



Rampion Offshore Wind Farm



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Navigation Risk Assessment

Rampion Offshore

Wind Farm

(Technical Note)

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1. INTRODUCTION

1.1 Background

Anatec was commissioned by E.ON Climate & Renewables (E.ON) to perform a shipping and navigation risk assessment for the proposed wind farm located within the Rampion Offshore Wind Farm Round 3 Zone (Zone 6). The wind farm is located approximately 7 nautical miles (nm) off the Sussex coastline on the south of England.

This report presents information on the proposed development relative to the existing navigational and future case navigational activity for the Rampion Offshore Wind Farm and forms part of the Environmental Impact Assessment (EIA).

1.2 Scope of the Assessment and Methodology

An EIA is a process which identifies the environmental effects of a project, both negative and positive, in accordance with EU Directives. A key requirement of the EIA is the Navigational Safety Risk Assessment (NRA). The NRA methodology is in line with the Department of Energy and Climate Change (DECC) Risk Assessment Methodology (Ref.i) and the Maritime and Coastguard Agency's (MCA) Marine Guidance Notice 371 (MGN 371) (Ref. ii).

An overview of the general methodology applied in the assessment is presented in Figure 1.1. (Further information on the regulations and guidance being addressed is presented in Section 2.) The NRA includes:

- Overview of base case environment;
- Marine Traffic Survey;
- Implications of Offshore Renewable Energy Installations (OREIs);
- Assessment of navigational risk pre and post development of Rampion Offshore Wind Farm;
- Formal Safety Assessment (FSA);
- Implications on marine navigation and communication equipment;
- Identification of mitigation measures;
- Search and Rescue (SAR) planning; and
- Through life safety management.

The NRA will review the following phases:

- Construction;
- Operation and maintenance; and
- Decommissioning.

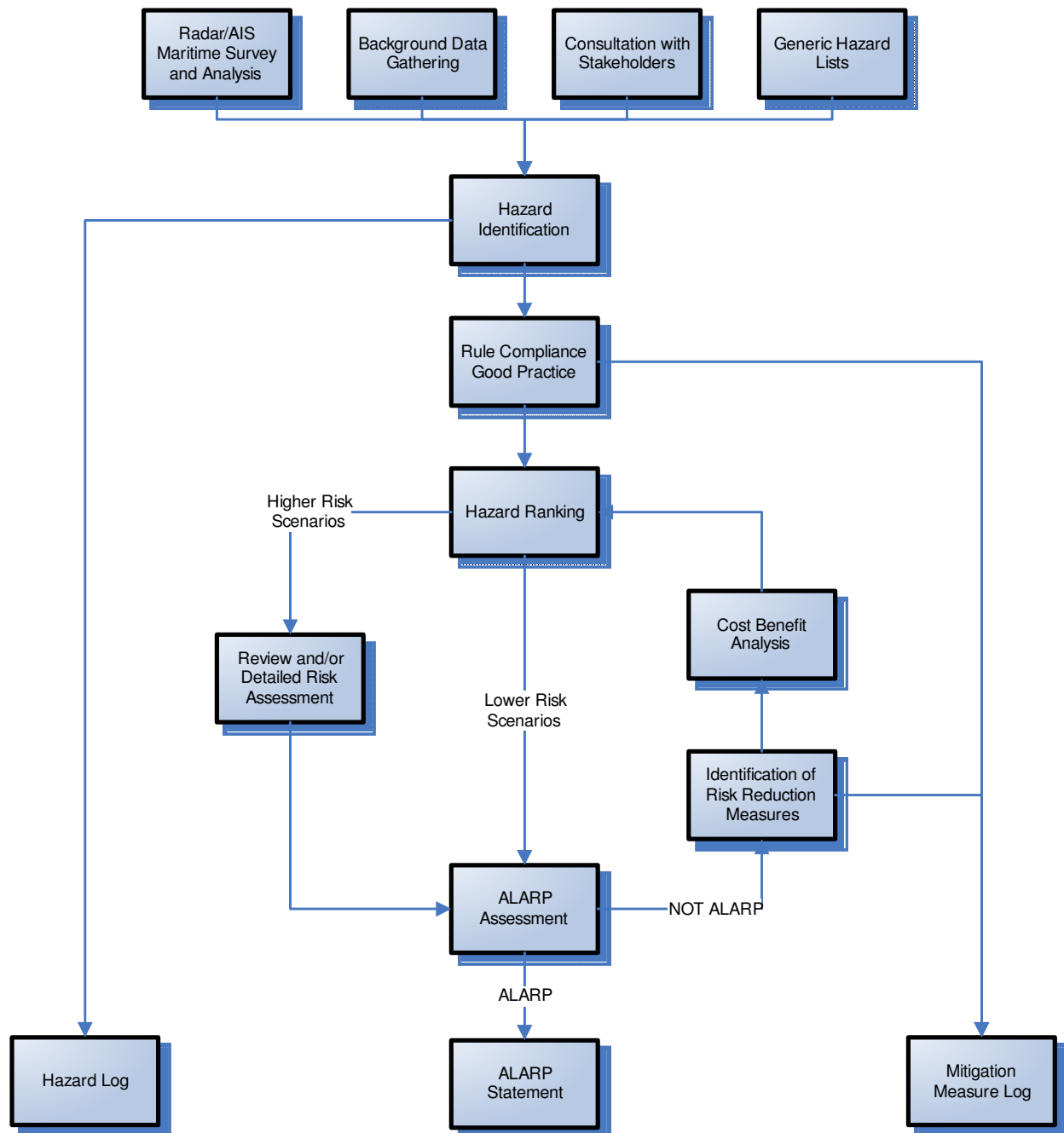


Figure 1.1 Overview of Methodology for Navigation Assessment

The NRA will consider the impact of the OREIs associated with the operational phase of the wind farm on the following maritime activities:

- Commercial shipping;
- Aggregates dredging;
- Commercial fishing; and
- Recreational activities.

In addition to these activities, consideration is given to the following:

- Impacts of structures on marine Radar;
- Impact of subsea cables;
- Impacts associated with construction / decommissioning phases; and
- Cumulative impacts with other nearby developments.

1.3 Abbreviations

The following abbreviations are used in this report:

ABP	-	Association of British Ports
AIS	-	Automatic Identification System
AtoN	-	Aid to Navigation
ALARP	-	As Low as Reasonably Practicable
ALB	-	All-Weather Lifeboat
AtoN	-	Aid to Navigation
BERR	-	Department for Business Enterprise & Regulatory Reform
CA	-	Cruising Association
COLREGS	-	International Regulations for Preventing Collisions at Sea
CoS	-	Chamber of Shipping
DECC	-	Department of Energy and Climate Change
DfT	-	Department for Transport
E.ON	-	E.ON Climate & Renewables
ERCoP	-	Emergency Response Cooperation Plan
ES	-	Environmental Statement
FSA	-	Formal Safety Assessment
GLA	-	General Lighthouse Authority
GPS	-	Global Positioning System
HAT	-	Highest Astronomical Tide
IALA	-	International Association of Marine Aids to Navigation and Lighthouses
ILB	-	Inshore Lifeboat
ICES	-	International Council for the Exploration of the Seas
IMO	-	International Maritime Organisation
ITZ	-	Inshore Traffic Zone
LAT	-	Lowest Astronomical Tide
LORAN	-	Long Range Navigation
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
MCZ	-	Marine Conservation Zone
MEHRA	-	Marine Environmental High Risk Area
MGN	-	Marine Guidance Notice
MHWS	-	Mean High Water Springs
MRCC	-	Maritime Rescue Co-ordination Centre

MRSC	-	Maritime Rescue Sub-Centre
MW	-	Mega Watt
nm	-	Nautical Miles
NRA	-	Navigational Risk Assessment
OREI	-	Offshore Renewable Energy Installations
PLL	-	Potential Loss of Life
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
TSS	-	Traffic Separation Scheme
VHF	-	Very High Frequency
WTG	-	Wind Turbine Generator

2. REGULATIONS AND GUIDANCE

2.1 Introduction

This section briefly summarises the key regulations and guidance relevant when considering the navigation safety issues associated with offshore wind farm developments in the UK.

2.2 MCA Marine Guidance Notice 371

This guidance notice (Ref. ii) highlights issues that need to be taken into consideration when assessing the impact on navigational safety from Offshore Renewable Energy Developments, proposed within United Kingdom internal waters, territorial sea or Renewable Energy Zones.

There are five annexes containing recommendations (1-4) and regulatory extract (5) as follows:

- Annex 1: Considerations on site position, structures and safety zones.
- Annex 2: Navigation, collision avoidance and communications.
- Annex 3: MCA shipping template, assessing wind farm boundary distances from shipping routes.
- Annex 4: Safety and mitigation measures recommended for OREI during construction, operation and decommissioning.
- Annex 5: Standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around an OREI.

A checklist referencing the sections in this report which address MCA requirements is presented in Appendix C.

2.3 MCA Wind Farm: “Shipping Route” Template

A trial performed by the Maritime & Coastguard Agency (MCA) at the North Hoyle Offshore Wind Farm (Ref. iii) indicated that Wind Turbine Generators (WTG) provide erroneous returns to Radar transceivers. Multiple side echoes may be generated that have the potential to mask real targets. This was again validated by trials carried out by the Renewables industry on the Kentish Flats Wind Farm within the Thames estuary (Ref. iv). The onset range from the WTG of erroneous returns is about 1.5 Nautical Miles (nm), with a progressive deterioration in the Radar picture. Adjustment of the Radar settings can filter out some of these unwanted Radar returns but comes at the cost of potentially losing small Radar cross sectional targets such as Buoys or small craft. The MCA’s Wind farm Shipping Route Template (Annex 3 of Ref. ii), is reproduced in Figure 2.1

It is noted that the template is not a prescriptive tool but needs intelligent application to explore where the distance should be measured from, e.g., route centre, 90% traffic level, nearest ship, etc. The potential boundaries are illustrated in Figure 2.2.

Marine traffic survey information collected for the Rampion Offshore Wind Farm area has been analysed within this study to inform such boundaries and investigate influencing factors such as route bias, vessel type, size and cargoes.

WIND FARM: “SHIPPING ROUTE” Template			
Distance in miles (nm) of Turbine Boundary from Shipping Route	Factors	Risk	Tolerability
< 0.25nm (500m)	500m inter-turbine spacing = small craft only recommended	VERY HIGH	INTOLERABLE
0.25nm (500m)	X band radar interference	VERY HIGH	
0.45nm (800m)	Vessels may generate multiple echoes on shore based radars	VERY HIGH	
0.5nm (926m)	Mariners’ high traffic density domain	HIGH	TOLERABLE IF ALARP (As Low As Reasonably Practicable)*
0.8nm (1481m)	Mariners’ ship domain	HIGH	
1 nm (1852m)	Minimum distance to parallel boundary of TSS	MEDIUM	
1.5nm (2778m)	S band radar interference ARPA affected	MEDIUM	
2 nm (3704m)	Compliance with COLREGS becomes less challenging	MEDIUM	
>2nm > (3704m)	But not near TSS	LOW	
3.5nm (6482m)	Minimum separation distance between turbines opposite sides of a route	LOW	
5nm (9260m)	Adjacent wind farm introduces cumulative effect Distance from TSS entry/exit	VERY LOW	BROADLY ACCEPTABLE
10nm (18520m)	No other wind farms	VERY LOW	

Figure 2.1 Wind Farm “Shipping Route” Template (Ref. ii)

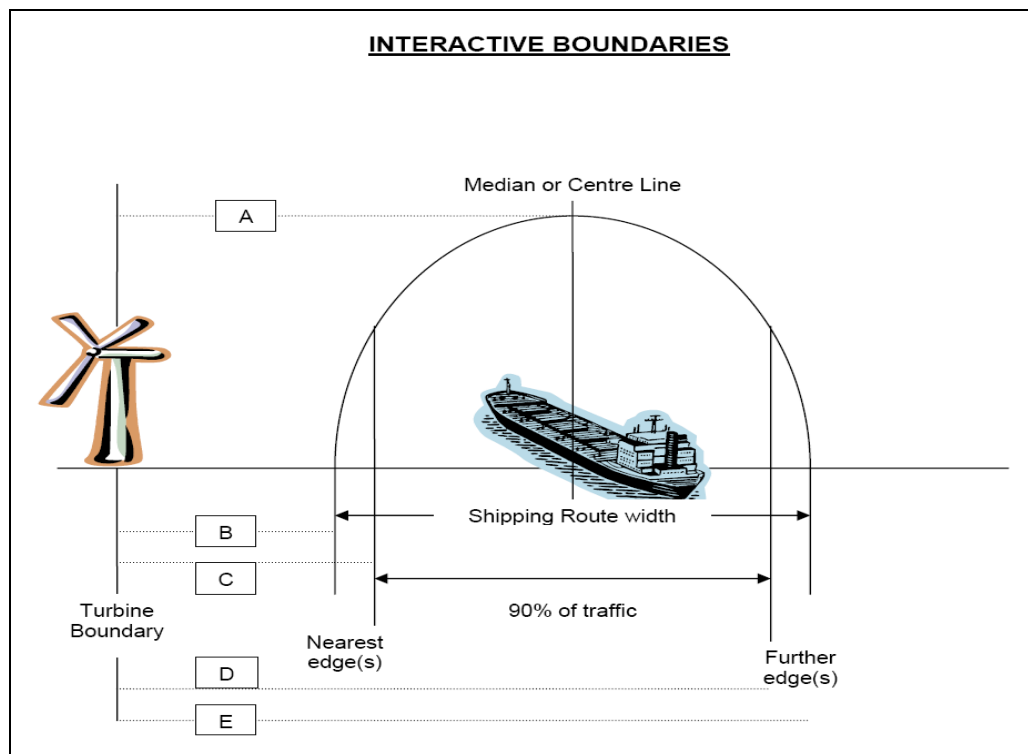


Figure 2.2 Interactive Boundaries (require Interpretative Flexibility, where:

A = Turbine boundary to the shipping route median or centre line

B = Turbine boundary to nearest shipping route edge

C = Turbine boundary to nearest shipping 90% traffic level*

D = Turbine boundary to further shipping 90% traffic level*

E = Turbine boundary to further shipping route edge

(* = or another % to be determined)

2.4 DECC Methodology

DECC produced a Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms in association with the MCA and the Department for Transport (DfT) (Ref. i). The Methodology is to be used as a template by Developers in preparing Navigation Risk Assessments and by regulators to undertake a review of the NRA.

The Methodology is centred around risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows that sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions.

The key features of the Marine Safety Navigational Risk Assessment Methodology are risk assessment (supported by appropriate techniques and tools), creating a hazard log, defining the risk controls (in a Risk Control Log) required to achieve a level of risk that is broadly acceptable (or tolerable with controls or actions), and preparing a submission that includes a Claim, based on a reasoned argument, for a positive consent decision.

Table 2.1 Key Features of the DECC Methodology (Ref. i)

1	Define a scope and depth of the submission proportionate to the scale of the development and the magnitude of the risk
2	Estimate the “base case” level of risk
3	Estimate the “future case” level of risk
4	Create a hazard log
5	Define risk control and create a risk control log
6	Predict “base case with wind farm” level of risk
7	Predict “future case with wind farm” level of risk
8	Submission

2.5 Marking of Man-Made Offshore Structures (IALA O-139)

The Rampion Offshore Wind Farm shall be marked according to International Association of Marine Aids to Navigation and Lighthouses (IALA) guidelines O-139 (Ref. v). Trinity House Lighthouse Service (THLS), as the General Lighthouse Authority (GLA), exercises control over the marking of Renewable Energy Installations in the waters of England and Wales. The Aids to Navigation (AtoN) required for the site during the different phases of construction, operation and decommissioning will be specified by THLS. The operator is also required to meet the availability, reliability and casualty response criteria laid out by THLS (Ref. vi)

2.6 Other Guidance

Other guidance documents used during the assessment are listed below:

- MCA Marine Guidance Notice 372 (MGN 372 M+F) Offshore Renewable Energy Installations (OREIs) Guidance to Mariners Operating in the Vicinity of UK OREIs (Ref. xiv);
- Royal Yachting Association (RYA) – The RYA’s Position on Offshore Energy Developments (Ref. vii).

3. Rochdale Envelope

3.1 Introduction

The scope of this NRA will reflect a Rochdale Envelope defined by E.ON Climate & Renewables. Improvements have been made to the site boundary and export cable route corridor in order to minimise the impact of the proposed wind farm.

The following section details the projected maximum extents of the project for which the significant effects will be assessed. For the collision risk modelling, a worst case assessment of the largest foundation type has been assumed. The worst case foundation for shipping and navigation is a keystone jacket design due to the larger dimensions compared to the others being foundation types being considered.

3.2 Rampion Site Boundary

The Rampion site is located off the Sussex coast, between Selsey Bill and Beachy Head, approximately 7.2nm to the south of Shoreham. The proposed development area encompasses 40.3nm² (138km²).

The corner coordinates of the Rampion project boundary are listed in Table 3.1.

Table 3.1 Corners of Rampion Site

Corner	Latitude	Longitude
A	50° 41' 11.35" N	000° 21' 55.86" W
B	50° 42' 24.83" N	000° 13' 45.70" W
C	50° 40' 39.36" N	000° 04' 26.23" W
D	50° 39' 31.72" N	000° 01' 28.06" W
E	50° 38' 34.93" N	000° 09' 02.89" W
F	50° 37' 08.04" N	000° 15' 42.14" W
G	50° 38' 13.35" N	000° 16' 17.09" W
H	50° 37' 03.36" N	000° 20' 36.07" W

Figure 3.1 shows the revised Rampion site boundary versus the originally proposed site.

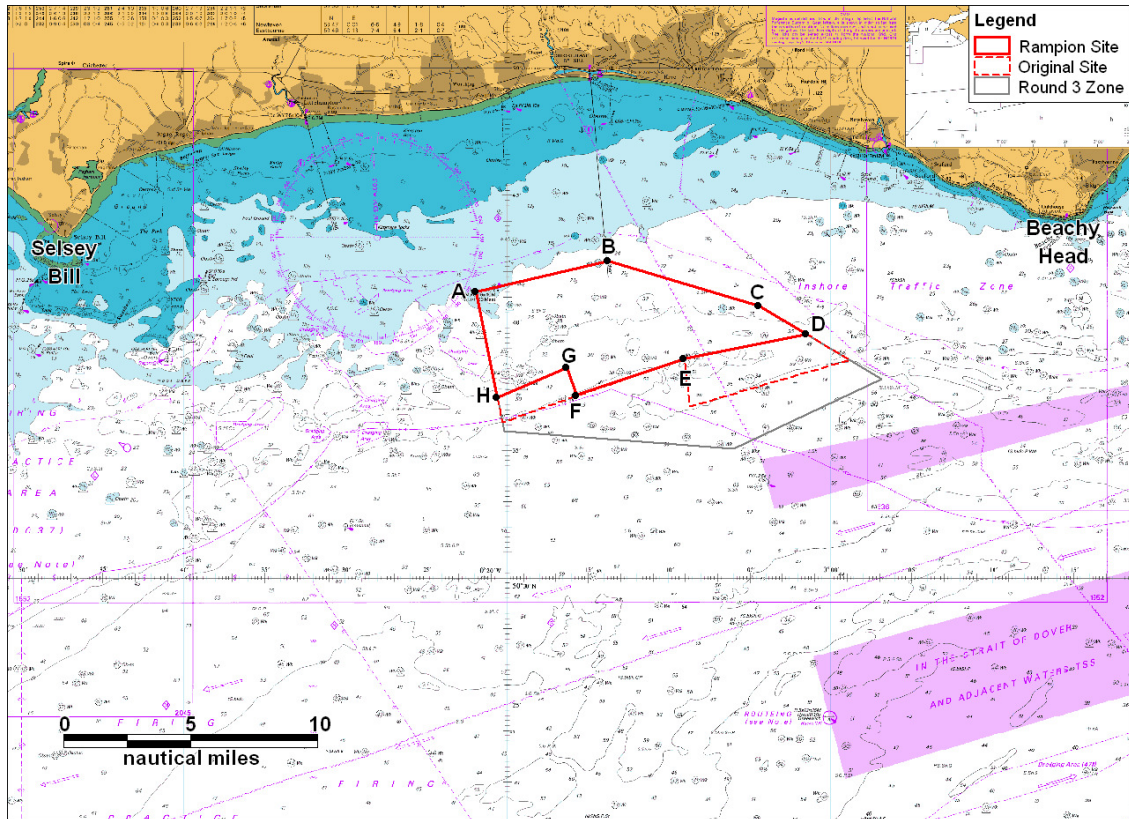


Figure 3.1 Chart Overview of the Rampion Project Boundary

The charted water depth of the site ranges from approximately 19-50m (lowest astronomical tide (LAT)).

The positions of Wind Turbine Generators (WTGs) and offshore substations in two indicative layouts for risk modelling within the Rampion site are presented in Figure 3.2 and Figure 3.3. Both of the layouts have the maximum number of WTGs the site is expected to include (175 WTGs). Scenario 1 is based on the maximum turbine spacing with turbines filling the site, whereas Scenario 2 considers the minimum proposed turbine spacing.

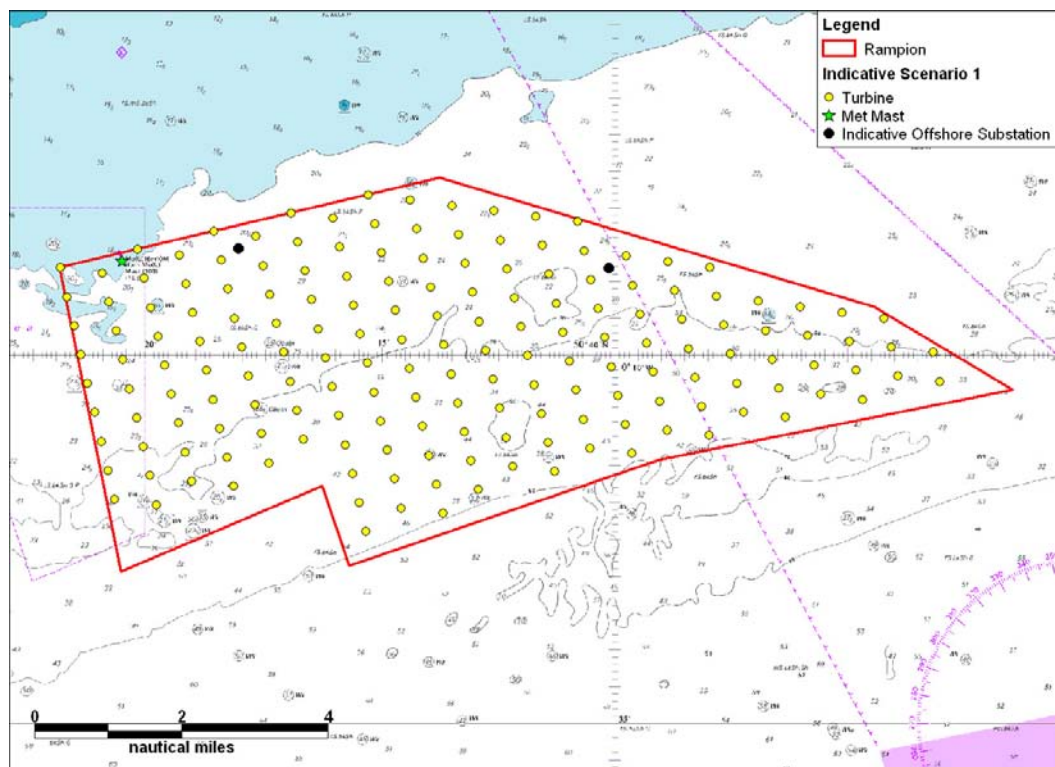


Figure 3.2 Scenario 1 WTGs and Substations

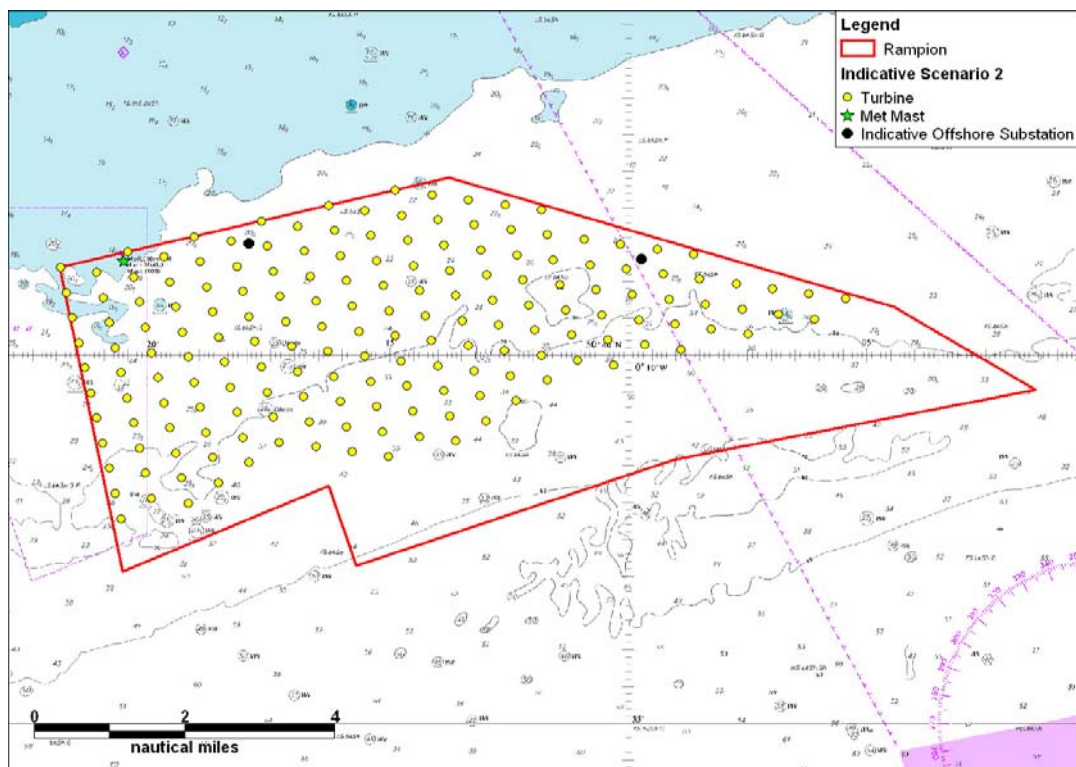


Figure 3.3 Scenario 2 WTGs and Substations

3.3 Structure Details

The NRA has used two indicative WTG layouts consisting of the maximum number of WTGs (175) (see Figure 3.2 and Figure 3.3).

It is expected that each turbine will generate between 3.0 MW and 7 MW. Table 3.2 presents typical dimensions of different sizes of wind turbines relevant to this study.

Table 3.2 Typical Dimensions for Minimum and Maximum Size WTGs

Wind Turbine Generator (WTG) Size	Hub Height above LAT (m)	Rotor Diameter (m)	Tip Height above LAT (m)
3.6 MW	116	128	180
7 MW	124	172	210

A typical design of the WTG is represented in Figure 3.4. There will be a minimum 22m rotor blade tip clearance (air draught) over Mean High Water Springs (MHWS) in accordance with MCA guidance contained within MGN 371, and RYA recommendations.

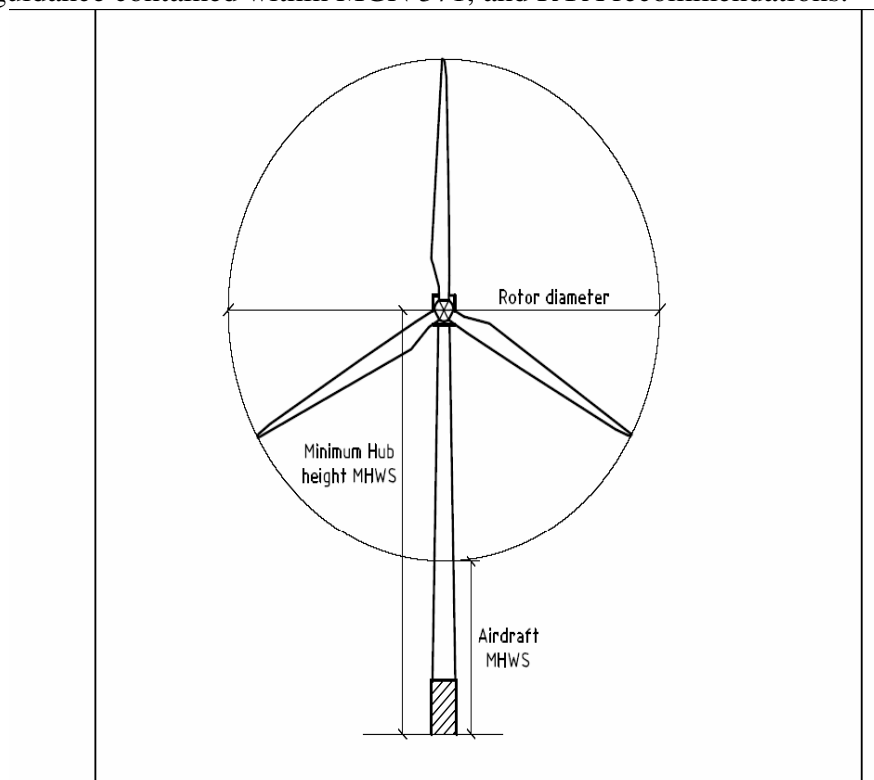


Figure 3.4 Outline Wind Turbine Generator (WTG) Structure

Six foundation concepts have been considered for the site:

- Monopile;
- Jacket;
- Keystone Jacket;

- Tripod;
- Mass Gravity Base; and
- Suction Caisson/Bucket.

For the Rochdale Envelope (worst case) collision risk assessment, the maximum WTG foundation width of 25.46m has been assumed (largest keystone jacket foundation).

In addition, for assessing navigational risk it is assumed that there will be two offshore substations installed to serve the development. The substations are expected to be located within a 2km wide band bordering the northern boundary of the site. As part of the worst case assessment the maximum substation dimension will be assumed at 45m x 45m.

3.4 Offshore Inter Array and Export Cable Routes

The transmission cable corridor runs from the north of the project boundary to the proposed cable landfall at East Worthing, as shown in Figure 3.5. It is noted that the cable route area has been revised in order to pass clear of the majority off anchoring activity off Shoreham.

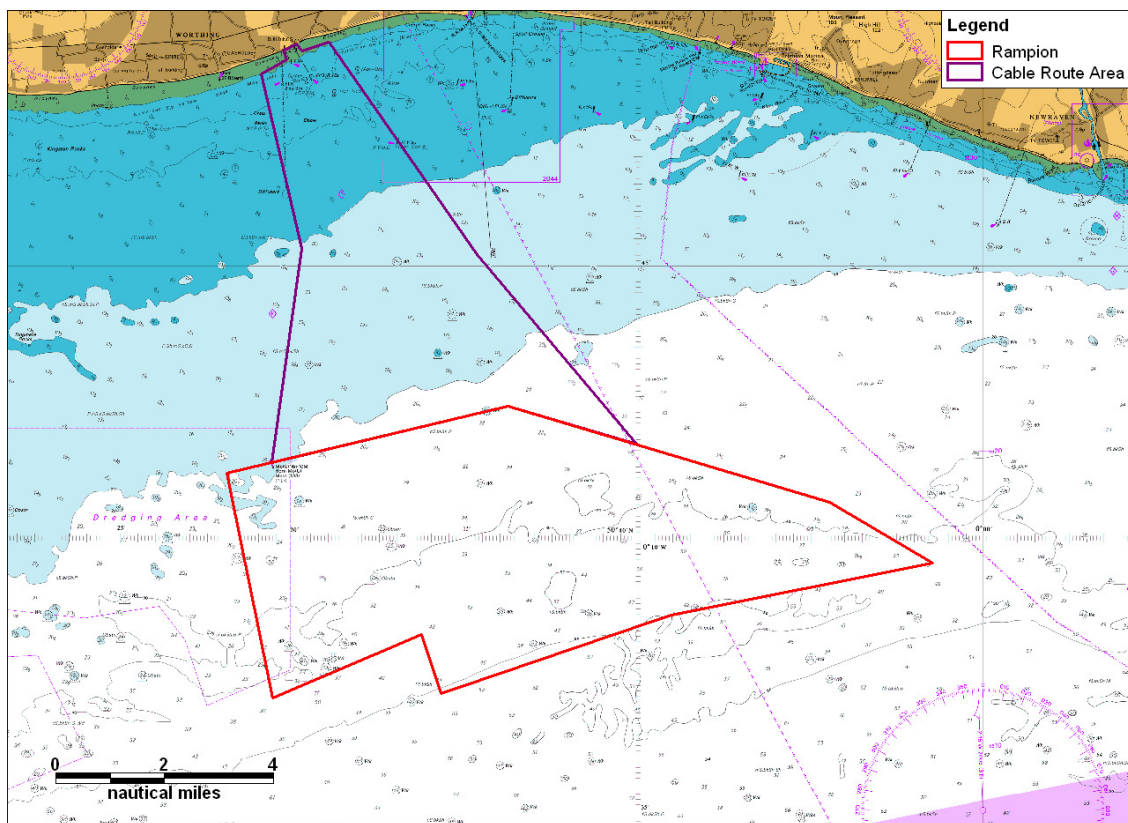


Figure 3.5 Export Cable Route associated with the Rampion Offshore Wind Farm

The Rochdale envelope for the project states that the export and inter-array cables will be buried and/or protected (burial target depth of 1m below the seabed superficial deposits). Any methods used to bury or protect the cable will consider navigational safety ensuring that navigable water depths are not adversely impacted.

4. MARINE NAVIGATIONAL MARKINGS

4.1 Introduction

Throughout the project marine navigational marking will be provided in accordance with the Trinity House requirements, which will comply with IALA standards on the Marking of Offshore Wind Farms (Ref. v) O-139 and the additional requirements of MCA MGN 371 (Ref. ii).

4.2 Construction/Decommissioning

During the construction / decommissioning of an offshore wind farm, working areas will be established and marked in accordance with the IALA Maritime Buoyage System (MBS). In addition to this, where advised by THLS, additional temporary marking will be applied.

Notices to Mariners, Radio Navigational Warnings-NAVTEX and/or broadcast warnings as well as Notices to Airmen will be promulgated in advance of and during construction / decommissioning of any individual structure/farm.

4.3 Marking of Individual Structures

The tower of every WTG will be painted yellow all around from the level of Highest Astronomical Tide (HAT) to 15 metres or the height of the Aid to Navigation, if fitted, whichever is greater.

As per the MCA requirements, each of the structures will be marked with clearly visible unique identification characteristics at a location that is easily and readily serviceable. The identifications characteristics will each be illuminated by a low-intensity light, so that the sign is visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision with it. This will be such that under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer (with naked eye), stationed 3 metres above sea levels, and at a distance of at least 150 metres from the WTG. The light will be either hooded or baffled so as to avoid unnecessary light pollution or confusion with navigation marks.

4.4 Proposed Markings

The markings for the proposed Rampion Offshore Wind Farm will be agreed in consultation with Trinity House once the final WTG layout has been selected. As per IALA guidelines, it is likely that:

- All corner towers or other significant points on the periphery of the wind farm will be marked as Significant Peripheral Structures (SPSs) and where necessary, depending on spacing, selected intermediate structures on the periphery of the wind farm (other than the SPSs) will be marked as Intermediate Peripheral Structures (IPSs).
- In all the layouts, towers designated as SPSs are to exhibit Flashing Yellow 5 second (Fl Y 5s) lights of 5nm nominal range and omnidirectional fog signals with a character of 1

blast of 2 seconds duration every 30 seconds and an IALA usual range of 2nm. Towers designated as IPSs are to exhibit Fl Y 2.5s lights of 2nm nominal range.

- All the lights are to be visible to shipping through 360 degrees and if more than 1 lantern is required on a tower to meet the all-round visibility requirement, then all the lanterns on that tower should be synchronised.
- All the lights are to be exhibited at the same height at least 6m above Highest Astronomical Tide (HAT) and below the arc of the lowest WTG rotor blades.
- All the lights are to be exhibited at least at night and when the visibility is reduced to 2nm or less. Fog signals are to be sounded at least when the visibility is 2nm or less.
- All the structures in the boundary of the WTG towers are to be coloured yellow from at least HAT to the height of the lights (the equivalent height on the unlighted structures).
- Any lighting required for aeronautical purposes is to be shielded / arranged such that it is not visible to shipping. If this cannot be achieved, then the requirement will be considered as having been met if the aviation light is reduced to 10% of its peak intensity when the visibility is more than 5km.

4.5 *Superintendence and Management*

E.ON will ensure that they have a reliable maintenance and casualty response regime in place such that the required availability targets are met.

5. CONSULTATION

5.1 Introduction

Consultation on navigational issues has been carried out with key stakeholders. This section summarises the main consultation meetings held to date on the Rampion Offshore Wind Farm project. It is noted that the consultation was carried out based on a broader site boundary than that currently proposed (see Section 3.2).

5.2 Maritime Coastguard Agency and Department for Transport

A meeting was held with MCA and DFT in April 2011, at DFT's offices in London, and the key notes from the meeting were as follows:

- MCA stated that E.ON would need to give consideration to the alignment issues on the boundary of the site.
- MCA stated that E.ON need to be aware of the issues around cable routes, separation distances and access to the cables by operators.
- MCA questioned why westbound traffic to Shoreham was using the Inshore Traffic Zone (ITZ), and stated that a review should be carried out as to where these vessels are bound for.
- It was stated that routeing alternatives for vessels going to/from Shoreham need to be considered, and that the MCA wouldn't want vessels to be encouraged to use the ITZ when they should not be using it.
- The deviations for vessels headed to/from Shoreham and routeing around the site will need to be quantified and regular users consulted. How vessels will join the eastbound lane of the TSS should be considered.
- MCA stated that consideration may need to be given to a lane through the site.

A further meeting was held with MCA and Trinity House in London in January 2012 as a follow up to the initial consultation with these stakeholders. The key points were as follows:

- Both MCA and Trinity House reiterated that E.ON should consider alignment issues on the boundaries of the site, especially WTGs on their own at the periphery of the site which may become a navigational hazard.
- Noting the Port of Shoreham and their users were requesting a 2nm channel through the site (see below), the MCA stated that this would require further consideration as it may not be the best in terms of overall safety of navigation and the interaction with entry/ exit of the TSS.
- Both MCA and THLS noted that in the event of a vessel breakdown and drifting in and around the site, there is little tug availability in the general area with the exception of perhaps some at Fawley within the Solent.

Following this meeting the MCA reviewed the consideration for a north to south channel through the Rampion Wind Farm, based on the discussions at the meeting. Their response is summarised below:

- The MCA view from the evidence provided is that a channel in this case does not appear to be a logical option.
- Vessels inbound to Shoreham would benefit from leaving the TSS early and the development would encourage this. It would incur deviations for south and east bound vessels leaving Shoreham. As the numbers and frequency are low this impact may be considered acceptable.
- MCA in principle do not support the channel option. Vessels operators and ports affected by the development should be engaged with and their views on the channel option sought.

5.3 *Trinity House Lighthouse Services*

A meeting was held at THLSs office in London in April 2011. The key points were as follows:

- THLS stated that they would not like to see an irregular pattern of WTG and that the WTGs on the outer boundary should be aligned. It was stated that the alignment of the southern boundary needs consideration.
- The East/West traffic which is using the Inshore Traffic Zone (ITZ) as opposed to the Traffic Separation Scheme (TSS) should be reviewed.
- It was stated that a key issue will relate to the deviations for the vessels to avoid the site, mainly for the traffic to/from Shoreham.

A further meeting was held with THLS and MCA in January 2012, and the main points from this meeting were summarised above in Section 5.2.

5.4 *Chamber of Shipping*

A meeting was held at Chamber of Shipping's (CoS) offices in London in April 2011. The key notes from the meeting were as follows:

- Chamber of Shipping stated that clearance from the Traffic Separation Scheme was a key issue and available sea room for vessels not using the TSS, i.e., vessels using the Inshore Traffic Zone.
- Key consultations would be with Port of Shoreham and Newhaven, with the impact on ships headed to and from Shoreham being the key issue.
- Dredging companies would also require to be consulted.

5.5 *Recreational Sailing (Cruising Association and Royal Yachting Association)*

A meeting was held at Cruising Association (CA) House in London in March 2011 to discuss the potential impacts on recreational sailing in the area with the CA, Royal Yachting Association (RYA) and Sussex Yacht Club. The main notes from the meeting are provided below:

- It was stated that the Royal Escape Race, which takes place in May, would go through the Rampion site. The race would still take place, but will require to go around the site and needs to avoid the TSS where ships are exiting and turning.
- Vessels rounding Beachy Head aim to clear it by around 2nm to avoid heavy overfalls.
- Recreational craft are likely to be heading mainly east to Ramsgate. Eastbourne and Brighton are generally used as stopovers.
- RYA and CA would both like as square and regular pattern (uniform alignment) of WTGs as possible.
- It is possible that it will be necessary to contact the CA equivalents in France and The Netherlands to inform their club members of the development.
- Promulgation of information will be important. The possibility of having a chart on the internet showing the positions of the different WTG towers. CA/RYA could produce links to websites to provide information to sailors.
- It was noted that Marine Conservation Zones (MCZs) could be a conflicting issue.
- Routeing advice for the area in CA Almanac as well as Pilot books should be checked. This would need to be updated with the development.
- Marine Coordination Centre could provide daily information on the activities in the area.

