational craft. The majority of recreational activity occurs during the summer months and predominantly on the weekend. There are no recreational facilities based at the Port of Immingham.

3.6.10 Established recreational vessel destinations in the Humber Estuary include: Hull Marina which has accommodation for 310 boats and 20 visitors; Goole Boathouse which offers 140 moorings and South Ferriby marina which provides accommodation for 100 boats plus 20 visiting vessels. In addition, there are various creeks around the estuary providing further capacity, namely Tetney Haven (Humber Mouth Yacht Club) where small numbers of moorings are available, Stone Creek (located on the north side of the river opposite Immingham), Hessle Haven and Barrow Haven, which both provide anchorages. The yacht havens of Brough and Winteringham (Humber Yawl Club) also provide limited mooring for small vessels and visiting yachts and motor cruisers (HES, 2021).

3.6.11 Figure 11 shows the recreational transits through the area from AIS data. It must be noted that a significant proportion of recreational vessels do not use AIS. Figure 13 presents information from the RYA and provides an estimate of recreational use for the study area.

Traffic Density

3.6.12 Vessel traffic density has been mapped for the study area through the use of AIS data, with an inherent bias towards commercial vessels, as discussed in Section 2. It is shown on Figure 14 that the majority of vessels transiting the study area do so in approach to Immingham Dock, within Immingham Roads and the Foul Holme Channel. There is a large quantity of vessel traffic across the northern section of the proposed development which is largely in association with the IOT Finger Pier.

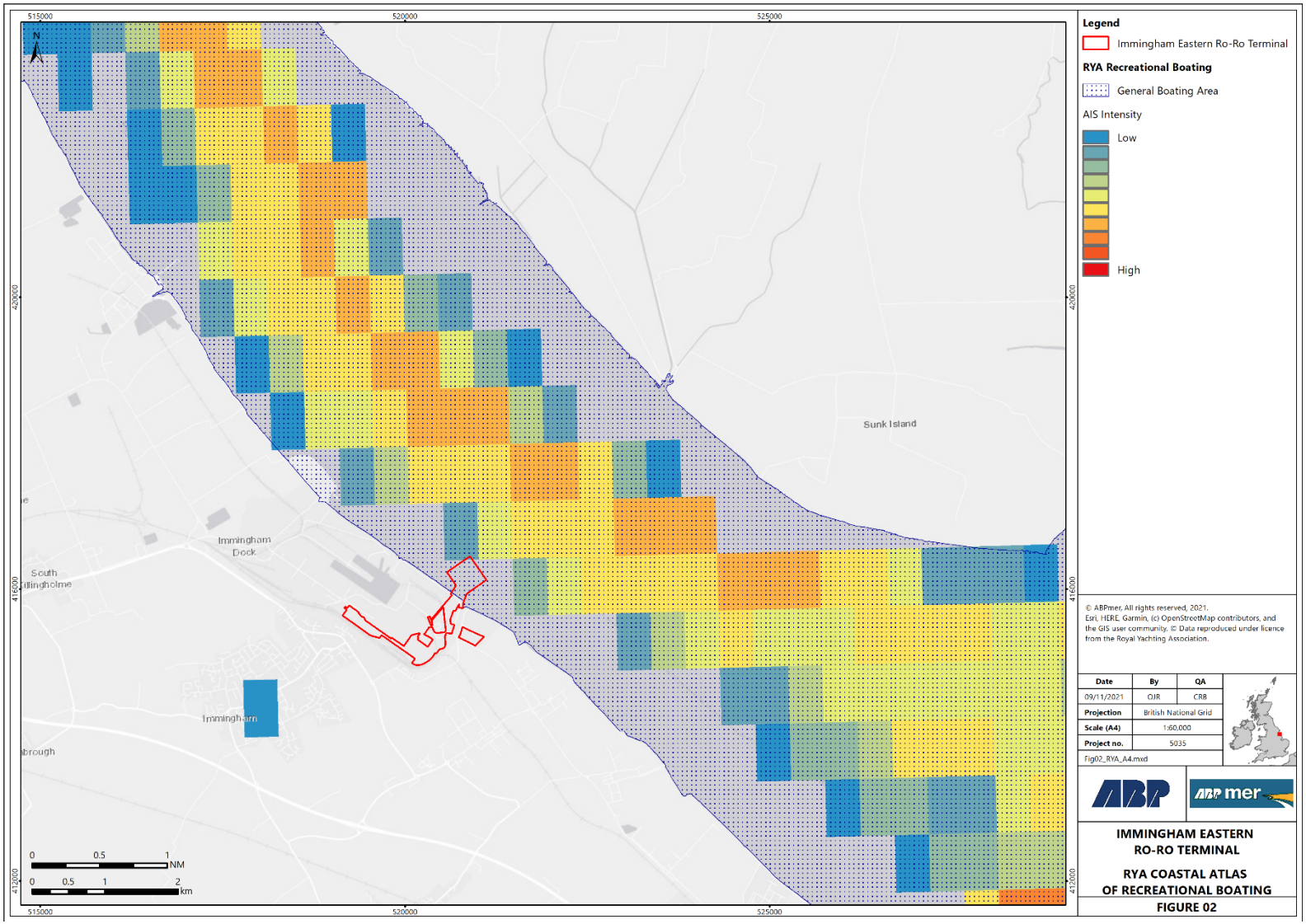

Figure 13 RYA coastal atlas of recreational boating

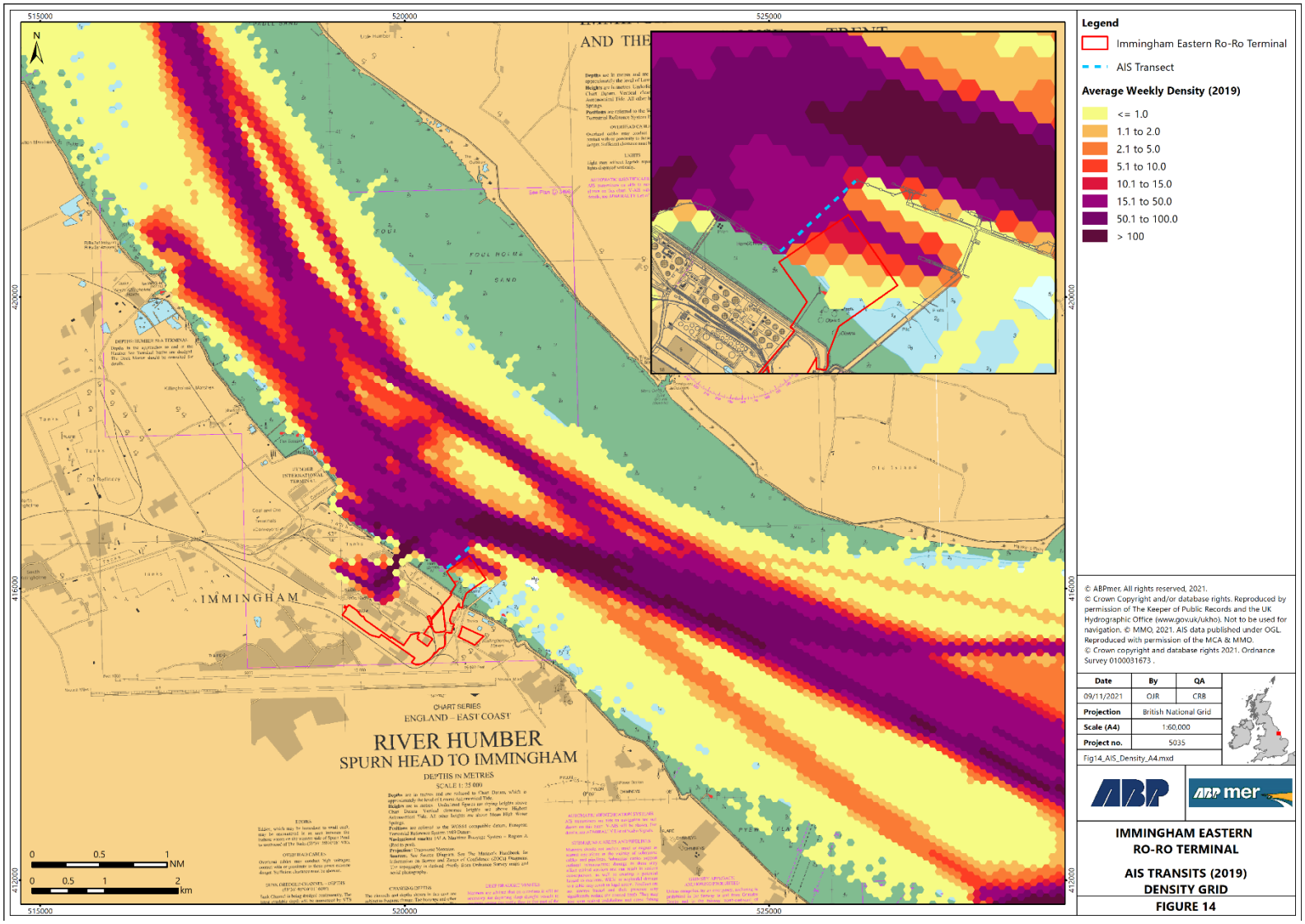

Figure 14 AIS vessel density

3.7 Marine accidents and incidents

3.7.1 The RNLI national dataset and the MarNIS local dataset hold the details of all reported marine safety incidents and other occurrences which have potential significance to navigational safety. These datasets have been used to identify accidents/incidents for the study area between 2011 and 2020 inclusive. This data is presented in Table 3 and Table 4.

3.7.2 From Table 3 it can be seen that there were 2,129 incidents in the study area during the 10-year data period. This equates to an annual frequency of 212.9 incidents a year. The most frequent incident type was 'Equipment failure (vessel)' with an annual frequency of 932. These events are generally reported to Humber VTS by the pilots and relate to any equipment such as propulsion or navigational equipment that are out of service. The next most common accidents/incident category was 'Impact with Structure' which is commonly reported at locations where there is significant dock infrastructure due to the constraints when entering the lock. The majority of these accidents/incidents have minor consequences. These accident/incident reports are displayed on Figure 15.

3.7.3 From Table 4 it can be seen that there were 70 marine accidents/incidents in the study area during the 10-year data which were attended by the RNLI. The most frequent of these was 'Equipment failure (vessel)' and 'Grounding' which both occurred with an annual frequency of 2.2. The following most common accidents/incidents are categorised as 'Other nautical safety'. These accident/incident reports are displayed on Figure 16.