5.6 Local Ports

Three local ports (Shoreham, Newhaven and Southampton) were consulted due to the proximity of the ports to the Rampion site. Summaries of the port consultation meetings are given in the following sections.

5.6.1 Shoreham Port

The consultation meeting with Shoreham Port was held at their offices in Shoreham in July 2011.

- The port stated that the number of vessels visiting Shoreham had increased significantly since December 2010. The port had signed new contracts with regular timber imports from Sweden as well as exporting biomass back to Sweden. These vessels will generally use the shipping lanes of the TSS and route north / south through the site.
- The port was up 33% on tonnage, with some business being new and other trade being at the expense of other ports.
- If vessels were to cross the westbound lane of the TSS to join the eastbound lane, then this would increase the risk and a large number of vessels (masters) would not do this, hence there would be larger deviations for these vessels.
- There are proposals in place for a new power station to be built in Shoreham. This will involve bringing in waste oil by sea using small tankers, with approximately 1 vessel per week. The vessel would mainly come from the east (Sweden and/or Holland) and would remain in the traffic lanes as opposed to using the ITZ, since they

would be carrying hazardous cargo. This power plant should be operational by approximately July 2013.

- Shoreham Port are concerned about the development resulting in deviations for vessels visiting / departing the port. They feel they could lose business to other local ports (e.g., Newhaven) given the additional steaming time to their port making it less accessible. The re-routeing will also make it less desirable as vessels will be beam in to the prevailing southwest winds if they route to the northeast of Rampion. During southerly winds inbound vessels to Shoreham hold the shipping lane until the CS1 buoy and then alter course to Shoreham, keeping the weather on their stern quarter.
- The question was raised regarding the possibility of moving the CS1 buoy, which would allow vessels to cross the lane earlier. It was noted that this was a question which could be asked of Trinity House.
- It was noted that the main marinas in the area where power boats etc. would operate from would be Eastbourne and Brighton.
- The port stated that based on the discussions (up to the time of the meeting) with local stakeholders; the stakeholders would be content with a 2nm corridor through the site. This 2nm lane would line up with the separation zone and the CS1 buoy.

5.6.2 Newhaven Port & Properties Ltd

The meeting with Port of Newhaven was held at their offices in Newhaven in July 2011.

- The port stated that the main scallop dredging season was October to February and that there were 2 to 3 vessels a week working out of Newhaven. It was noted that a number of Scottish fishing vessels also work in the area.
- Cargo vessels heading to Spain/Portugal from Newhaven would pass through the proposed site.
- Vessels headed eastbound from Newhaven on occasion request permission to use the ITZ, whereas some vessels will leave and join the TSS at the entrance. Other vessels will cross the westbound lane at right angles and join the scheme at a shallow angle, midway along the scheme.
- Relatively few dredgers were picked up during the maritime traffic survey in January 2011, as the plant in Newhaven had shutdown. Dredgers associated with the port operate at the Nab and Owers Bank dredging areas.
- There are 10 chartered angling boats working out of Newhaven which may operate around the site on occasions.
- The port stated that the proposed development at Rampion would not have any major impacts on the traffic to/from Newhaven.

5.6.3 ABP Southampton

The meeting with the port was held at ABP's office in Southampton in July 2011.

- The port was interested in the use of large construction vessels in the area.
- The port raised the issue of Jack-Up barges in the area, and that if they wanted to jack down in certain areas, they would not be able to advise on this given the fact they

would not have sufficient knowledge of the seabed in the area, as not many geophysical surveys have been carried out to date.

- The port commented that E.ON should consult with the Queens Harbour Master at Portsmouth as their area of jurisdiction extends slightly further east than Southampton's.
- The port stated that the proposed development at Rampion would not have any impact on the vessels visiting their port.

5.7 Shipping Operators

Consultation with operators of vessels operating in the vicinity of the Rampion site was undertaken in August and September 2011. AIS data for the Rampion area were interrogated to identify the owners/operators that had regular vessels and/or a number of vessels on regular routes in the vicinity of the Rampion site.

From this 16 operators and owners were identified along with a further four operators of vessels stated by Shoreham port as regular users of the port. These operators were contacted by email, followed up by a telephone call, requesting feedback on the Rampion site.

In addition to the users identified through AIS data analysis, an information pack on the proposed development was issued to Shoreham and Newhaven ports, in order for them to pass on to port users.

A summary of the responses is presented in Table 5.1.

Table 5.1 Ship Operators Responses

Manager	Responses
Wallenius Wilhelmsen Logistics	None of their vessels have or would use the Inshore Traffic Zone where the Rampion Wind Farm will be located, so they did not see any issues for their operations.
Eitzen Gas A/S	The wind farm site is located in the inshore traffic zone and their vessels heading in or out of Fawley (within the Solent) pass clear of the site. They also contacted their vessels and all vessels were of the opinion that the presence of the wind farm will not have any impact on vessels safe navigation.
Tarmac Marine Dredging Ltd	Do not have any objections to the site on navigational grounds given where they load and transit in the general area. They do have license application areas in the area, but do not expect any conflicts of interest.
Reederei Erwin Strahlmann eK	They had concerns regarding a vessel drifting in the traffic separation scheme due to engine damage. There is a risk that, due to tidal streams and/or a southerly wind, the vessel will hit a WTG. The availability of a standby tug was also raised.

Manager	Responses
Hanson Aggregates Marine Ltd	Stated that they operate in active areas adjacent to the Rampion development and have an Application area (Area 499) which intersects the Rampion site. They stated that they had had meetings with E.ON where the activities of the dredging industry were highlighted. The need for 2km east to west buffers and 500m north to south buffers around aggregate extraction licenses, until such time as the aggregate resource has been extracted and the area suitable for handing back, was stated. Stated that the wind farm would impact on vessel routeing to and from current and future aggregate extraction areas and has the potential to impact upon safety considerations. Hanson's Area 499 represents a significant investment and development opportunity, and safeguarding the area and associated transit routes is a key consideration. They would wish to see all aspects of the current license activities successfully resolved and agreed before any considerations as to wind farm development are finalised.
Westminster Dredging Company Limited (WDCo)	They requested further information on WTG layouts and spacings, and also on any restrictions on navigation through the wind farm, pre and post construction. Stated that if navigation is not permitted through the wind farm at the time of their beach replenishment works for the Environment Agency and other local authorities then it may have a very serious effect on the economics of both their current and future contracts. Following the provision of the information requested (as far as possible) they did not foresee any significant problems, dependent on final details. In addition to the response from WDCo, further responses were received from those associated with their operations: Pevensey Coastal Defence Limited stated that they have contracts with the Environment Agency to maintain sea defences in Pevensey Bay until 2025. A significant part of their annual work involves a recharge of about 20,000 m³ of aggregates from Owers Bank delivered to Eastbourne. They stated that this operation depends on a dredger being able to get to and from the dredging ground in the time between high tides and that any delay or change in sailing route will have a measurable impact on their operation. The Environment Agency stated that WDCo are one of their framework suppliers for a number of projects and sites across the south coast. The concern was expressed that dredgers would be required to make longer journeys resulting in additional costs. They stated that they would expect suitable compensation arrangements to be factored into the development of the wind farm to mitigate for these additional costs.

Manager	Responses
Leafe and Hawkes Limited	The Rampion Offshore Wind Farm development will be on the route Leafe and Hawkes coasters regularly take between Rouen and other northern French ports to Shoreham port and as such poses an ‘unwelcome hazard’ for their Captains and other crew. Leafe and Hawkes stated that they generally find offshore wind farms, including Rampion, to be extremely unwelcome by those navigating their vessels.
Ahlmark Lines AB	Stated that they operate major regular scheduled Liner Services from several Swedish ports to Shoreham. They stated concerns that Shoreham port has tidal restrictions that offer a narrow operational window for their vessels. The navigational effects and potential delays caused by the Rampion Wind Farm would have an adverse effect on their scheduling. They stated their support for Shoreham Port’s proposal for a 2 nautical mile channel which would afford an alternative to the existing route from the shipping lanes.
Jonsson Novabolagen AB	Stated that they operate major regular scheduled Liner Services from several Swedish ports to Shoreham. They stated that the Port of Shoreham has tidal restrictions that only offer a narrow operational window for their vessels. The navigational effects and potential delays caused by the position of the wind farm would have an adverse on their scheduling. They stated their support for Shoreham Port’s proposal for a 2 nautical mile corridor which would provide an alternative to the existing route from the shipping lanes.
TTS (Shipping) Ltd	Stated that they are a regular user of Port of Shoreham with vessels up to 4,500 Dead Weight Cargo Capacity trading with cargoes of forest products from Finland, Sweden, Latvia, Lithuania and Estonia and therefore approach Shoreham from an easterly direction. They stated that the proposed wind farm would increase the time of the sea passages and thus increase the cost of the voyage, whilst increasing the problems vessels can encounter when trying to enter the port during heavy swells. They stated that they endorse the response of Shoreham Port that a 2 nautical mile corridor through the zone out to the Greenwich Light should be implemented.

5.8 Hazard Review Workshop

A Hazard Review Workshop was held at E.ON’s office in Brighton, Sussex on the 20th January 2012. The purpose of the workshop was to identify and review the potential navigational hazards associated with the proposed offshore wind farm development with input from local navigational stakeholders.

Additional details on the workshop results are provided in Section 13 (a full methodology and results are provided in Appendix A), with a log of the minutes recorded in Appendix D.

6. EXISTING ENVIRONMENT

6.1 Introduction

This section presents the following baseline information relating to navigation in the vicinity of the proposed Rampion Offshore Wind Farm:

- Ports
- IMO Routing measures
- Marine Environmental High Risk Areas
- Ministry Of Defence (MOD) Practice and Exercise Areas (PEXAS)
- Chartered Wrecks
- Chartered Anchorages
- Aid to Navigation
- Marine Aggregates Dredging
- Metocean data

6.2 Port Facilities/Services

A chart of the proposed Rampion Offshore Wind Farm relative to nearby ports and harbours is presented in Figure 6.1.

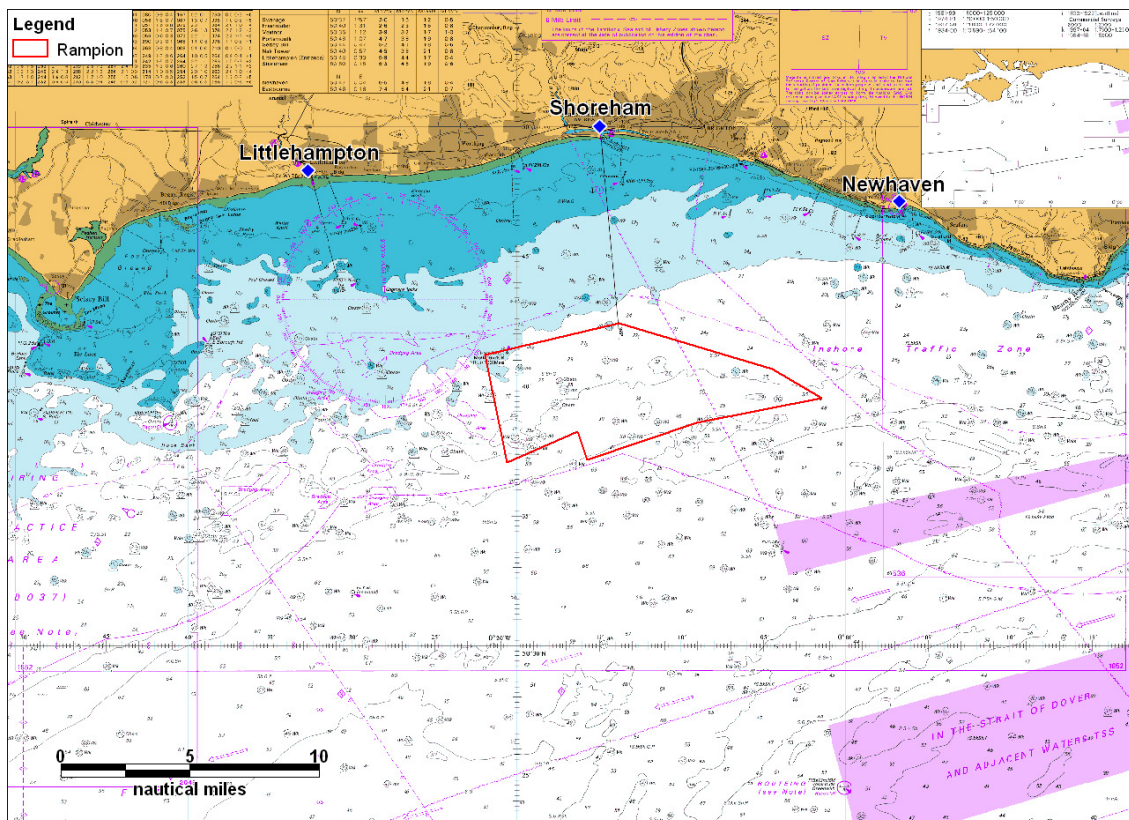


Figure 6.1 Overview of Ports and Harbours

The nearest ports to the Rampion Offshore Wind Farm site, handling commercial vessels, are Shoreham (7.3nm to the north and Newhaven (8nm to the northeast). Littlehampton, which takes limited commercial vessels, is approximately 9.6nm to the northwest of the site. The following subsections give details on port approaches and facilities at these ports.

6.2.1 Shoreham

Shoreham port extends about 3 miles east to west. The port entrance leads to the ‘Western Arm’ of the port, which is formed by the lower reaches of the River Adur, and the ‘Eastern Arm’ which leads to locks that give access to the Canal. A Vessel Traffic Service (VTS) information only service is maintained for the monitoring of shipping within the ports jurisdiction and approaches.

The maximum size of vessels handled by Shoreham is overall length 120m and beam 20m, (handled within the Eastern Arm). The maximum draught handled is 5.5m on neap tides and 6.7m on spring tides.

Pilotage is compulsory for all vessels carrying dangerous cargoes and other vessels over 50m in length. The Pilot Boarding Station is within 2 miles of the entrance to the harbour, from 4 hours before high water until tidal conditions after high water make entry into the harbour unsafe. One small tug is available at Shoreham

6.2.2 Newhaven

Newhaven port, situated at the mouth of the River Ouse, is used commercially and as a cross channel ferry terminal. The approach to Newhaven is through a maintained dredged channel protected to the west by a breakwater. The channel leads north between piers which form the entrance to the harbour, which is an extension of the maintained channel.

From the harbour entrance, the harbour extends 9 cables NNW. Quays used by ferries and commercial vessels form the greater part of the east bank, berths on the west bank are used by small craft.

Pilotage is compulsory for all vessels over 49m in length, and all vessels carrying dangerous goods. The Pilot Boarding Station is about a mile to the southwest of the breakwater. One tug is available at the port.

6.2.3 Littlehampton

Littlehampton Harbour is a small commercial and yachting port, situated at the mouth of the River Arun. The harbour is formed by the lower reaches of the river, and has a single commercial berth on the east bank, and pontoons and berths for recreational craft on both banks.

The maximum size of vessels handled is 70m length overall, 2,000 DWT. The maximum draught of vessels handled is 4.6m (high water springs) and 3.8m (high water neaps), and vessels take the ground at low water. Pilotage is compulsory for all merchant vessels and the pilot boarding station is 1nm to the south of the harbour entrance.

6.3 Chartered Anchorages

A chart of the nearby charted anchorages and those extracted from the Admiralty Sailing Directions for the area (Ref. viii) are presented in Figure 6.2.

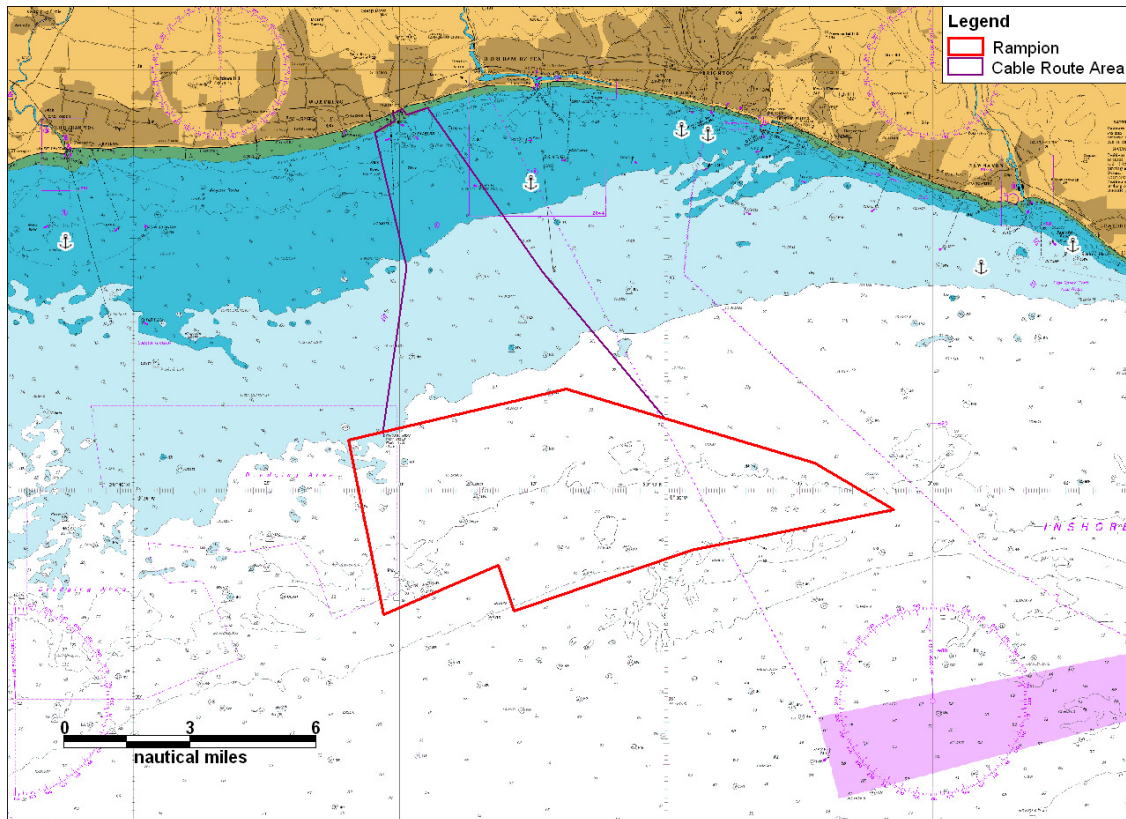


Figure 6.2 Anchorages Relative to the Rampion Wind Farm Site

Details of the anchorage areas shown, from west to east, are as follows:

- Off Littlehampton – anchorage may be obtained 2 miles to the south of the harbour entrance, in depths of 5m, with a sea bed of stiff blue clay. Small craft may anchor nearer to the harbour entrance clear of the leading line, according to the wind.
- Off Shoreham – offers anchorage in depths between 4 and 10 m, between 1 and 3 miles off Shoreham. The bottom in this area is sand over clay and chalk initially, then sand and shingle with patches of chalk further offshore. The recommended anchorage shown on the chart is 2 miles to the south of the harbour entrance.
- Off Brighton – offers temporary anchorage in depths of over 5m, either 3.5 miles SSW of the head of West Pier or 3 cables SSW of Marine Palace Pierhead.
- Off Newhaven – two recommended anchorages are charted off Newhaven. To the west, approximately 1.5nm off the coast, in a depth of around 14m. To the east of Newhaven, in a depth of about 5.5m, in Seaford Road.

6.4 Routing Measures

The main navigational features in the vicinity of the proposed Rampion Offshore Wind Farm are International Maritime Organisation (IMO) routing measures. The termination point of the Dover Strait Traffic Separation Scheme (TSS) lies to the south of the Rampion site, with the eastern part of the site within the adjacent Inshore Traffic Zone (ITZ). This is shown in Figure 6.3.

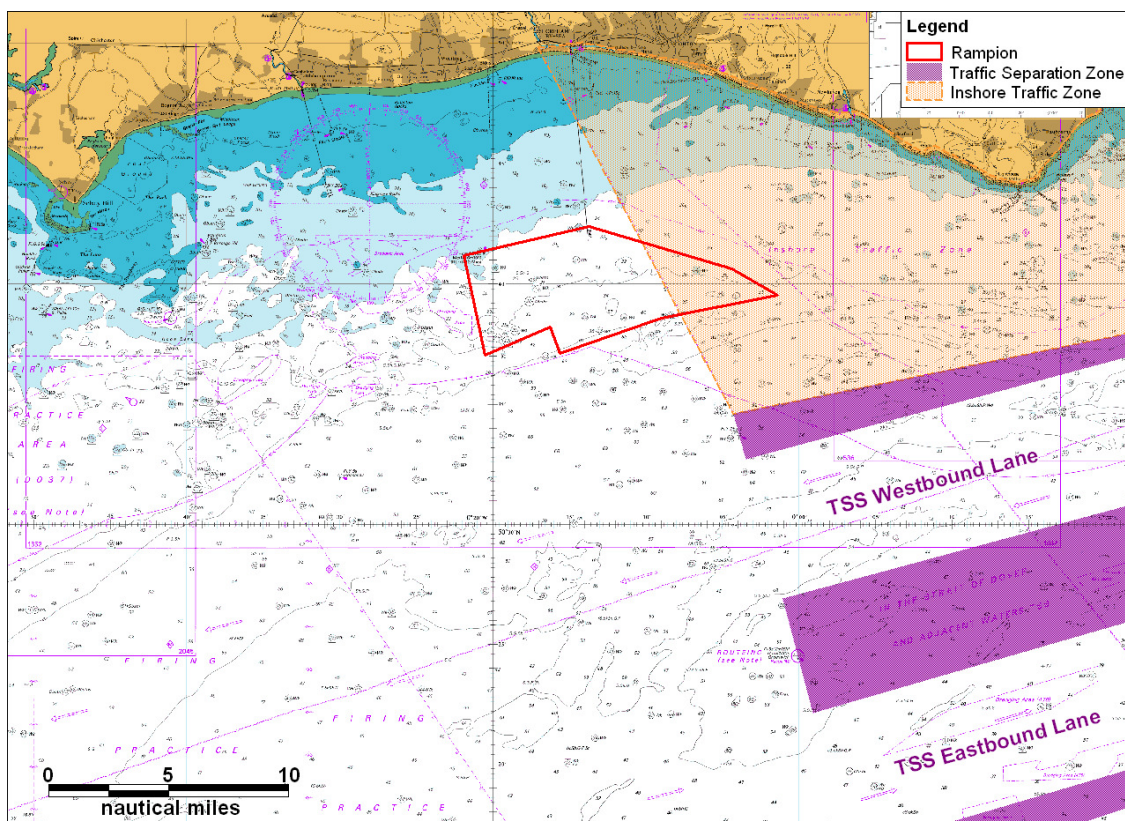


Figure 6.3 IMO Routing Measures in the Vicinity of Rampion

At its closest point there is approximately 4.4nm between the site's southern boundary and the traffic separation zone.

6.4.1 International Convention on the Prevention of Collision at Sea 72/77(COLREGS)

All vessels operating at sea are bound by the guidance contained in The International Regulations for the Prevention of Collisions at Seas 72/77 (COLREGS). Rule 10 of COLREGS concerns navigation in the vicinity of Traffic Separation Schemes and Inshore Traffic Zones and is therefore relevant to navigation in the Rampion area. The rules of note are listed below:

Rule 10(b)

A vessel using a traffic separation scheme shall:

- (i). proceed in the appropriate traffic lane in the general direction of traffic flow for that lane;
- (ii). so far as practicable keep clear of a separation line or separation zone;
- (iii). Normally join or leave a traffic lane at the termination of the lane, but when joining or leaving from either side shall do so at as small an angle to the general direction of traffic flow as practicable.

Rule 10(c)

A vessel shall, so far as practicable, avoid crossing a TSS but if obliged to do so shall cross on a heading as nearly as practicable at right angles to the general direction of flow.

Rule 10(d)

- (i). A vessel shall not use an inshore traffic zone when she can safely use the appropriate traffic lane within the adjacent traffic separation scheme. However, vessels of less than 20 metres in length, sailing vessels and vessels engaged in fishing may use the inshore traffic zone.
- (ii). Notwithstanding sub-paragraph (i) above, a vessel may use an inshore traffic zone when en route to or from a port, offshore installation or structure, pilot station or any other place situated within the traffic zone, or to avoid immediate danger.

Rule 10(f)

A vessel navigating in areas near the terminations of Traffic Separation Schemes shall do so with particular caution.

Rule 10(h)

A vessel not using a traffic separation scheme shall avoid it by as wide a margin as is practicable.

6.5 Aids to Navigation

A plot of the navigational aids in the vicinity of the Rampion Offshore Wind Farm site, based on the Admiralty Sailing Directions for the area (Ref. viii) and Admiralty charts of the area, is presented in Figure 6.4.

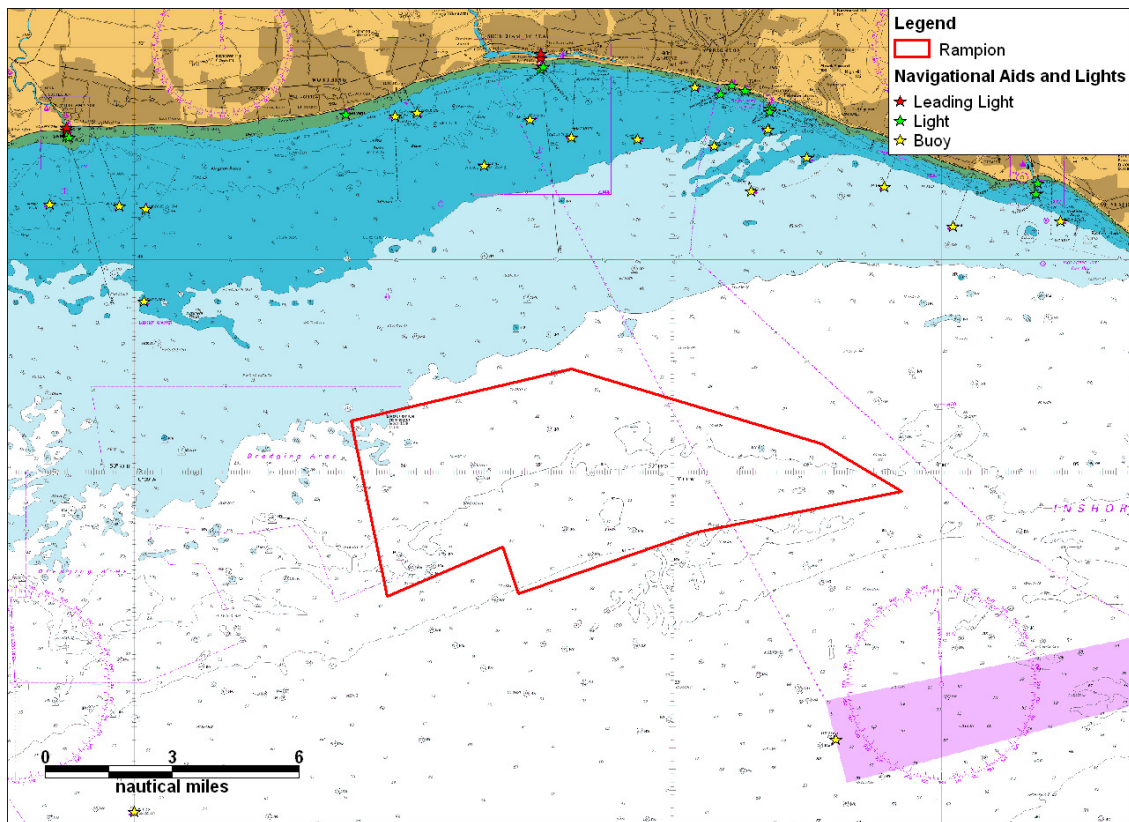


Figure 6.4 Overview of Navigational Aids relative to Rampion

6.6 Marine Environmental High Risk Areas

There are two Marine Environmental High Risk Areas (MEHRAs) located within 50nm of the proposed Rampion Offshore Wind Farm. A chart overview of these areas is presented in Figure 6.5.

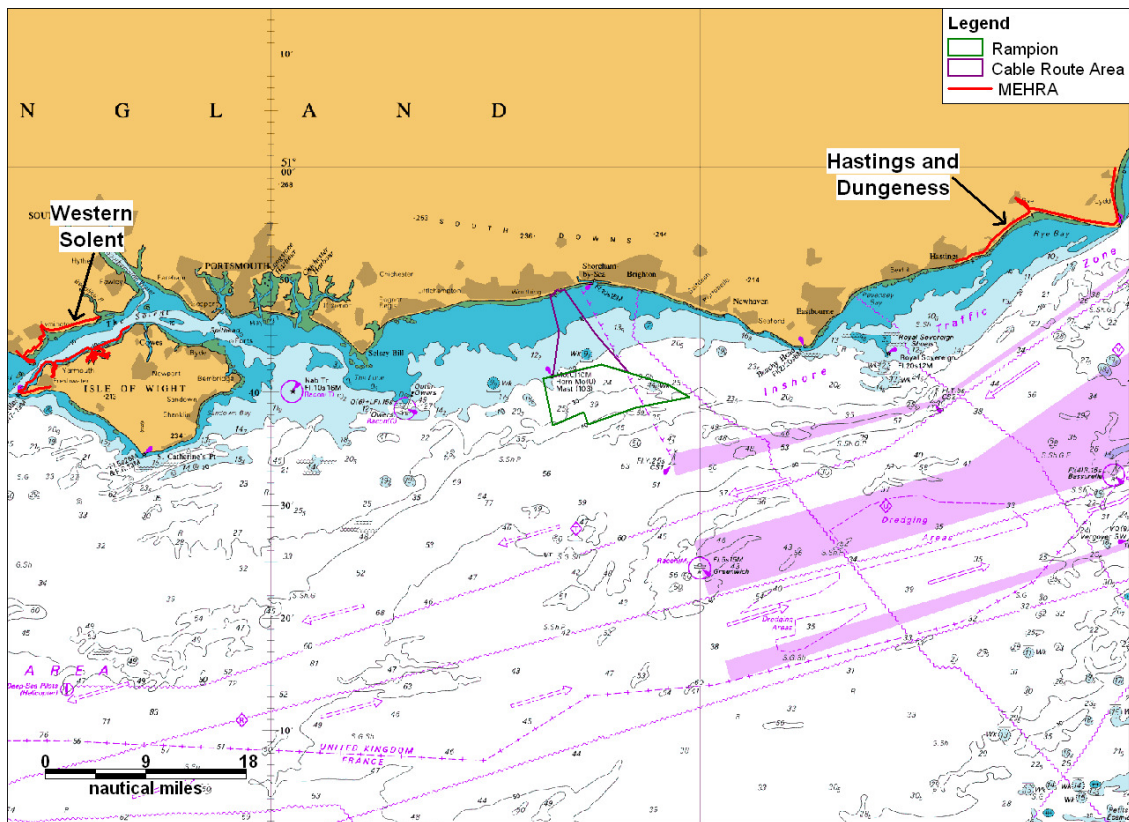


Figure 6.5 Overview of Nearby MEHRAs

Hastings and Dungeness and Western Solent have been identified as MEHRAs by the UK Government, (i.e. an area of environmental sensitivity and at high risk of pollution from ships.)

The Government expects mariners to take note of MEHRAs and either keep well clear or, where this is not practicable, exercise an even higher degree of care than usual when passing nearby.

6.7 Wrecks

Based on the admiralty charts of the area there are a number of wrecks within both the Rampion wind farm site and the export cable corridor, as shown in Figure 6.6.

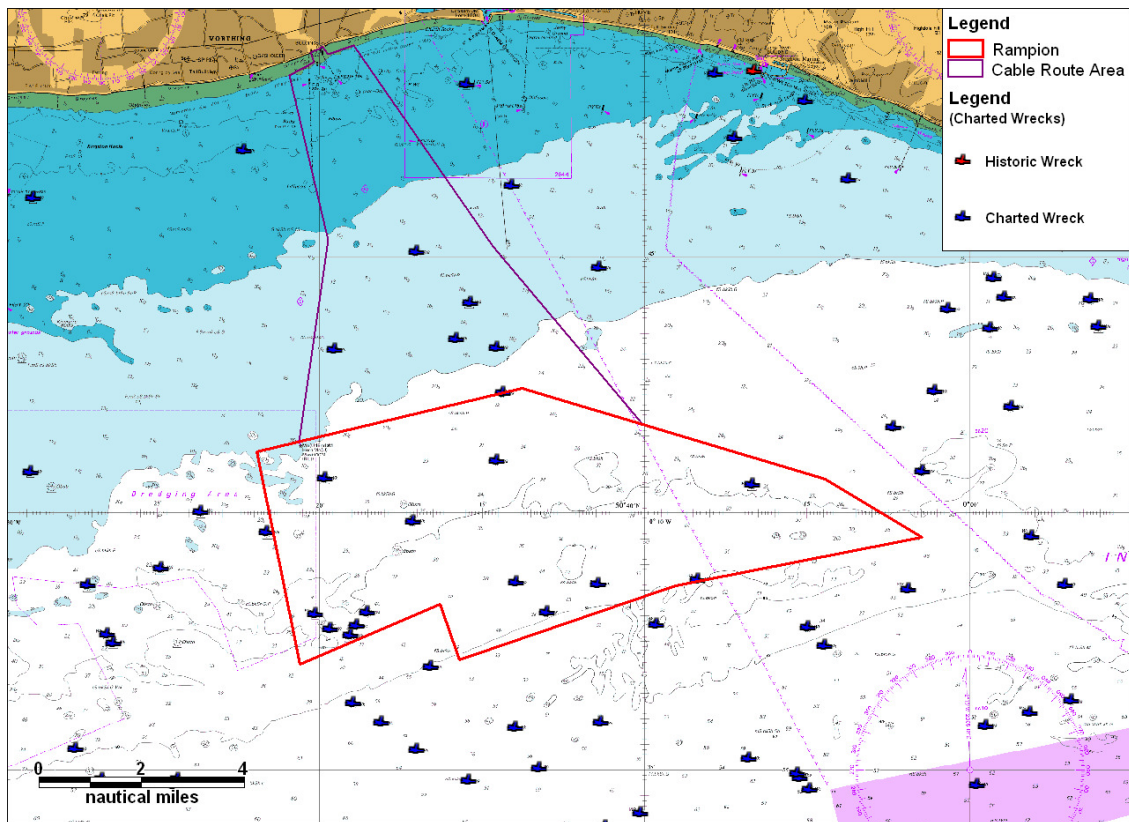


Figure 6.6 Charted Wrecks relative to the Rampion Offshore Wind Farm

There are a total of fourteen charted wrecks located within the site boundary.

6.8 *Aggregates Dredging*

Figure 6.7 presents the licensed and pre application dredging areas in proximity to the Rampion site, as well as several spoil grounds in the area.

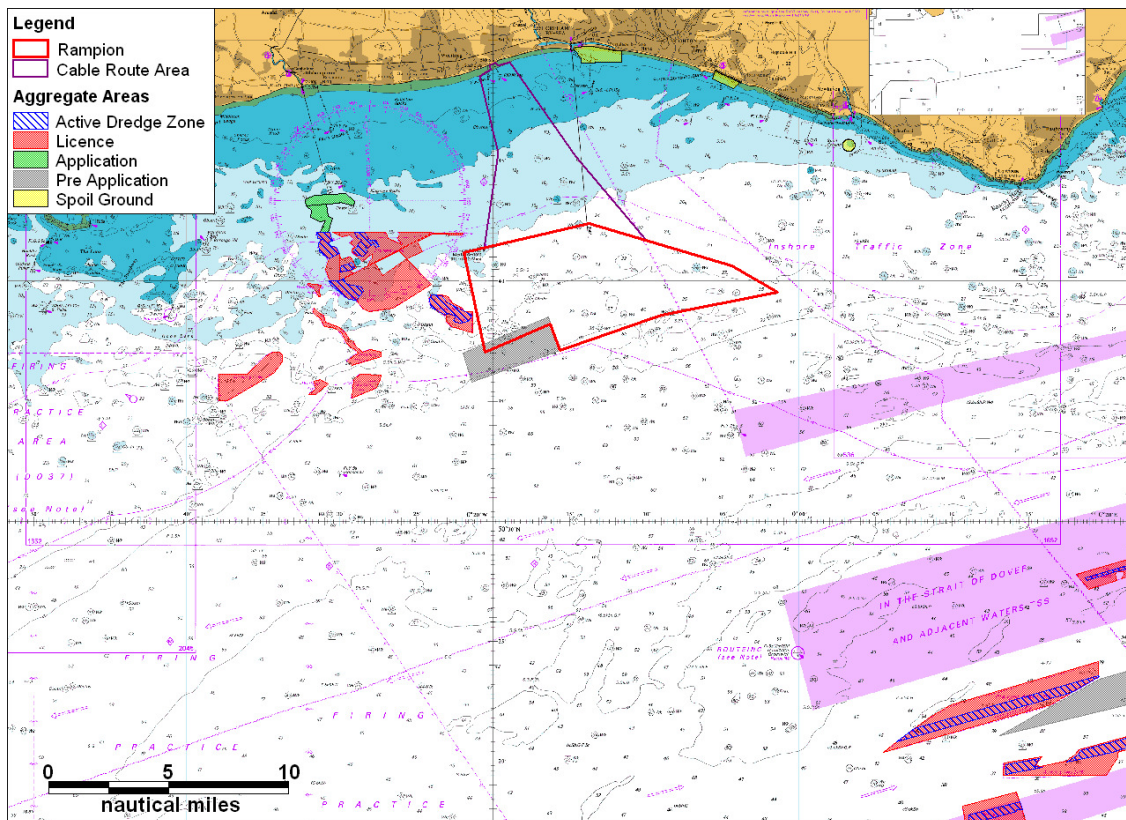


Figure 6.7 Aggregate Dredging Areas relative to the Rampion Offshore Wind Farm

It can be seen that there are a number of licensed marine aggregate dredging areas to the west of the Rampion site, in the Owers Bank dredge region. The nearest to Rampion is approximately 280m from the site's western boundary. In addition, there is a pre application area (Area 499) which lies partially within the southwest part of the site. No aggregates dredging areas intersect the export cable corridor.

The transits of dredgers in the vicinity of the Rampion wind farm site are presented in the maritime traffic surveys section (Section 8).

6.9 Exercise Areas

Figure 6.8 presents the military and practice areas relative to the proposed Rampion Offshore Wind Farm.

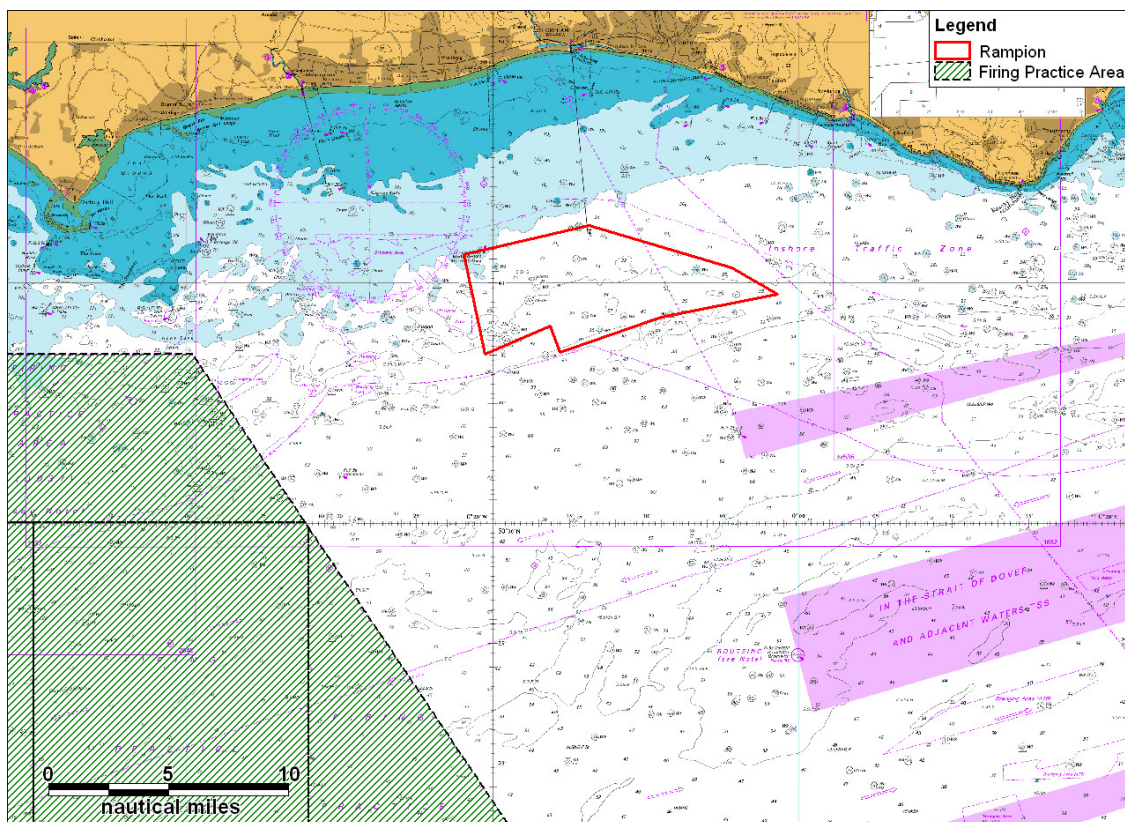


Figure 6.8 Military Practice Areas relative to the Rampion Offshore Wind Farm

Firing practice areas D037, D039 and D040 are located approximately 10nm to the southwest of the Rampion site boundary.