Table 3 MarNIS Accident Incident for the study area 2011 to 2020

Incident Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Collision ship - ship	2	5	3	2	4	3	4	4	6	1	**34**
Equipment failure (port)	3	7	3	10	9	3	17	9	3	5	**69**
Equipment failure (vessel)	52	72	84	84	88	77	170	130	70	105	**932**
Event Management	0	0	0	0	0	0	5	6	1	0	**12**
Fire/Explosion	3	1	3	2	3	2	5	0	0	2	**21**
Grounding	3	0	1	2	5	6	4	9	0	2	**32**
Heaving Lines	0	0	0	0	0	0	0	9	16	13	**38**
Impact with Structure	66	66	77	47	36	30	73	49	36	34	**514**
Other nautical safety	0	0	0	24	23	31	75	56	46	35	**290**
Other nautical safety hazard	11	25	28	0	0	0	0	0	0	0	**64**
Pilot boarding arrangements	0	0	0	0	0	0	0	0	0	2	**2**
Ranging	4	3	5	20	11	14	10	7	4	0	**78**
Sinking and capsizing	0	0	0	0	0	0		0	1	0	**1**
Striking with Floating Object	2	1	0	3	1	0	1	0	3	0	**11**
Striking with ship (moored)	3	6	5	4	0	3	5	0	3	2	**31**
Total	**149**	**186**	**209**	**198**	**180**	**169**	**369**	**279**	**189**	**201**	**2,129**

Table 4 RNLI Accident Incident for the study area 2011 to 2020

Incident Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Collision	0	0	0	0	0	2	0	0	0	0	**2**
Equipment failure (vessel)	5	1	4	1	2	3	1	1	4	0	**22**
Fire/Explosion	0	1	0	0	0	0	0	0	0	0	**1**
Grounding	3	0	9	4	0	3	1	2	0	0	**22**
Other nautical safety	1	2	0	1	0	1	2	3	5	2	**17**
Person in distress	1	0	0	0	1	0	0	2	0	1	**5**
Person(s) in the water	1	0	0	0	0	0	0	0	0	0	**1**
Total	**11**	**4**	**13**	**6**	**3**	**9**	**4**	**8**	**9**	**3**	**70**

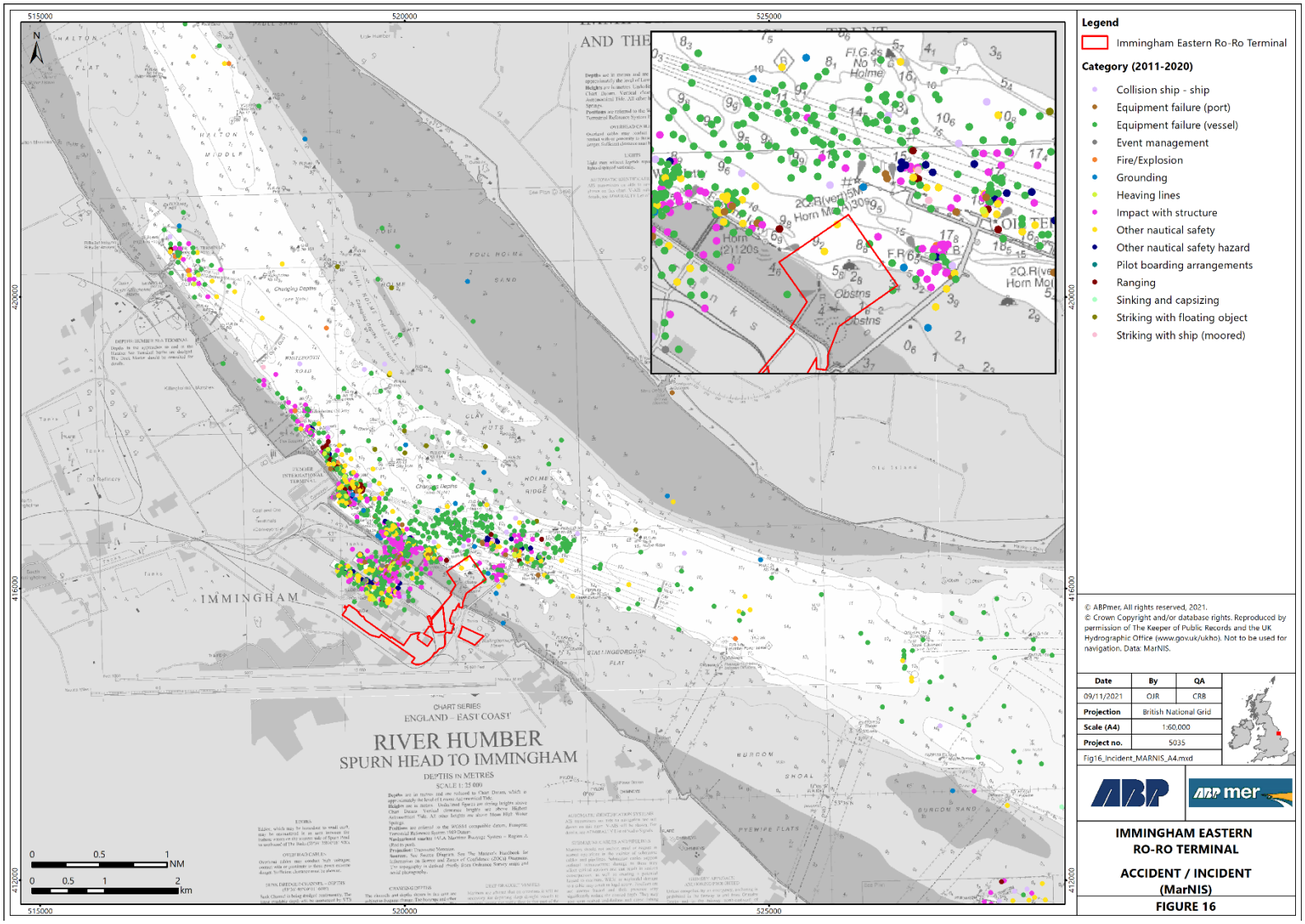

Figure 15 MarNIS accident/incident reports

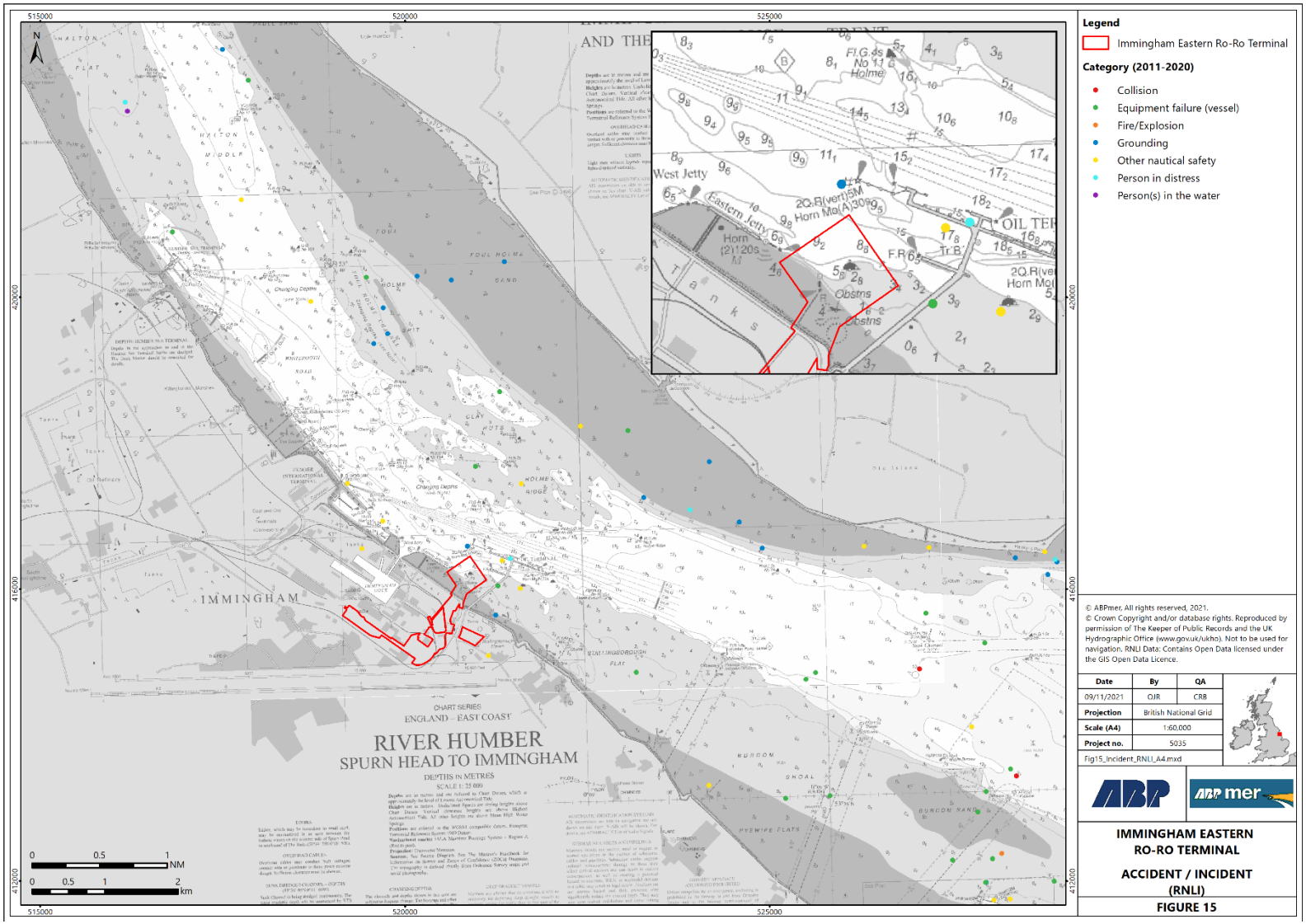

Figure 16 RNLI accident/incident reports

4 Marine Development

4.1.1 The proposed construction of the berths will consist of static structures which will rest upon an open piled network of steel tubular piles. These piles will maintain the floating section of the infrastructure in place. This will consist of floating pontoons and linkspan structures which will all be fabricated off site and floated or craned into position respectively.

4.1.2 The project also includes the need for a capital dredge to deepen the berth pocket, the most appropriate dredge methods are still under consideration. It is likely that this process will use a combination of backhoe dredging with the use of a trailer suction hopper dredger (TSHD) where possible.