No restrictions are placed on the right to transit the practice areas at any time although Mariners are advised to exercise caution. Exercise and firing only take place when the areas are considered to be clear of all shipping.

6.10 Metocean Data

6.10.1 Introduction

This section presents nearby metocean statistics for the Rampion site which have been used as input to the risk assessment.

According to the Admiralty Sailing Directions (Ref. viii), the general area enjoys a mild maritime climate. Gales are infrequent during the summer months, but are more common in mid-winter.

Rainfall is plentiful and frequent, and distributed throughout the year, with February to June generally being the driest months. It is frequently cloudy throughout the year with coasts obscured, at times, by low clouds and rain.

Sea fog is most common in winter with westerly airflow over the English Channel. Land fog is most frequent in the autumn and winter and may occasionally extend out to sea in settled conditions. Visibility is generally good although marginally worse than that experienced in the western half of the English Channel.

6.10.2 Wind

The wind data for the area in terms of average direction is presented in Figure 6.9 (Ref. ix). The predominant wind direction is from the southwest.

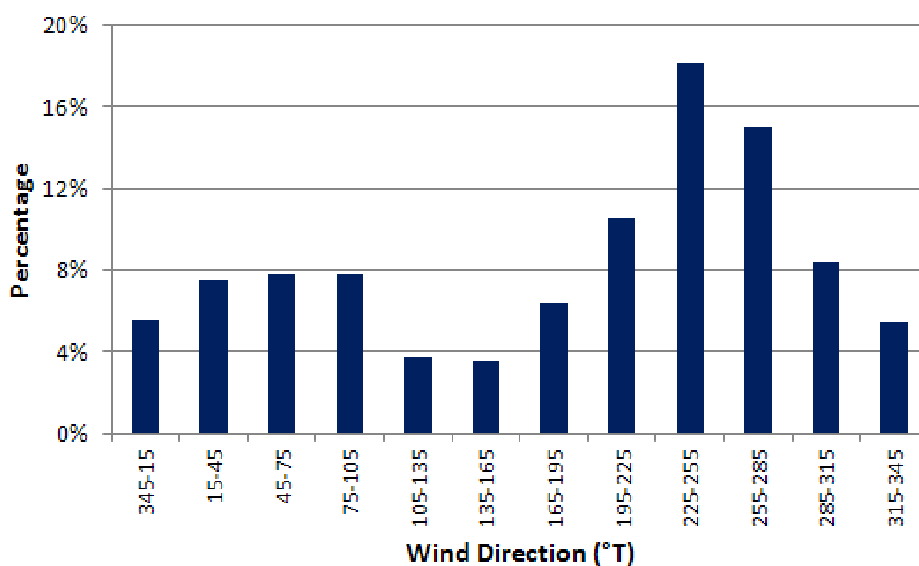


Figure 6.9 Annual Average Wind Direction

6.10.3 Wave

Significant wave height data for the area is presented below (Ref. ix).

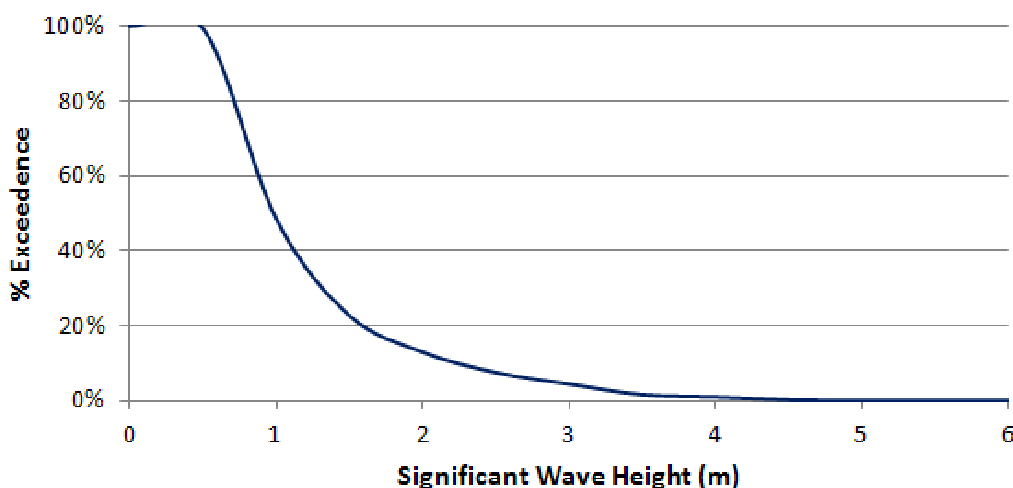


Figure 6.10 Significance Wave Height Exceedence Curve

6.10.4 Visibility

Historically, visibility has been shown to have a major influence on the risk of ship collision. The annual average probability of bad visibility (defined as less than 1km) for the area is approximately 0.03, i.e., an average of 3.0% of the year.

6.10.5 Tide

A description of the tidal streams in the general area is provided below (Ref. viii):

The east-going stream generally sets northeast towards the bays between Selsey Bill and Dungeness, but the west-going stream sets southwest clear of the land. The east onshore set is of little consequence to eastbound vessels, but could have a considerable effect on westbound vessels proceeding against it.

To the north of the line between Selsey Bill and Beachy Head the tidal streams are much weaker than off the points.

Chart Datum and Ordnance Datum for the proposed sites based on values recorded at Shoreham are presented below.

Table 6.1 Chart Datum and Ordnance Datum Figures from Shoreham

Tidal Level	Height above Chart Datum
Mean High Water Springs (MHWS)	6.3m
Mean High Water Neaps (MHWN)	4.8m
Mean Low Water Neaps (MLWN)	1.9m
Mean Low Water Springs (MLWS)	0.6m

Admiralty Chart 1652 (Tidal Diamond “E” approximately 2.7nm to the north of Rampion) indicates that currents in the area set in a generally easterly/north easterly direction on the flood and westerly/south westerly on the ebb, with a peak spring tidal rate of 1.6 knots and peak neap rate of 0.9 knots.

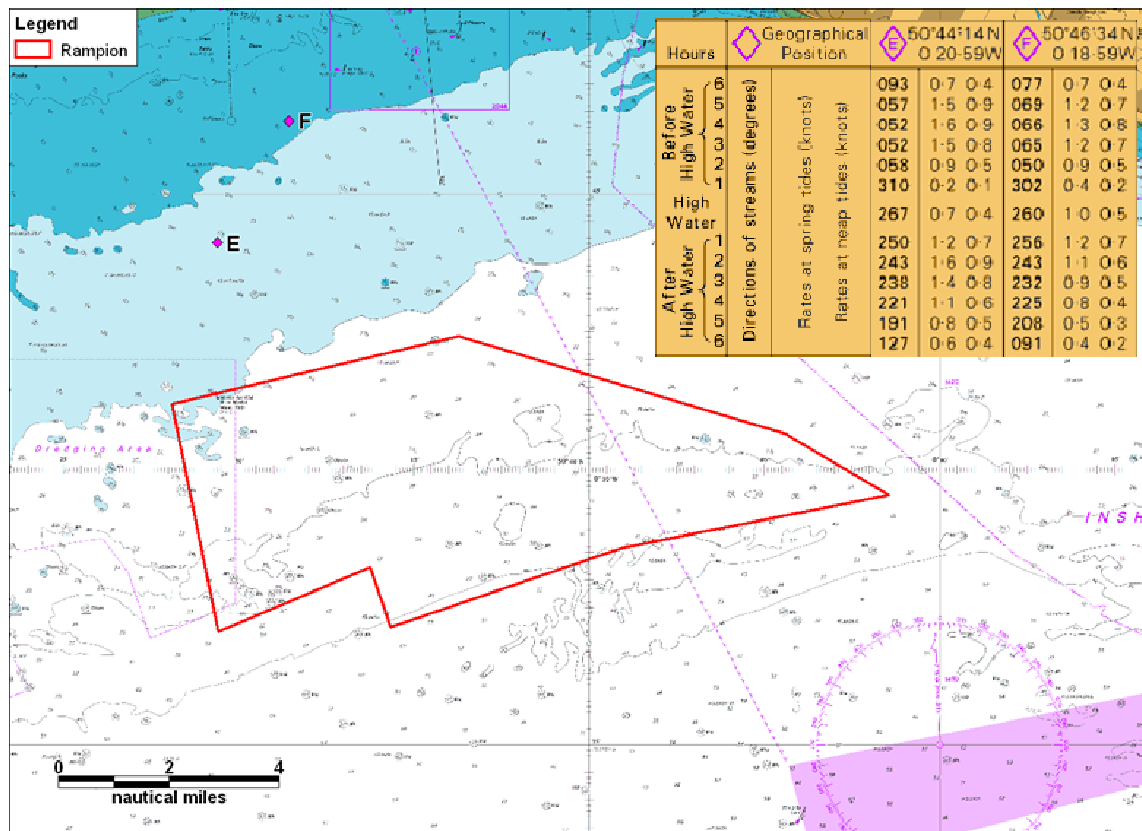


Figure 6.11 Tidal Stream data for the Proposed Site (Tidal Diamonds “E and F”)

7. MARITIME INCIDENTS

7.1 Introduction

This section reviews maritime incidents that have occurred in the vicinity of the Rampion site in recent years.

The analysis is intended to provide a general indication as to whether the area of the proposed development is currently a low or high risk area in terms of maritime incidents. If it was found to be a particular high risk area for incidents, this may indicate that the development could exacerbate the existing maritime safety risk in the area.

Data from the following sources has been analysed:

- Marine Accident Investigation Branch (MAIB)
- Royal National Lifeboat Institution (RNLI)

(It is noted that the same incident may be recorded by both the sources.)

7.2 MAIB

All UK commercial vessels are required to report accidents to MAIB. Non-UK vessels do not have to report unless they are in a UK port or are in 12 mile territorial waters and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report accidents to MAIB.

The locations¹ of accidents, injuries and hazardous incidents reported to MAIB within 10nm of the Rampion site for the ten years between January 2001 and December 2010 are presented in Figure 7.1, colour-coded by type.

¹ MAIB aim for 97% accuracy in reporting the locations of incidents.



The overall distribution by incident type, excluding incidents within port/harbour areas, is presented in Figure 7.2.

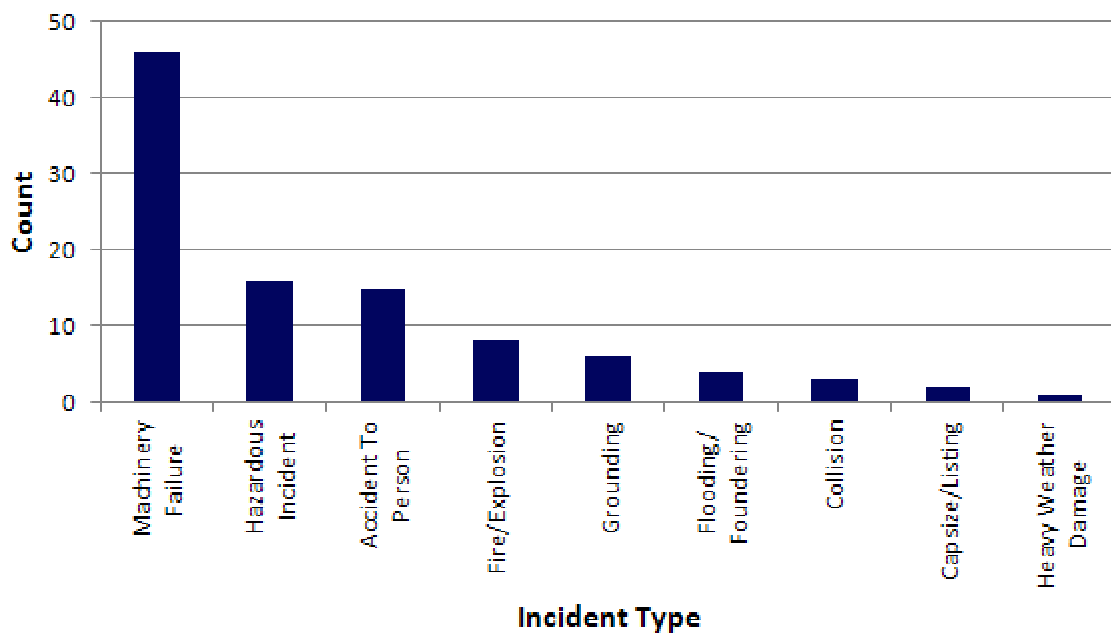


Figure 7.2 MAIB Incidents by Type within 10nm of the Rampion Site (2001-10)

The most common incident types recorded within 10nm of the Rampion site were machinery failure, hazardous incident and accident to person, representing 76% of all incidents over the ten year period.

Figure 7.3 presents the distribution of incidents per year in the area.

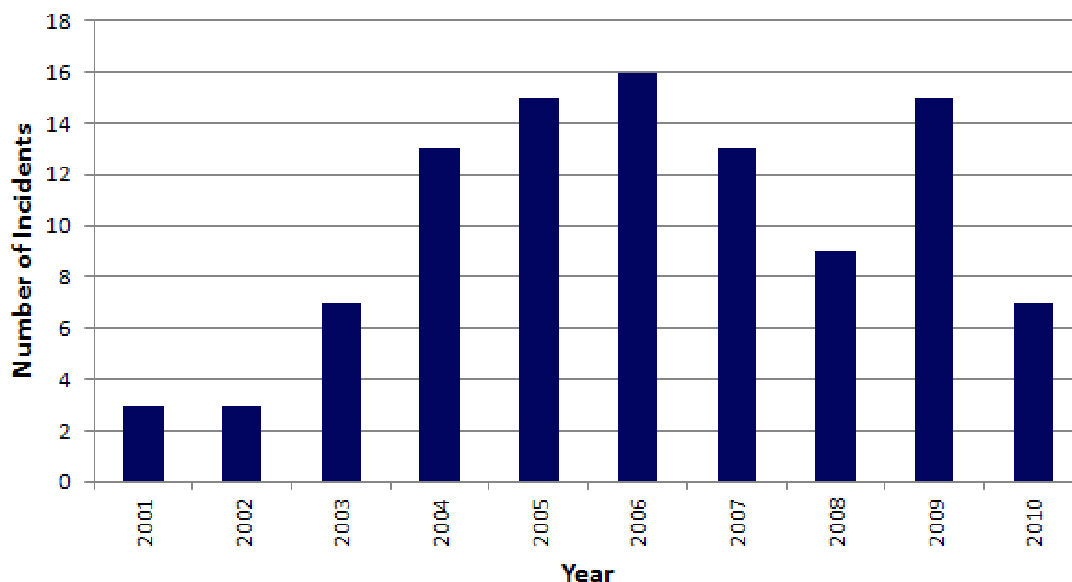


Figure 7.3 MAIB Incidents by Year within 10nm of the Rampion Site (2001-10)

The highest number of incidents within 10nm of the Rampion site was recorded in 2006 with 16 incidents reported.

Seven incidents, involving a total of eight vessels, were reported within the Rampion site. Of these, 4 incidents were reported as ‘Machinery Failure’, 2 were reported as ‘Hazardous Incidents’ and 1 as ‘Accident to Person’.

7.3 RNLI

Data on RNLI lifeboat responses within 10nm of the Rampion site in the ten-year period between 2001 and 2010 have been analysed. A total of 1,965 launches were recorded by the RNLI (excluding hoaxes and false alarms).

Figure 7.4 presents the geographical location of incidents colour-coded by casualty type.

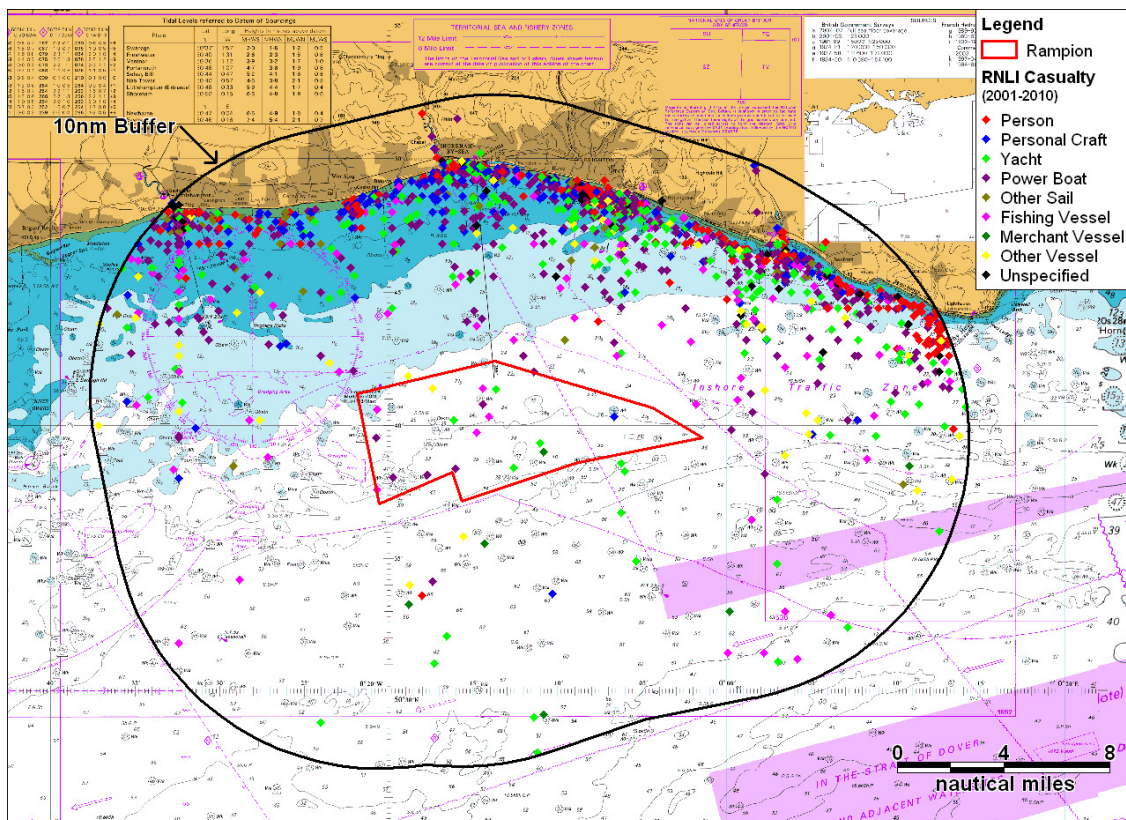


Figure 7.4 RNLI Incidents by Casualty Type within 10nm of the Rampion Site

The RNLI tended to respond to incidents near to the shore (to the north of the Rampion site).

There were a total of 17 launches to 17 unique incidents within the Rampion site over the 10 year period analysed. Details of these incidents are given below:

- Fouled propeller on a large power boat; Inshore Lifeboat (ILB) from Brighton launched on 12th May 2001.

- Machinery failure on a large power boat; Shoreham ALB responded on 28th June 2002.
- Machinery failure on an angling vessel; ILB from Littlehampton responded on 21st July 2002.
- Fouled propeller on a yacht; ALB from Shoreham responded on 1st May 2003.
- Machinery failure on a large power boat; Shoreham ALB responded on 3rd October 2003.
- Fouled propeller on a large power boat; Shoreham ALB responded on 21st December 2004.
- Sail failure on a yacht; ALB from Shoreham responded on 16th May 2005.
- Ill leisure diver; Brighton ILB responded on 03 July 2005.
- Ill crewman on a large fishing vessel; Shoreham ALB responded on 10th August 2005.
- Machinery failure on a small fishing vessel; Shoreham ALB responded on 16th August 2005.
- Machinery failure on a large fishing vessel; ALB from Shoreham responded on 3rd August 2006.
- Ill crewman on a small merchant vessel; Shoreham ALB responded on 28th February 2008.
- Machinery failure on a small power boat; ALB from Shoreham responded on 9th June 2008.
- Machinery failure on a diver support craft; ALB from Shoreham responded on 3rd May 2009.
- Leak and swamping on a yacht; ALB from Shoreham responded on 3rd July 2009.
- Fouled propeller on a small fishing vessel; Shoreham ALB responded on 10th August 2009.
- Machinery failure on a sailing yacht; Shoreham ALB responded on 9th May 2010.

The overall distribution by casualty type, within 10nm of the Rampion site, is summarised in Figure 7.5.

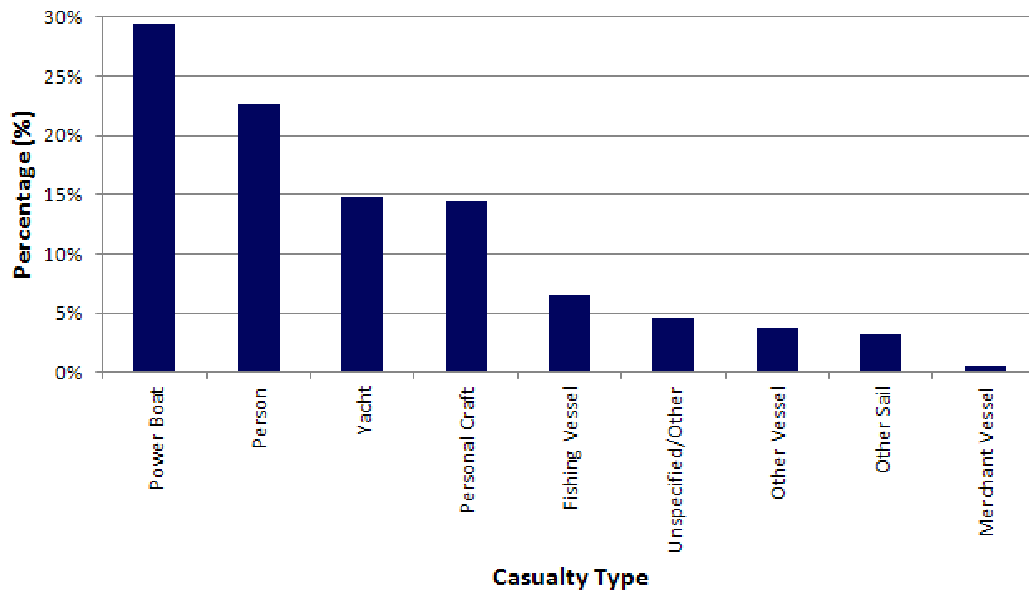


Figure 7.5 RNLI Incidents by Casualty within 10nm of the Rampion Site (2001-2010)

The most common vessel types involved were power boats (29%), yachts (15%) and personal craft (14%). Person represented 23% of incidents within 10nm of the Rampion site.

A chart of the incidents colour-coded by cause is presented in Figure 7.6.

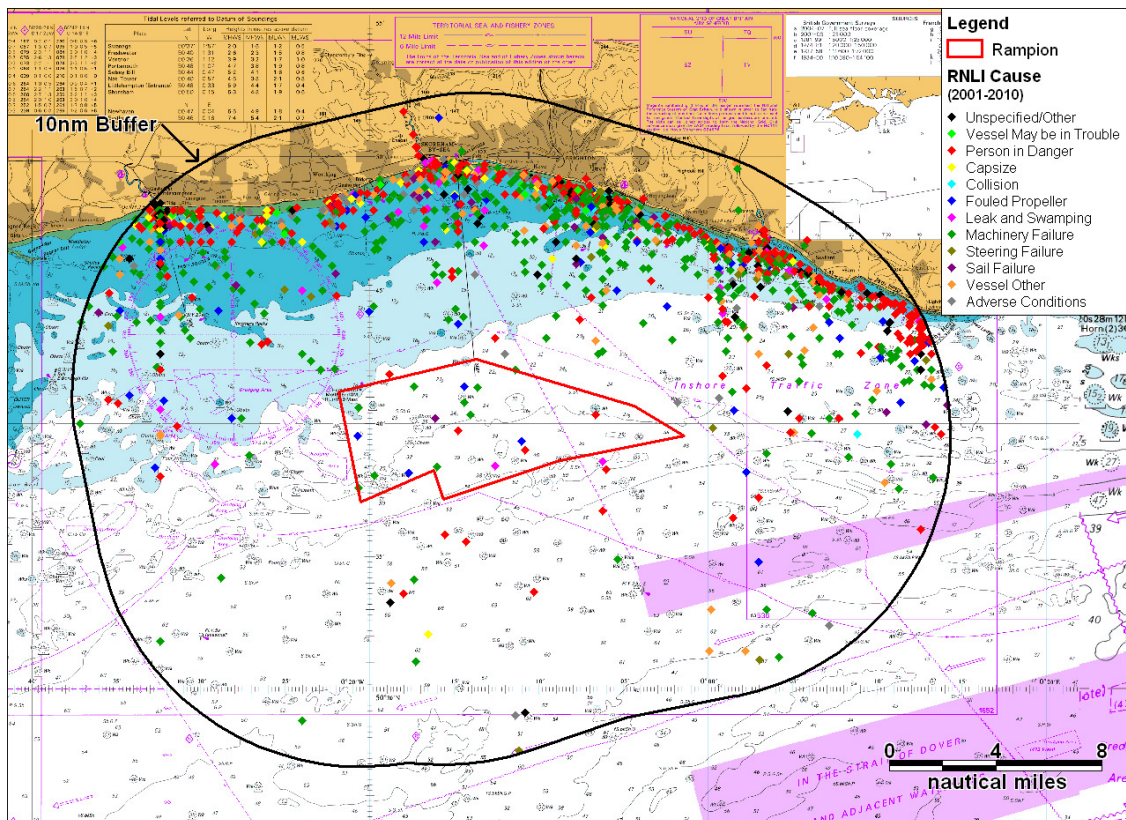


Figure 7.6 RNLI Incidents by Cause within 10nm of the Rampion Site

The reported causes are summarised in Figure 7.7.

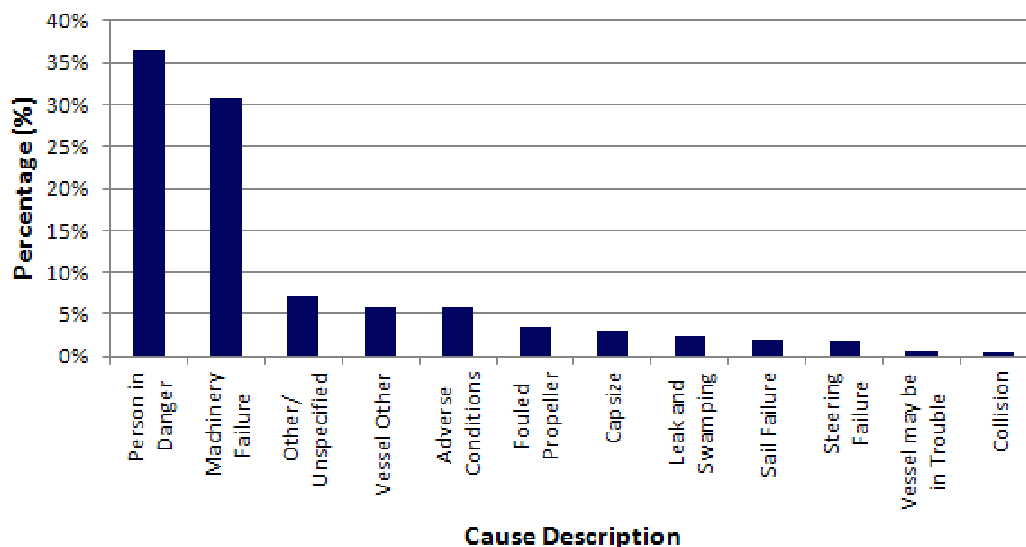


Figure 7.7 RNLI Incidents by Cause within 10nm of the Rampion Site (2001-10)

The two main causes were person in danger (36%) and machinery failure (31%). The annual rate of incidents in the past ten years is summarised in Figure 7.8.

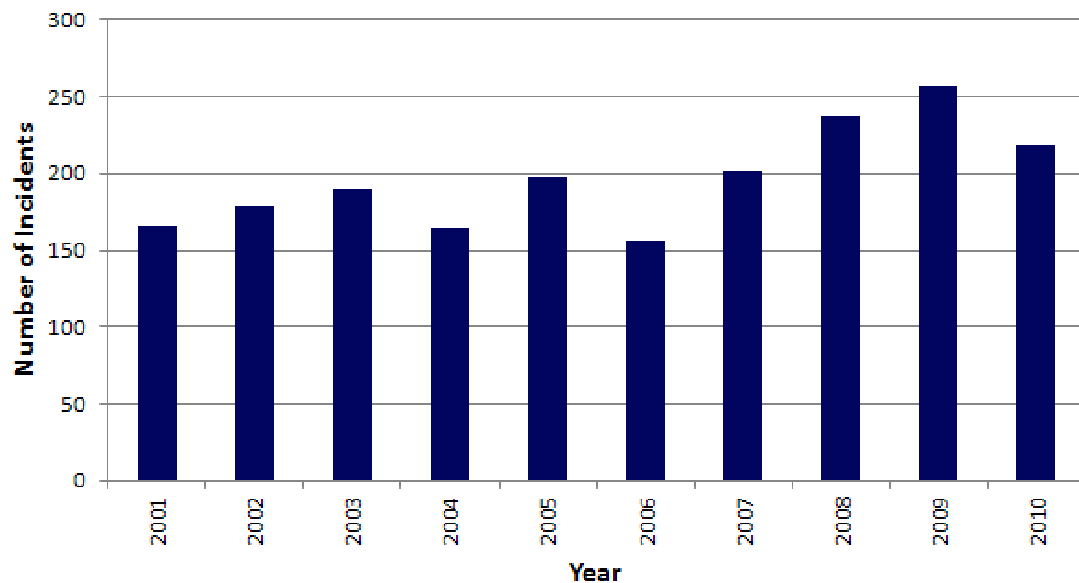


Figure 7.8 RNLI Incidents by Year within 10nm of the Rampion Site (2001-10)

There was an average of over 190 RNLI incidents recorded within 10nm of the Rampion site from 2001-2010, with an average of approximately 2 incidents per year within the site.

The stations and types of lifeboat responding to incidents (ALB and ILB) are illustrated in Figure 7.9.

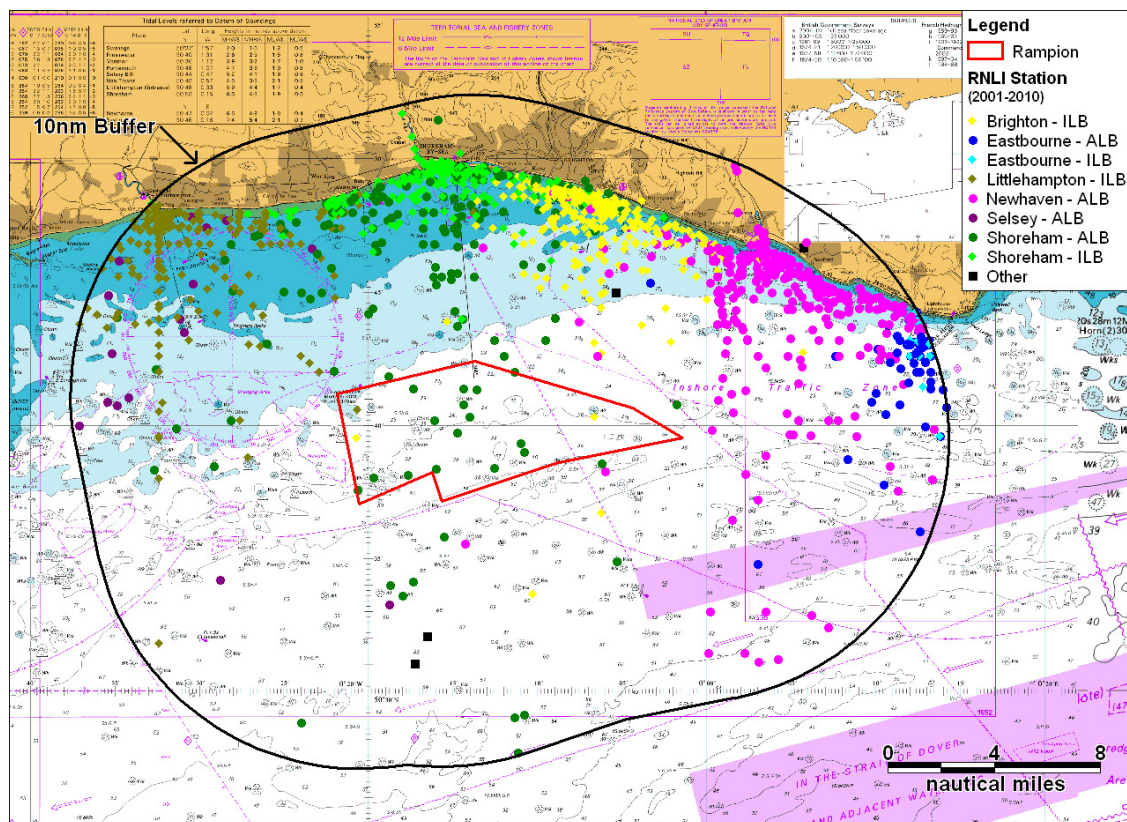


Figure 7.9 RNLI Incidents by Station within 10nm of the Rampion Site (2001-10)

The majority of incidents within 10nm of the site were responded to by Brighton ILB (27%), Littlehampton ILB (22%), Newhaven ALB (18%) and Shoreham ILB (17%). It can be seen that the ALBs generally responded to the incidents further from the coast, including the majority of incidents within the Rampion site.

Section 19.2 presents the RNLI lifeboat stations and other SAR resources relative to the Rampion site.

7.4 Accident/ Incidents Conclusions

Based on the review of incidents, it can be seen that the proposed Rampion Wind Farm site has experienced a relatively low rate of accidents in recent years. However, a higher rate of incidents was recorded inshore of the site in more coastal areas, i.e., close to the Sussex coast.

8. MARITIME TRAFFIC SURVEYS

8.1 Introduction

This section summarises the results of the maritime traffic surveys carried out for Rampion site, using a combination of shore-based AIS / Radar data and visual observations.

AIS is required on board all vessels of more than 300 gross tonnage (GRT) engaged on international voyages, cargo vessels of more than 500 GRT not engaged on international voyages, passenger vessels irrespective of size built on or after 1st July 2002, and fishing vessels over 45m in length (at the time of surveying).

Therefore, larger vessels were recorded on AIS, while smaller vessels without AIS installed (i.e., fishing vessels under 45m and recreational craft) were recorded, where possible, on Radar. A proportion of smaller vessels also carry AIS voluntarily.

8.2 Survey Details

Two shipping traffic surveys of the Rampion site were carried out using Automatic Identification System (AIS) and Radar to collect track data on vessel movements. This was supplemented by manual observation of vessels within visual range to obtain information on type and size, where the information was not available from AIS. The objective of the survey was to identify the vessel activity both within and adjacent to the Rampion site.

Data was recorded from the National Coast Watch Institution (NCI) Shoreham Station, approximately 7.3nm to the north of the Rampion site.

Figure 8.1 presents the equipment setup at the site.



Figure 8.1 Radar Scanner located at Shoreham Coastwatch Station

The survey location relative to the Rampion site is presented in Figure 8.2. The 20nm buffer provides an indication of meaningful data coverage relative to the Rampion site.

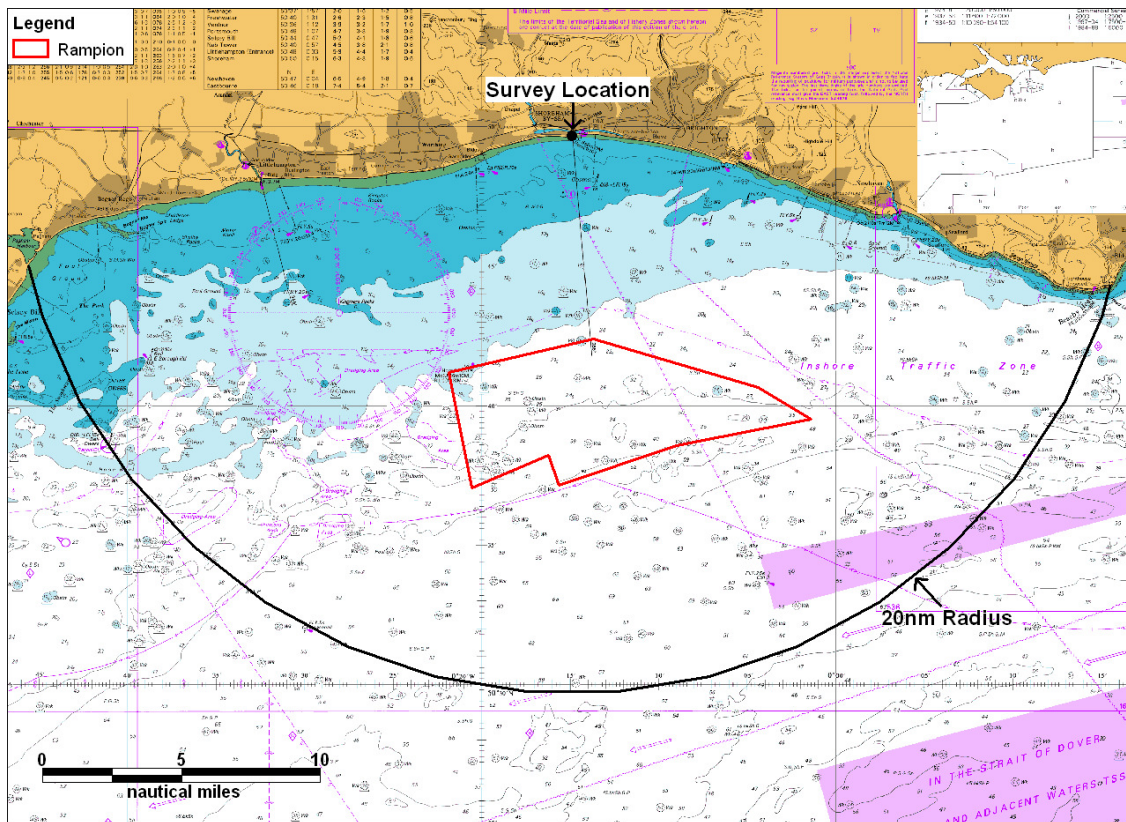


Figure 8.2 Chart Overview of Survey Location

In accordance with the requirements of MGN 371, the survey was carried out over two 14 day survey periods, in order to collect data on vessel movements in the area during the winter and summer, as well as to cover tidal variations. AIS and Radar data were recorded from Shoreham during the following survey periods:

- 17th to 31st January 2011; and
- 16th to 30th July 2011.

(Note: the first and last day of both survey periods were partial days due to survey equipment set-up and removal, so both surveys were comprehensive over a 14 day period.)

In addition, the 28 days of survey data has been supplemented with longer term AIS data collection from Shoreham, in order to validate vessel routeing and for the identification of regular traffic.

8.3 Shipping Levels and Types

Plots of the tracks recorded during the winter and summer survey periods, colour-coded by vessel type, are presented in Figure 8.3 and Figure 8.4.

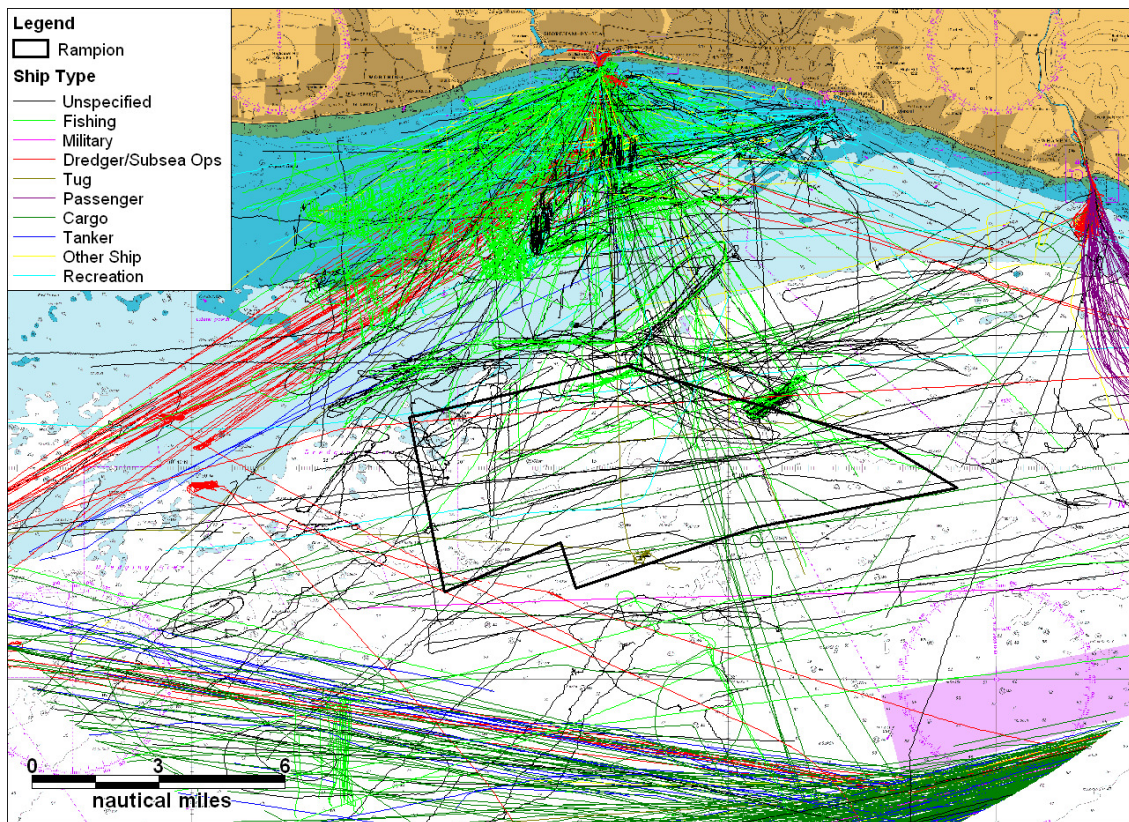


Figure 8.3 Combined AIS and Radar Tracks by Type (14 days, January 2011)

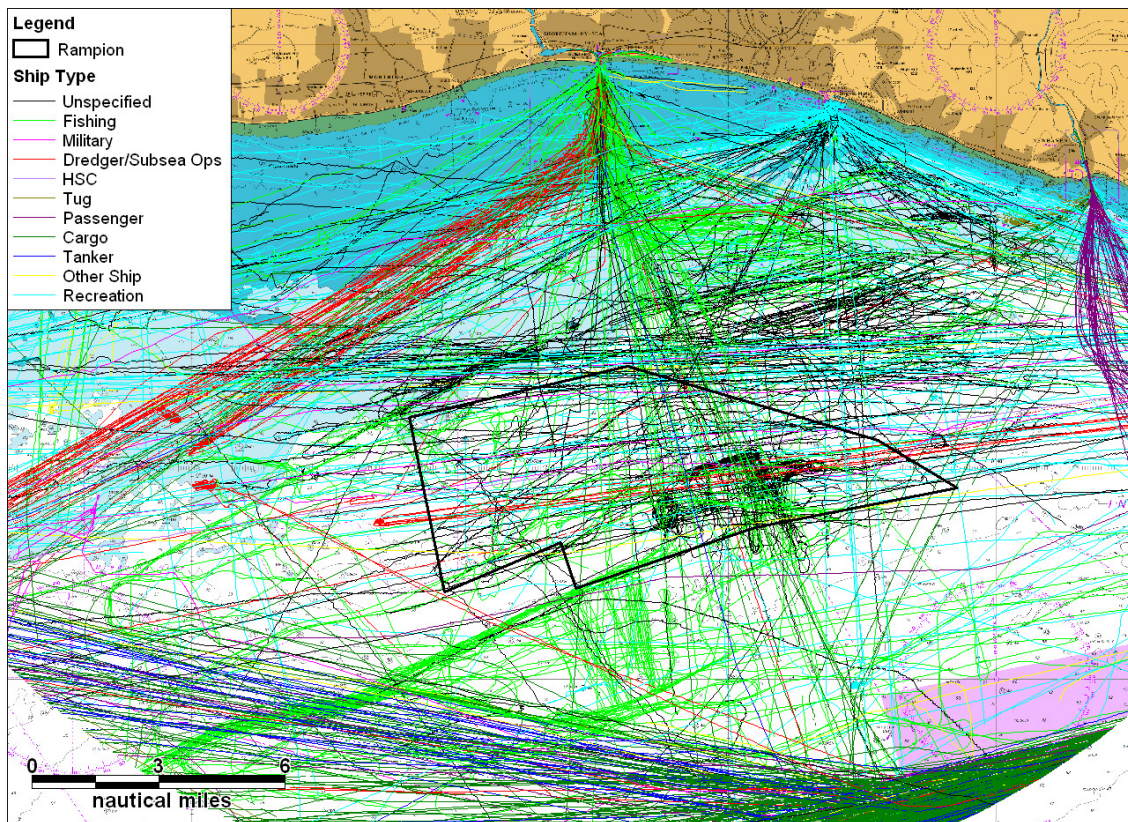


Figure 8.4 Combined AIS and Radar Tracks by Type (14 days, July 2011)

Overall, there was an average of 85 vessels per day passing within 20nm of the survey location (based on the effective survey duration of 28 days of AIS and Radar tracks.)

Figure 8.6 presents the tracks intersecting the Rampion site during the combined 28 day survey period.

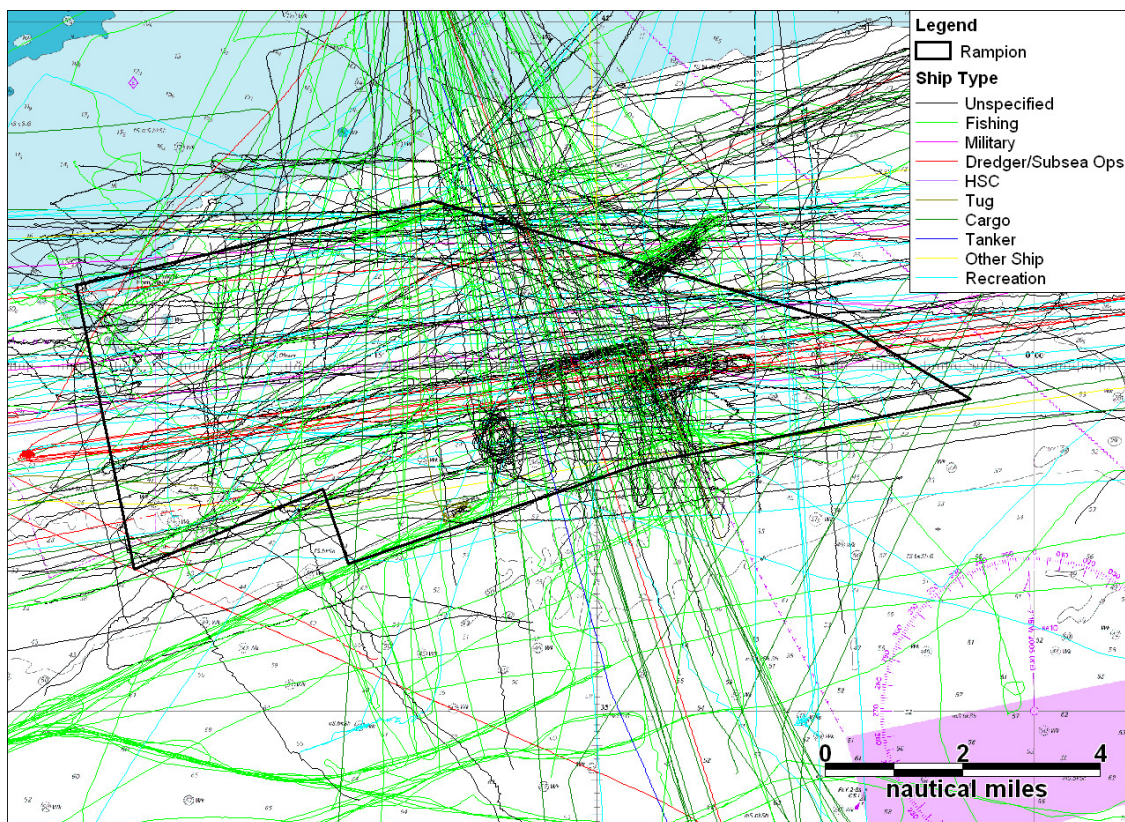


Figure 8.5 Combined AIS and Radar Tracks by Type – Intersecting the Rampion Site

Figure 8.6 presents the daily number of vessels passing through the Rampion site during the two survey periods.

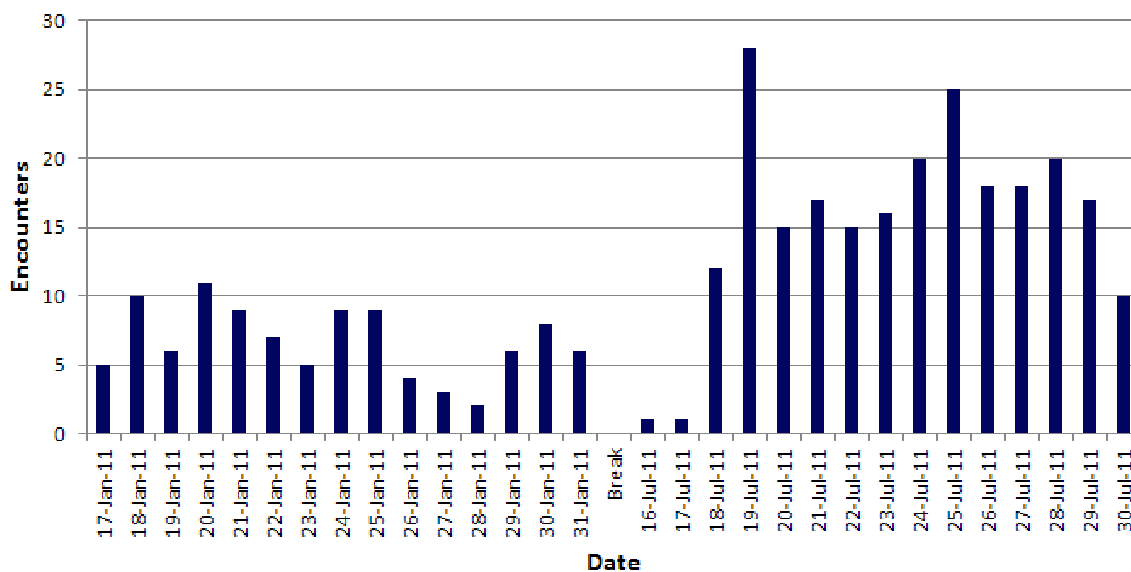


Figure 8.6 Vessels per day intersecting the Rampion Site

It can be seen that the level of activity within the Rampion development was higher during the survey in July 2011 compared with the survey in January 2011. There was an average of 7 to 8 vessels per day passing through the Rampion site during the winter survey in comparison with an average of 16 to 17 vessels per day during the July survey. It is noted that the majority of these tracks were Radar tracks (61%) as opposed to AIS tracks (39%).

The busiest day within the Rampion site was Tuesday 19th July 2011, with 28 vessels passing through the site. A plot of the busiest day is presented in Figure 8.7.

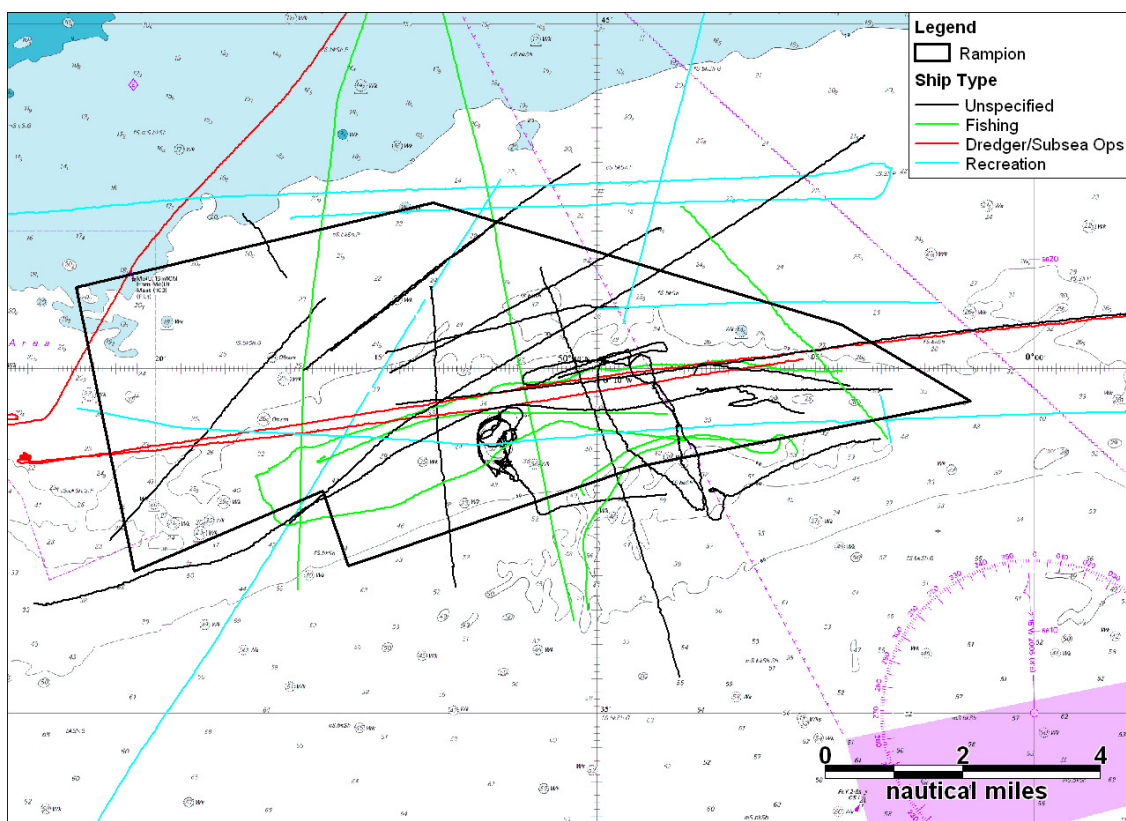


Figure 8.7 Vessels passing through the Rampion Site - Busiest day (19th July 2011)

Figure 8.8 presents the type distribution for vessels passing through the Rampion site (excluding unspecified).

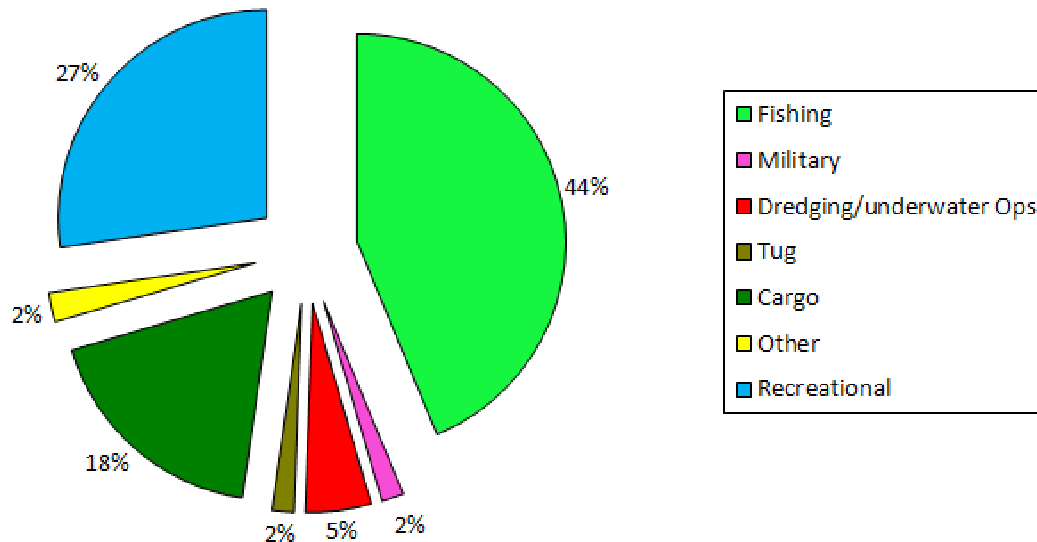


Figure 8.8 Vessel Type Distribution Passing through the Rampion Site

Unspecified ships accounted for 47% of all vessels recorded within the Rampion site during the survey periods. These were generally Radar targets with no visual identification. It is noted that these targets are likely to be fishing vessels and recreational craft.

Excluding unspecified ships, fishing vessels were the most common type recorded within the site comprising 44% of traffic. Recreational craft made up 27% of traffic; followed by cargo vessels contributing 18%, and dredgers and underwater operations vessels (5%).

Analyses of the cargo vessels, dredgers and underwater operations vessels, tankers and passenger vessels recorded during the survey are presented in the following sections (recreational and fishing vessel tracks are considered separately in Sections 11.3 and 12.2, respectively).

8.3.1 Cargo Vessels

A chart of cargo vessel tracks within 20nm of the survey location is presented in Figure 8.9.

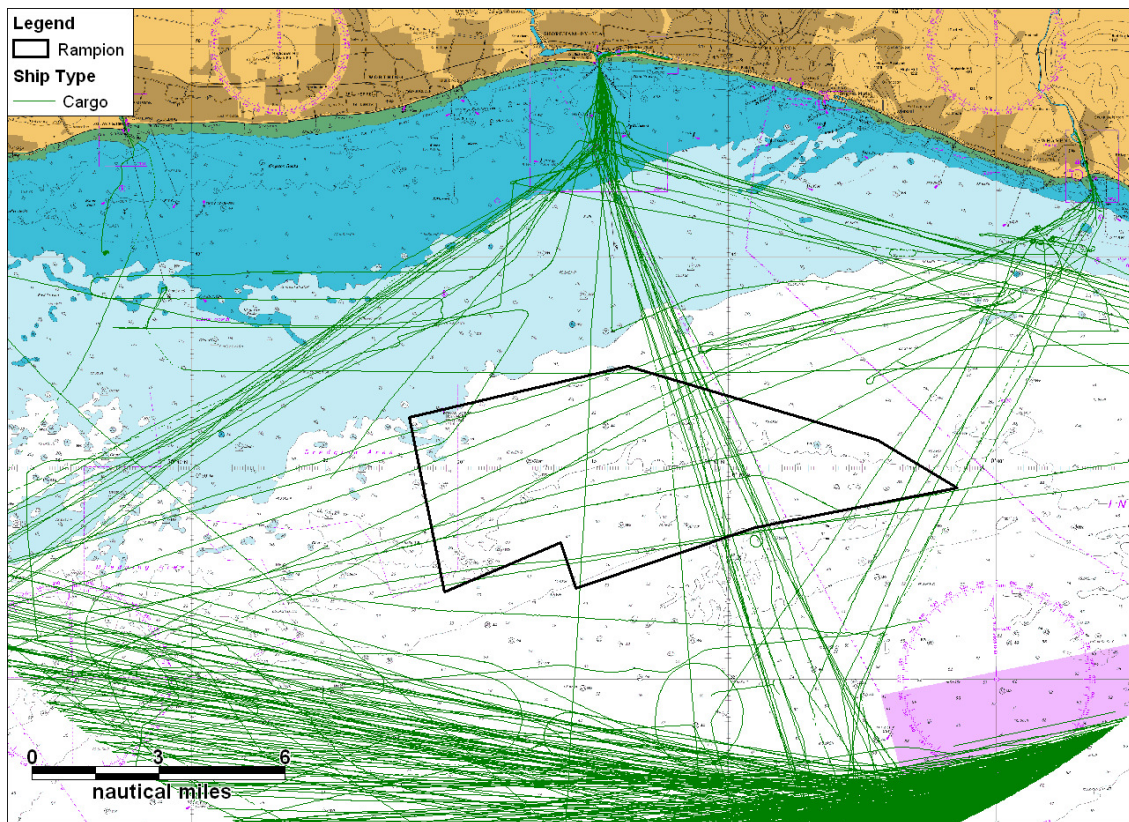


Figure 8.9 Cargo Vessel Tracks (28 days)

Cargo ships were the most common type within 20nm of the survey location, accounting for 32% of all vessels recorded during the survey period. The vast majority of cargo vessels tracked during the survey were exiting the westbound lane of the Dover Strait TSS, and passed to the south of the Rampion site.

In terms of vessels passing through the Rampion site during the survey there was an average of just over 1 cargo vessel per day. Of these approximately 47% passed north/south through the site headed to/from Shoreham, and 34% were associated with Newhaven.

8.3.2 Dredgers and Underwater Operations Vessels

A chart of dredgers and underwater operations vessels within 20nm of the survey location is presented in Figure 8.10.

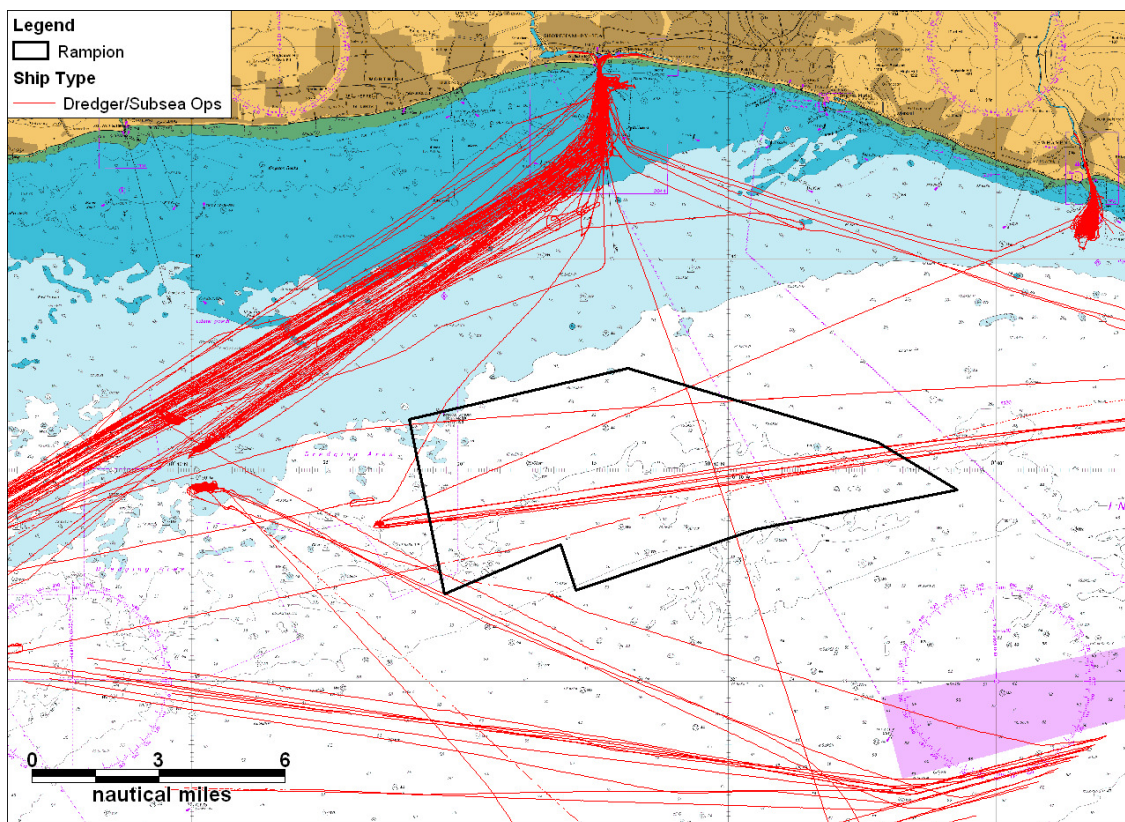


Figure 8.10 Dredgers and Underwater Operations Vessels (28 days)

The majority of dredgers and underwater operations vessels tracked were associated with Shoreham, and passed to the northwest of the Rampion site. In terms of vessels passing through the site, the vessel *Sospan Dau* passed east/west through the site on nine occasions during the summer survey period only, generally between Pevensey (East Sussex) and the Owers Bank dredge area to the west of the site. During the January survey period the *Sospan Dau* was operating within the port approaches of Newhaven and Shoreham.

In consultation with Newhaven Port during July 2011 (Section 5.6.2), it was noted that the plant in Newhaven was shut down during the first survey in January 2011, and therefore no dredgers associated with Newhaven were recorded. It was stated that dredgers from Newhaven operate at the Nab and Owers bank dredging areas. At the time of the meeting, the plant was due to reopen, however, as can be seen in the figure above these vessels were not observed during the summer survey in late July.

Therefore, the routeing of dredgers operating out of Newhaven has been assessed through on-going data collection (AIS only) from Shoreham. A plot of 28 days of AIS data from November and December 2011, during which time dredgers were recorded operating out of Newhaven, is presented in Figure 8.11.

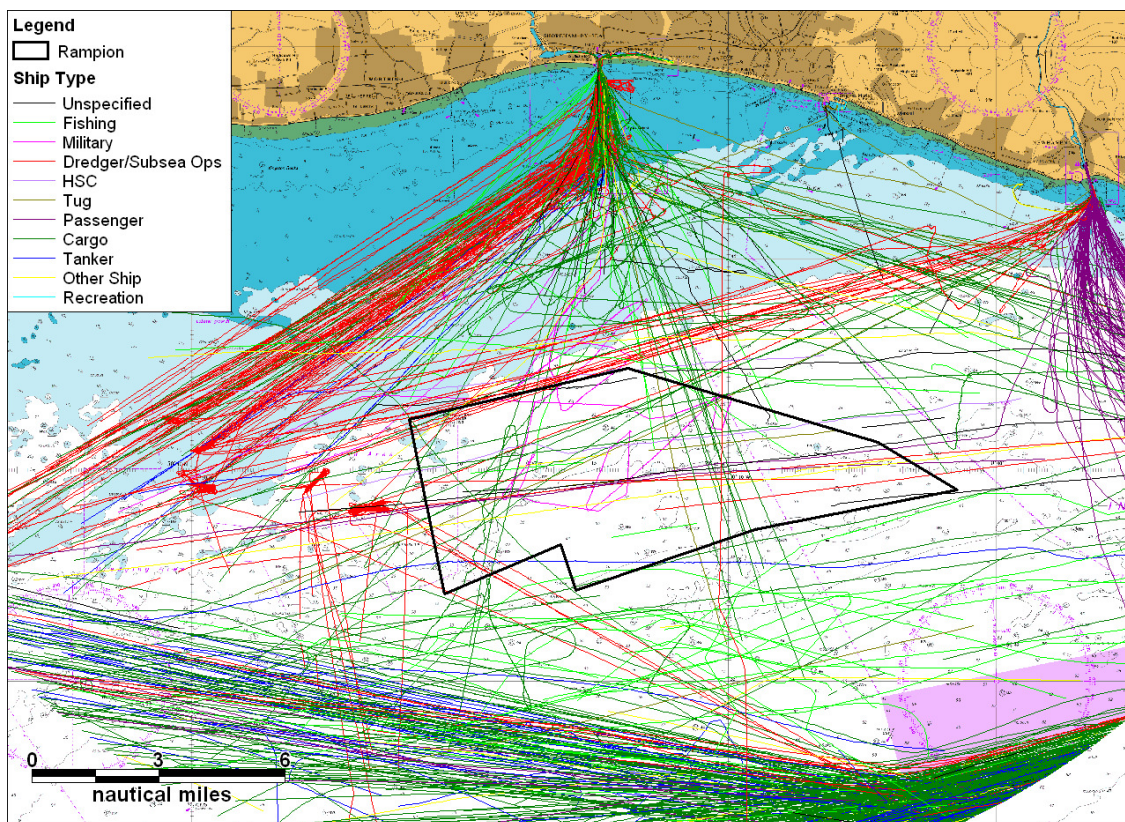


Figure 8.11 AIS Tracks by Type (28 days, November – December 2011)

It can be seen that the dredgers operating out of Newhaven tended to pass through or in close proximity to the northern part of the Rampion site, dependent on the dredging areas which they were routing to/from.

Westminster Dredging Company Limited stated at the hazard workshop that although the survey data gathered shows the routing of the *Sospan Dau* when involved in beach replenishment works at Pevensey (east/west through Rampion as shown in Figure 8.10), such works occur at other locations in the area, which would give rise to different routing by the vessels involved. Figure 8.12 presents 14 days of AIS data gathered from Shoreham during October and November 2011. During this time the *Sospan Dau* was engaged in works at Pevensey and Hastings (both East Sussex), and was routing to/from Dredge Area 435/2.

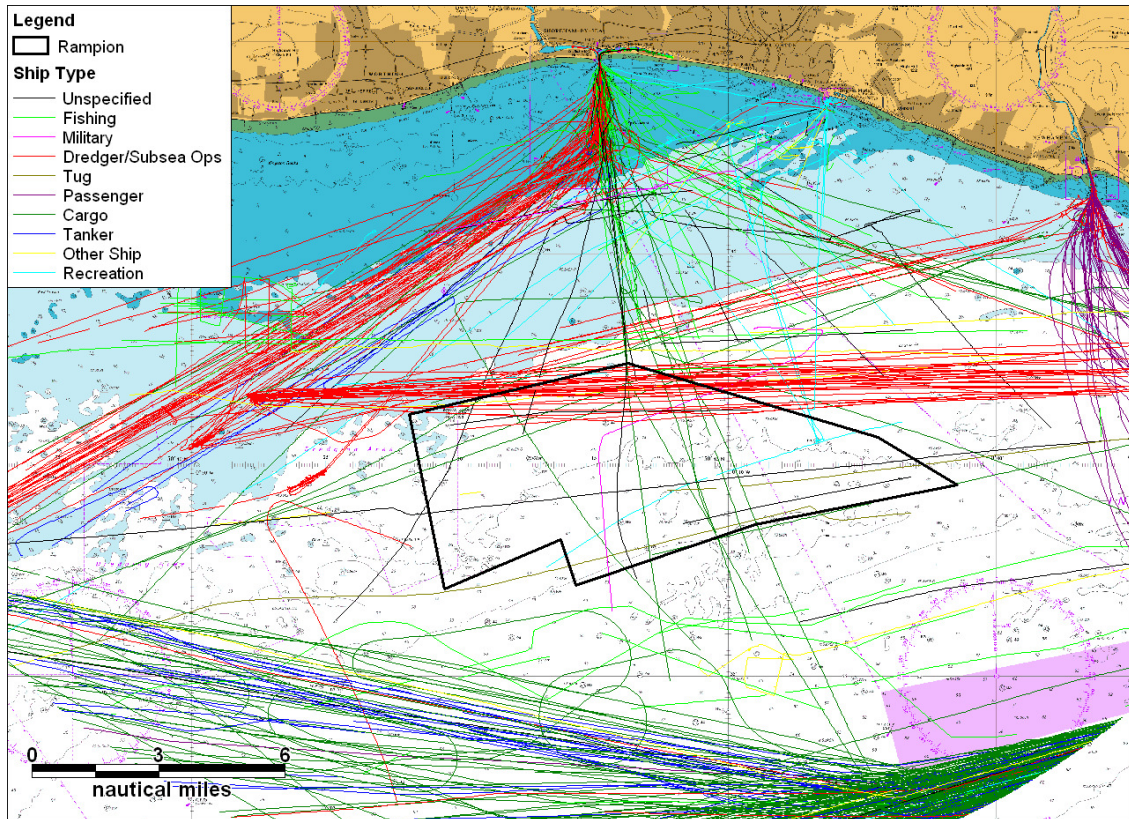


Figure 8.12 AIS Tracks by Type (14 days, September – October 2011)

It can be observed that the east/west tracks of the dredger engaged in beach replenishment works were further to the north than those observed during the July/August survey, and passed through the northern part of the Rampion site.

8.3.3 Tankers

An overview of the tanker tracks recorded within 20nm of the survey location during the combined 28 day survey period is presented in Figure 8.13.

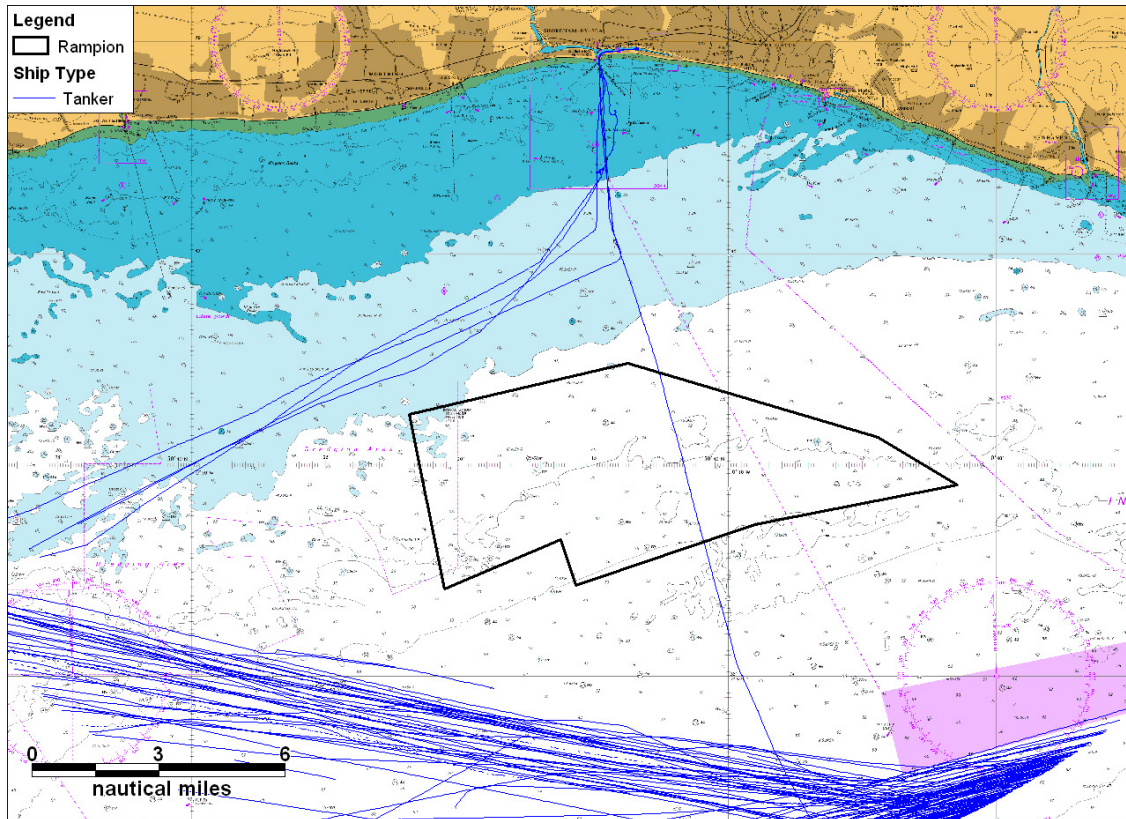


Figure 8.13 Tanker Vessel Tracks (28 days)

The vast majority of tankers tracked within 20nm of Shoreham were exiting the TSS. The only tanker recorded within the Rampion site during the two surveys was the products tanker *Galway Fisher*. This vessel was tracked heading south through the site from Shoreham to Dunkirk (France), having been tracked passing to the NNW of Rampion earlier the same day, when headed to Shoreham.

8.3.4 Passenger Vessels

A plot of the passenger vessel tracks recorded during the survey periods is presented in Figure 8.14.

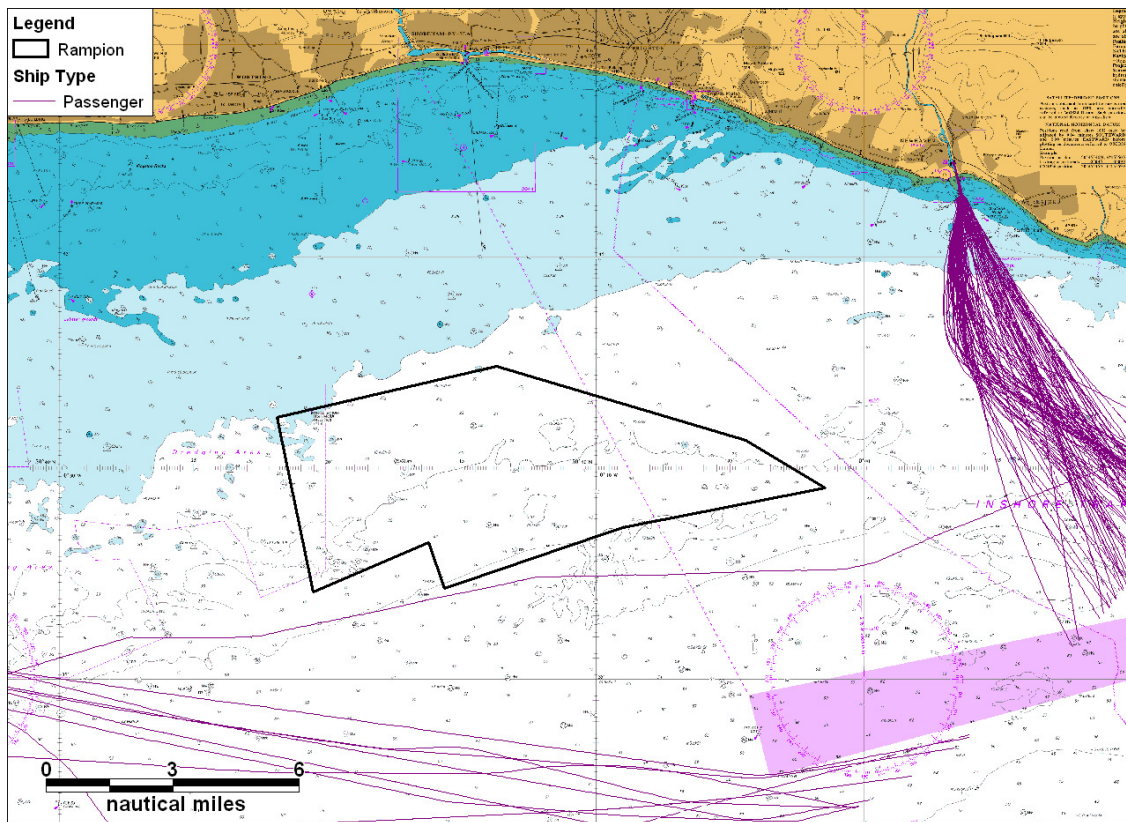


Figure 8.14 Passenger Vessel Tracks (28 days)

The Transmanche Ferries operated vessels *Cote D’Albatre* and *Seven Sisters* were recorded regularly during the surveys, although the *Seven Sisters* was only recorded during the January survey. These vessels were operating on the service between Newhaven and Dieppe, with two sailings in each direction per day.

The *Balmoral* was the passenger vessel to pass in closest proximity to the site during the 28 days of surveying was the. This is a passenger day trip vessel that operates from various ports along the south coast, and does not continually operate in the vicinity of the Rampion site. This vessel passed 0.2nm to the south of the Rampion site during the July survey, headed east for Ramsgate.

8.4 Ship Length and Draught Information

Based on the information available from AIS, the tracks recorded within 20nm of the survey location were colour-coded by length and draught (where available). It is noted that Radar targets have an unspecified ship length and draught as this information was not available.

8.4.1 Ship Length

Figure 8.15 presents the shipping data by ship length.

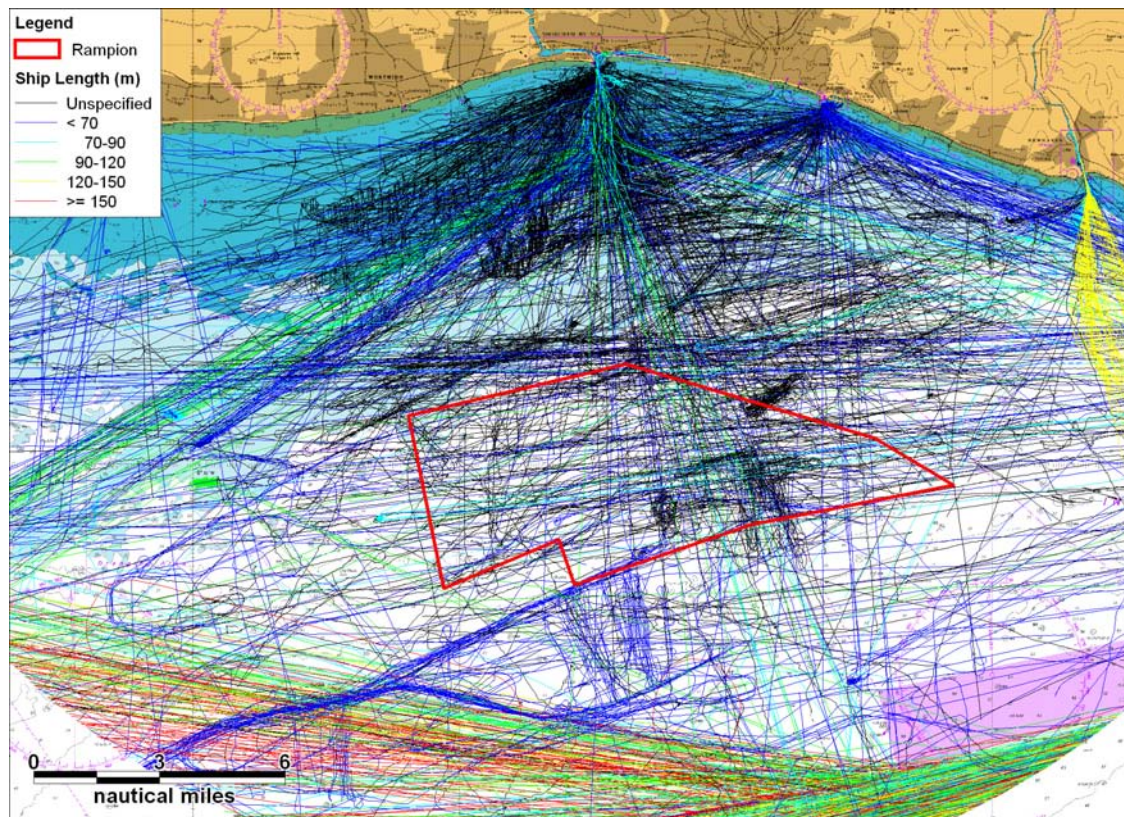


Figure 8.15 Combined AIS and Radar Tracks by Ship Length

It can be seen that the larger vessels recorded during the survey were mostly associated with the Dover Strait TSS and passed to the south of the Rampion site. The average length of vessels passing within the site during the survey period was 40m.

The longest vessel crossing the Rampion site was the general cargo vessel *Emsmoon* at 112m, which passed southbound through the centre of the site on the 17th July 2011, headed from Shoreham to Hull. This vessel has a maximum draught of 6.4m. The AIS track of *Emsmoon* recorded on the 17th July 2011 is presented in Figure 8.16.