4.2 Construction

4.2.1 The marine works to be undertaken during the project are described below:

- An open piled approach jetty which will provide access for vehicles and wheeled cargo to and from the shore to the berths. The approach jetty will be approximately 105 m in length and extend from the shore spanning the existing pipelines and the sea wall, and terminating at a newly created bankseat (foundation for linkspan);
- The linkspan will be a single structure which will allow vehicles and cargo to transfer from the approach jetty across the bankseat to the floating pontoons. It will span the distance between the bankseat and the first pontoon, with its free end resting upon the edge of this pontoon. The linkspan length will be optimised to ensure that vehicular accessibility from the approach jetty to the berthed ro-ro vessels via the pontoons can be maintained at all states of the tide;
- The floating pontoons (two in number) will be approximately 40 m x 90 m with an overall depth of 7 m and will provide the resting point for the moored vessels' stern ramp. The pontoons will each be secured in place by two restraint dolphins which will ensure that they can range up and down freely with the tide;
- Positioned centrally to each floating pontoon and extending away in a north westerly direction, it is currently anticipated will be an open piled finger pier approximately 260 m in length. These will be lined with fender panels on both sides and equipped with mooring infrastructure (fixed bollards and/or quick-release hooks) so that vessels can berth on either side of each pier (i.e. providing up to two berths per pier, four in total);
- The two pontoons will be linked with another linkspan which will hinge on one of the pontoons with the free end resting on the other;

- A capital dredge will be required to ensure accessibility and safe mooring for vessels at all states of the tide; and

- The dredge berth pocket will be optimised to include side slopes so as to ensure its stability. ABP is seeking a beneficial use for the dredged arisings - comprising of alluvial and glacial materials - but if this does not prove possible, then it is likely that the arisings will have to be deposited at licensed sites within the estuary.

4.3 Operation

4.3.1 The Terminal will operate 24 hours a day, seven days a week and 364 days a year (though with lower activity at night compared to the day). Up to four vessels (i.e. one per berth) will arrive at the Terminal per day. At this stage it is considered likely that each of these vessels will arrive at around 07:00am each day and depart around 19:00pm for overnight sailing. Tug vessels will help to manoeuvre the arriving vessel onto the berth. Whilst berthed at the Terminal, vessels will be on Ship to Shore power.

5 Hazard Identification Workshop

5.1.1 In order to provide an assessment of navigational risk during the construction and operational phases of the proposed breakwater and overnight berth; a hazard workshop with harbour authority representatives was held. The hazard identification workshop was held on 29 October 2021 over Microsoft Teams. During the workshop, a presentation was given of the available baseline data and exercises were carried out to identify potential hazards associated with the proposed scheme.

5.1.2 The aim of the workshop was to identify navigational safety concerns relative to the study's scope. In addition, attendees at the workshop provided anecdotal information regarding marine use of the study area, which was used to further describe the information collected through the navigation baseline activities. Following discussion of the hazards, suitable mitigation measures were discussed which could further reduce the level of risk associated with the proposed development.

5.1.3 The outputs from the workshop were used to inform the individual NRAs detailed in the following sections and presented in Appendices A and B. The attendees at the hazard workshops are shown in Table 5.

Table 5 Hazard Workshop Attendees

Attendee	Organisation
Gary Wilson	Head of Marine – ABP Humber
Mark Collier	Dock Master – ABP Immingham
Ben Brown	Assistant Pilotage Operations Manager – ABP Humber
Tom Jeynes	ABP
Adam Fitzpatrick	ABPmer
Harry Aitchison	ABPmer

6 Navigational Risk Assessment

6.1.1 This preliminary NRA has been carried out to determine the risk to vessel navigation associated with the proposed development (as described above). To assess navigational risk, the specifics of the proposed development have been assessed in relation to the impacts during:

- Construction: Capital dredge and installation of infrastructure; and
- Operation: Change to the study areas vessel movements including any maintenance dredging.

6.1.2 The process for carrying out an NRA follows the methodology from MGN 654, Annex 1 'Methodology for assessing marine navigational safety and emergency response risks of OREIs' (MCA, 2021); plus, the process identified in the PMSC 'Guide to Good Practice' (DfT, 2018). The following outlines the steps to carrying out an NRA:

1. Identification of hazard definitions;
2. Listing of potential hazard scenarios (i.e., descriptions of hazard and outcome);
3. Identification of causes that may lead to one of the described hazard scenarios (i.e. an accident or incident outcome);
4. Consideration of existing (embedded) mitigation measures, which either control or address the outcome of an accident or incident; and
5. Additional (future) risk controls, which are not currently in place, but could be used to further reduce or eliminate risk.

6.1.3 The following sections identify the outcome from the above steps, carried out within this preliminary NRA. Section 7 describes and expands on the NRA outcome.

6.2 Hazard definitions

6.2.1 The first step in the NRA process is the consideration of potential hazards resulting from the proposed development. Table 6 provides hazard category definitions taken from the DfT and MCA; 'Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations' (MCA, 2021).

Table 6. Hazard category definitions

Category	Description
Foundering	To sink below the surface of the water.
Collision	Collision is defined as a vessel striking, or being struck by, another vessel, regardless of whether either vessel is under way, anchored or moored; but excludes hitting underwater wrecks.
Allision	Defined as a violent contact between a vessel and a fixed structure.
Contact	Contact is defined as a vessel striking, or being struck by, an external object that is not another vessel or the sea bottom. Sometimes referred to as impact.
Fire	Fire is defined as the uncontrolled process of combustion characterised by heat or smoke or flame or any combination of these.
Explosion	An explosion is defined as an uncontrolled release of energy which causes a pressure discontinuity or blast wave.
Loss of hull integrity	Loss of Hull Integrity (LOHI) is defined as the consequence of certain initiating events that result in damage to the external hull, or to internal structure and sub-division, such that any compartment or space within the hull is opened to the sea or to any other compartment or space.
Flooding	Flooding is defined as sea water, or water ballast, entering a space, from which it should be excluded, in such a quantity that there is a possibility of loss of stability leading to capsizing or sinking of the vessel.
Grounding	Grounding is defined as the ship coming to rest on, or riding across underwater features or objects, but where the vessel can be freed from the obstruction by lightening and/or assistance from another vessel (e.g. tug) or by floating off on the next tide.
Stranding	Stranding is defined as being a greater hazard than grounding and is defined as the ship becoming fixed on an underwater feature or object such that the vessel cannot readily be moved by lightening, floating off, or with assistance from other vessels (e.g. tugs).
Capsizing	The overturning of a vessel after attaining negative stability.
Machinery related accidents	Machinery related accidents are defined as any failure of equipment, plant and associated systems which prevents, or could prevent if circumstances dictate, the ship from manoeuvring or being propelled or controlling its stability.

Category	Description
Payload related accidents	Payload related accidents include loss of stability due to cargo shifting and damage to the vessel's structure resulting from the method employed for loading or discharging the cargo. This category does not include incidents which can be categorised as Hazardous Substance, Fires, Explosions, Loss of Hull Integrity, Flooding accidents etc.
Hazardous substance accidents	Hazardous substance accidents are defined as any substance which - if generated as a result of a fire, accidental release, human error, failure of process equipment, loss of containment, or overheating of electrical equipment - can cause impairment of the health and/or functioning of people or damage to the vessel. These materials may be toxic or flammable gases, vapours, liquids, dusts or solid substances.
Accidents to personnel	Accidents to personnel are defined as those accidents which cause harm to any person on board the vessel e.g. crew, passengers, stevedores; which do not arise as a result of one of the other accident categories. Essentially, it refers to accidents to individuals, though this does not preclude multiple human casualties as a result of the same hazard, and typically includes harm caused by the movement of the vessel when underway, slips, trips, falls, electrocution and confined space accidents, food poisoning incidents, etc.
Accidents to the general public	Accidents to the general public are defined as those accidents which lead to injury, death or loss of property amongst the population ashore resulting from one of the other ship accident categories.

6.2.2 Five of these hazard categories have been scoped out of the NRA. The categories that have been scoped out are shown in Table 7 along with the rationale for doing so. The rationale considers the construction methodology for the proposed development and the potential outcomes, in terms of navigational hazards, both during construction and once the proposed development is *in situ*.

Table 7. Scoped out Hazard categories

Scoped Out: Hazard Category	Rationale
Flooding/Foundering	Neither the construction phase nor the operational phase has the potential to cause a vessel to lose hull integrity or be subject to a flood event or foundering. These may occur from allision, collision or grounding, which are considered separately.
Loss of hull integrity	
Machinery related accidents	A failure of equipment during the proposed project construction or operations phases is considered to be contained within normal practice of contractor works in port. Equipment failure has been included as a cause where it has been identified as relevant for individual hazard scenarios.
Capsizing	The risk of capsize to additional craft required by the project is not considered significant to the proposed works.
Accidents to the general public	The facility is provided with an exclusion zone and is not accessible by the general public from the sea or landside.

6.3 Hazard scenarios

6.3.1 From the hazard categories scoped into the NRA, the study team at ABPmer has identified the following specific hazard scenarios (listed in Table 8 and Table 9) for the proposed construction and operational phases. In total, twelve hazard scenarios are identified for the construction phase and seven for the operational phase.

Table 8. Construction phase hazards

Assessment No.	Hazard Category	Hazard Scenario
C.1	Accidents to personnel	Person overboard during dredge/construction works
C.2	Allision/Contact	Dredge/construction vessels impact with infrastructure during construction phase
C.3	Allision/Contact	Commercial vessel with marine works
C.4	Collision	Two craft associated with the marine works
C.5	Collision	Dredger/construction vessel collides with commercial vessel
C.6	Collision	Dredger collision with vessel at ‘F’ anchorage when disposing of dredge material
C.7	Grounding	Dredger grounding whilst engaged in operations
C.8	Hazardous substance accidents	Hazardous chemical spill from construction vessel

Assessment No.	Hazard Category	Hazard Scenario
C.9	Swamping	Workboat takes on water from excessive wash
C.10	Payload related accident	Incorrect payload distribution affects stability
C11	Other	Vessel mooring failure
C.12	Other	Dropped item during construction

Table 9. Operational phase hazards

Assessment No.	Hazard Category	Hazard Scenario
O.1	Allision/Contact	Ro-Ro contacts infrastructure
O.2	Allision/Contact	Commercial vessel with Immingham Eastern Ro-Ro
O.3	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with commercial vessel
O.4	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with recreational vessel
O.5	Collision	Vessel proceeding to/from Immingham Eastern Ro-Ro with tanker moored at IOT
O.6	Grounding	Whilst manoeuvring to south-western berth
O.7	Other	Vessel breaks free of moorings

6.3.2 The hazard scenarios identified in Table 8 and Table 9 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, along with outcomes that are less serious and could occur on a more frequent basis. The full descriptions and evaluations for each hazard scenario are presented as a full NRA, in table format, in Appendix A for the Construction phase, and Appendix B for the operational phase.

6.3.3 The assessment of risk is based upon the descriptions of the 'Most Likely' and 'Worst Credible' to determine the outcome in respect of effect to people, property, the environment and port business. This approach follows the best practice guidance from the PMSC 'Guide to Good Practice' (DfT, 2018). In making the assessment, the outcome from each scenario using the receptors of 'people, property, environment, business' was evaluated to give an embedded risk with currently available mitigation measures in place.