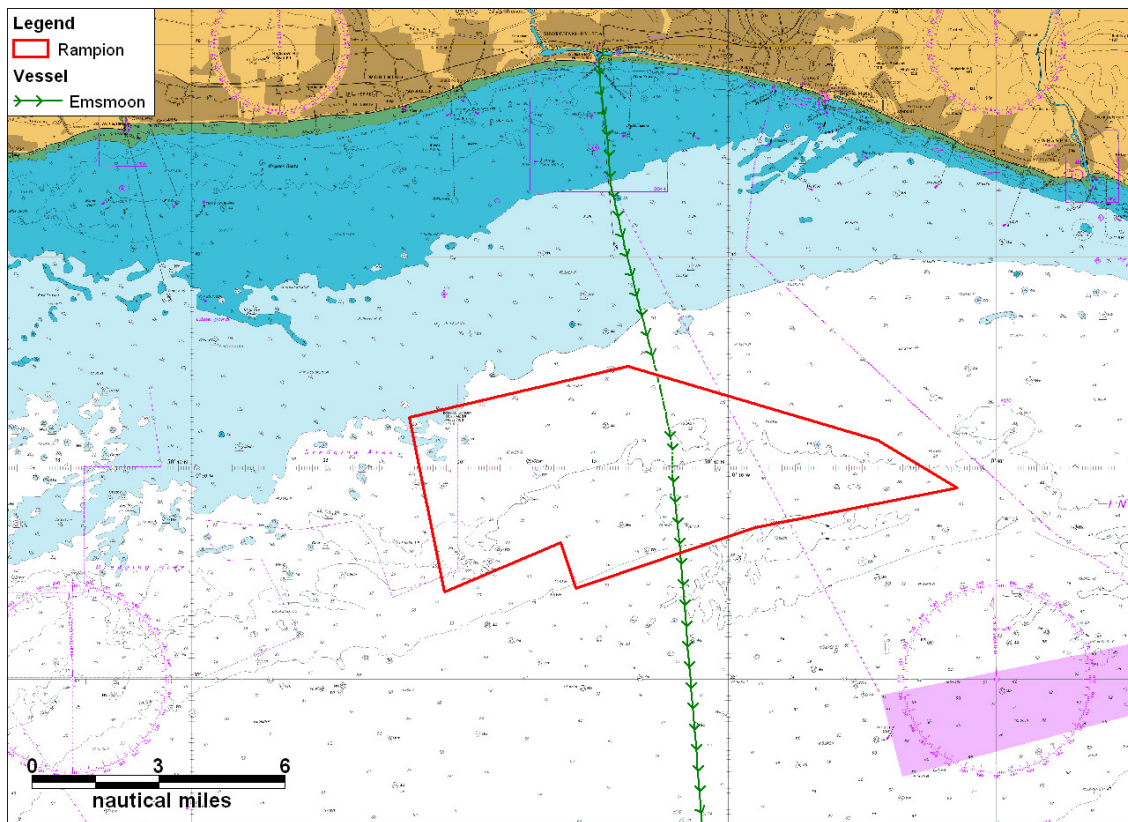


Figure 8.16 AIS Track of the Longest Ship Tracked: *Emsmoon* (17 July 2011)

8.4.2 Ship Draught

Figure 8.17 presents the shipping data colour-coded by ship draught.

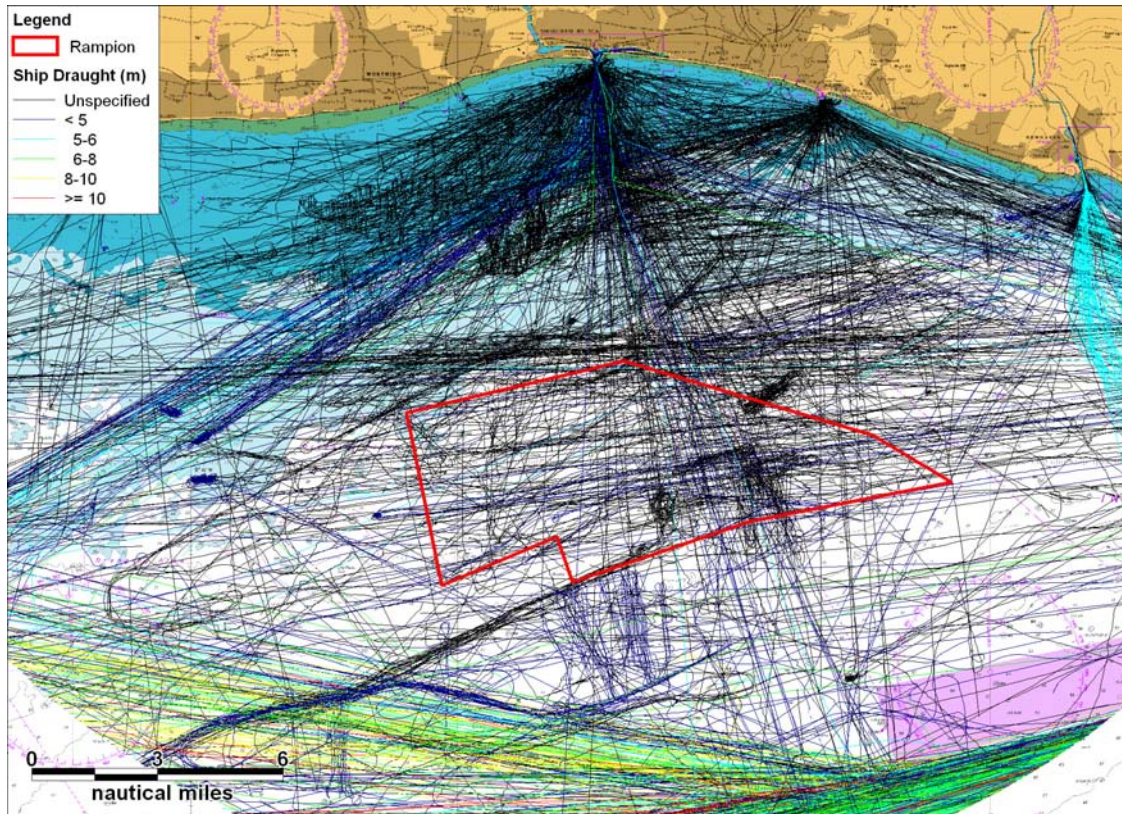


Figure 8.17 Combined AIS and Radar Tracks by Ship Draught

The average draught of vessels passing within Rampion site during the survey was 3.6m.

The vessel passing through the Rampion site which broadcast the deepest draught on AIS was the dredger *Sand Weaver*, with a draught of 5.8m. This vessel was tracked heading to Shoreham through the northwest tip of the site on the 19th July 2011. The AIS track of *Sand Weaver* is presented in Figure 8.16.

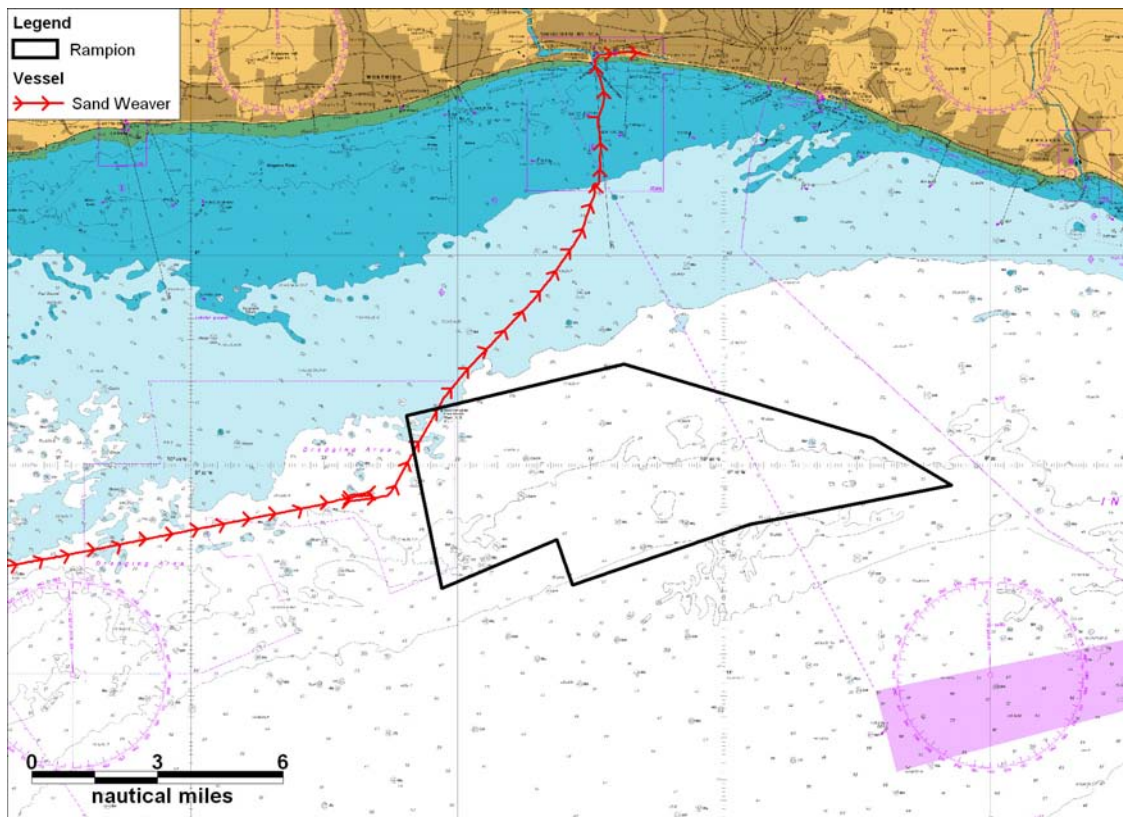


Figure 8.18 AIS Track of the Deepest Draught Ship Tracked: *Sand Weaver* (19 July 2011)

8.5 Speed Distribution

The speed distribution of the vessels tracked within the Rampion site is summarised in Figure 8.19.

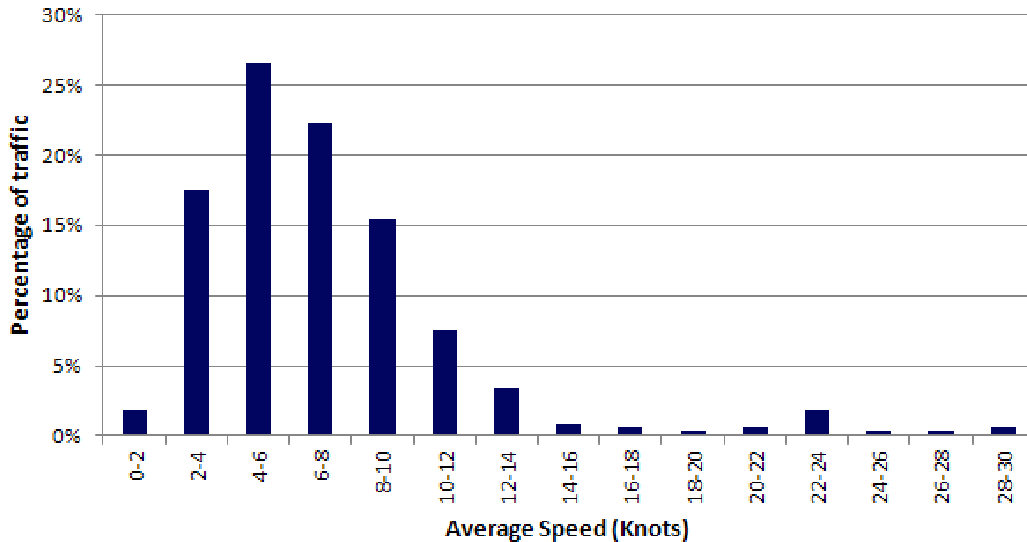


Figure 8.19 Speed Distribution of Vessels Passing within the Rampion Site

The average speed of vessels intersecting the Rampion site during the survey period was 7.3 knots.

The fastest vessel tracked on AIS within the Rampion site was the *Portunas*, a small pleasure craft, travelling at an average speed of 25.7 knots. This vessel was recorded heading east through the site on the 23rd July 2011.

8.6 Anchored vessels

The positions of vessels at anchor recorded during the combined 28 day survey period are presented in Figure 8.20.

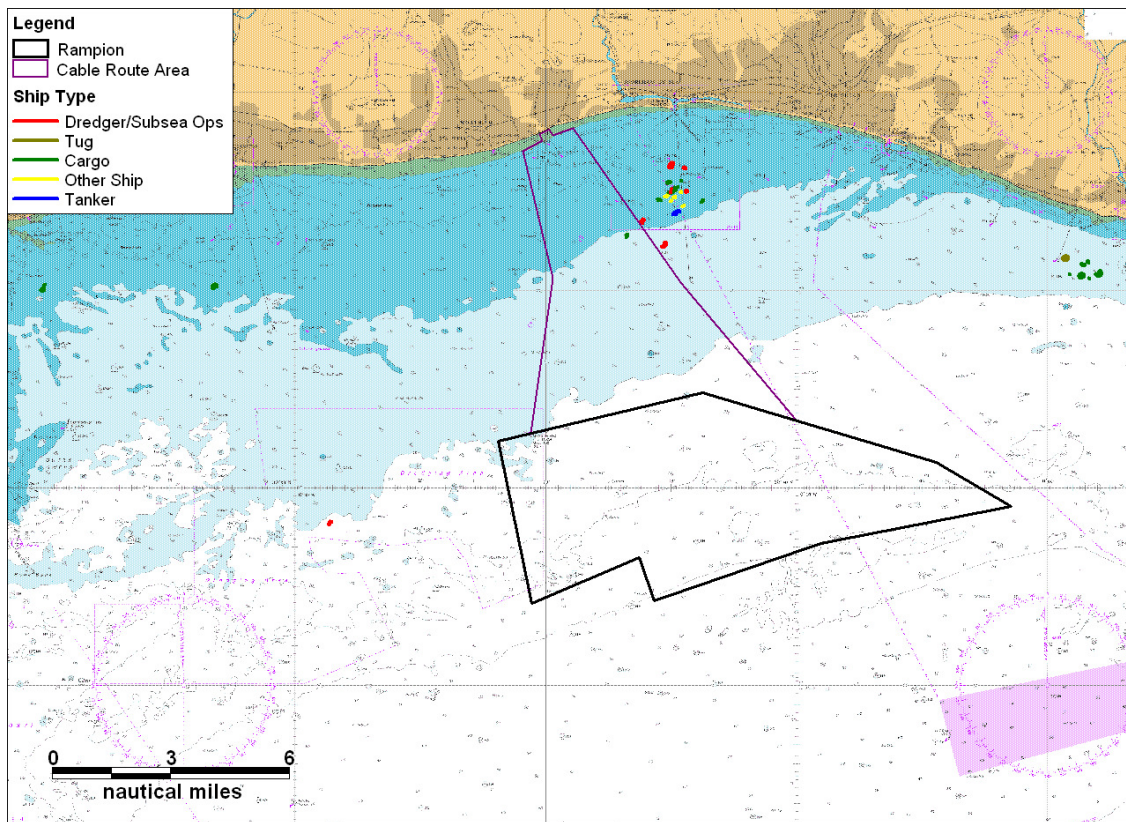


Figure 8.20 All Anchored Vessels during Surveys (28 days of surveying)

Overall, 23 unique vessels broadcast their navigation status on AIS as ‘at anchor’ within 20nm of the Shoreham survey location over the 28 days. A number of these vessels were recorded anchoring on more than one occasion.

It can be seen that the majority of the vessels anchoring within 20nm of the survey location were either anchored off Shoreham or Newhaven. Vessels anchored off Shoreham tended to be from 1.5 to 3.5nm from the coast, in the vicinity of the charted anchorage, with the majority of this anchoring activity to the east of the export cable route.

8.6.1 Long Term Anchoring Analysis

Given the proximity of the anchoring activity off Shoreham to the export cable route, a detailed assessment of the anchoring activity in the area was undertaken based on the long term AIS data collected from Shoreham, with AIS data from 1st April 2011 to 22nd February 2012 analysed.

It is noted that there were periods of downtime within the AIS system for which there was no AIS data available. Over the survey period, AIS data was recorded on a total of 289 days, with a little over 120 hours of downtime recorded across these days. Taking this downtime into account, the overall effective survey period is approximately 284 days.

The identification of vessels at anchor off Shoreham was undertaken within a study area encompassing the proposed offshore export cable, as shown in Figure 8.21.

An area where vessels have anchored, provided by Shoreham Port based on discussion with vessel Masters and Pilots, is also shown on the figure below. The area extends approximately 5.5nm south of Shoreham and is approximately 3.5nm in width.

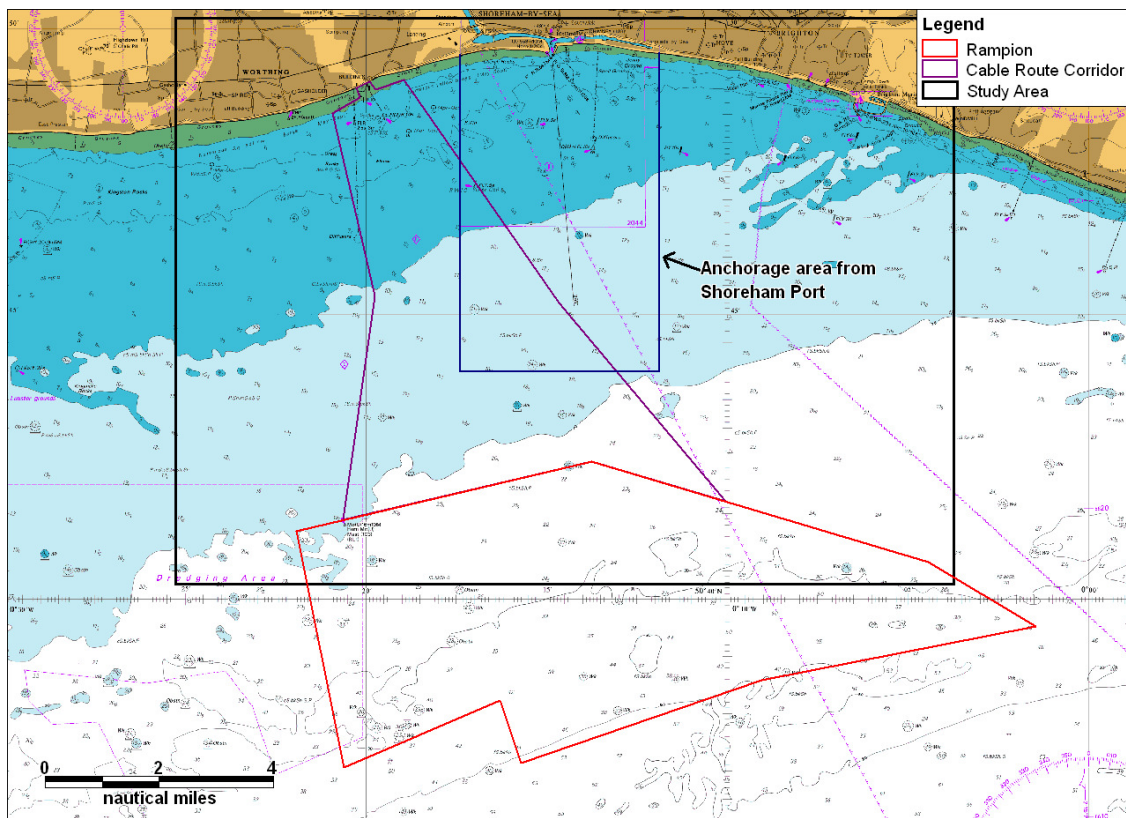


Figure 8.21 Study Area Encompassing the Export Cable Corridor

AIS data records the navigational status of vessels. The main analysis of vessels identified to be at anchor in the vicinity of the proposed export cable corridor (within the study area shown above) uses the navigational status broadcast over AIS to determine which of the vessels in the area were at anchor.

The analysis by navigational status assumes that the vessel is broadcasting the correct information on AIS. However, it has been observed that vessels at anchor do not always update their navigational status, as it relies on the officer-of-the watch updating the vessel's AIS. To overcome this, further analysis by vessel speed was undertaken to supplement the navigational status analysis. The tracks of vessels with non-anchoring status that were recorded with speeds below 1 knot for longer than 30 minutes were analysed more closely to identify if they were anchored.

The results of all vessels identified to be at anchor by both methods were combined to provide a single dataset for analysis, presented in Figure 8.22

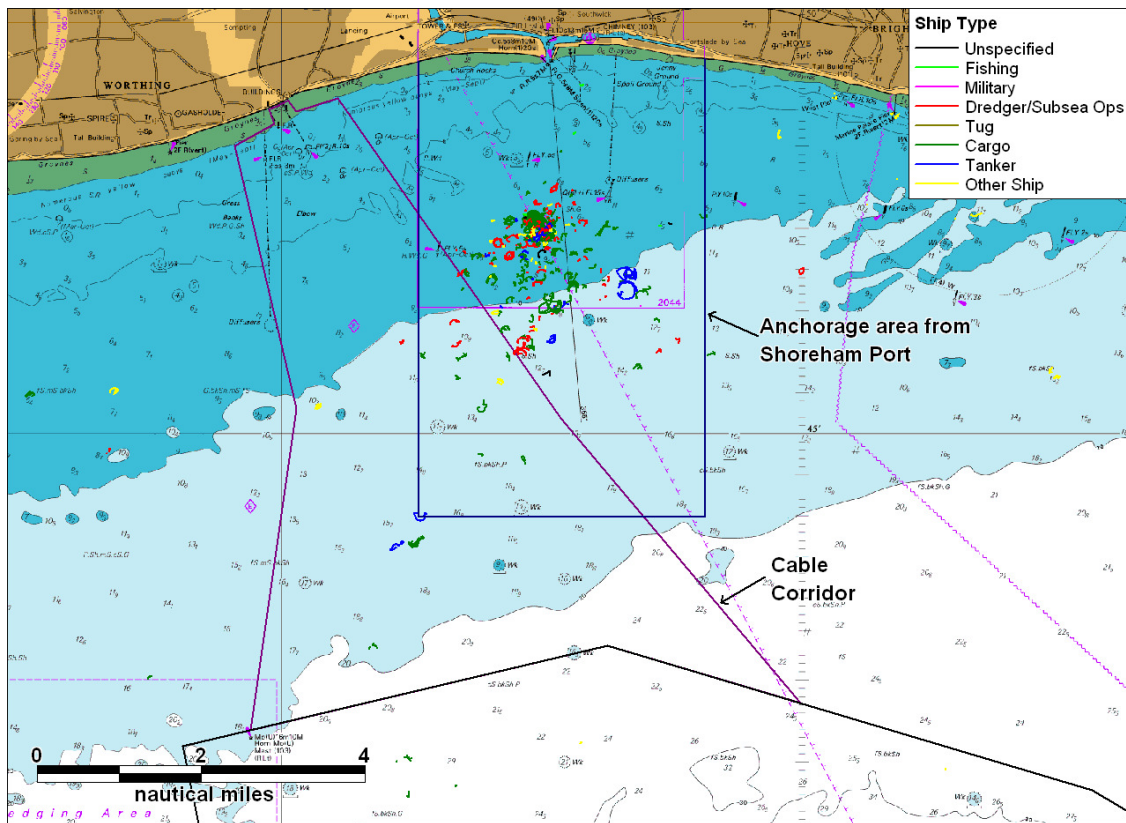


Figure 8.22 All vessels at Anchor in proximity to the Export Cable Corridor

During the survey period, there were a total of 313 anchored vessels in the extent shown in the previous figure, with 103 unique vessels recorded at anchor in the area. A maximum of five unique vessels were recorded at anchor in the study area on a single day, with an average of 1 to 2 vessels at anchor per day.

The majority of the anchored vessels were identified by their navigational status (82%), while 18% were identified by supplementary speed analysis.

Shoreham Port stated that vessel masters are likely to decide where to anchor based on the prevailing weather conditions, as well as the likelihood of being able to enter the port on the next tide. It can be seen that the majority of anchoring was in the vicinity of the charted anchorage and pilot station off Shoreham, and a detailed plot of the vessels at anchor in this area is presented in Figure 8.23. However, some vessels were also recorded at anchor further to the south and west, within the export cable corridor.

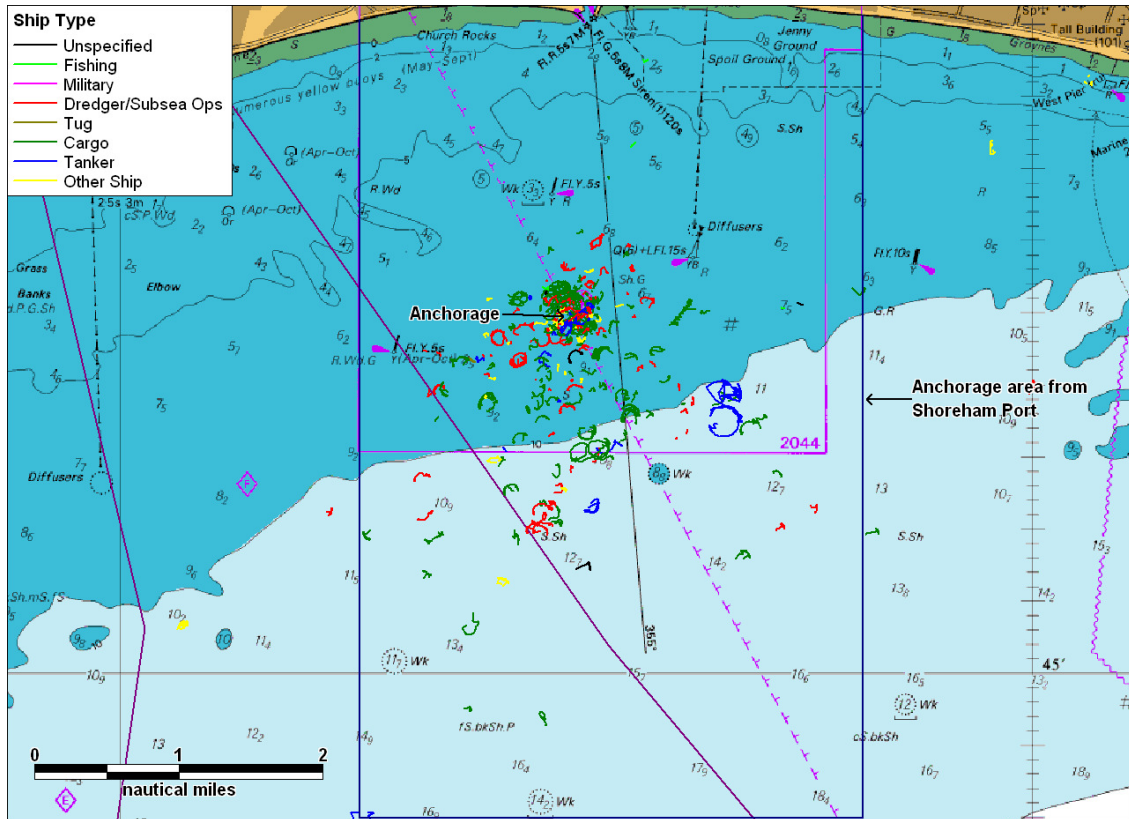


Figure 8.23 All vessels at Anchor in proximity to the Charted Anchorage off Shoreham

Over the survey period 19 vessels were identified at anchor within the proposed export cable corridor, corresponding to approximately 6% of vessels recorded at anchor within the study area.

8.6.2 Anchored Vessels by Ship Type

Based on the information broadcast on AIS for the vessels identified as anchoring in the vicinity of the proposed export cable corridor, an analysis of ship types is presented in Figure 8.24.

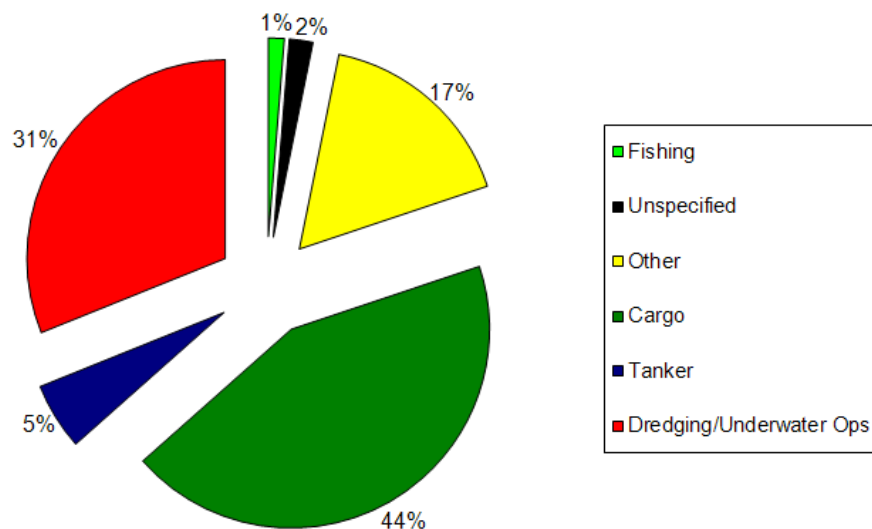


Figure 8.24 Anchored Vessel Type Distribution

The most common ship types recorded at anchor over the survey period were cargo vessels (44%), dredgers (31%) and ‘other’ ships (17%).

8.6.3 Anchored Vessels by Ship Size

A plot of all the vessels recorded at anchor during the survey period, colour-coded by deadweight tonnage (DWT), is presented in Figure 8.25.

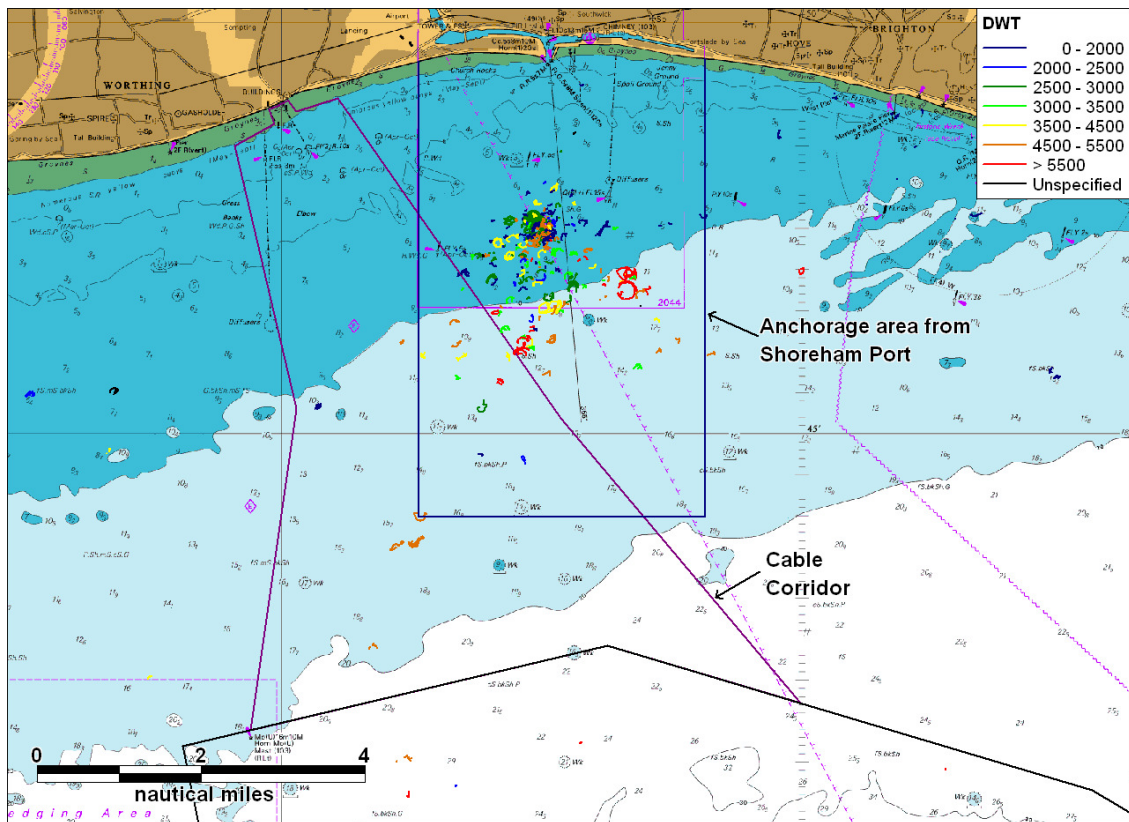


Figure 8.25 Vessels at Anchor in proximity to the Export Cable Corridor, by Vessel Size

The largest vessel recorded at anchor during the survey period was the Bulk / Oil Carrier *Seapower*, with a deadweight tonnage of 74,868 DWT. This vessel was recorded at anchor within the Rampion Offshore Wind Farm site, approximately 9nm to the south of Shoreham on the 3rd November 2011. This was by far the largest vessel recorded at anchor in the area, with next largest vessel being the offshore support vessel *Fugro Saltire* (6,500 DWT).

A breakdown of vessels at anchor by size is presented in Figure 8.26 (excluding 1.3% unspecified).

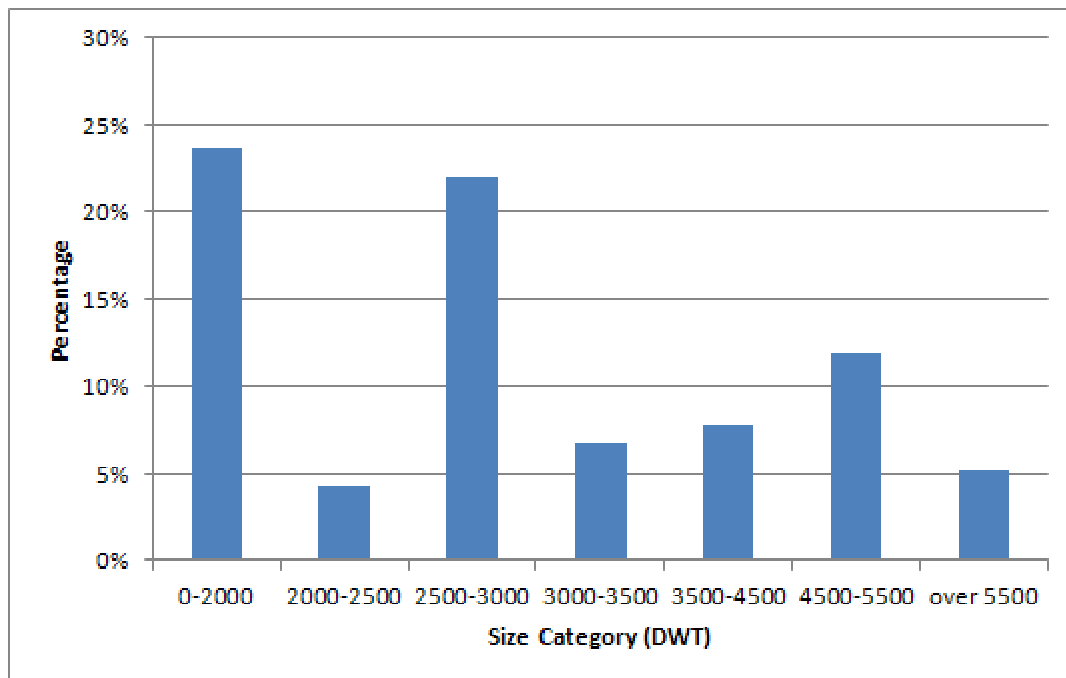


Figure 8.26 Anchored Vessel Size Distribution

The most frequent size categories of vessels anchoring in the vicinity of the proposed export cable corridor were less than 2,000 DWT (24%) and 2,500-3,000 DWT (22%).

8.6.4 Anchored Vessel Density

The anchored vessel track data has been converted to density grids in order to demonstrate hot-spots of anchoring activity. The results grids using 250m x 250m and 500m x 500m cells are presented in Figure 8.27 and Figure 8.28, respectively.

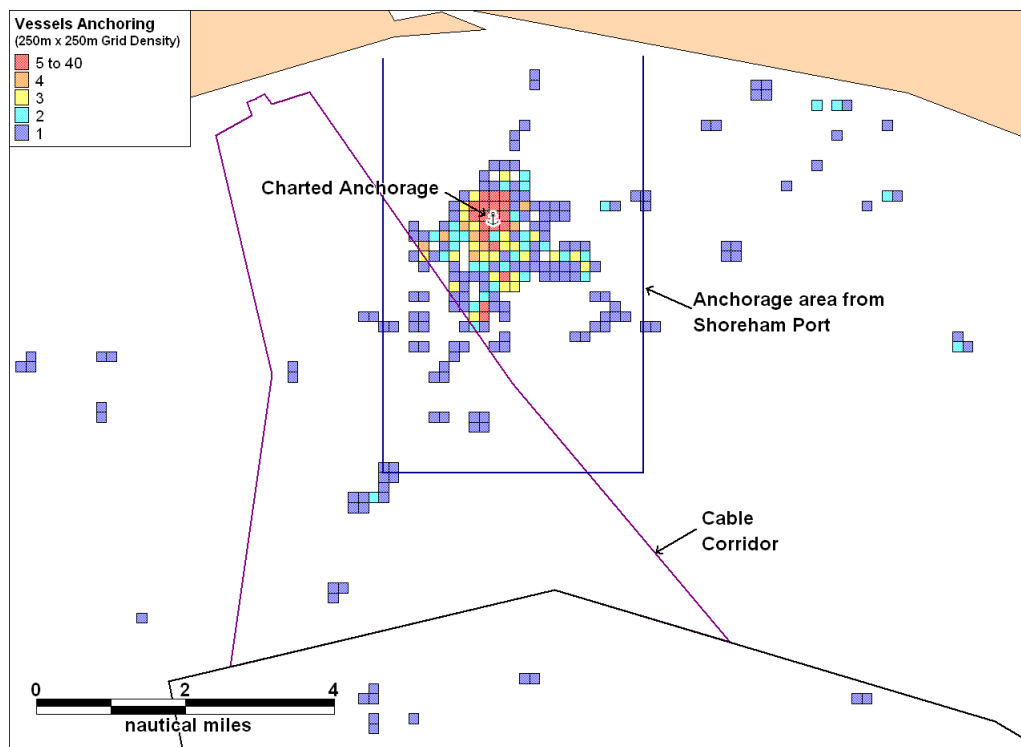


Figure 8.27 Anchored Vessel Density (250m x 250m grid)

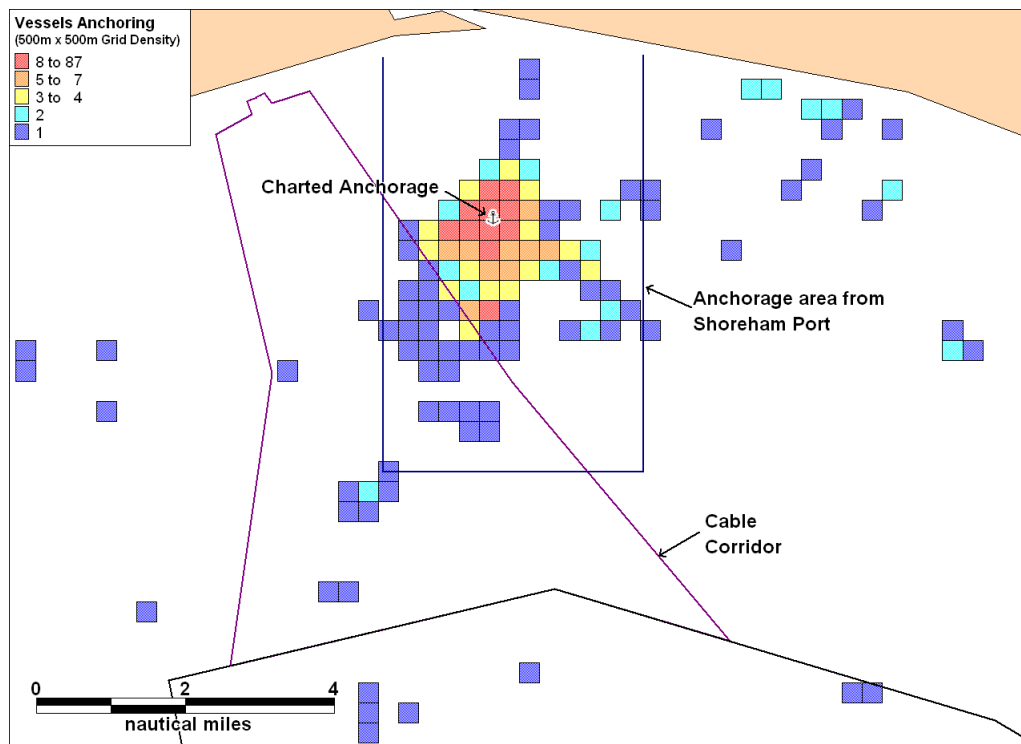


Figure 8.28 Anchored Vessel Density (500m x 500m grid)

It can be seen from the figures above that the majority of anchoring activity is between 1.7nm and 3nm to the south of Shoreham, in the vicinity of the charted anchorage and pilot station. The area of greatest anchoring density lies to the east of the proposed export cable corridor, which was revised in order to minimise the risk of cable / anchor interaction.

9. IMPACT ON COMMERCIAL SHIPPING NAVIGATION

Based on analysis of the shipping data (see Section 8), it is considered that the proposed Rampion Offshore Wind Farm will not displace transiting ships currently using the densest routes in the area including the westbound lane of the Dover Strait TSS which passes to the south of the proposed wind farm (vessels headed to East Solent pass at least 2nm to the south of the site).

In terms of local traffic, the majority of ships recorded during the survey passed clear of the Rampion site. This includes a proportion of shipping associated with the port of Shoreham which passes 1.5-3.5nm to the northwest of the site as well as the Newhaven ferry route to the east of Rampion.

The route that will be most significantly displaced by the siting of the wind farm is the north-south shipping route bound to/from Shoreham, which passes through the centre of the site. In addition, there will be a minor displacement for shipping routes which transit east/west within the ITZ and dredging transit routes which currently pass through the development.

The anticipated routeing for the vessels displaced by the wind farm are presented in the following sections. The hazards associated with the shipping changes due to the proposed wind farm have been quantified as part of the Formal Safety Assessment (see Sections 13 and 14).

9.1 *Route 1 – North/South Shoreham Traffic*

Given the relatively low number of vessels using the north/south route bound to/from Shoreham, the 28 days of survey data has been supplemented with longer term AIS data in order to provide improved characterisation of the route. In the consultation meeting and the hazard workshop, Shoreham Port stated that the number of vessels using the port had increased significantly since the first survey in January 2011 with the signing of new contracts. More recent AIS data from April to July 2011 (effective duration of approximately 110 days) has therefore been analysed to capture this increased level of shipping activity.

The commercial vessel tracks recorded following the north/south route through the site have been isolated and are presented in Figure 9.1.

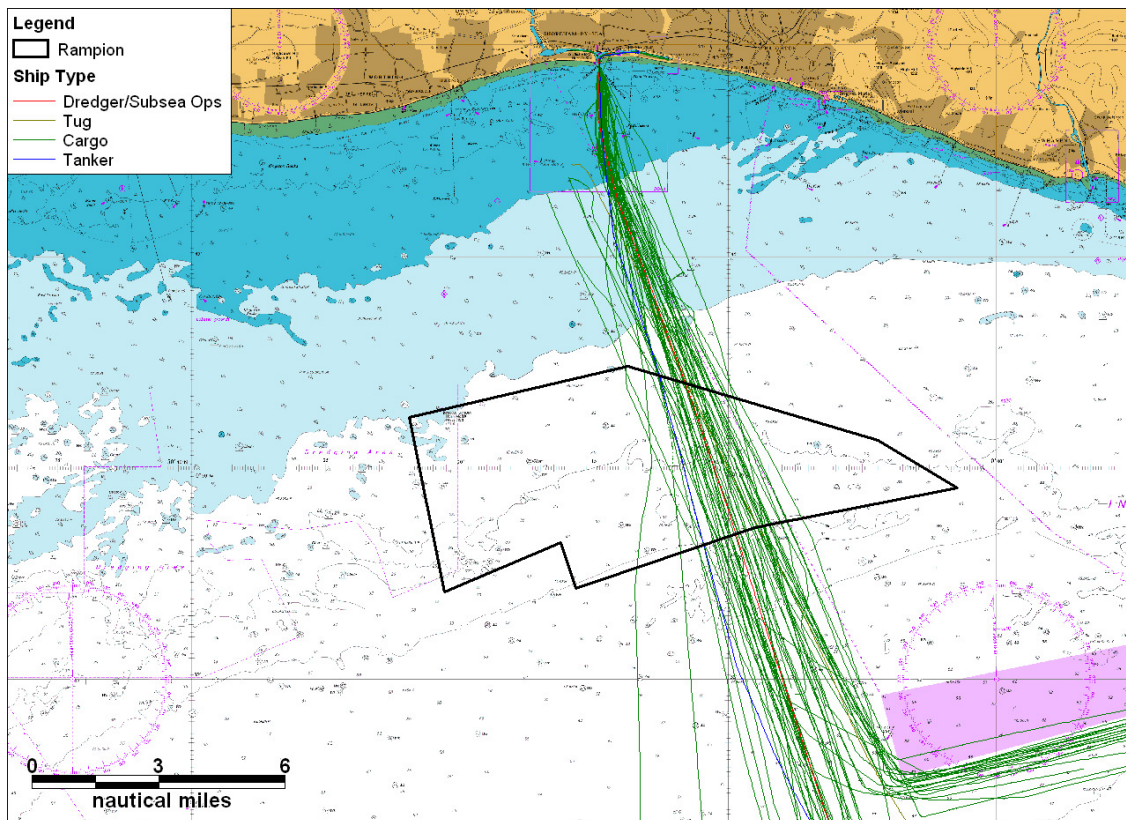


Figure 9.1 North/South Shipping through Rampion

An average of approximately one vessel every two days was identified using this route, the majority of which are cargo vessels. Of the vessels identified on this route 38% are on a northerly heading to Shoreham and 62% are bound to the south.

Figure 9.2 presents the tracks identified on this route on a wider geographical extent in order to show the differing way points associated with routeing of northbound and southbound vessels entering and exiting the TSS.

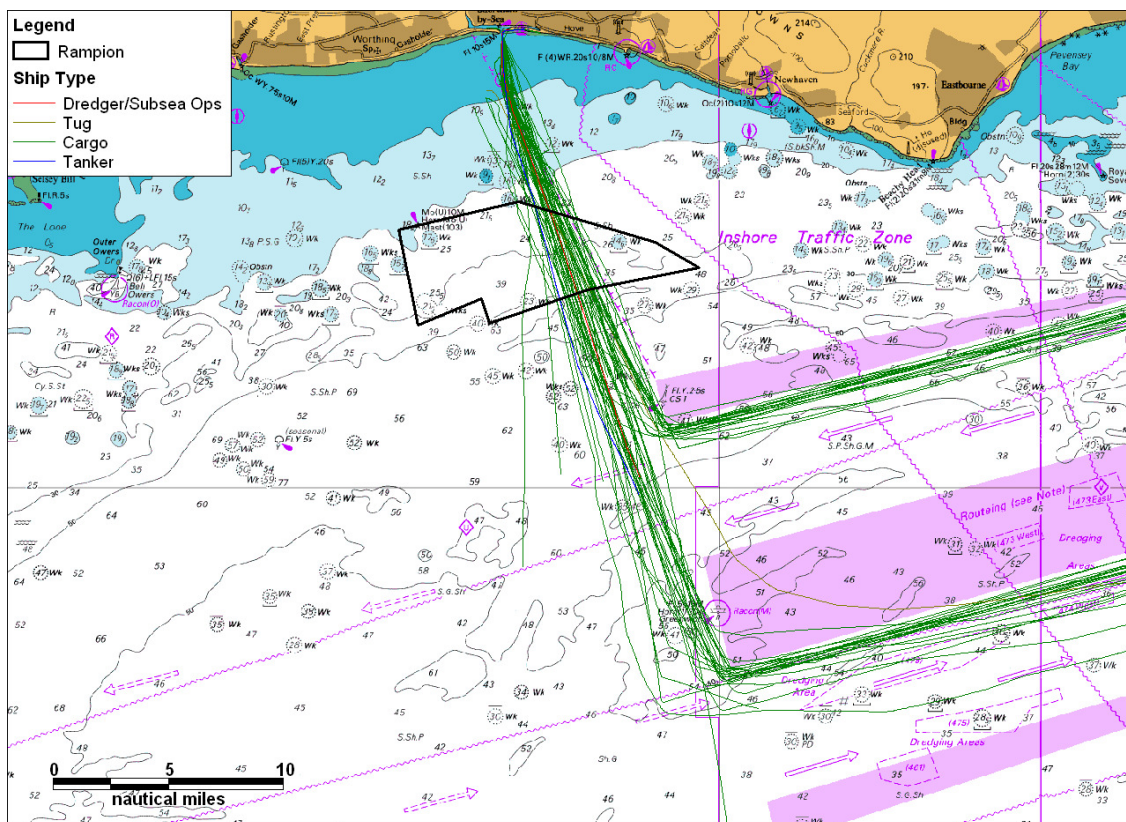


Figure 9.2 North/South Shipping and TSS Routing

The majority of vessels on this route are associated with the Dover Strait TSS, although some vessels were identified to be routeing between Shoreham and ports in northern France such as Fecamp and Rouen. Routeing options following the construction of the Rampion wind farm will differ for northbound and southbound vessels, as well as vessels routeing to/from France, therefore the deviations for these routes have been considered separately in the following subsections.

9.1.1 Southbound Shipping from Shoreham to the Eastbound TSS Lane

It is anticipated that the majority of vessels routeing south from Shoreham to join the eastbound lane of the Dover Strait TSS would route to the west of the site, where there is sufficient sea room to deviate around the proposed wind farm. Although vessels could re-route to the east, it is considered unlikely in this assessment due to implications of COLREGs rule 10, where a vessel not using a traffic separation scheme should avoid it by as wide a margin as practicable.

The existing route and potential re-routes are shown in Figure 9.3.

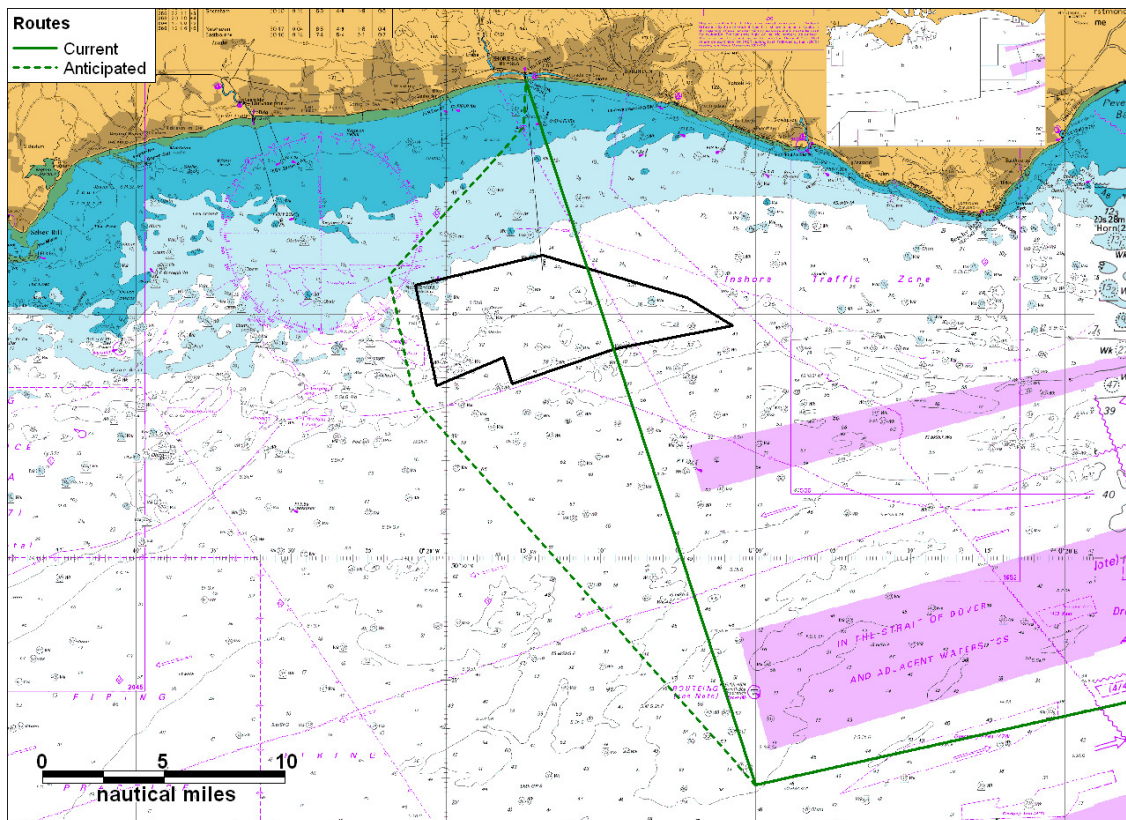


Figure 9.3 Current and Anticipated Routes from Shoreham to Eastbound TSS Lane

Routeing to the west of the wind farm and seeking to achieve a minimum passing distance of 1.0m from the site boundary would result in an increase in voyage distance of 6nm, corresponding to an increase in time transit time of approximately 45 minutes based on the average speed of vessels on this route (8.2 knots). It is noted there is sufficient sea room for vessels to pass further from the site, should they consider it necessary, for example, in adverse weather conditions.

The alternative route presented would have commercial impacts on vessels including their ability to meet schedules, potentially increase manning requirements and increased fuel costs.

9.1.2 Northbound Shipping from the Westbound TSS Lane to Shoreham

Following the development of the Rampion Offshore Wind Farm, vessels transiting from the westbound TSS lane to Shoreham would have the options of routeing to the west or east of the site, or exiting the lane early and using the ITZ to Shoreham. Historical route preference has encouraged vessels routeing to Shoreham to remain within the TSS until the termination. A route through the ITZ would mean a break to this traditional routeing, however, vessels have been noted within the traffic survey as using this alternative route to Shoreham, leaving the TSS at a shallow angle (as required by COLREGS rule 10– see Section 6.4.1) after either the CS2 or CS3 buoy.

These alternative routes are presented in Figure 9.4.

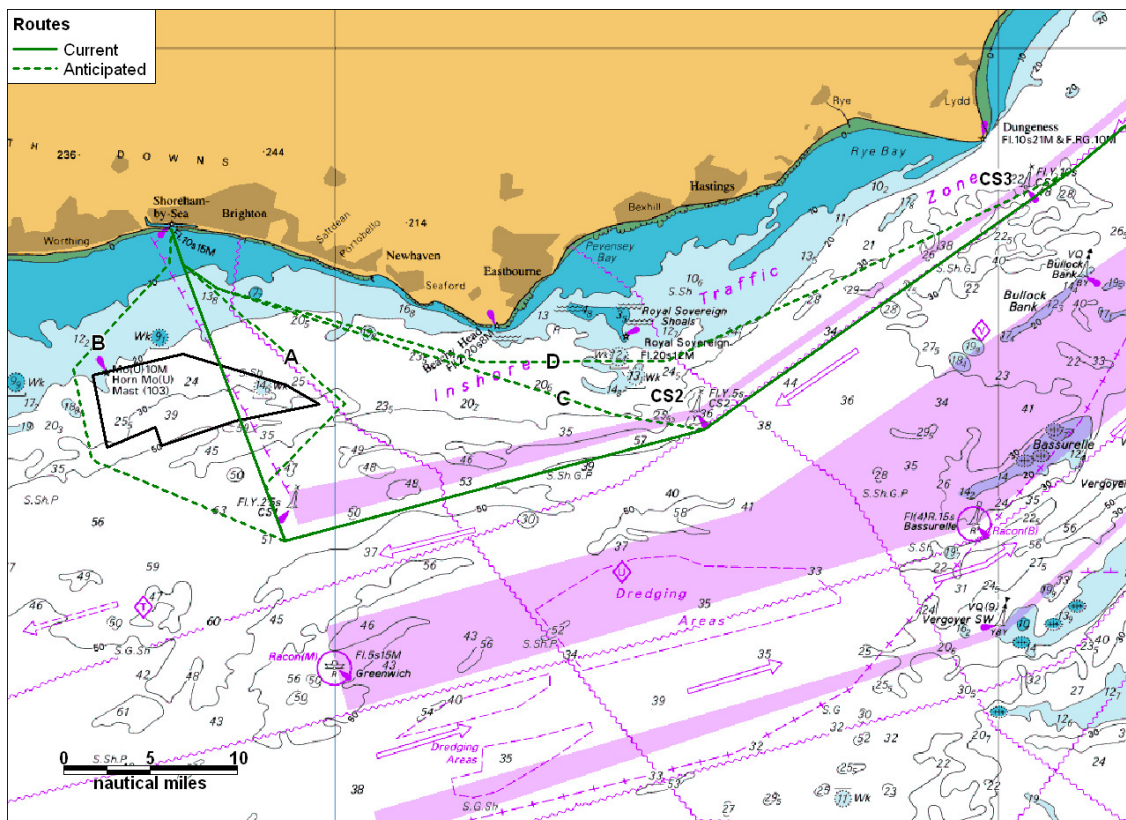


Figure 9.4 Current and Anticipated Routes from Westbound TSS Lane to Shoreham

Leaving the TSS early in order to route through the ITZ to Shoreham is a significantly shorter sea-passage than the route passing through the Rampion site (10 to 13nm shorter, depending on the point at which vessels leave the TSS). It is therefore expected that the Rampion Offshore Wind Farm would lead to an increase in the number of vessels routing through the ITZ to Shoreham.

It is noted that Shoreham Port has indicated that not all Masters would leave the TSS early. Future routing patterns may also see any vessels bringing waste oil (for the new power station to be built at Shoreham) choose not to pass close to the coast after the CS2 buoy due to the hazardous nature of the cargo they are carrying.

The Rampion Offshore Wind Farm could therefore lead to an increase in passage distance for those vessels that do not leave the TSS early, with a deviation of approximately 5.3nm expected for vessels routing to the east of the site (alternative A), and 8.5nm for vessels routing to the west (alternative B). These increases in route length correspond to increases in journey time of approximately 40 minutes for routing to the east of the site, and 1 hour for routing to the west.

It was also noted at the hazard workshop and following consultation with Shoreham Port that the current routing from the exit of the TSS to Shoreham enables vessels to keep adverse

weather on their stern quarter during southerly winds, which is the predominant wind direction in the area. Following development of Rampion a vessel routing to Shoreham through the ITZ would be beam on to a southerly wind; this could result in potential health and safety implications for both vessels and crew.

In adverse weather, in order to avoid over exposure to beam seas, vessels routing from the westbound TSS lane to Shoreham may elect to pass to the south Rampion before heading north to Shoreham, thereby keeping the weather on their stern quarter. This potential adverse weather routing is presented in Figure 9.5.

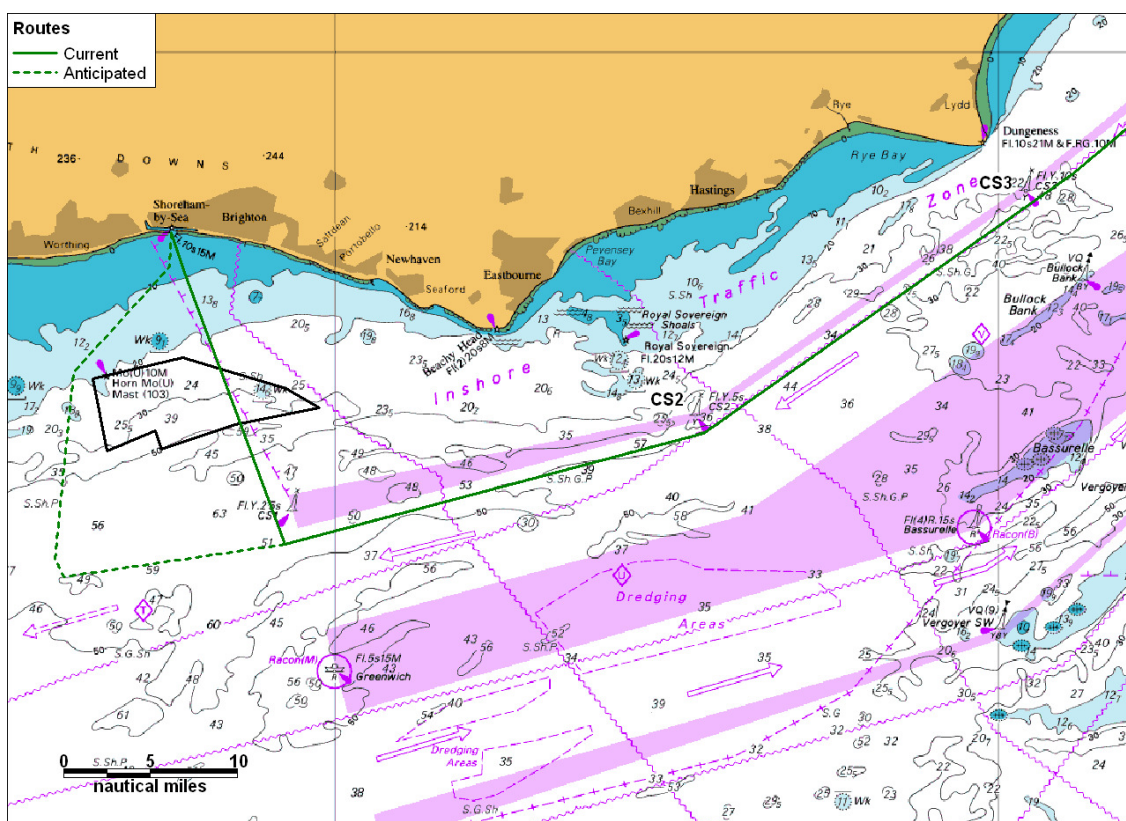


Figure 9.5 Adverse Weather Routeing to from Westbound TSS Lane to Shoreham

The increase in route length for the potential adverse weather route presented above is approximately 15.9nm, compared with the present day routing through the site.

The identified alternative routes which result in an increase in mileage and time would have commercial impacts on vessels and may impact an operator's ability to meet schedules, potentially increase manning requirements and fuel costs. In addition, it is noted that deviations leading to increased sailing times could result in vessels missing the tidal opportunity to enter Shoreham.

9.1.3 North/South Shipping between Shoreham and Northern France

As noted in the previous section, a relatively small proportion of the traffic passing north/south through the Rampion site is routeing between Shoreham and ports in northern France. The current transit route for such a vessel (between Shoreham and Fecamp) and two alternative routing options are presented in Figure 9.6.

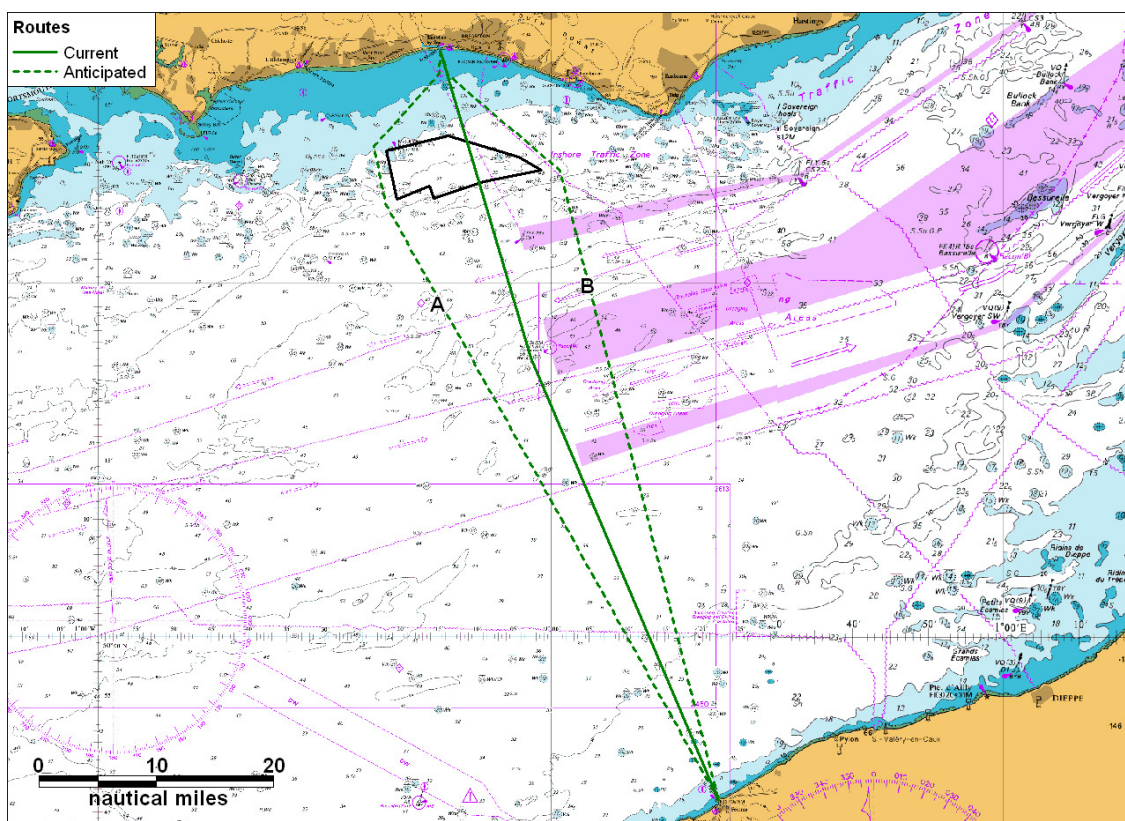


Figure 9.6 Current and Anticipated Routes between Shoreham and Fecamp

Whilst routing to the east of the Rampion site and crossing the TSS lanes at right angles (alternative B) requires the smallest deviation (increase in route distance of 1.7nm), this option may be considered high risk due to vessels interacting with traffic within the lanes and near the entry/exit point. If a vessels routes to avoid crossing the TSS lanes then increase in voyage distances for alternative A is 5.2nm.

9.2 Inshore Traffic Zone Shipping

Given the location of the proposed Rampion Offshore Wind Farm site at the western limit of the Inshore Traffic Zone, vessels routeing east / west through the inshore traffic zone will be displaced by the wind farm. A variety of vessel types route east / west bound through the Rampion site within the ITZ, including commercial vessels such as cargo vessels, tugs and aggregate dredgers, as well as recreational craft and commercial fishing vessels on passage.

The AIS tracks of vessels recorded passing east / west through Rampion during a 70 day period (the two maritime traffic surveys as well as data from longer term surveying) are presented in Figure 9.7.

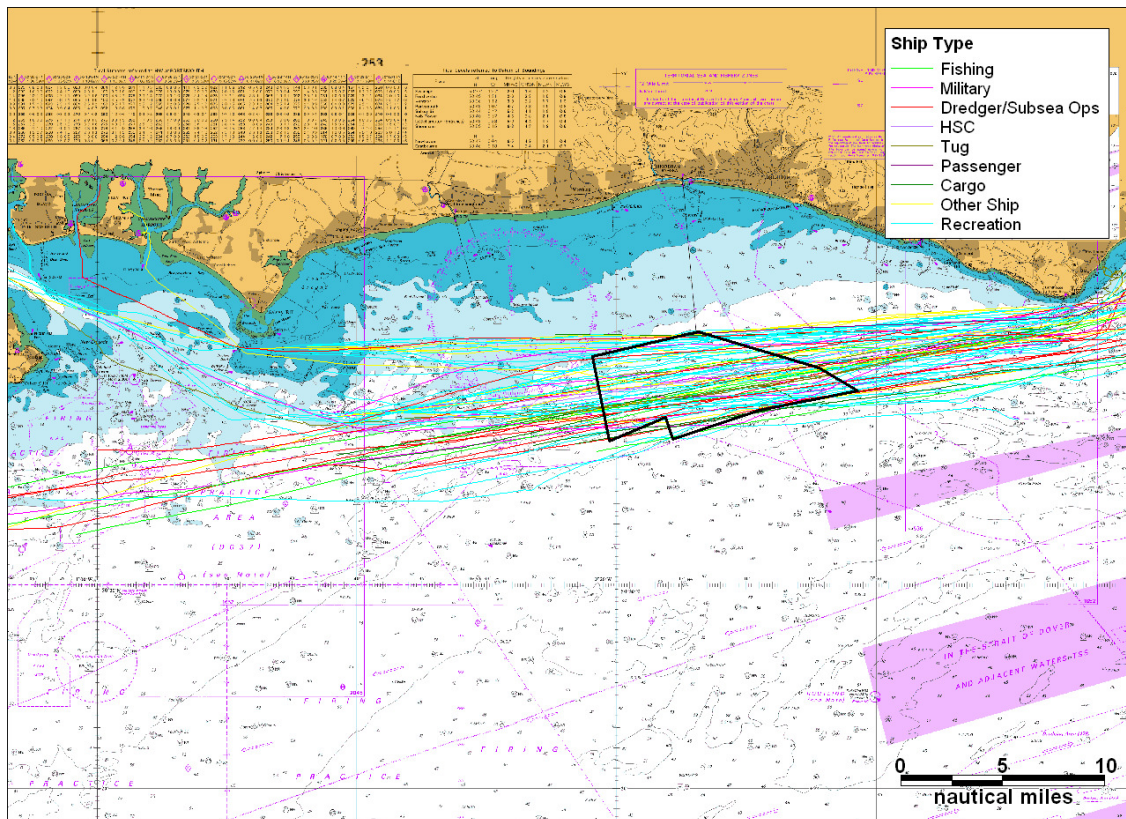


Figure 9.7 East / West Routeing through Rampion (70 days)

It can be seen that, to the east of Rampion, vessels generally pass within 5nm of Beachy Head and to the west vessels were associated with Solent ports or transiting to the south of the Isle of Wight.

The routeing options in this section consider the routes of two example commercial vessel tracked east / west through the site (one associated with the Solent and one passing south of the Isle of Wight), however, the reroutes presented to the north and south of Rampion apply in general to any vessel using the ITZ and passing east / west through Rampion.

The tug *MTS Indus* was tracked passing westbound through the Rampion site, headed for Southampton from Eastbourne. Figure 9.8 presents alternative routes passing to the north and south of the Rampion site.

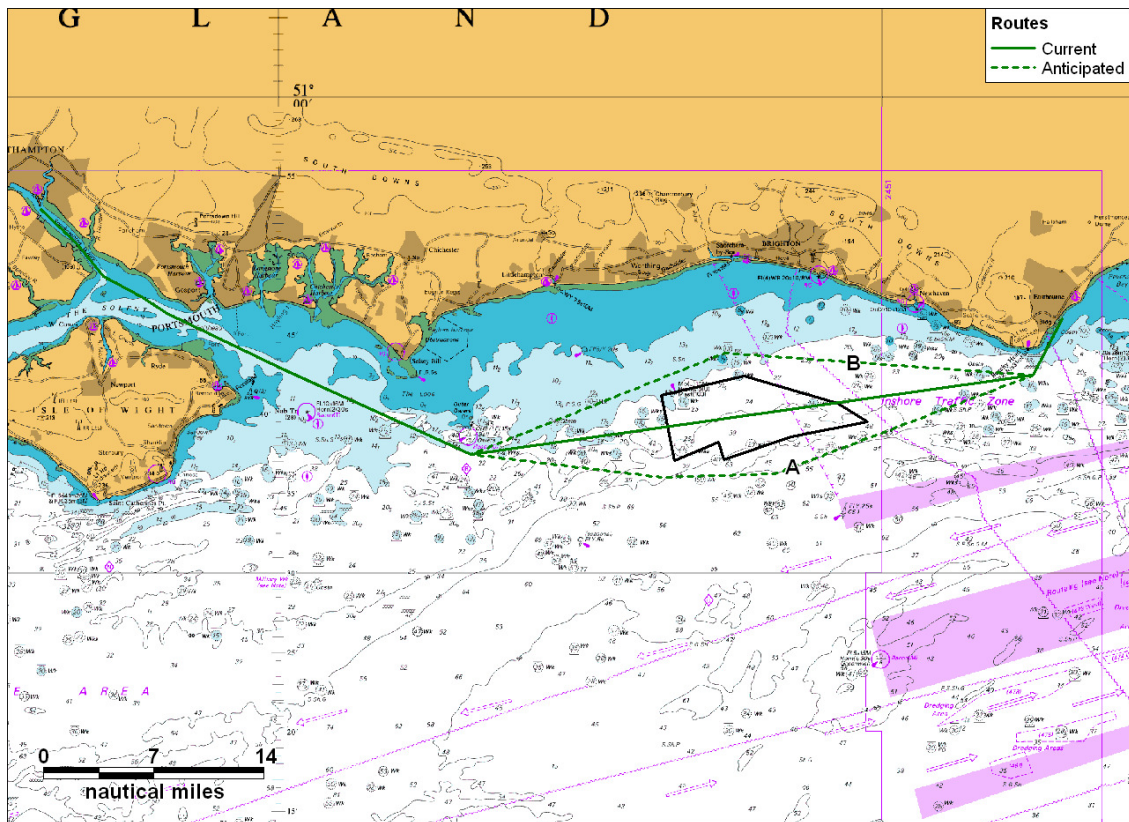


Figure 9.8 Eastbourne – Southampton Routeing

The increase in route length for vessels routeing to the south of the Rampion site (alternative A) would be approximately 0.9nm, with routeing to the north of the site (alternative B) resulting in a similar increase in route length.

The general cargo ship *Torrent* was tracked headed east / west through the Rampion site twice, on both occasions routeing between Rye and Porthoustock (Cornwall). An overview of the route passing through the Rampion site is presented in Figure 9.9 with an alternative to the south of the site.

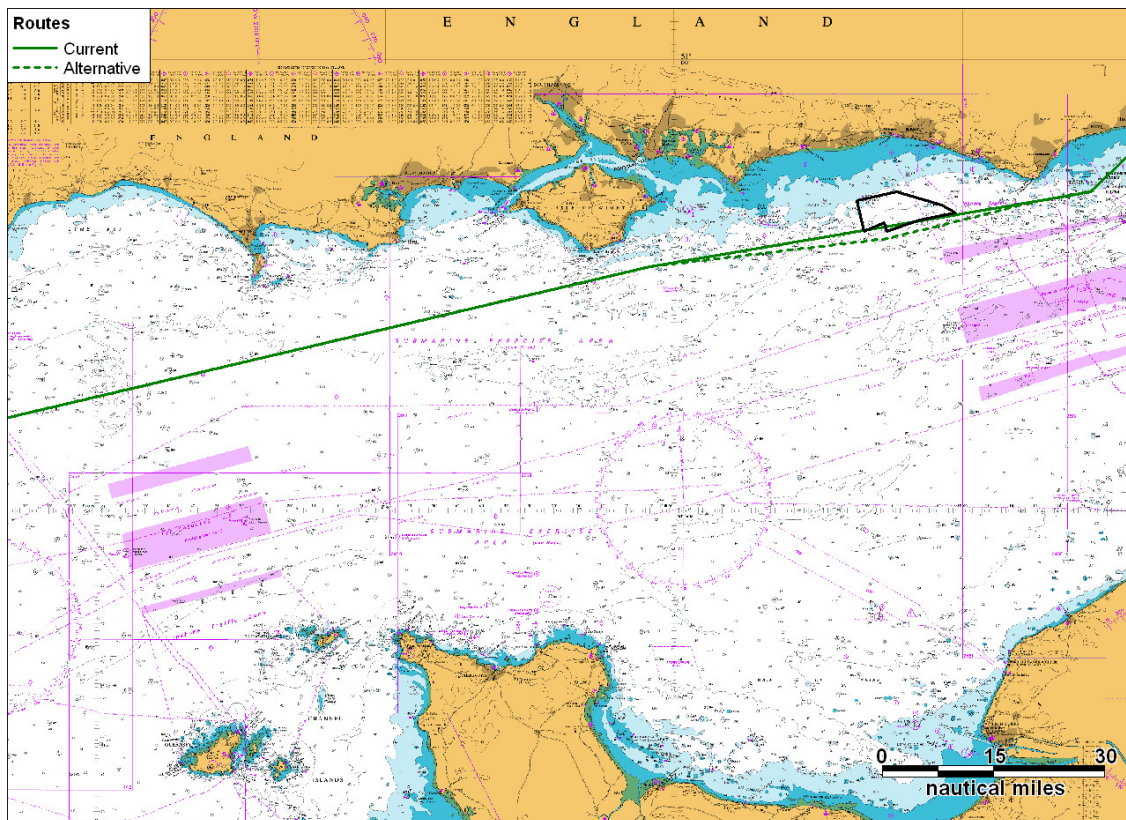


Figure 9.9 Porthoustock – Rye Routing

The increase in route distances to pass to the south of the Rampion site is estimate to be 0.1nm.

As noted above the alternative routes presented and the resulting deviations, whilst being specific to particular vessel transits, are considered indicative of the rerouteing for other vessels routeing east / west through the Rampion site.

9.3 Dredging Transit Routes

Based on the dredging movements recorded during the two maritime traffic surveys and long term AIS data collection from Shoreham, it is considered that the proposed wind farm will not significantly impact dredgers operating out of Shoreham, as they generally pass well to the northwest of the Rampion site.

Dredgers transiting between Newhaven, the Nab Bank and the Owers Bank dredging areas tend to pass through, or in close proximity to the north of the site. The vessels on these routes are likely to increase their passing distance from the north of Rampion, with only a slight deviation from the current route.

Dredgers were also tracked passing through the southwest part of the Rampion site, routeing from the TSS to the dredge areas to the west of the site. These vessels are likely to route to the southwest of the wind farm, with an increase from the current route distance of up to 1nm

expected (based on a vessel headed to the dredge area in closest proximity to the sites western boundary and routeing around the potential additional development area).

Average tracks for dredgers operating out of Newhaven and those routeing from the TSS lane, both prior to and after construction of the Rampion Offshore Wind Farm, are presented in Figure 9.10.

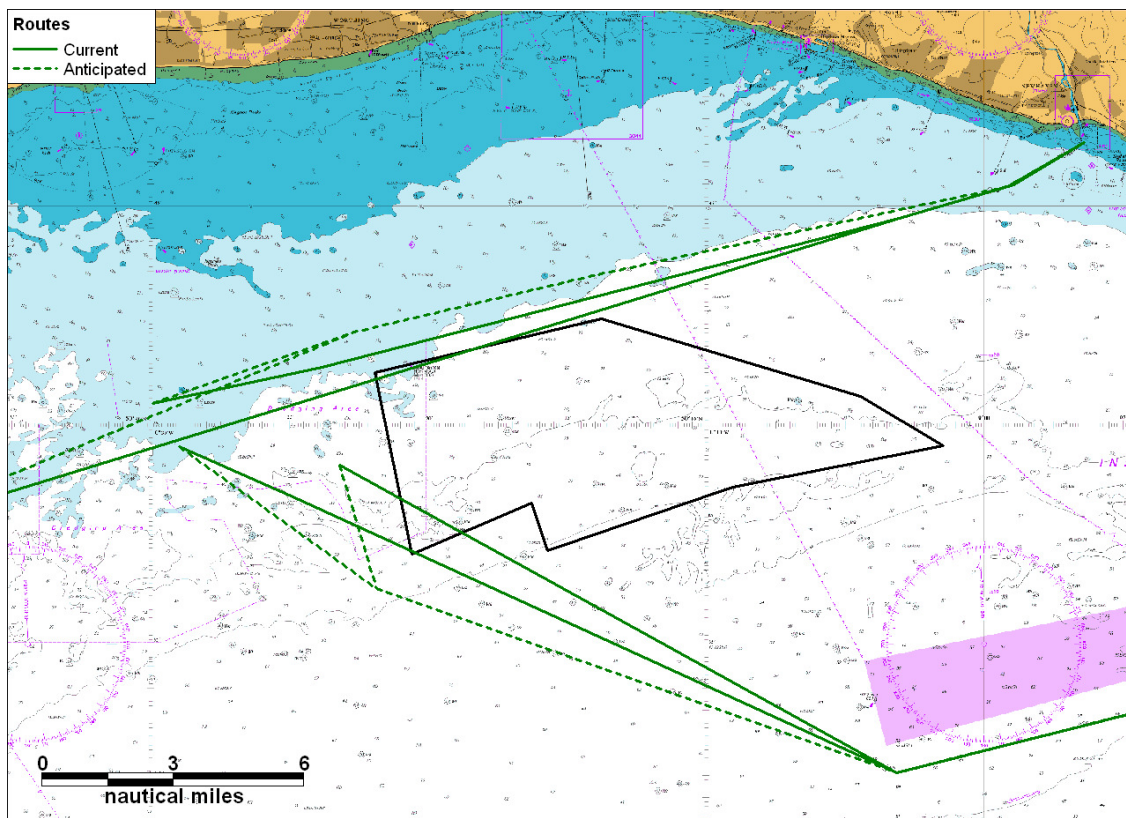


Figure 9.10 Current and Anticipated Dredging Routes from Newhaven and the Westbound TSS Lane

The other dredge routes which have been identified as passing through the Rampion site are those of the *Sospan Dau* when engaged in beach replenishment works. Through the use of long term AIS data collection two different routes used by this vessel have been identified when the vessel was operating within different dredge areas.

When routeing to/from dredge area 435/2 (as in Figure 8.12) the *Sospan Dau* tended to pass through the northern part of Rampion, with an increase in route distance of approximately 0.2nm over the current route required to pass to the north of the site. However, when routeing between Pevensy and dredge area 124/1 B, adjacent to the west of Rampion, the vessel's current route passes through the centre of the site (see Figure 8.10). The increase in transit distance, routeing to the south of the Rampion site, is estimated to be 2.8nm.