6.4 Hazard scenario causes

6.4.1 The possible causes leading to each of the identified hazard scenarios have been considered, both individually or in combination. Table 10 presents a compiled frequency of causes from the 19 hazard scenarios. Appendices A and B list these against each assessment.

Table 10. Cause frequency

Cause	Frequency
Adverse weather conditions	17
Human error/fatigue - Vessel Personnel	17
Inadequate procedures in place onboard vessel	16
Vessel breakdown or malfunction	13
Communication failure - Operational/procedural	12
Incorrect assessment of tidal flow	12
Restricted visibility	12
Excessive vessel speed	11
Inadequate bridge resource management	11
Interaction with passing vessel	9
High traffic density	7
Communication failure - Personnel	6
Failure to follow passage plan	6
AIS failure	5
Inadequate training/competence - Others	5
Failure to comply with safe systems of work	4
Human error/fatigue - Marine personnel	4
Manoeuvre misjudged	4
COLREGS failure to comply	3
Risk Assessment, Incomplete/not reviewed	3
Failure of berth mooring systems	2
Inadequate maintenance/inspection	2
Notice to Mariners failure to observe	2
Towing equipment failure	2
Anchored vessel represents a hazard	1
Communication failure - equipment	1
Failure to observe standing notices	1
Inadequate dredging	1
Inadequate hydrographic surveying	1
Inadequate number/type tugs	1
Inadequate procedures shoreside	1
Lifting equipment failure	1
Loss of vessels stability (due to other than loss of watertight integrity)	1
Port Equipment (inc craft) mechanical breakdown/system malfunction	1
Ship/Tug/Launch failure	1
Unplanned interaction with recreational/fishing craft	1

6.4.2 The next stage of the process considers these causes in the context of embedded controls, which might be applicable to prevent the hazard scenario from occurring.

6.5 Embedded risk controls

6.5.1 Each hazard scenario has been considered in light of embedded risk controls. It should be noted that embedded risk controls, in the context of marine safety, relate to processes, practices and available safety resources that are in existence prior to the project development or are incorporated into the current design for the bridge. These might include for example, international regulations (such as the International Regulations for Preventing Collisions at Sea (COLREGS)), training of personnel (such as the International Standards of Training, Certification and Watchkeeping for Seafarers (STCW)), or search and rescue provision (such as the UK Coastguard service or RNLI).

6.5.2 Table 11 presents the embedded risk controls for the construction phase, along with a frequency count of the number of assessments in which they apply. Following the construction of the berths, certain controls (which already exist) will be updated to include new operating instructions. These include controls such as 'Passage Plans' and 'Navigation Guidelines', or controls that are embedded within the build, such as 'Protective Marine Infrastructure'.

Table 11. Construction phase embedded risk control frequency

Embedded Risk Control	Frequency
Vessel Traffic Services	11
Availability of pollution response equipment	5
Emergency services equipment - shore side	5
Oil spill contingency plans	5
Port Facility Emergency Plan	5
Communications equipment	4
Pilotage service/PEC	4
Tier 2 contractor	4
AIS/Radar coverage	3
Notices to mariners	3
Towage, available and appropriate	2
Accurate tidal measurements	1
Harbour website	1
International COLREGS 1972 (as amended)	1
Passage planning	1
Vessel maintenance	1
Vessel safety management system (ISM code)	1

6.5.3 Table 12 presents controls which are considered to exist at the point the project moves into its operational phase, based on current controls in place at the facility and the design plans works.

Table 12. Operational phase embedded risk control frequency

Embedded Risk Control	Frequency
Vessel Traffic Services	7
Pilotage service/PEC	6
Availability of pollution response equipment	5
Tier 2 contractor	5
Passage planning	4
International COLREGS 1972 (as amended)	3
Arrival/Departure, advance notice of	3
Communications - traffic broadcast	3
Communications equipment	2
Aids to navigation, Provision & maintenance of	2
Vessel simulation study	2
Dredging programme	1
Hydrographic surveying program	1
Recreational vessel guidance	1

6.6 Risk evaluation: existing

6.6.1 The risk classification associated with each of the 16 hazard scenarios has been assessed to a pre-defined scale. The scale used within this preliminary NRA is shown in Table 13 and utilises the approach taken in Environmental Impact Assessments (EIAs), which applies specific mitigation to risks evaluated to be 'Significant' (or higher). In the context of marine safety, it must be remembered that the overriding objective identified in the PMSC is to reduce risk to a point which is 'as low as reasonably practicable'.

Table 13. Risk classification

Classification	Outcome
Very High Risk	VH
High Risk	Hig
Significant Risk	Sig
Moderate Risk	Mod
Low Risk	Low
Negligible Risk	Neg
No Risk	Non

6.6.2 Therefore, any identified control which contributes to reducing risk is considered, irrespective of the initial risk outcome. For example, a hazard scenario with a baseline or existing risk score of moderate or low, would still be taken forward for risk reduction to satisfy the requirement of the 'as low as reasonably practicable' principle.

6.6.3 After applying embedded controls to each hazard scenario, the outcome in respect of the assessed risk has been determined. The embedded risk level takes account of the likelihood reduction and consequence reduction from each risk control. Appendices A and B provide the full evaluation of each hazard scenario. Table 14 shows the outcome for each of the 16 hazard

scenarios, ranked by embedded risk level (i.e. with existing control measures).

Table 14. Hazard scenarios ranked by embedded risk

Assessment No.	Hazard Category	Hazard Scenario	Inherent Risk		Current Risk	
Construction Phase						
C.4	Allision/Contact	Commercial vessel with marine works	6.19	Hig	5.06	Sig
C.6	Collision	Dredger/construction vessel collides with commercial vessel	6.08	Hig	5.06	Sig
C.2	Allision/Contact	Dredger/construction vessel impact with infrastructure during construction phase	6.29	Hig	4.94	Mod
C.9	Hazardous substance accidents	Hazardous chemical spill from construction vessel	5.82	Sig	4.91	Mod
C.7	Collision	Dredger collision with vessel at 'F' anchorage when disposing of dredge material	6.18	Hig	4.88	Mod
C.11	Payload related accident	Incorrect payload distribution affects stability	4.96	Mod	4.88	Mod
C.12	Other	Dropped item during construction	4.96	Mod	4.88	Mod
C.10	Swamping	Workboat takes on water from excessive wash	5.31	Sig	4.84	Mod
C.3	Other	Vessel mooring failure	5.25	Sig	4.66	Mod
C.5	Collision	Two craft associated with the marine works	5.30	Sig	4.63	Mod
C.1	Accidents to personnel	Person overboard during dredge/construction works	4.91	Mod	4.50	Mod
C.8	Grounding	Dredger grounding whilst engaged in operations	5.19	Sig	4.31	Mod
Operational Phase						
O.2	Allision/Contact	Commercial vessel with Immingham Eastern Ro-Ro	6.38	Hig	4.94	Mod
O.4	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with recreational vessel	6.5	Hig	4.75	Mod
O.3	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with commercial vessel	6.26	Hig	4.72	Mod
O.1	Allision/Contact	Ro-Ro contacts infrastructure	5.44	Sig	4.69	Mod
O.5	Collision	Vessel proceeding to/from Immingham Eastern Ro-Ro with tanker moored at IOT	6.22	Hig	4.44	Mod
O.7	Other	Vessel breaks free of moorings	4.44	Mod	4.38	Mod
O.6	Grounding	Whilst manoeuvring to south-western berth	5.15	Sig	3.42	Low

6.7 Additional (future) risk controls

6.7.1 Additional controls have been identified through consultation and by the ABPmer study team, to apply practical and achievable control measures, to further reduce risk. These (future) risk controls relate to the construction (Table 15) and operational phases (Table 16) of the proposed development. The frequency of selection is identified in the column of each table.

Table 15. Construction, future risk controls

Control	Frequency
Communications - between project team and port	9
Contractor risk assessment method statement (RAMS)	7
Weather limits	5
Monitoring of wind/wave conditions	5
AIS equipment	4
Designated point of contact	4
Safety boat	4
Availability of pollution response equipment	3
Aids to navigation, Provision & maintenance of	1
Hydrographic surveying program	1
Dropped items procedure	1
Loading/unloading plan	1

Table 16. Operational, future risk controls

Control	Frequency
Update arrival/sailing parameters	5
Update ALRS, Sailing Directions and UKHO Charts	5
Hydrographic surveying program	1
Mooring studies and plans	1
Shore side facility maintenance programme	1

Discussion of future risk controls

6.7.2 The following text outlines the context in which the future risk controls have been used within the NRA. Table 15 and Table 16 above are split into Construction and Operation phases, whilst the following section provides a commentary on the purpose and application of each identified control. It should be noted that controls may appear in both tables but are described only once.

6.7.3 **Aids to navigation, Provision & maintenance of:** With new infrastructure which is not familiar to regular local sailors it is important to have the sight and marine works appropriately lit at all times.

6.7.4 **AIS equipment**: All construction craft including barges should have AIS transmitters to allow monitoring of movements by Humber VTS and other vessels.

6.7.5 **Availability of pollution response equipment**: The assessment of required pollution response equipment should be considered with construction contractors having tier 1 equipment to ensure any pollution events can be restricted to a singular vessel/craft.

6.7.6 **Communications - between project team and port**: Discussion of upcoming activities with the personnel at Immingham and HES. This role would be the main line of communication between the works and the SHA for the exchange of marine information and emergency response.

6.7.7 **Contractor risk assessment method statement (RAMS)**: Contractors would require risk assessment method statements covering all of the construction activities which will require overview and checks by the Harbour Authority prior to the commencement of activities.

6.7.8 **Designated point of contact**: For the construction activities with contact details provided to local stakeholders to provide appropriate information and respond to emergency situations

6.7.9 **Dropped items procedure**: During the construction of the site large items can be dropped in the water and cause a navigation risk to surface navigation. To stop this from happening contractors should have a procedure for actions to be taken if large items are dropped during the construction phase.

6.7.10 **Hydrographic surveying program**: The current programme of survey at the facility will need updating to effectively monitor the depth of water in the port following the capital dredge and to inform any maintenance dredging requirements. The results of the survey will be provided to the UKHO for use in navigational charts and compared with previous surveys to identify areas of sediment accretion (and inform potential requirements for maintenance dredging). In addition, it will identify any obstructions or items which may have been introduced to the area during construction.

6.7.11 **Loading/unloading plan**: Heavy infrastructure and equipment being delivered by barge will require plans for the order and method of loading and unloading at the marine works.

6.7.12 **Update arrival/sailing parameters**: The new berth will require updated local instructions on the requirements for arrival/sailing planning for the vessels visiting the area.