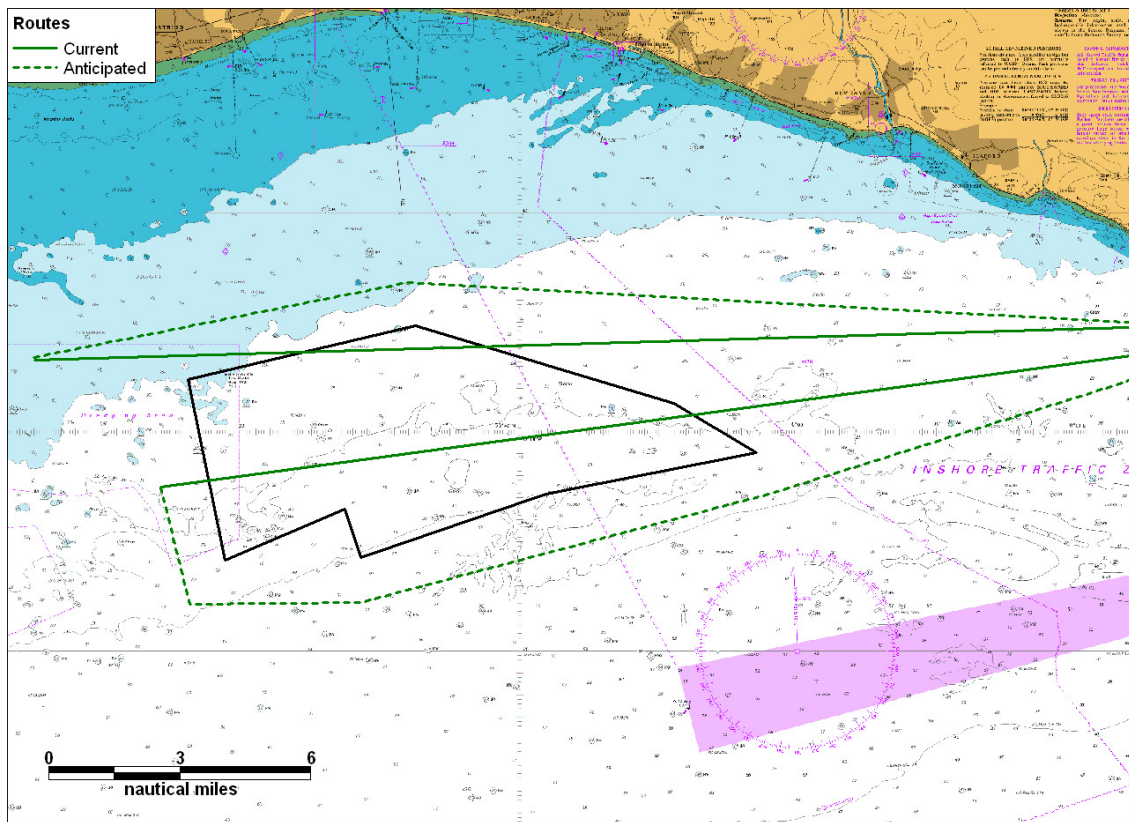


Figure 9.11 Current and Anticipated Routing for the Dredger *Sospan Dau*

During consultation for the Rampion project it was noted that the beach replenishment operation depends on a dredger being able to get to and from the dredging area in the time between high tides. Westminster Dredging Company Limited indicated that, dependent on the WTG spacing within the wind farm, the vessel *Sospan Dau* may route through the wind farm which would result in an increased risk of ship/WTG collision.

10. IMPACT ON AGGREGATES DREDGING

There are a number of licensed marine aggregates dredging areas in the vicinity of the Rampion site, with the nearest being 280m to the west of the site boundary (see Section 6.8). Also, a pre application area lies partially within the southwest part of the site.

The impact of the proposed Rampion Offshore Wind Farm on dredgers when they are on transit was discussed alongside deviations for other merchant shipping in the previous section.

The impacts of the development and operation of Rampion Offshore Wind Farm in close proximity to aggregates dredging areas were discussed at the Hazard Review Workshop, which was attended by dredging operators who work in the vicinity of Rampion.

The need for buffer zones between WTGs and dredging areas were discussed to allow dredgers to safely manoeuvre within a licensed area and in proximity to a wind farm development. It was concluded during the workshop that these ‘buffers’ need to be considered on a site specific basis, giving consideration to factors such as wind, and the strength and direction of tides.

Marine aggregate dredgers are manoeuvrable vessels with a high level of navigational accuracy. This level of manoeuvrability and accuracy does vary vessel to vessel therefore it is considered appropriate that the buffer distance from WTG should be at the discretion of the Master of the vessel, based on the operational details (for example, dredge direction or weather and tidal conditions). In the Rampion development area tidal flow directions are generally east to west.

It is noted that during consultation, Hanson Aggregates Marine Ltd stated the need for 2km east to west buffers and 500m north to south buffers around aggregate extraction licenses.

Consideration should also be given to a mechanical failure on board a dredger operating in the dredging areas in close proximity to the site’s western boundary, given that the currents in the area set in a generally east / north easterly direction on the flood, the vessel may drift towards the wind farm. This has the potential to result in vessel to structure collisions as well as interaction between the dredger’s suction pipe and subsea cabling associated with the wind farm.

It was noted at the Hazard Workshop that in the event a drifting dredger collides with a wind farm structure, then fenders on the structure may be of benefit. At the time of writing (October 2012) it is not confirmed whether fenders will be used on the Rampion Offshore Wind Farm structures. Also, it was noted that parallel inter-array cabling, in the direction of likely drifting, could mitigate the risk of interaction between the dredgers’ pipes and cabling.

In addition to the direct impacts of the presence of the surface structures associated with the wind farm on aggregates dredging, the change in vessel routing as a result of the wind farm may result in higher risks of collisions with vessels when dredging.

Vessels displaced to the west of Rampion, for example a proportion of vessels routing to/from Shoreham, will tend to pass through the dredge areas to the west, leading to an increase in the frequency of encounters for vessels engaged in dredging operations within this area. However, given the relatively low number of vessels on the displaced routes, the in-combination impact is considered to be minor.

11. RECREATIONAL CRAFT ACTIVITY

11.1 Introduction

This section reviews recreational craft activity at the Rampion site based on the two marine traffic surveys (January and July 2011) and information published by the Royal Yachting Association (RYA).

11.2 RYA Data

11.2.1 Introduction

The RYA, supported by the CA, identified recreational cruising routes, general sailing and racing areas around the UK in the Coastal Atlas (Ref. x). This work was based on extensive consultation and qualitative data collection from RYA and CA members, through the organisations' specialist and regional committees and through the RYA affiliated clubs. The consultation was also sent to berth holder associations and marinas.

The reports note that recreational boating, both under sail and power is highly seasonal and highly diurnal. The division of recreational craft routes into Heavy, Medium and Light Use is therefore based on the following classification:

- *Heavy Recreational Routes:* - Very popular routes on which a minimum of six or more recreational craft will probably be seen at all times during summer daylight hours. These also include the entrances to harbours, anchorages and places of refuge.
- *Medium Recreational Routes:* - Popular routes on which some recreational craft will be seen at most times during summer daylight hours.
- *Light Recreational Routes:* - Routes known to be in common use but which do not qualify for medium or heavy classification.

11.2.2 Rampion Site Recreational Data

A summary plot of the recreational sailing activity and facilities in the wider area is presented in Figure 11.1. This is based on the latest RYA data (2010).

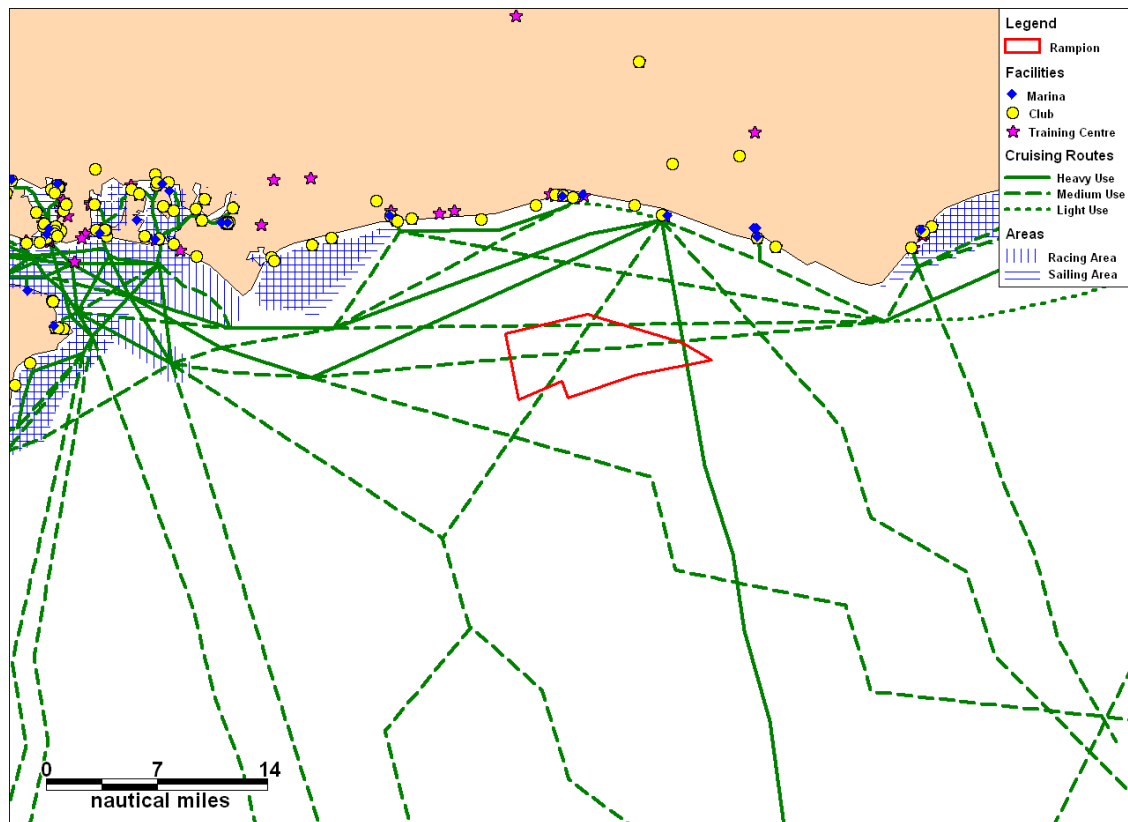


Figure 11.1 Recreational information for Rampion Sea Area

In terms of recreational facilities, there are numerous marinas and clubs along the Sussex coast, 7-8nm from the northern boundary of the site.

The recreational activity and facilities in the vicinity of the Rampion Offshore Wind Farm site are presented in Figure 11.2.

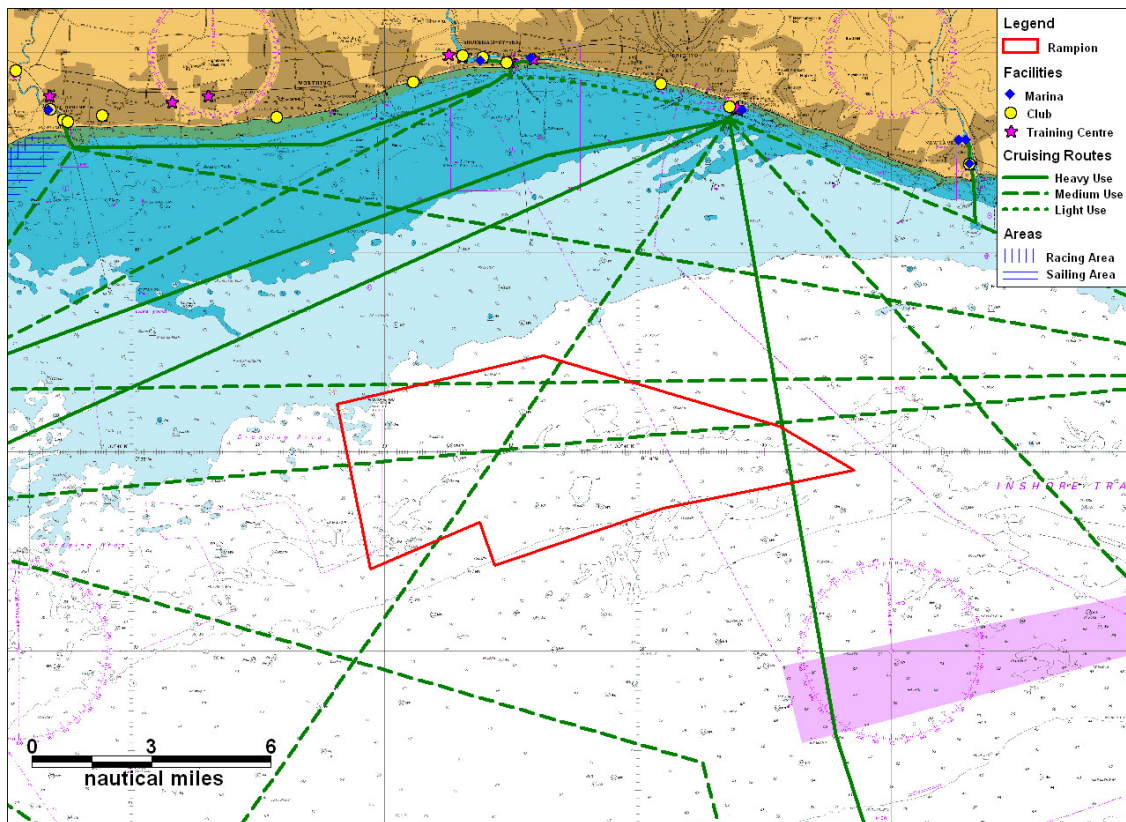


Figure 11.2 Detailed Recreational Data for the Rampion Site

Based on the RYA published data, the Rampion Site is intersected by two ‘medium use’ cruising routes passing east/west through the site, and two cross-channel transit routes from Brighton, one ‘heavy use’ and one ‘medium use’.

It is noted that there are also races that would pass through the Rampion site. The Sussex Yacht Club program for 2011 included the Pactolus race from Shoreham to Fecamp, and the Royal Escape race from Brighton to Fecamp, both of which would pass through the Rampion site.

11.3 Survey Data

The level of recreational activity recorded during the survey in January 2011 was relatively low, with an average of 3 to 4 recreational craft recorded per day. The recreational craft tracks recorded during the 14 day survey period are presented in Figure 11.3.

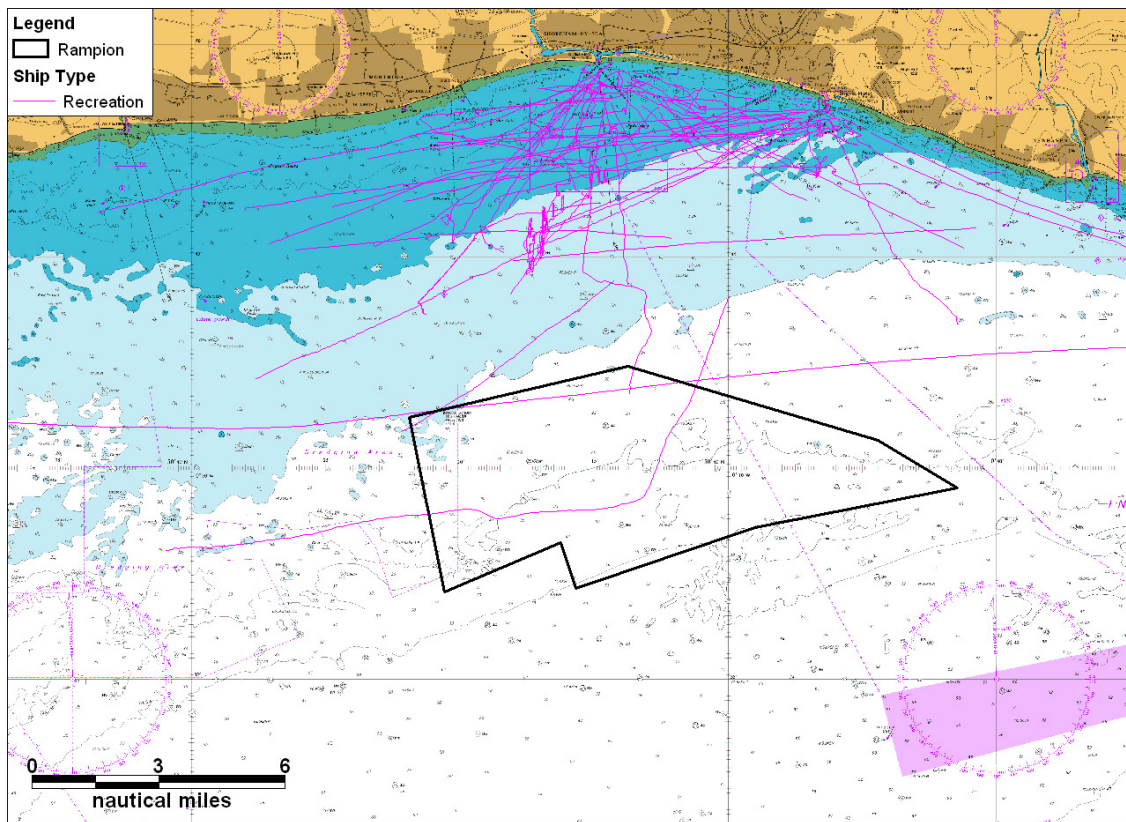


Figure 11.3 All Recreation Craft Tracks 17th – 31st January 2011 (14 days)

As expected the level of recreational activity was greater during the survey in July 2011, with an average of 16 to 17 craft recorded per day. The level of recreational activity fluctuated during the 14 day survey period, with a peak in recreational activity recorded on Saturday 23rd July when 25 recreational craft were recorded. The recreational tracks recorded during the 14 day summer survey are presented in Figure 11.4.

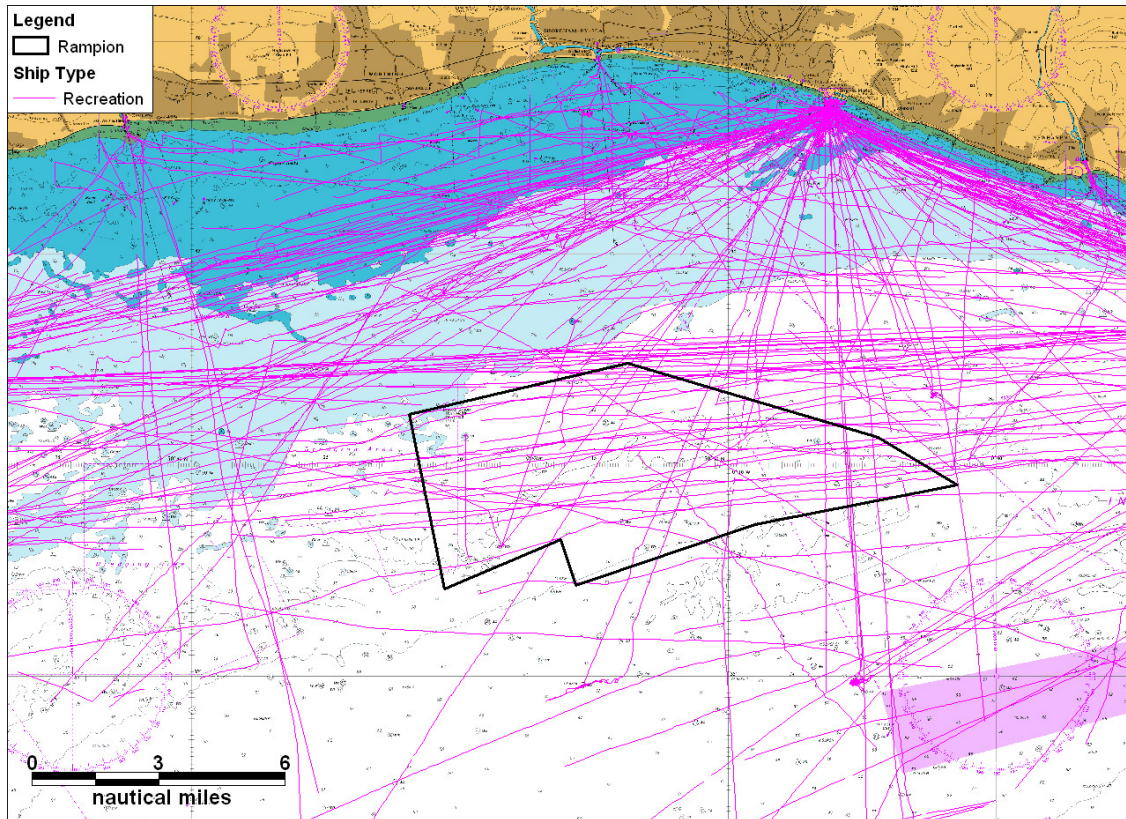


Figure 11.4 All Recreation Craft Tracks 16th – 30th July 2011 (14 days)

An average of just over three recreational craft per day were recorded passing through the Rampion site during the summer survey period. The majority of those recorded passing through the site were headed east/west with a large proportion of these recreational craft associated with ports in the Solent. Based on the recreational craft recorded on AIS using this route, the majority of these were sailing vessels, typically 10-24m in length. However, power boats were also recorded in the area during the summer survey period, including a number which intersected the Rampion site.

Recreational craft were also tracked passing north/south through the Rampion site, with the majority of these craft associated with Brighton. These included recreational diving boats, generally travelling to wrecks located to the south of the Rampion site.

11.4 Recreational Craft Impact Assessment

The air clearance between tip of the WTG rotor blade and sea level conditions at Mean High Water Springs (MHWS) will not be less than 22m, as guided by the MCA and RYA. This minimises the risk of interaction between rotor blades and yacht masts.

Recreational craft should be able to transit through the array in suitable conditions, which could result in an increased frequency of recreational craft and WTG collision, as well as being able to route around the site. Recreational craft routeing east/west will have the option

of passing inshore or offshore of the wind farm should they wish to avoid routeing through the site.

The Rampion Offshore Wind Farm will result in a reduction in available sea room within the Inshore Traffic Zone (ITZ), particularly to the south of Rampion due to the proximity of the site to the Traffic Separation Zone (4.4nm). This could increase the frequency of vessel-to-vessel encounters and hence collisions.

As noted above, water based racing events take place in the vicinity of the Rampion site, with a number of races currently passing through the site, such as cross channel races from Shoreham and Brighton to Fecamp. At the hazard workshop, it was considered unlikely that the route of any races would pass through the wind farm site following construction. This would limit the risk of vessel to WTG collisions. However, routeing around Rampion would result in deviations for races, potentially lengthening the course and leading to races not being completed within the hours of daylight. In addition, races routeing around the wind farm would pass through areas used by other vessels displaced from the site, for example commercial shipping routeing around Rampion, increasing the frequency of vessel-to-vessel encounters and hence collisions.

In terms of vessels engaged in other recreational activities such as recreational fishing and diving, the Rampion Offshore Wind Farm may result in reduced access to sites used for these activities such as wrecks, for example due to safety zones during the construction and decommissioning phases. Recreational craft within the wind farm site, including those engaged in fishing and diving, will be clear of larger vessels navigating around the wind farm, which is likely to result in a reduction in encounters for these vessels. However, vessels operating outside of the array and in close proximity to the wind farm boundary, for example the recreational dive craft operating out of Brighton observed over the wrecks to the south of the Rampion site, are likely to see an increased rate of vessel-to-vessel encounters as a result of displaced traffic routeing around the wind farm.

The risks have been quantified as part of the Formal Safety Assessment (see Sections 13 and 14).

12. FISHING VESSEL ACTIVITY

12.1 Introduction

This section reviews the fishing activity at the proposed Rampion Offshore Wind Farm based on the maritime traffic surveys, and sightings and satellite data for the area.

12.2 Survey Tracks

The fishing vessels tracked during the survey in January 2011 are presented in Figure 12.1.

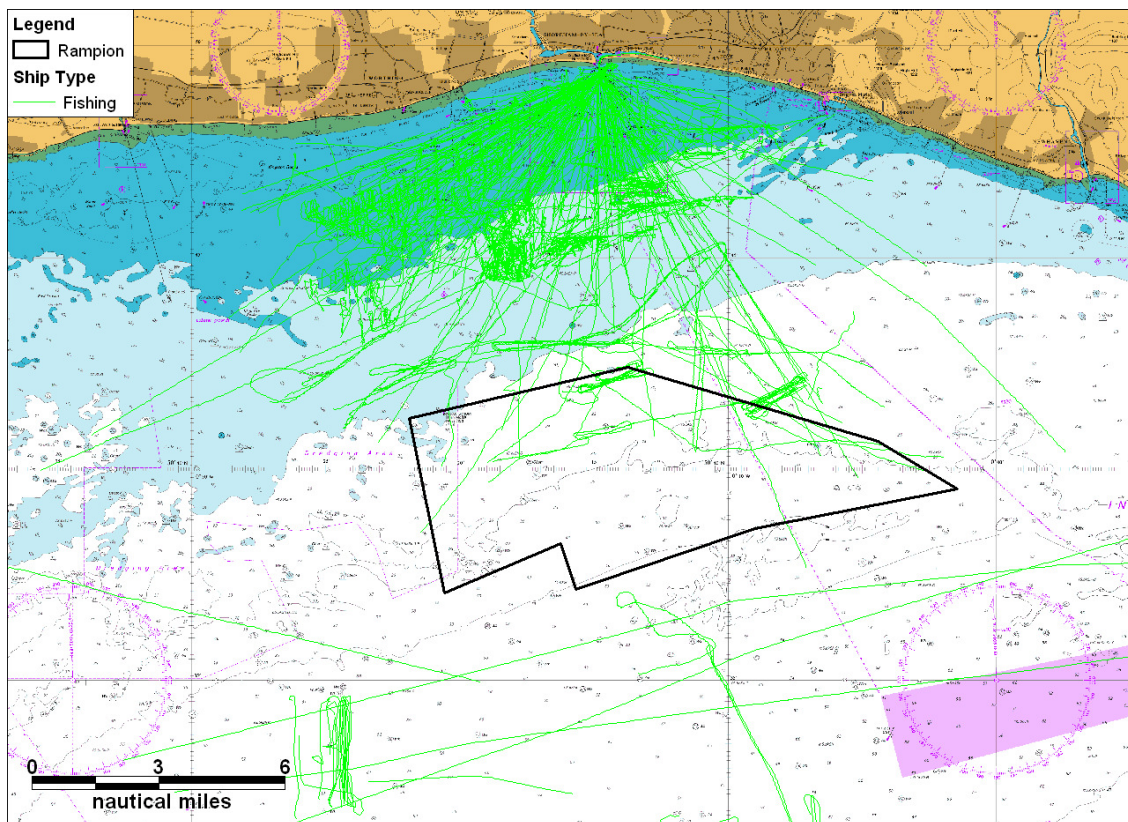


Figure 12.1 Fishing Vessel Tracks (14 days, January 2011)

The majority fishing vessels tracked were working out of Shoreham, with most of the smaller boats leaving Shoreham heading east or west. However, a number of beam trawlers operating out of Shoreham did head south and were observed operating within and in close proximity to the site.

In total, 1 to 2 fishing vessels were recorded per day within the Rampion Offshore Wind Farm site, and this included both transiting vessel and those that are engaged in fishing.

A plot of the fishing vessel tracks recorded during the second survey, in July 2011, is presented in Figure 12.2.

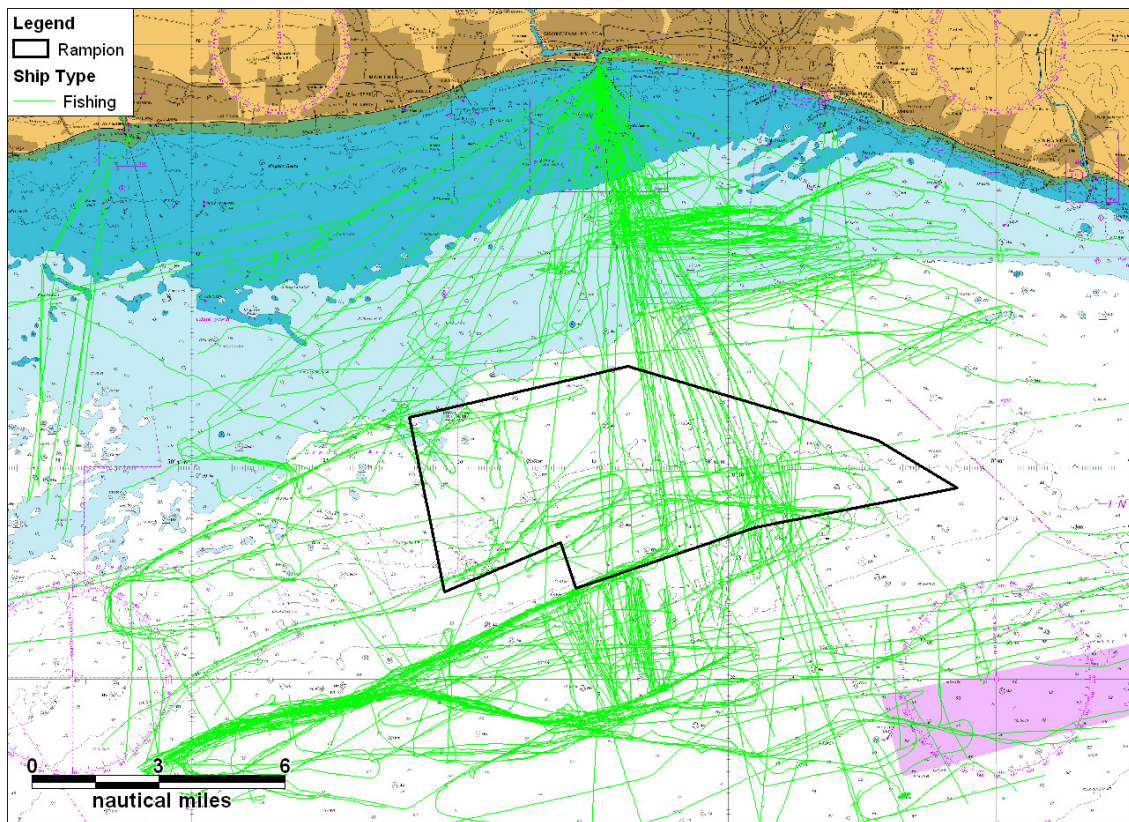


Figure 12.2 Fishing Vessel Tracks (14 days, July 2011)

The level of fishing activity recorded within the Rampion site was greater during the July survey period, with an increased number of vessels transiting the site and vessels engaged in fishing within the site. As was the case in the first survey, the majority of the smaller fishing boats operating out of Shoreham went to the east or west.

12.3 Fishing Surveillance Data

12.3.1 Geographical Division

Fisheries statistics in the UK are reported by International Council for the Exploration of the Seas (ICES) statistical Rectangles and Subsquares. The Rampion site is located within ICES Rectangle Subsquare 30E9/4, with the export cable corridor located within Subsquares 30E9/2 and 30E9/4, as shown in Figure 12.3.

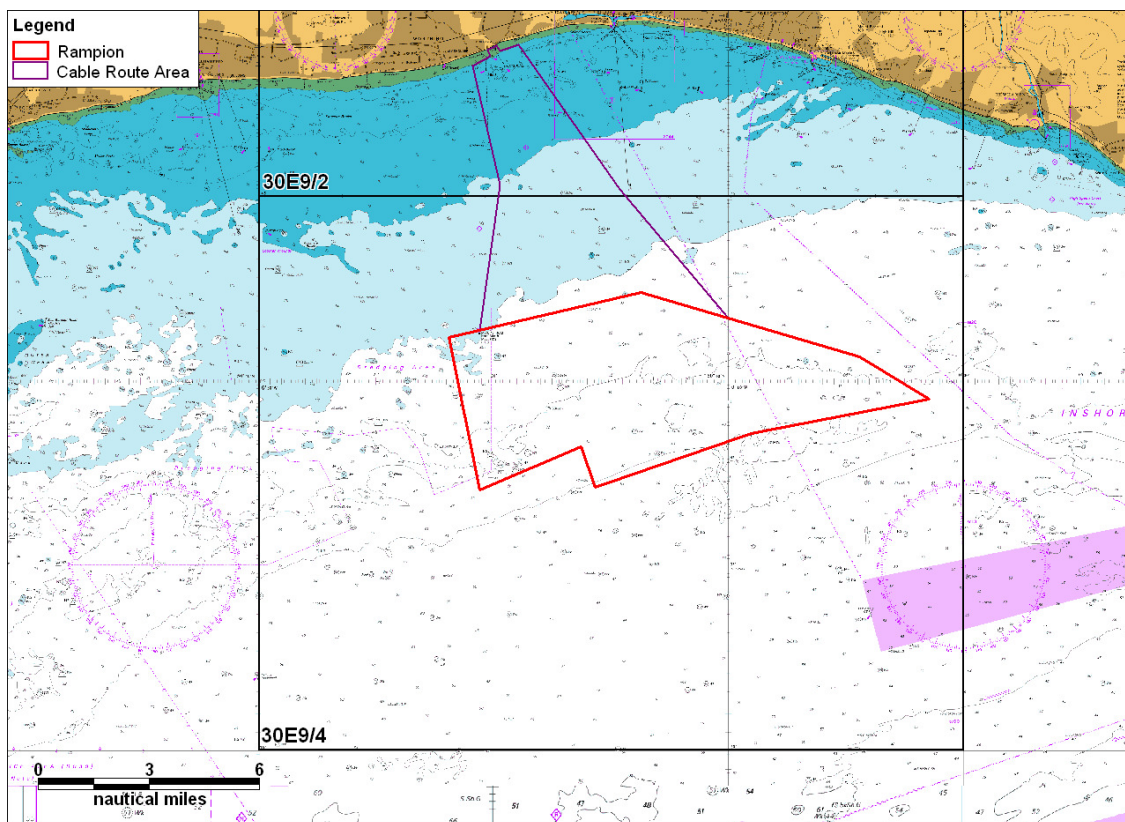


Figure 12.3 ICES Subsquares Encompassing the Rampion Site and Export Cable Route

The Subsquares encompassing the Rampion site has an area of approximately 286nm² (981km²).

12.3.2 Sightings Data

The numbers of fishing vessel sightings, surveillance patrols and hence average sightings per patrol within each ICES Subsquares encompassing the Rampion site and export cable corridor in the five-year period 2005-09 are presented in Table 12.1.

Table 12.1 Average sightings per patrol (2005-09)

ICES Subsquares	Sightings	Patrols	Sightings per Patrol
30E9/2	2,008	566	3.5
30E9/4	1,412	655	2.2

Therefore, the Subsquares 30E9/4 had an average of just over 2 fishing vessel sightings per patrol. Subsquares 30E9/2, which intersects the proposed export cable corridor has a higher number of sightings per patrol, however, it is noted that this includes vessels within port.

The fishing vessel sightings colour-coded by nationality are presented in Figure 12.4.

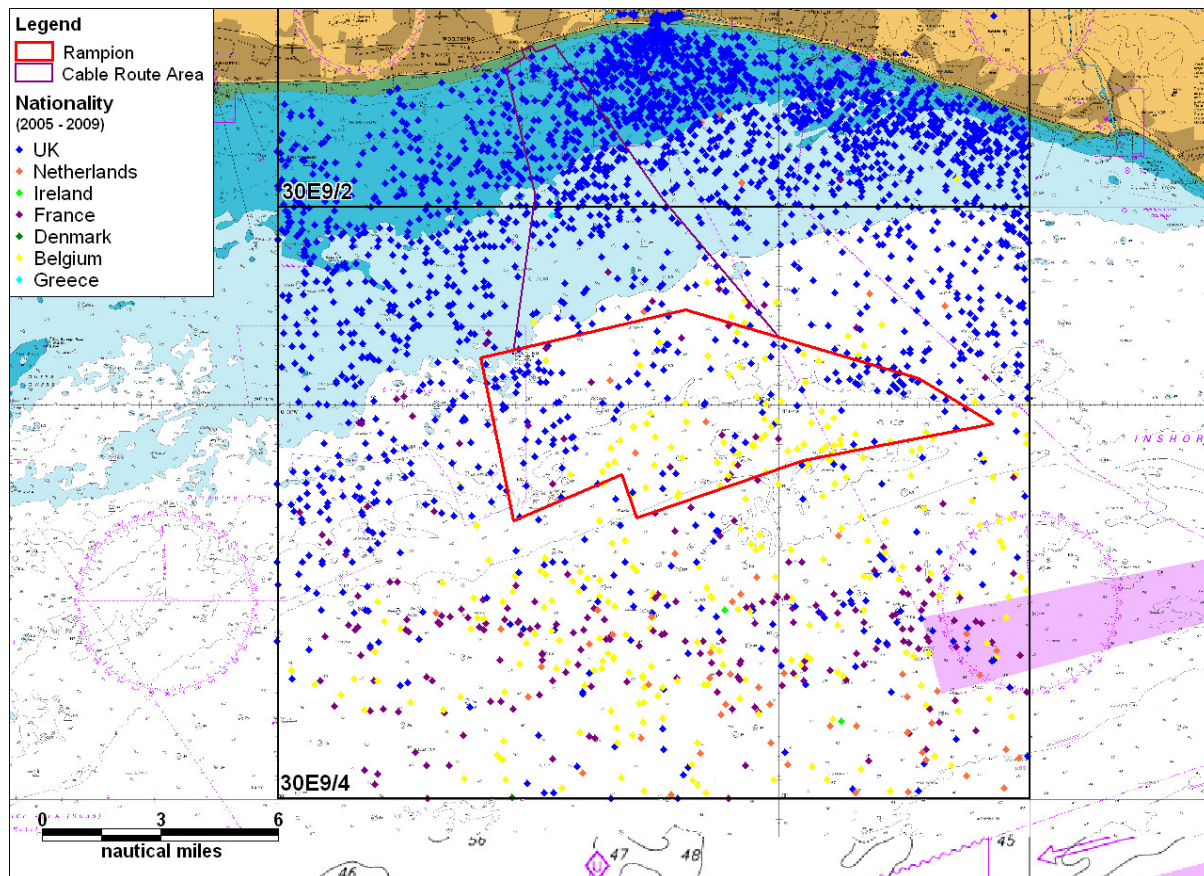


Figure 12.4 Fishing vessel Sightings by Nationality (2005 – 2009)

It can be seen that the vast majority of the fishing vessel sightings within the Rampion site were either UK (58%) or Belgian (33%) registered.

The fishing vessel sightings colour-coded by gear type are presented in Figure 12.5.

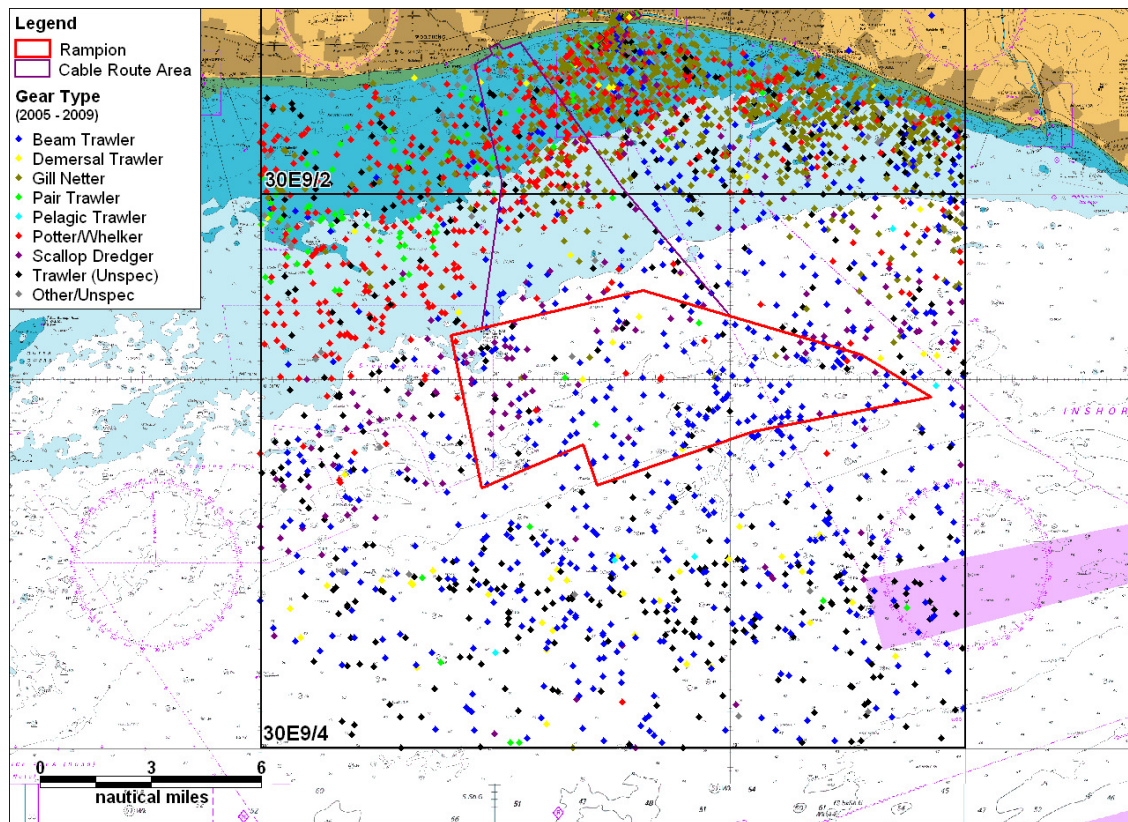


Figure 12.5 Fishing vessels Gear Type

In terms of the Rampion site there were 209 sightings with the most common types recorded being beam trawlers (62%), scallop dredgers (18%), and unspecified trawlers (8%).

In proximity to the coast, within the cable route corridor, the most common fishing vessel types recorded were gill netters and potters/whelkers.

The fishing vessels colour-coded by activity when sighted are presented in Figure 12.6.