6.7.13 **Monitoring of wind/wave conditions**: Monitoring of weather forecasts by the construction contractor which can be obtained and compared with the weather limit allowing for reliable planning and assessment of risk regarding the weather operating limits for construction or dredge activities.

6.7.14 **Mooring studies and plans:** The use of a mooring study to evaluate and analyse vessel berthing at the new infrastructure to determine if the mooring patterns are sufficient for the intended use.

6.7.15 **Safety boat**: The availability of a safety boat in the area of marine works provides for rapid response to emergency situations and an overview of the activity being conducted. A safety boat can provide immediate response to persons entering the water, oil/hazardous chemical spills, assistance to work craft or the marshalling of non-work craft.

6.7.16 **Shore side facility maintenance programme**: The regular maintenance of infrastructure including mooring bollards/hooks, will need to be considered to ensure that the facility is maintained and fit for use with regular inspections.

6.7.17 **Update ALRS, Sailing Directions and UKHO Charts**: With new infrastructure put in place relevant sailing publication should be updated as they are used by vessels during passage planning.

6.7.18 **Weather limits**: Before commencement of works, the maximum weather limits for operations should be assessed and set for all activities. These can then be monitored and adjusted throughout the construction process. In addition, an operational weather limit should also be considered taking into account the vessel manoeuvring requirements onto the berth and how the prevailing weather would affect the activity.

6.8 Risk evaluation: future

6.8.1 Following the application of the additional (future) risk controls, the outcome in respect of the assessed future risk has been determined. The future risk outcome takes account of the likelihood reduction and consequence reduction from each risk control. Table 17 shows the hazard scenarios, ranked by future risk level.

Table 17. Hazard scenarios ranked by future risk

Assessment No.	Hazard Category	Hazard Scenario	Baseline Risk		Existing Risk		Future Risk	
Construction Phase								
C.2	Allision/Contact	Dredger/construction vessel impact with infrastructure during construction phase	6.29	Hig	4.94	Mod	4.67	Mod
C 6	Collision	Dredger/construction vessel collides with commercial vessel	6.08	Hig	5.06	Sig	4.42	Mod
C 7	Collision	Dredger collision with vessel at 'F' anchorage when disposing of dredge material	6.18	Hig	4.88	Mod	4.37	Mod
C 11	Payload related accident	Incorrect payload distribution affects stability	4.96	Mod	4.88	Mod	4.09	Mod
C 4	Allision/Contact	Commercial vessel with marine works	6.19	Hig	5.06	Sig	3.96	Low

Assessment No.	Hazard Category	Hazard Scenario	Baseline Risk		Existing Risk		Future Risk	
C 3	Other	Vessel mooring failure	5.25	Sig	4.66	Mod	3.96	Low
C 8	Grounding	Dredger grounding whilst engaged in operations	5.19	Sig	4.31	Mod	3.82	Low
C 9	Hazardous substance accidents	Hazardous chemical spill from construction vessel	5.82	Sig	4.91	Mod	3.75	Low
C 12	Other	Dropped item during construction	4.96	Mod	4.88	Mod	3.44	Low
C 10	Swamping	Workboat takes on water from excessive wash	5.31	Sig	4.84	Mod	3.39	Low
C 5	Collision	Two craft associated with the marine works	5.30	Sig	4.63	Mod	3.06	Low
C 1	Accidents to personnel	Person overboard during dredge/construction works	4.91	Mod	4.50	Mod	2.86	Low
Operational Phase								
O.2	Allision/Contact	Commercial vessel with Immingham Eastern Ro-Ro	6.38	Hig	4.94	Mod	4.61	Mod
O.4	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with recreational vessel	6.50	Hig	4.75	Mod	4.41	Mod
O.1	Allision/Contact	Ro-Ro contacts with terminal infrastructure	5.44	Sig	4.69	Mod	4.40	Mod
O.3	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with commercial vessel	6.26	Hig	4.72	Mod	4.40	Mod
O.5	Collision	Vessel proceeding to/from Immingham Eastern Ro-Ro with tanker moored at IOT	6.22	Hig	4.44	Mod	4.09	Mod
O.7	Other	Vessel breaks free of moorings	4.44	Mod	4.38	Mod	3.89	Low
O.6	Grounding	Whilst manoeuvring to south-western berth	5.15	Sig	3.42	Low	3.33	Low

7 NRA Discussion

7.1.1 This section expands upon the risk assessments and comments on future risk controls, as part of the existing facilities operations for hazard scenarios which have been assessed to be in the 'Significant Risk' band or higher. Section 7.2 provides a commentary on construction hazard scenarios and Section 7.3 addresses the operational phase of the proposed development.

7.2 Construction hazard scenarios

(C.4) Allision - Commercial vessel with marine works

7.2.1 This hazard scenario considers an allision or contact between a commercial vessel such as a tanker and marine infrastructure in the area leading to hull damage and pollution. Consideration of this scenario mainly relates to the tankers which transit to/from the IOT Finger Piers. An allision of a tanker with a solid structure has the potential to result in damage to the hull which may lead to loss of cargo. This would represent serious consequences including the potential for a tier 3 (national level) oil spill response being required.

7.2.2 Standard operating procedures, including the tankers only transiting on a flood tide so that manoeuvrability can be maintained at slow speeds, the Pilotage/PEC system and port oil spill response equipment, means that there is a high level of embedded mitigation relevant to this scenario. Due to the potential severity, this risk is determined to be significant and the application of future controls is suggested:

- Communications – between project team and the Port regarding planned activities and movements;
- Availability of pollution response equipment at the marine works; and
- Aids to navigation – established as soon as the marine works present a hazard to navigation.

7.2.3 The use of communication channels between the project team and the Port allows for more effective coordination, which reduces both the likelihood and consequence risk. The availability of pollution response equipment allows for a fast and efficient response to pollution events, reducing the consequence of any pollution event. Aids to navigation are essential with any fixed infrastructure in a navigable area. For vessels manoeuvring to and from nearby jetties and piers, the use of AtoN will greatly reduce the likelihood of incidents in the dark. Following application of future controls, this risk is deemed to be moderate.

(C.6) Collision - Dredger/construction vessel collides with commercial vessel

7.2.4 This hazard scenario considers a collision between a dredging vessel or construction vessel which collides with a tanker on route to the IOH Finger Piers.

7.2.5 The increase in activity in the area around the IOH Finger Pier increases the likelihood of interaction with tanker vessels. The provision of VTS, Pilotage/PEC services, Notice to Mariners and AIS/Radar coverage of the area, assist in mitigating this risk. In addition, the consequence of this scenario is also reduced by the port's Oil Spill Contingency Plan, Tier 2 contractors and the availability of pollution equipment. Due to potential severity, this risk is determined to be significant, and the application of the following future controls is suggested:

- Communications – between project team and the Port regarding planned activities and movements; and
- AIS equipment – in place for all construction craft.

7.2.6 The use of mandatory AIS equipment by all construction craft will enable other vessels to identify the craft in advance. Additionally AIS would enable the consultation of movements which allow for effective planning and Pilots/PEC holders to be made aware of hazards. Following application of future controls, this risk is deemed to be moderate.

7.3 Operation hazard scenarios

7.3.1 None of the scenarios identified during the operational phase of the project have a current risk rated as significant or above. The future controls that have been identified to further reduce these risks to a level that would be considered ALARP include:

- Hydrographic surveying program;
- Update arrival/sailing parameters;
- Update ALRS, Sailing Directions and UKHO Charts;
- Mooring studies and plans; and
- Shore side facility maintenance programme.

8 Summary

8.1.1 This preliminary NRA considers the marine risks created through the construction and operational phases of the proposed Immingham Eastern Ro-Ro Terminal. The preliminary NRA has identified nineteen hazard scenarios: twelve in the construction phase and seven in the operational phase, of the proposed development.

8.1.2 The NRA process has considered each scenario, applying controls currently available at the port and those proposed in the project design. Further applicable controls have then been considered, as appropriate, by the study team. These risk controls were applied to each hazard scenario, and the resultant navigational risk evaluated.

8.1.3 From the construction phase, the assessments considered to have the highest risk following application of all controls are:

- (C.6) Dredger/construction vessel collides with commercial vessel; and
- (C.4) Commercial vessel with marine works

8.1.4 There were no other hazard scenarios which were considered to be a significant risk, following application of embedded control measures.

8.1.5 The following future risk controls should be considered to ensure that risks associated with the construction phase of the project are reduced to a level considered ALARP:

- Communications - between project team and the Port;
- Contractor risk assessment method statement (RAMS) – in place and reviewed by the Harbour Authority before works commence;
- Weather limits – for construction and lifting operations;
- Monitoring of wind/wave conditions;
- AIS equipment – for all construction craft including barges;
- Designated point of contact – for the marine works;
- Safety boat;
- Availability of pollution response equipment – tier 1 equipment located at the marine works;
- Aids to navigation – in place from when the marine works presents a hazard to navigation;
- Dropped items procedure; and
- Loading/unloading plan – for heavy equipment and infrastructure from barges.

8.1.6 From the operational phase, none of the assessments were considered to be significant or above, after application of embedded controls. The effectiveness of controls for the management of traffic and response to emergencies reduces this risk to moderate for the operational phase of the project.

8.1.7 The following future risk controls should be considered to ensure that risks associated with the operational phase of the project are reduced to a level considered ALARP:

- Update arrival/sailing parameters – both for vessels using the Ro-Ro Terminal and those using the IOT Finger Pier;
- Update ALRS, Sailing Directions and UKHO Charts;
- Hydrographic surveying program – amendments of the current program reflecting the new infrastructure;
- Mooring studies and plans – to confirm whether there is sufficient restraint for the intended use of the Terminal; and
- Shore side facility maintenance programme – scheduled checks and maintenance including any mooring bollards/hooks.

8.1.8 Following application of identified future controls, there are no hazards which are considered to be of significant risk or higher.

9 References

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10 Abbreviations/Acronyms

Acronym	Definition
AIS	Automatic Identification System
ALARP	As Low As Reasonable Practicable
AtoN	Aids to Navigation
CD	Chart Datum
CHA	Competent Harbour Authority
COLREGS	International Regulations for Preventing Collisions at Sea 1972
DfT	Department for Transport
DWT	Deadweight
ES	Environmental Statement
FSA	Formal Safety Assessment
GLA	General Lighthouse Authority
GT	Gross Tonnage
GtGP	Guide to Good Practice on Port Marine Operations
H&S	Health & Safety
Hig	High Risk
IALA	International Association of Marine Aids to Navigational and Lighthouse Authorities
ID	Identity
IMO	International Maritime Organization
LLA	Local Lighthouse Authority
LOA	Length Overall
LOHI	Loss of Hull Integrity
Low	Low Risk
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MMO	Marine Management Organisation
Mod	Moderate Risk
MSMS	Marine Safety Management System
NA	Not Applicable
Neg	Negligible Risk
Non	No Risk
NPSfP	National Policy Statement for Ports
NRA	Navigational Risk Assessment

OREI	Offshore Renewable Energy Installations
PEC	Pilot Exemption Certificate
PMSC	Port Marine Safety Code
RAMS	Risk Assessment Method Statement
RNLI	Royal National Lifeboat Institution
Ro-Ro	Roll-On Roll-Off
RYA	Royal Yachting Association
SEA	Strategic Environmental Assessment
SHA	Statutory Harbour Authority
Sig	Significant Risk
SOP	Standard Operating Procedure
STCW	Standards of training, Certification and Watchkeeping
TSHD	Trailer Hopper Suction Dredger
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VH	Very High Risk
VTS	Vessel Traffic Service

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

11 Glossary

Term	Definition
Adverse weather conditions	Conditions during which navigation or mooring of vessels is adversely affected
AIS failure	A failure of the 'Automatic Identification System' equipment which provides vessel automated location signals
Cargo handling	The management, loading and unloading of goods from a vessel
COLREGS failure to comply	A failure of a crew on a vessel to observe the requirements of the International Regulations for Preventing Collisions at Sea 1972 (as amended), informally known as the 'rules of the road'
Communication failure - equipment	Failure of communications between personnel (specifically due to equipment failure)
Communication failure - Operational/procedural	Failure of communications between personnel (due to equipment failure, language problems or misunderstandings) – which is operational and/or procedural
Communication failure - Personnel	Failure of communications between personnel (due to equipment failure, language problems, procedural reporting failures or misunderstandings)
Competence	A measure of the experience and qualification of the mariner
Designated berth unavailable	The berth at which the vessel is planned to use, is not available
Excessive vessel speed	The vessel is travelling too fast in the given situation
Failure to comply with safe systems of work	A failure to follow the stated 'safety systems of work' as part of the safety management system
Failure to comply with Towage guidelines	When carrying out towing within a port, guidelines for the safe operation of this activity are published
Failure to comply with VTS/LPS/SOPs instructions	A failure of ship or port personnel to follow the stated instructions of the Local Port Service (as written within Standard Operating Procedures)
Failure to follow passage plan	The journey/voyage plan of the vessel, is not followed by the crew or embarked pilot
Fire/Explosion	Fire/Explosion
Human error	Human error

Human error/fatigue - Port/Marine Personnel	Human error – port/dock employees
Human error/fatigue - Ship Personnel	Errors made by personnel working onboard the vessel
Inaccurate vessel details provided	Information provided by the vessel's Master, crew or vessel agent is inaccurate
Inadequate bridge resource management	A lack of human resource, or competent resource on the vessels bridge to carry out navigation and/or shipboard functions
Inadequate maintenance/inspection	An inadequate maintenance or inspection regime by the port or a vessel
Inadequate number/type tugs	A lack of tug resource
Inadequate procedures in place onboard vessel	The vessel's Safety Management System is not followed as stated or does not adequately prescribe for this operation
Inadequate procedures shoreside	The procedures for port or third-party contractor staff are not followed as stated or do not adequately prescribe for this operation
Inadequate training/competence - Others	Training and/or competence of others (not associated with a vessel or the port)
Incapacitated master (drinks/drugs)	Consumption of alcohol or the use of drugs by a mariner, specifically the vessel's Master (Captain)
Incorrect assessment of tidal flow	An incorrect interpretation of the tidal flow or the effects it will have on vessel navigation by a mariner
Interaction	Vessels interact when one passes close to another, causing a deviation in course or movement in berthed vessels. The greater the speed, the more pronounced the interaction
Language problems	Difficulties caused by language/understanding between personnel
Malicious action by external parties	A third party carried out a malicious, egregious or intentional action
Protest by external parties	Protests
Restricted visibility	The restriction of visibility through atmospheric conditions, such as fog, mist, heavy rain or snow
Risk Assessment, Incomplete/not reviewed	Completion of the risk assessment writing, checking or review process

Ship/Tug/Launch failure	Failure, of any type, by a ship/tug/launch involved in a maritime operation
Shoreside light backscatter	The background lights in the port and/or harbour obscure or affect navigational lights of other vessels or aids to navigation, such as buoys
Tug failure towing equipment	A tug whilst providing services to another vessel, may suffer a failure in the tow wire/rope or associated equipment
Vessel breakdown or malfunction	A breakdown, malfunction or defect with equipment onboard the vessel
Vessel fails to notify hazardous cargo	Vessels carrying dangerous cargos are required to report these in advance to the harbour authority
Weather and hydro failure - equipment	Failure of equipment used to measure environmental conditions

Appendix A Navigational Risk Assessment: Construction

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
1	Accidents to personnel	Person overboard during dredge/construction works	Jack up rig collapses with multiple persons overboard during operations works leading to multiple fatalities from drowning. No pollution, major delay to construction works during investigation, international negative publicity.	50	4	0	0	4	Person overboard during the dredge/construction works, person recovered to shore and treated for cold water immersion. No pollution, minor delay to construction works.	1	1	0	0	1	4.91	Mod	1	Human error/fatigue - Vessel Personnel
																	5	Human error/fatigue - Marine personnel
																	7	Inadequate procedures in place onboard vessel
																	20	Towing equipment failure
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	37	Failure to comply with safe systems of work
																	48	Risk Assessment, Incomplete/not reviewed
																	49	Loss of vessels stability (due to other than loss of watertight integrity)
																	76	Inadequate training/competence - Others

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
26	Communications equipment	Vessels have VHF radios available	5%	5%	4.50	Mod	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham and HES	10%	0%	2.86	Low
62	Emergency services equipment - shore side	Ambulance service	5%	0%			116	Weather limits	Maximum weather limits for operations set and monitored	10%	0%		
130	Vessel safety management system (ISM code)	Requires emergency procedures to be available	5%	0%			117	Monitoring of wind/wave conditions	Weather forecasts obtained and compared with limits	10%	0%		
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	10%	20%			135	Safety boat	Ready on standby during construction activities	0%	30%		
							140	Contractor risk assessment method statement (RAMS)	Covering all of the construction activities and checked by the Harbour Authority prior to commencement	10%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
2	Allision/Contact	Dredger/construction vessel impact with infrastructure during construction phase	Dredge/construction vessel makes heavy with port infrastructure during restricted visibility or the hours of darkness. Significant damage to vessel, serious injury to crew, tier 1 pollution, vessel out of service until repairs completed, delay to marine works.	25	3	2	2	3	Slow speed impact with infrastructure whilst manoeuvring/berthing. Minor damage to vessel, no injuries, no pollution, minor delay to marine works.	1	1	0	0	1	6.29	Hig	1
																	6	
																	7	
																	11	
																	20	
																	25	
																	26	
																	28	
																	61	
																	68	
																	76	
																	84	
																	103	

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
7	Pilotage service/PEC	Towage operations would require a pilot	20%	0%	4.94	Mod	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham and HES	10%	0%	4.67	Mod
19	Port Facility Emergency Plan	Details the Harbour Authority's response to an emergency	0%	10%			140	Contractor risk assessment method statement (RAMS)	Covering all of the construction activities and checked by the Harbour Authority prior to commencement	10%	0%		
26	Communications equipment	VHF radio available	5%	5%									
36	Availability of pollution response equipment	Port has tier 1 equipment available	0%	10%									
142	Vessel Traffic Services	To coordinate an emergency response	0%	20%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
3	Other	Vessel mooring failure	Unmanned barge has mooring failure and drifts resulting in allision or grounding. Cargo (piles/construction materials) enter the water, major delay to operations whilst barge and cargo recovered, no injuries.	25	0	4	1	3	Construction craft or barge has a single mooring line failure but does not result in a breakout. Additional mooring lines used to secure craft, no injuries, no pollution, minor delay to works.	1	0	0	0	1	5.25	Sig	1	Human error/fatigue - Vessel Personnel
																	7	Inadequate procedures in place onboard vessel
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	40	Failure of berth mooring systems
																	68	Interaction with passing vessel
																	103	Excessive vessel speed

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
26	Communications equipment	VHF radio available	10%	5%	4.66	Mod	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham and HES	10%	0%	3.96	Low
32	Towage, available and appropriate	Available at the port	0%	10%			9	Designated point of contact	For the construction activities to provide appropriate information and respond to emergency situations	0%	5%		
76	Harbour website	Humber VTS website has weather information	5%	0%			116	Weather limits	Maximum weather conditions for any temporary moorings	15%	0%		
142	Vessel Traffic Services	Provide weather and tidal information	15%	20%			117	Monitoring of wind/wave conditions	Weather forecasts obtained and compared with limits	10%	0%		
							140	Contractor risk assessment method statement (RAMS)	Covering all of the construction activities and checked by the Harbour Authority prior to commencement	10%	0%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
4	Allision/Contact	Commercial vessel with marine works	Tanker proceeding to IOH finger piers makes contact with marine works resulting in damage to hull and loss of cargo. Serious injuries from impact, tier 3 pollution, international negative publicity, marine works cease during response and following investigation.	50	2	4	4	4	Tanker transiting to berth makes contact with infrastructure at slow speed, leading to minor damage to vessel, no loss of cargo, minor injury to crew and delay to marine works.	10	1	1	0	1	6.19	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	33	High traffic density
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	87	Notice to Mariners failure to observe
																	103	Excessive vessel speed
																	109	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
7	Pilotage service/PEC	Tankers proceeding to the IOT finger piers require a Pilot or PEC holder	30%	0%	5.06	Sig	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham, HES and the Pilots	20%	0%	3.96	Low
10	Passage planning	Include local information that may affect the transit	10%	0%			36	Availability of pollution response equipment	Construction contractor to have tier 1 equipment	0%	10%		
19	Port Facility Emergency Plan	Details the Harbour Authority's response to an emergency	0%	10%			57	Aids to navigation, Provision & maintenance of	Marine works to be appropriately lit at all times	20%	0%		
21	Oil spill contingency plans	Covers the response to a pollution event	0%	5%									
24	Tier 2 contractor	Provides additional resource and equipment for larger pollution events	0%	10%									
26	Communications equipment	VHF radio available to report accident	0%	5%									
28	AIS/Radar coverage	VTS monitor movements of vessels in the Harbour Area	20%	0%									
41	Notices to mariners	Issued by the Harbour Authority with information about the development	10%	0%									
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	0%	20%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
5	Collision	Two craft associated with the marine works	Vessel collision whilst transiting near the marine works results in significant hull damage and serious injuries. Tier 1 pollution, vessels out of service until repairs completed, significant disruption to construction activities.	50	2	4	2	4	Vessels take avoiding action resulting in minor collision. Minor damage to both vessels, no injuries, no pollution, minor delay to works.	10	0	1	0	1	5.30	Sig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	33	High traffic density
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	82	AIS failure
																	103	Excessive vessel speed
																	109	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
19	Port Facility Emergency Plan	Details the Harbour Authority's response to an emergency	0%	10%	4.63	Mod	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham and HES	10%	0%	3.06	Low
21	Oil spill contingency plans	Covers the response to a pollution event	0%	5%			9	Designated point of contact	For the construction activities to provide appropriate information and respond to emergency situations	0%	10%		
36	Availability of pollution response equipment	Port has tier 1 equipment available	0%	10%			36	Availability of pollution response equipment	Construction contractor to have tier 1 equipment	0%	10%		
62	Emergency services equipment - shore side	Ambulance service	0%	5%			56	AIS equipment	All construction craft including barges to have AIS transmitters	15%	0%		
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	0%	20%			135	Safety boat	Ready on standby during construction activities	0%	10%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
6	Collision	Dredger/construction vessel collides with commercial vessel	Collision as tanker is proceeding to the IOH finger piers results in significant hull damage to both vessels and cargo entering the water. Tier 3 pollution, serious injuries from impact, major delays to operations, international negative publicity.	50	2	4	4	4	Slow speed collision between coastal vessel and dredger/construction craft. Collision occurs at night or during restricted visibility and results in minor hull damage to both vessels. Minor injuries, no pollution, minor delay to marine works.	10	1	1	0	1	6.08	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	33	High traffic density
																	48	Risk Assessment, Incomplete/not reviewed
																	56	COLREGS failure to comply
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	76	Inadequate training/competence - Others
																	82	AIS failure
																	87	Notice to Mariners failure to observe
																	103	Excessive vessel speed
																	109	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
7	Pilotage service/PEC	Pilots have expert local knowledge and maintain awareness of operations at the Port	30%	0%	5.06	Sig	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham, HES and the Pilots	20%	0%	4.42	Mod
19	Port Facility Emergency Plan	Details the Harbour Authority's response to an emergency	0%	5%			56	AIS equipment	All construction craft including barges to have AIS transmitters	20%	0%		
21	Oil spill contingency plans	Covers the response to a pollution event	0%	5%									
24	Tier 2 contractor	Provides additional resource and equipment for larger pollution events	0%	10%									
28	AIS/Radar coverage	VTS monitor movements of vessels in the Harbour Area	20%	0%									
36	Availability of pollution response equipment	Port has tier 1 equipment available	0%	10%									
41	Notices to mariners	Issued by the Harbour Authority with information about the development	10%	0%									
60	International COLREGS 1972 (as amended)		5%	0%									
62	Emergency services equipment - shore side	Ambulance service	0%	5%									
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	0%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
7	Collision	Dredger collision with vessel at 'F' anchorage when disposing of dredge material	Collision between dredger and bunker vessel whilst it is at anchor in 'F' anchorage. Damage to both vessels hull results in loss of cargo from bunker vessel, serious injuries, tier 3 pollution. Disruption to all operations on the Humber during pollution response, international negative publicity.	50	2	4	4	4	Collision at slow speed whilst dredger depositing arisings. Minor contact damage, no damage to dredge or construction plant. No injuries, no pollution, minor delay to marine works.	1	0	0	0	1	6.18	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	17	Anchored vessel represents a hazard
																	23	Communication failure - Operational/procedural
																	24	Communication failure - equipment
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	28	Restricted visibility
																	33	High traffic density
																	48	Risk Assessment, Incomplete/not reviewed
																	61	Incorrect assessment of tidal flow
																	82	AIS failure
																	109	Manoeuvre misjudged

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
19	Port Facility Emergency Plan	Details the Harbour Authority's response to an emergency	0%	10%	4.88	Mod	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham, HES and the Pilots	20%	0%	4.37	Mod
21	Oil spill contingency plans	Covers the response to a pollution event	0%	5%			56	AIS equipment	All construction craft including barges to have AIS transmitters	20%	0%		
24	Tier 2 contractor	Provides additional resource and equipment for larger pollution events	0%	10%									
28	AIS/Radar coverage	VTS monitor movements of vessels in the Harbour Area	30%	0%									
36	Availability of pollution response equipment	Port has tier 1 equipment available	0%	5%									
62	Emergency services equipment - shore side	Ambulance service	0%	5%									
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	20%	20%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
8	Grounding	Dredger grounding whilst engaged in operations	Dredger grounds whilst engaged in dredging operations on ebb tide resulting in damage to dredge equipment and vessel becoming stranded. Towage required to refloat dredger causing significant delay to marine works.	25	0	3	0	3	Dredger grounds but is able to refloat under its own power. Minor delay to operations whilst dredge equipment checked for damage. No injuries, no pollution.	1	0	1	0	1	5.19	Sig	1	Human error/fatigue - Vessel Personnel
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	61	Incorrect assessment of tidal flow

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
30	Accurate tidal measurements	VTS provide accurate tidal measurements	15%	0%	4.31	Mod	116	Weather limits	Maximum weather limits for operations set and monitored	10%	0%	3.82	Low
32	Towage, available and appropriate	Tugs available in the local area	0%	20%			117	Monitoring of wind/wave conditions	Weather forecasts obtained and compared with limits	10%	0%		
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	0%	10%			140	Contractor risk assessment method statement (RAMS)	Covering all of the construction activities and checked by the Harbour Authority prior to commencement	10%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
9	Hazardous substance accidents	Hazardous chemical spill from construction vessel	Damage to hydraulic systems result in oil entering the water. Tier 2 oil pollution response required and negative publicity for the port, delay to works during pollution response.	10	0	0	3	2	Oil spill on deck from plant or refuelling results in a small amount of oil entering the water. Tier 1 response required.	1	0	0	2	0	5.82	Sig	1	Human error/fatigue - Vessel Personnel
																	5	Human error/fatigue - Marine personnel
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	31	Failure to observe standing notices
																	37	Failure to comply with safe systems of work
																	75	Inadequate maintenance/inspection
																	76	Inadequate training/competence - Others

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
21	Oil spill contingency plans	Covers the response to a pollution event	0%	5%	4.91	Mod	9	Designated point of contact	For the construction activities to provide appropriate information and respond to emergency situations	0%	10%	3.75	Low
24	Tier 2 contractor	Provides additional resource and equipment for larger pollution events	0%	20%			36	Availability of pollution response equipment	Construction contractor to have tier 1 equipment	0%	20%		
36	Availability of pollution response equipment	Port has tier 1 equipment available	0%	5%			135	Safety boat	Available at all times, can be used to deploy pollution equipment	0%	15%		
118	Vessel maintenance	Scheduled maintenance program for vessel equipment	10%	0%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
10	Swamping	Workboat takes on water from excessive wash	Workboat with low freeboard takes on water from excessive wash or adverse weather. The stability is affected and the craft capsizes with multiple fatalities, tier 1 pollution and national negative pollution.	25	4	1	1	3	Workboat takes on a small amount of water during adverse weather conditions and operations are halted. Minor delay to works, no pollution or injuries.	1	0	0	0	1	5.31	Sig	1	Human error/fatigue - Vessel Personnel
																	7	Inadequate procedures in place onboard vessel
																	37	Failure to comply with safe systems of work
																	103	Excessive vessel speed

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
7	Pilotage service/PEC	Vessels 60m or over in length require a Pilot or PEC holder	20%	0%	4.84	Mod	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham, HES and the Pilots	10%	0%	3.39	Low
41	Notices to mariners	Issued by the Harbour Authority with information about the development	10%	5%			56	AIS equipment	All construction craft including barges to have AIS transmitters	20%	0%		
62	Emergency services equipment - shore side	Ambulance service	0%	5%			135	Safety boat	Ready on standby during construction activities	0%	20%		
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	0%	10%			140	Contractor risk assessment method statement (RAMS)	Covering all of the construction activities and checked by the Harbour Authority prior to commencement	10%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
11	Payload related accident	Incorrect payload distribution affects stability	Incorrect unloading of barge results in stability compromised. Barge develops significant list causing construction materials to enter the water, the barge to flood and sink. Materials and barge present a hazard to navigation until recovered, major delay to works.	25	0	4	2	4	Vessel takes on list whilst loading, operations cease. Cargo requires unloading causing delay to operations. No injury, damage or pollution.	1	0	0	0	1	4.96	Mod	5	Human error/fatigue - Marine personnel
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	37	Failure to comply with safe systems of work
																	59	Inadequate procedures shoreside
																	75	Inadequate maintenance/inspection

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	0%	10%	4.88	Mod	116	Weather limits	Maximum weather limits for operations set and monitored	15%	0%	4.09	Mod
							117	Monitoring of wind/wave conditions	Weather forecasts obtained and compared with limits	15%	0%		
							121	Loading/unloading plan	Heavy lift operations need plans for the order and method of loading and unloading	20%	0%		
							140	Contractor risk assessment method statement (RAMS)	Covering all of the construction activities and checked by the Harbour Authority prior to commencement	10%	5%		

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
12	Other	Dropped item during construction	Item dropped in water causing underwater obstruction and Harbour Authority not notified. Passing vessel makes contact with the obstruction causing damage to hull, tier 2 pollution, vessel out of service requiring survey and repair. Significant port reputational damage.	25	0	4	2	4	Dropped item reported and operations cease until it is recovered. No injuries, no damage, minor delay to works.	1	0	0	0	1	4.96	Mod	5	Human error/fatigue - Marine personnel
																	23	Communication failure - Operational/procedural
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	69	Port Equipment (inc craft) mechanical breakdown/system malfunction
																	108	Lifting equipment failure

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
142	Vessel Traffic Services	Coordinate an emergency response and manage traffic in the area	0%	10%	4.88	Mod	5	Communications - between project team and port	Discussion of upcoming activities with the personnel at Immingham and HES	0%	5%	3.44	Low
							9	Designated point of contact	For the construction activities to provide appropriate information and respond to emergency situations	0%	5%		
							17	Hydrographic surveying program	Post construction hydrographic survey of berths and approaches	20%	5%		
							111	Dropped items procedure	Contractor to have procedure for actions to be taken if large item is dropped during construction	0%	10%		
							116	Weather limits	Maximum weather limits for operations set and monitored	10%	0%		
							117	Monitoring of wind/wave conditions	Weather forecasts obtained and compared with limits	10%	0%		
							140	Contractor risk assessment method statement (RAMS)	Covering all of the construction activities and checked by the Harbour Authority prior to commencement	10%	0%		

Appendix B Navigational Risk Assessment: Operation

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
1	Allision/Contact	Ro-Ro contact with terminal infrastructure	Ro-Ro makes heavy contact with one of the piers during berthing leading to hull damage and damage to the pier. Minor injuries, no pollution, Ro-Ro requires survey before proceeding, pier out of service until repairs completed, significant delay to operations.	25	1	4	0	4	Ro-Ro has a slow speed impact with pier during berthing leading to minor damage to vessel and pier, no injuries, no pollution, minor delay to operations.	10	0	1	0	1	5.44	Sig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	28	Restricted visibility
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	78	Ship/Tug/Launch failure
																	103	Excessive vessel speed

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
7	Pilotage service/PEC	Expert local knowledge	50%	0%	4.69	Mod	115	Update arrival/sailing parameters	Local instructions on the requirements for arrival/sailing planning	10%	0%	4.40	Mod
26	Communications equipment	VHF communications with VTS and other vessels	0%	10%			119	Update ALRS, Sailing Directions and UKHO Charts	Used by vessels during passage planning	10%	0%		
57	Aids to navigation, Provision & maintenance of	AtoN provided for the terminal	20%	0%									
129	Vessel simulation study	Testing of vessel arrivals and manoeuvring to inform the design	20%	10%									
142	Vessel Traffic Services	Control vessel movements and coordinate emergency response	10%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
2	Allision/Contact	Commercial vessel with Immingham Eastern Ro-Ro	Tanker proceeding to IOH finger piers makes contact with Immingham Eastern Ro-Ro Terminal resulting in damage to hull and loss of cargo. Minor injuries from impact, tier 3 pollution, international negative publicity, marine works cease during response and following investigation.	50	1	4	4	4	Tanker transiting to berth makes contact with infrastructure at slow speed, leading to minor damage to vessel, no loss of cargo, minor injury to crew and delay to marine works.	10	1	1	0	1	6.38	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	25	Communication failure - Personnel
																	26	Adverse weather conditions
																	28	Restricted visibility
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	103	Excessive vessel speed

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
7	Pilotage service/PEC	Expert local knowledge	50%	0%	4.94	Mod	115	Update arrival/sailing parameters	Local instructions on the requirements for arrival/sailing planning	10%	0%	4.61	Mod
24	Tier 2 contractor	Provides additional resource and equipment	0%	15%			119	Update ALRS, Sailing Directions and UKHO Charts	Used by vessels during passage planning	10%	0%		
26	Communications equipment	VHF communications with VTS and other vessels	0%	10%									
36	Availability of pollution response equipment	Port has tier 1 equipment	0%	10%									
57	Aids to navigation, Provision & maintenance of	AtoN provided for the terminal	20%	0%									
129	Vessel simulation study	Testing vessels passing the terminal to the IOT finger piers	20%	10%									
142	Vessel Traffic Services	Control vessel movements and coordinate emergency response	10%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
3	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with commercial vessel	Vessels make contact leading to significant hull damage for both vessels and damaged cargo. Major injuries from the impact, tier 2 pollution, international negative publicity.	50	2	4	3	4	Vessels take avoiding action resulting in a minor collision. Minor damage to both vessels, no injuries, no pollution, delay to operations.	10	0	1	0	1	6.26	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	33	High traffic density
																	56	COLREGS failure to comply
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	82	AIS failure
																	103	Excessive vessel speed

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
3	Communications - traffic broadcast	VTS provide vessel traffic information	10%	0%	4.72	Mod	115	Update arrival/sailing parameters	Local instructions on the requirements for arrival/sailing planning	10%	0%	4.40	Mod
7	Pilotage service/PEC	Expert local knowledge and updated on activities	50%	10%			119	Update ALRS, Sailing Directions and UKHO Charts	Used by vessels during passage planning	10%	0%		
10	Passage planning	Required for all commercial vessels	10%	0%									
13	Arrival/Departure, advance notice of	Vessels required to provide notice to VTS	10%	0%									
24	Tier 2 contractor	Provides additional resource and equipment	0%	20%									
36	Availability of pollution response equipment	Port has tier 1 equipment	0%	10%									
60	International COLREGS 1972 (as amended)		10%	0%									
142	Vessel Traffic Services	Control vessel movements and coordinate emergency response	20%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
4	Collision	Ro-Ro on passage to/from Immingham Eastern Ro-Ro Terminal with recreational vessel	Vessel collision whilst on passage results in significant damage to the recreational vessel, ingress of water and sinking. Multiple fatalities, minor pollution, significant delay to port operations, international negative publicity.	50	4	2	1	4	Vessels make slow speed contact resulting in significant damage to recreational vessel, minor injuries, no pollution, minor delay to operations, negative publicity.	10	1	1	0	1	6.50	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	16	Unplanned interaction with recreational/fishing craft
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	33	High traffic density
																	56	COLREGS failure to comply
																	61	Incorrect assessment of tidal flow
																	76	Inadequate training/competence - Others
																	82	AIS failure
																	103	Excessive vessel speed

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
3	Communications - traffic broadcast	VTS provide vessel traffic information	10%	0%	4.75	Mod	115	Update arrival/sailing parameters	Local instructions on the requirements for arrival/sailing planning	10%	0%	4.41	Mod
7	Pilotage service/PEC	Expert local knowledge and updated on activities	50%	10%			119	Update ALRS, Sailing Directions and UKHO Charts	Used by vessels during passage planning	10%	0%		
10	Passage planning	Required for all commercial vessels	10%	0%									
13	Arrival/Departure, advance notice of	Vessels required to provide notice to VTS	10%	0%									
24	Tier 2 contractor	Provides additional resource and equipment	0%	20%									
36	Availability of pollution response equipment	Port has tier 1 equipment	0%	10%									
60	International COLREGS 1972 (as amended)		10%	0%									
82	Recreational vessel guidance	Published on the Humber VTS website	10%	0%									
142	Vessel Traffic Services	Control vessel movements and coordinate emergency response	20%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
5	Collision	Vessel proceeding to/from Immingham Eastern Ro-Ro with tanker moored at IOT	Ro-Ro makes contact whilst passing berthed vessel leading to hull damage, flooding and loss of cargo. Minor injuries, tier 3 pollution, international negative publicity. Severe pollution in navigational channel, vessels out of service and require drydock for repairs.	50	2	4	4	4	Minor collision at slow speed whilst passing results in damage to hull but no loss of cargo. No injuries, no pollution, delay to operations at IOT.	25	0	1	0	1	6.22	Hig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	23	Communication failure - Operational/procedural
																	26	Adverse weather conditions
																	28	Restricted visibility
																	33	High traffic density
																	61	Incorrect assessment of tidal flow
																	68	Interaction with passing vessel
																	72	Failure to follow passage plan
																	103	Excessive vessel speed

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
3	Communications - traffic broadcast	VTS provide vessel traffic information	10%	0%	4.44	Mod	115	Update arrival/sailing parameters	Local instructions on the requirements for arrival/sailing planning	10%	0%	4.09	Mod
7	Pilotage service/PEC	Expert local knowledge and updated on activities	50%	10%			119	Update ALRS, Sailing Directions and UKHO Charts	Used by vessels during passage planning	10%	0%		
10	Passage planning	Required for all commercial vessels	10%	0%									
13	Arrival/Departure, advance notice of	Vessels required to provide notice to VTS	10%	0%									
24	Tier 2 contractor	Provides additional resource and equipment	0%	20%									
36	Availability of pollution response equipment	Port has tier 1 equipment	0%	10%									
60	International COLREGS 1972 (as amended)		10%	0%									
142	Vessel Traffic Services	Control vessel movements and coordinate emergency response	20%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
6	Grounding	Whilst manoeuvring to south-western berth	Ro-Ro proceeding to southernmost berth grounds on mud and unable to refloat under own power. Significant delays to operations whilst tug assistance organised. Vessel unable to proceed until survey and repair completed. No injuries, no pollution, port reputational damage	25	0	2	0	2	Vessel grounds briefly but able to continue to the berth. Minor delay to operations whilst survey completed. No injuries, no pollution, port reputational damage.	5	0	1	0	1	5.15	Sig	1	Human error/fatigue - Vessel Personnel
																	6	Inadequate bridge resource management
																	7	Inadequate procedures in place onboard vessel
																	11	Vessel breakdown or malfunction
																	26	Adverse weather conditions
																	28	Restricted visibility
																	61	Incorrect assessment of tidal flow
																	106	Inadequate hydrographic surveying
																	107	Inadequate dredging

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
7	Pilotage service/PEC	Expert local knowledge and has	50%	10%	3.42	Low	17	Hydrographic surveying program	Updated based on the new development	10%	0%	3.33	Low
10	Passage planning	Required for all commercial vessels	10%	0%									
11	Dredging programme	Regular dredging operations based on survey results	20%	0%									
17	Hydrographic surveying program	Surveys are regularly conducted as per the program	20%	0%									
24	Tier 2 contractor	Provides additional resource and equipment	0%	20%									
36	Availability of pollution response equipment	Port has tier 1 equipment	0%	10%									
142	Vessel Traffic Services	Control vessel movements and coordinate emergency response	20%	10%									

Assessment Number	Hazard Category	Hazard Scenario Title	Worst Credible Scenario	Years between worst occurrence	Consequence				Most Likely Scenario	Years between likely occurrence	Consequence				Inherent Risk	Inherent Risk	Cause ID	Causes
					People	Property	Planet	Port			People	Property	Planet	Port				
7	Other	Vessel breaks free of moorings	Vessel breaks moorings and drifts resulting in contact with infrastructure, collision or grounding. Damage to vessel from slow speed impact, minor injuries, possible minor pollution, significant delays to operations and reputational damage.	25	1	3	1	3	Single mooring failure but vessel remains alongside. Further mooring lines used. Minor delay to operations	1	0	0	0	1	4.44	Mod	1	Human error/fatigue - Vessel Personnel
																	7	Inadequate procedures in place onboard vessel
																	26	Adverse weather conditions
																	40	Failure of berth mooring systems

Control ID	Embedded Controls				Current Risk	Current Risk	Control ID	Further Applicable Controls				Final Risk	Final Risk
	Control	Comment	Likelihood Reduction	Consequence Reduction				Control	Comment	Likelihood Reduction	Consequence Reduction		
142	Vessel Traffic Services	Provides weather information to vessels	10%	0%	4.38	Mod	124	Mooring studies and plans	Analysis of mooring arrangements combined with the local weather conditions	20%	0%	3.89	Low
							122	Shore side facility maintenance programme	Regular maintenance of infrastructure including mooring bollards/hooks	20%	0%		

Contact Us

ABPmer

Quayside Suite,
Medina Chambers
Town Quay, Southampton
SO14 2AQ

T +44 (0) 23 8071 1840
F +44 (0) 23 8071 1841
E enquiries@abpmer.co.uk

www.abpmer.co.uk