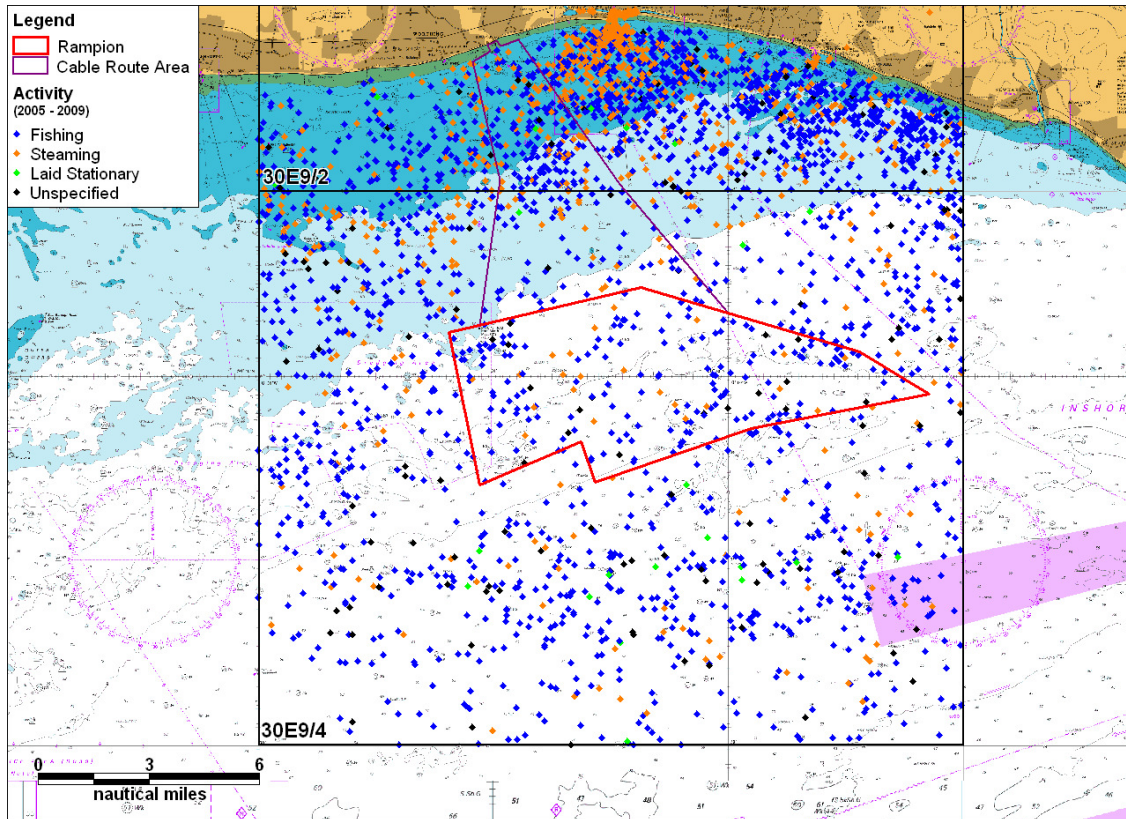


Figure 12.6 Fishing vessels by Activity

Excluding unspecified, 68% of vessels sighted were engaged in fishing, i.e., gear deployed, 31% were steaming (transiting to/from fishing grounds) and 1% were laid stationary (vessels at anchor or pair vessels whose partner vessel is taking the catch whilst the other stands by).

Within the Rampion site, the large majority of vessels sighted (excluding unspecified) were engaged in fishing (89%), while steaming vessels accounted for 11%.

12.3.3 Satellite Tracking Data

The latest satellite data set analysed is from 2009 and the data include both UK and foreign vessels of 15m length and over, with positions received at a minimum of every two hours. The satellite positions have been converted to a density grid and this is presented in Figure 12.7.

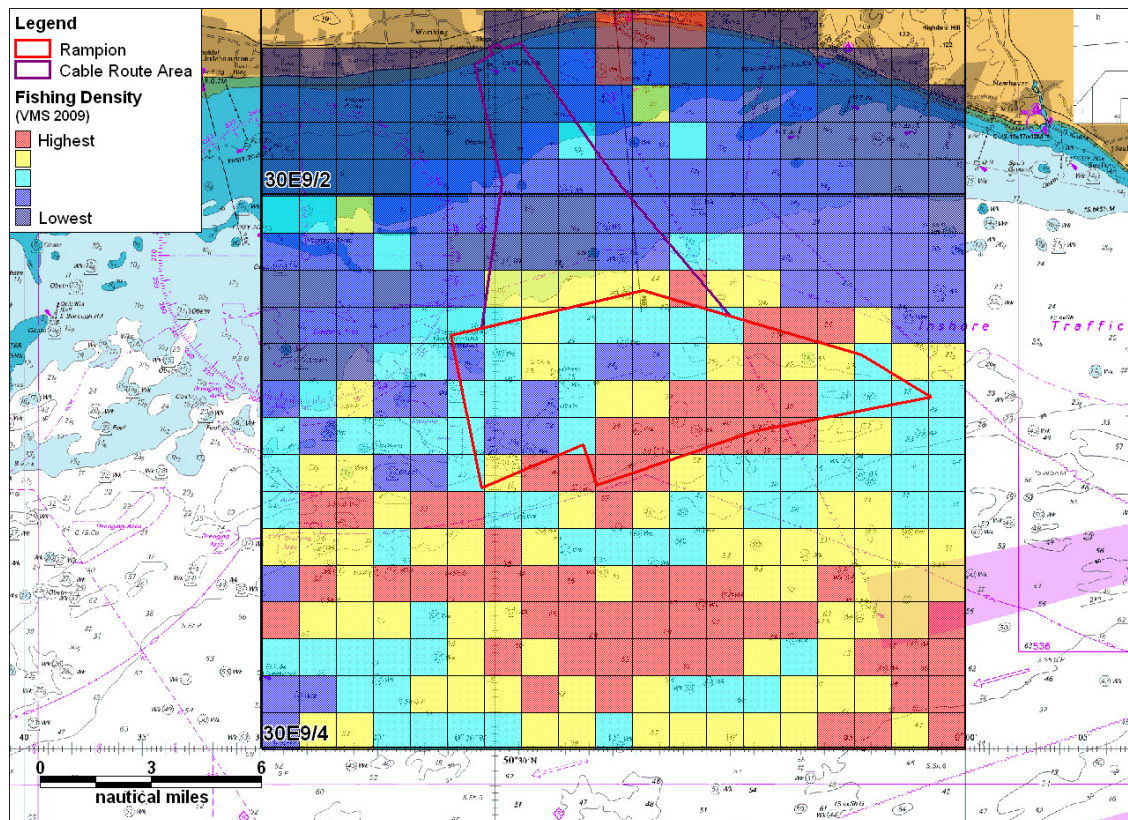


Figure 12.7 Fishing Vessel Density (2009)

It should be noted that the grid in the figure above is shaded according to relative density within the area of the grid.

As was the case with the sightings data, UK-registered fishing vessels were recorded most frequently within the Rampion site, accounting for 44% of fishing vessel positions. Belgian registered fishing vessels were the next most frequent within the Rampion site (29%) followed by vessels registered in France (26%).

Vessel type information was available for 42% of all recorded positions within the Rampion site. Of the fishing vessel positions within the site for which type information was available, the vast majority were beam trawlers (86%) or scallop dredgers (12%).

12.4 Commercial Fisheries Assessment

A detailed assessment of the fishing activity in the vicinity of the Rampion Offshore Wind Farm has been performed as part of the Environmental Statement (Ref. xi).

12.5 Fishing Vessel Impact Assessment

Based on the current fishing activity in the area, with vessels engaged in fishing within the site as well as steaming through it, and the assumption that this will continue after the wind farm is built, there will be a risk of collision between fishing vessels and WTGs. This risk is reviewed in the Hazard Review Workshop (Section 13) and Risk Assessment (Section 14).

There is also potential to impact on the navigation of fishing vessels to and from fishing grounds, for example, increased transit distances and times. This issue will be most significant during the construction and decommissioning phases when safety zones (see Section 18) will be in force and vessels will not be able to enter these areas, increasing transit distances. During the operations phase of the Rampion Offshore Wind Farm there should be sufficient spacing between WTGs for vessels to transit through the site if conditions are considered suitable.

The presence of the Rampion wind farm will also result in the displacement of shipping inshore of the wind farm, for example a proportion of east / west shipping within the ITZ is expected to route to the north of the site. This will displace shipping into areas used by smaller fishing vessels, potentially leading to an increase in vessel-to-vessel encounters and hence collisions between these vessels. However, there is sea room available to the north of the wind farm site and it can be seen from the sightings data (the satellite data does not cover vessels under 15m in length) that there is a separation between the Rampion site boundary and the areas of densest fishing vessel activity which tend to be in proximity to the coast.

Should fishing vessels be displaced from the wind farm site during the operational phase of the project, or during construction when 500m safety zones will be in place, alternative fishing grounds are also likely to be in areas of increased shipping density. Fishing activity may be displaced into areas of greater commercial vessel activity (either existing routes or traffic displaced by the Rampion development), areas used by recreational craft or routes to and from the Rampion site used by construction or operation and maintenance vessels associated with the project.

The risk of interaction between fishing gear and subsea cabling associated with the proposed sites is discussed in Section 14.4.

13. FORMAL SAFETY ASSESSMENT

13.1 Introduction

The IMO Formal Safety Assessment process (Ref. xii) as approved by the IMO in 2002 under SC/Circ.1023/MEPC/Circ392 has been applied within this study. This is a structured and systematic methodology based on risk analysis and cost benefit assessment (if applicable). There are five basic steps within this process:

1. Identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes);
2. Assessment of risks (evaluation of risk factors);
3. Risk control options (devising regulatory measures to control and reduce the identified risks);
4. Cost benefit assessment (determining cost effectiveness of risk control measures); and
5. Recommendations for decision-making (information about the hazards, their associated risks and the cost effectiveness of alternative risk control measures).

Figure 13.1 is a flow diagram of the FSA methodology applied.

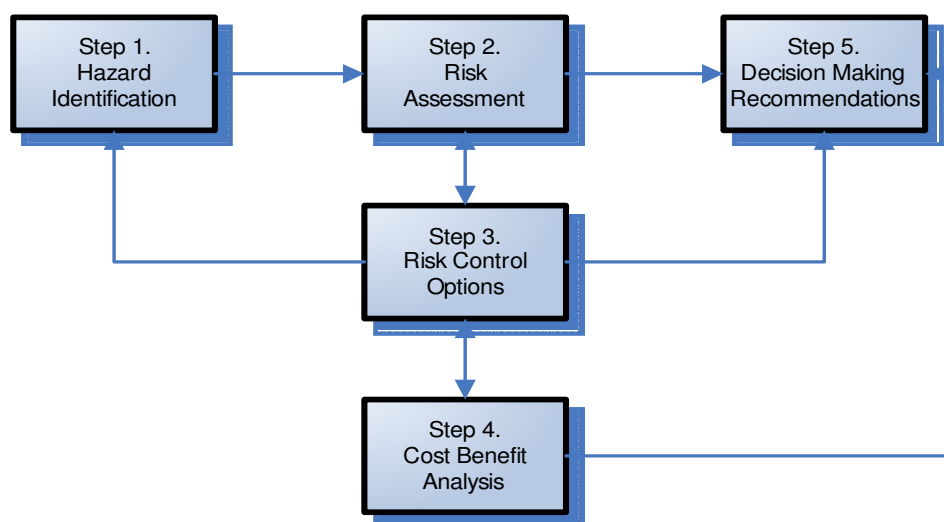


Figure 13.1 Overview of Formal Safety Assessment

As indicated within the IMO FSA guidelines and the DECC guidance on risk assessment methodology (Ref. i) for offshore renewable projects, the depth of the assessment should be commensurate with the nature and significance of the problem. Within the assessment of proportionality consideration was given to both the scale of the development and the magnitude of the risks/navigational impact.

From review it was concluded that the proposed site is a large scale development with the potential to impact navigational safety. As a result, the content and methods of the risk assessment were responsive to this and included the following:

- Comprehensive Hazard Log
- Risk Ranking
- Detailed and quantified Navigational Risk Assessment for selected hazards
- Preliminary search and rescue overview
- Preliminary emergency response overview
- Comprehensive risk control/mitigation measures log

13.2 Hazard Identification

A Hazard Review Workshop was held in Brighton on 20th January 2012 attended by local maritime stakeholders, as outlined in Table 13.1. Twenty four representatives from organisations including THLS, British Chamber of Shipping and a number of shipping operators were invited with 16 people in total attending the event.

Table 13.1 Hazard Review Workshop Attendees

Attendee	Position	Company/Organisation
Stuart Carruthers	Cruising Manager	Royal Yachting Association (RYA)
Ted Osborn	Regulation and Technical Services Committee	Cruising Association (CA)
Peter Burry	Regulation and Technical Services Committee	Cruising Association (CA)
Laurence Woodhams	Director	Sussex Yacht Club
Roland McKie	Staff Officer Maritime Operations	Maritime and Coastguard Agency (MCA)
Lee Fisher	Operations Manager	Solent Coastguard
Mike O'Sullivan	Offshore Industry Liaison Officer	Solent Coastguard
Mike Tubb	Operations Manager	Newhaven Lifeboat Station
Philip Smith	Marine Safety and Environment	Department for Transport
Julian Seaman	Harbour Master	Shoreham Port
Dave Collins-Williams	Harbour Master	Newhaven Port & Properties Ltd
Nigel Griffiths	Principal Resources Manager	Hanson Aggregates marine Ltd
Graham Singleton	Resource and Systems Manager	CEMEX UK Marine Ltd

Attendee	Position	Company/Organisation
David McCluskey	Marine and Crew Manager	Westminster Dredging Company Ltd
Robert Clark	Deputy Chief Fisheries and Conservation Officer	Sussex Inshore Fisheries and Conservation Authority
David Guy	Fisheries Liaison	Newhaven Fish & Flake Ice Society
Eleri Owen	Consents Manager	E.ON Climate & Renewables
Ali MacDonald	Senior Risk Analyst	Anatec
Peter Carey	Risk Analyst	Anatec

13.3 Risk and Mitigation Measures

The risks involved with the development and the associated mitigation measures are summarised in the following table. In all cases, the competency of mariners has been assumed when assigning the risk of each hazard.

Project: A2348

Client: E.ON Climate & Renewables

Title: Rampion Offshore Wind Farm – Navigation Risk Assessment

Hazard	Key Points	Mitigation
Commercial vessel (powered) collision with wind farm structure.	The majority of vessels passing the site naturally pass outside the wind farm site, i.e., those exiting the TSS and passing to the south and vessels on the coastal route to Shoreham. However, there are less dense commercial vessel routes which pass through and in close proximity to the site. Rampion Offshore Wind Farm will have appropriate Aids to Navigation and information on the development will be effectively promulgated. The marking of the wind farm with AIS as an Aid to Navigation will need further consultation with THLS. The consequences of a commercial vessel collision with a wind farm structure will be highly dependent on the vessel type. Competent mariners and compliance with the COLREGS will further contribute to mitigation and risk reduction.	• Aids to Navigation including lighting marking in line with O-139 • Promulgation of Information including charting and Notice to Mariners • Application for and use of Safety Zones during construction, in line with DECC Guidance • Implementation of a SAR ERCoP and Active Safety management System • AIS monitoring • Promulgation of information to local users including recreational clubs • Marine Coordination on site during works • Guard vessel during construction/decommissioning
Drifting (NUC) vessel	Drifting vessels at the exit of the westbound TSS lane are relatively frequent.	• Assessment of tug availability to

Project: A2348

Client: E.ON Climate & Renewables

Title: Rampion Offshore Wind Farm – Navigation Risk Assessment

Hazard	Key Points	Mitigation
collision with WTG.	This is due to vessels encountering engine problems within the TSS and aiming to continue to the exit to clear the area of dense traffic within the lane. Historical information shows vessels will generally attempt repairs having left the high risk areas of the TSS. With prevailing south-westerly winds vessels Not Under Command (NUC) may drift from the TSS towards the Rampion site if they cannot recover themselves or anchor. Local harbour tugs identified in the area, e.g., Shoreham, may not have the capability to take larger vessels in tow and may not be suitable for providing towing support in open sea conditions. The nearest powerful tugs would be from Southampton. The transit time to Rampion for the available tugs may be too high for them to successfully intervene, dependent on the situation of the drifting vessel, and weather / sea conditions. Whilst there may be tugs of opportunity in the area, but there can be no guarantee of this, especially those within the Solent which are often engaged in VLCC escorts and cannot leave their stations.	respond to NUC events within safety management systems. • Guard vessel during construction/decommissioning • Implementation of a SAR ERCoP and Active Safety management System including practiced response to NUC events
Fishing vessel collision with WTG.	It is likely that a fishing vessel collision with a WTG would result in damage to the fishing vessel as opposed to the WTG. Although there are single-handed inshore fishing boats in the area, local information indicates they are unlikely to be as far out as the wind farm site.	• Promulgation of information to users including charted information and Notices to Fishermen/Mariners • Local Fisheries Liaison

Hazard	Key Points	Mitigation
	Beam trawlers fish in and around the proposed site. Kingfisher notifications are not generally used in the area. Notifications to fishermen should be done in conjunction with other publications such as Sea Fish and/or notice to mariners. A website showing offshore obstructions by sea area would be of benefit.	• Aids to Navigation including lighting marking in line with O-139 • Implementation of a SAR ERCoP and Active Safety Management System
Recreational craft collision with WTG	There is a relatively high level of recreational craft activity in the area, with coastal and cross channel cruising routes through the site, compared to other areas of the UK. Sailing races currently pass through the Rampion site, but it is not considered likely that races will pass through the wind farm during or post construction. The increase in the use of AIS (Class B) by recreational craft means that it may be possible to intervene in some cases when vessels are observed heading on a closed CPA with a WTG, through AIS monitoring.	• Promulgation of information to local users and charted information • Minimum Blade Clearance as per MGN 371 • Aids to Navigation including lighting marking in line with O-139 • Implementation of a SAR ERCoP and Active Safety management System • Application for and use of Safety Zones during construction, as per DECC guidance • Guard vessel during construction • AIS monitoring

Project: A2348

Client: E.ON Climate & Renewables

Title: Rampion Offshore Wind Farm – Navigation Risk Assessment

Hazard	Key Points	Mitigation
		• Marine Coordinator on site during construction/decommissioning works
Marine Aggregate Dredger collision with WTG / Suction pipe snagging on cabling.	Buffer zones between WTGs and dredging areas need to be considered on a site specific basis, giving consideration to tides and wind. In the event of machinery failure while dredging the vessel may drift into wind farm structures, and in addition the pipe may snag on subsea cabling. Procedures in the event of a drifting vessel dragging its pipe need to be identified on a site specific basis (i.e., should the vessel anchor) and this will depend on cable burial depths. Tug availability is an issue. Given the proximity of the dredge areas to the site, the available tugs may be too far away and so would not have time to intervene in the event of a dredger drifting towards the site.	• Promulgation of information to local and international users • Aids to Navigation including lighting marking in line with O-139 • Cable protection and or burial as per MGN 371 • Buffer Zone – separation between extraction areas and WTGs • Fenders installed on structures to mitigate low speed collision • Parallel inter-array cabling (in the direction of likely drift)
Vessel-to-vessel collision due to avoidance of site or work vessels in the area.	ITZ will become more congested, with traffic displaced by the wind farm and additional vessel activity associated with the development. The formation of ‘pinch points’ with larger numbers of vessels aiming for a particular area as they route around the wind farm was raised as a concern at the	• Promulgation of information including notice to mariners and fisherman • Aids to Navigation including lighting marking in line with O-

Hazard	Key Points	Mitigation
	workshop. Traffic displaced inshore of the wind farm, into areas used by smaller fishing vessels. While there is no evidence of significant impact of WTGs on communication equipment, AIS or VHF, there are Radar effects possibly reducing the detection of small vessels within or in proximity to the wind farm.	139 • Implementation of a SAR ERCoP and Active Safety management System • AIS monitoring
Fishing Gear interaction with inter array / export cabling or subsea equipment.	The likely seabed penetration of fishing gear is around 1 inch, with a penetration of around 3 inches for scallop dredging. The proposed burial depth was seen as sufficient. It was not considered likely that repeated scallop dredging in an area could lead to a cable becoming exposed. Single-handed fishing vessels operate within the proposed export cable corridor. From a fishing perspective, at present it is not certain whether rock dumping or mattresses would be preferable in areas where the cable can't be buried. Parallel inter-array cabling would reduce the risk of gear interaction. NE to SW is the preferred direction.	• Promulgation of information • Aids to Navigation including lighting marking in line with O-139 • Installation procedures • Inspection and maintenance procedures • Guard vessel during construction/decommissioning construction • Fisheries Liaison Officer • Application for and use of Safety Zones during construction • Appropriate cable protection

Hazard	Key Points	Mitigation
		and/or burial • Parallel Inter-array cabling • Implementation of a SAR ERCoP and Active Safety management System
Vessel anchoring on and/or dragging anchor over subsea equipment.	A proportion of vessels anchoring off Shoreham anchor within the proposed export cable corridor, in the vicinity of the charted recommended anchorage. The vessels anchoring off Shoreham can drop anchor to 3 - 4m below the seabed. The cable corridor will not be an official no anchoring zone.	• Promulgation of information and chartered cables • Promulgation of information to local users during construction/decommissioning • Installation procedures • Inspection and maintenance procedures • Appropriate cable protection and/or burial • Navigational marking indicating the export cable landfall and direction • Application for and Use of Safety Zones during construction • Implementation of a SAR ERCoP and Active Safety

Hazard	Key Points	Mitigation
		management System • AIS monitoring • Guard vessel during construction
Deliberate unauthorised boarding of a WTG or mooring to structure. (possible damage to the device)	Given the location of the wind farm mooring to wind farm structures was considered a reasonably likely event. However, it was considered more doubtful that anyone would attempt to climb the tower. Due to the distance of the coast, the development may be out of range of certain craft such as jet skis.	• QHSE plans including Safety Management System (SMS) • Promulgation of information to local users • Inspection and maintenance procedures • Implementation of a SAR ERCoP and Active Safety management System

13.4 Risk Analysis

Following identification of the key navigational hazards, risk analyses were carried out to investigate selected hazards in more detail. This allowed more attention to be focused upon the high risk areas to identify and evaluate the factors which influence the level of risk with a view to their effective management. Four risk assessments were carried out as per the DECC guidelines:

1. Base case without wind farm level of risk
2. Base case with wind farm level of risk
3. Future case without wind farm level of risk
4. Future case with wind farm level of risk

The following scenarios were investigated in detail, quantitatively or qualitatively.

Without Wind Farm:

- Vessel-to-vessel collisions

With Wind Farm

- Vessel-to-vessel collisions
- Vessel-to-wind farm collisions (powered and drifting)
- Cable interaction

All the quantified risk assessments were carried out using Anatec's COLLRISK software which conforms to the DECC methodology as outlined in Annex D3 in the Guidance (Ref. i). In line with this, Anatec makes the declaration that the models used within this work have been validated and are appropriate for the intended use. As required the following have been considered and justified:

- Tuning of parameters
- Consistency checks
- Behavioural reasonableness
- Sensitivity analysis
- Comparison with the real world

The results of the detailed risk analyses are presented in Section 14. Where considered appropriate in high risk scenarios, the change in individual and societal risk (based on Potential Loss of Life), as well as the risk of pollution, were calculated and compared to background risk levels in the UK.

13.5 Risk Control Measures

A summary of measures is presented in Section 21.

14. RISK ASSESSMENT

14.1 Introduction

This section assesses the risks identified from the hazard review to require more detailed assessment. This is divided into without wind farm (pre-installation) and with wind farm (post-installation) risks.

The base case assessment uses the present day vessel activity level identified from the two maritime traffic surveys (and longer term AIS data collection), consultation and other data sources. The future case assessment makes conservative assumptions on shipping traffic growth over the life of the wind farm.

The collision risk modelling is based on the Rochdale Envelope, with the modelling undertaken for two indicative WTG layouts (refer to Section 3.3 for more details).

14.2 Without Wind Farm Risk

14.2.1 Encounters

An assessment of current vessel-to-vessel encounters has been carried out by replaying at high speed 28 days of AIS and Radar data gathered from Shoreham.

An encounter distance of 1nm has been considered. The tracks of vessels during encounters recorded during the 28 days of analyses, and heat maps based on the geographical distribution of encounters within a 1nm grid of cells, are presented in Figure 14.1. This helps to illustrate where existing shipping congestion is highest and the therefore where offshore developments, such as wind farms, could potentially increase congestion and therefore also increase the risk of encounters/collisions.

It can be seen that the encounter frequency is greatest at the termination point of the westbound lane of the TSS, and inshore of Rampion, particularly in the vicinity of Shoreham, Brighton Marina and Newhaven as well as at Beachy Head. The density of encounters within and in close proximity to the proposed wind farm is relatively low.

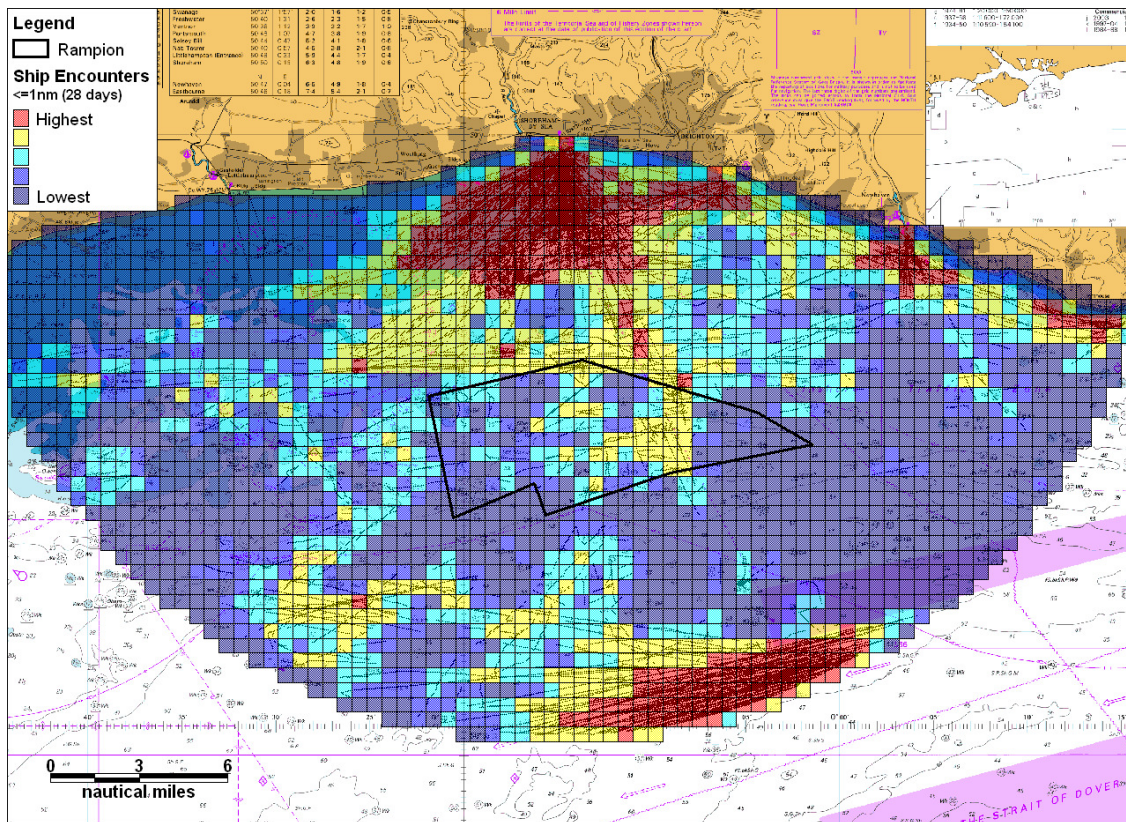


Figure 14.1 Ship Encounters within 1nm relative to a 1x1nm Grid

Due to the location of the proposed wind farm site, an encounter distance of 1nm has been used for further analysis of encounters.

There were 1,181 encounters during the 28 day period. Figure 14.2 presents the number of encounters per day. (It is noted that the first and last days of both survey periods were partial days of surveying.)

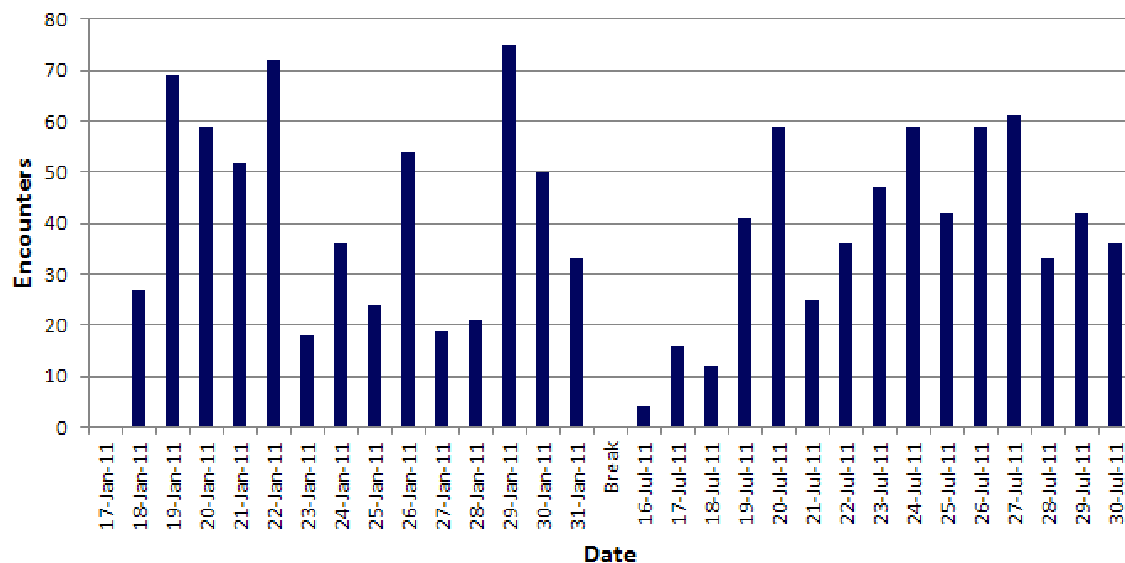


Figure 14.2 Number of Encounters per Day

The average number of encounters was 42 per day, with the highest number (75 encounters) observed on 29 January 2011.

Figure 14.3 presents the distribution of vessel types involved in encounters (excluding unspecified).

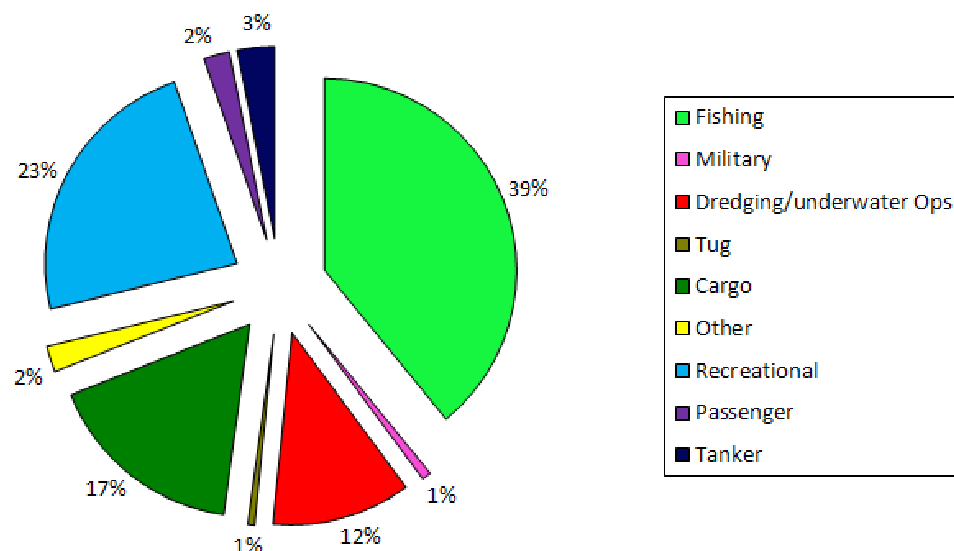


Figure 14.3 Vessel Types involved in Encounters

It can be seen that the majority of encounters involved fishing vessels (39%), recreational craft (23%), cargo vessels (17%) and dredgers (12%).

The locations of encounters colour-coded by ship type during the 28 day period are presented in Figure 14.4.

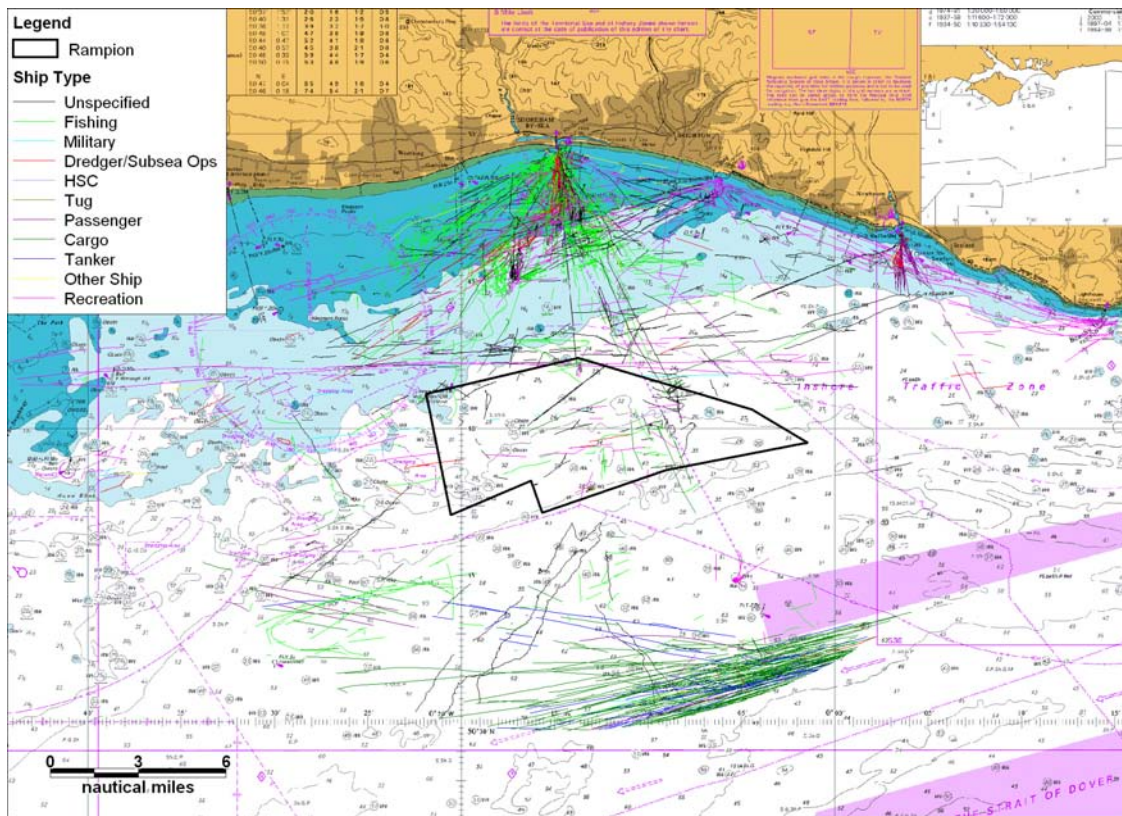


Figure 14.4 Overview of 1nm Encounters during 28 days

14.2.2 Vessel-to-Vessel Collisions

Based on the existing routing and encounter levels in the area, Anatec's COLLRISK model has been run to estimate the existing vessel-to-vessel collision risks in the local area around the proposed sites. The route positions and widths are based on the survey analysis with the annual densities based on port logs and Anatec's ShipRoutes database, which take seasonal variations into consideration.

Based on the model run for the area, the baseline vessel-to-vessel collision risk level pre-wind farms is in the order of 1.2 major collisions per year.

It is emphasised the model is calibrated based on major incident data at sea which allows for benchmarking but does not cover all incidents, such as minor impacts, or incidents occurring within port. Other incident data from RNLI and MAIB is presented in Section 7. This includes other minor incidents including collisions in port (from 2001 to 2010, four collisions were reported by MAIB within 10nm of the proposed site and RNLI responded to 8 collision incidents, one of which was also reported by MAIB).

14.3 With Wind Farm Risk (Base Case)

14.3.1 Vessel-to-Vessel Collisions – Change in Risk

The revised routing pattern following construction of the wind farm has been estimated based on the review of impact on navigation (see Section 9). The main change is displacement of ships passing through the wind farm area on approach/departure from Shoreham and Newhaven, as well as vessels routing within the ITZ. It is assumed that ships will be able to pre-plan their revised passage in advance of encountering the wind farm due to effective mitigation in the form of information distribution about the development to shipping through Notices to Mariners, updated charts, liaison with ports, etc. Fishing vessels and recreational craft may also be displaced from the site to other areas, which could increase the frequency of encounters.

Based on vessel-to-vessel collision risk modelling of the revised traffic pattern, the collision risk was estimated to increase, with the change in collision frequency due to the wind farm development estimated to be 1.5×10^{-3} per year for Scenario 1 and 7.5×10^{-4} per year for Scenario 2.

As noted earlier, the model is calibrated based on major incidents at sea which allows for benchmarking but does not cover all incidents, such as minor impacts, or incidents occurring within port.

The following potential affects have not been quantified but may indirectly influence the vessel-to-vessel collision risk:

- Radar interference
- Visual obscuration when ships approach each other.

The Radar interference issue is discussed in Section 16. It is noted that any potential impact is only likely to be a problem during bad visibility and this is mitigated to an extent by the widespread adoption of AIS which will assist vessels in discriminating genuine targets (although AIS is not currently mandatory for smaller vessels, e.g., fishing and recreational craft).

The visual issue is reviewed in Section 20.2 and is not considered a significant factor for the proposed sites due to its position and orientation relative to the shipping lanes and the other navigational features in the area.

14.3.2 Ship Collision with Structure

There are two main scenarios for passing ships colliding with offshore structures such as WTGs and substations:

- **Powered Collision:** Where the vessel is under power but errant
- **Drifting Collision** Where a ship on a passing route experiences propulsion failure and drifts under the influence of the prevailing conditions.

Each scenario is assessed below.

Powered Ship Collision

Based on the ship routeing identified for the area and the anticipated change in routeing due to the site, and assuming effective mitigation in terms of making mariners aware of the site through Notices to Mariners, charts, lights and markings, etc., the frequency of an errant ship under power deviating from its route to the extent that it comes into proximity with the proposed wind farm sites is not considered to be a likely event.

From consultation with the shipping industry it is assumed that merchant ships will not attempt to navigate between WTGs due to the restricted sea room and will be directed by the navigational aids in the area although, as noted earlier, Westminster Dredging Company Limited indicated that the vessel *Sospan Dau* may route through the wind farm.

Based on modelling of the revised routeing, proposed layouts, local metocean data, the frequency of a passing powered vessel collision was estimated and the results are presented in Table 14.1.

Table 14.1 Powered Ship-to-Structure Collisions – Base Case with Wind Farms

WTG Layout	Annual Collision Frequency	Collision Return Period
Scenario 1	1.9E-04	5,300 years
Scenario 2	2.0E-04	5,100 years

These collision frequencies are below the historical average of 5.3×10^{-4} per installation-year for offshore installations on the UKCS (1 in 1,900 years). The risk to the proposed wind farms is estimated to be highest for the indicative layout in scenario 2. However the relatively low ship-to-structure collision frequency for both scenarios is generally reflective of low level of commercial traffic passing in close proximity to the wind farm.

The individual collision frequencies ranged from 3.4×10^{-5} for a turbine at the northwest corner of the site, to negligible for a WTG within the centre of the wind farms. Plots showing the passing powered collision frequency for each WTG in the two potential layouts, as well as the substations and met mast are presented in Figure 14.5 and Figure 14.6.

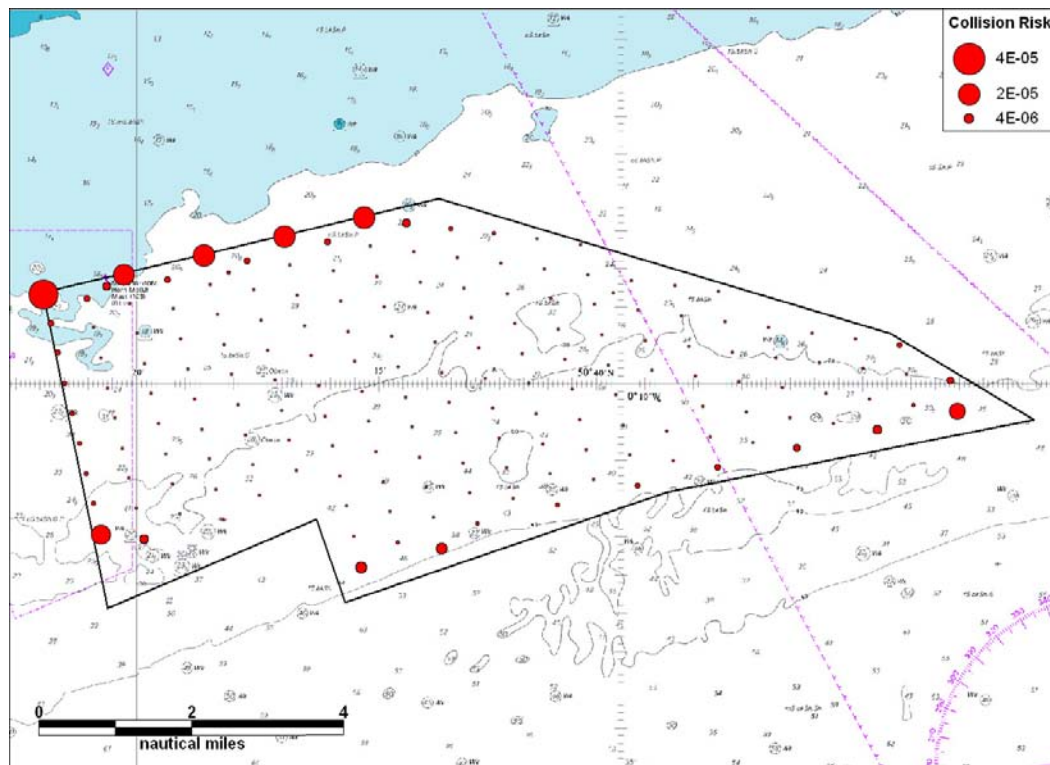


Figure 14.5 Annual Passing Powered Collision Frequency for Scenario 1

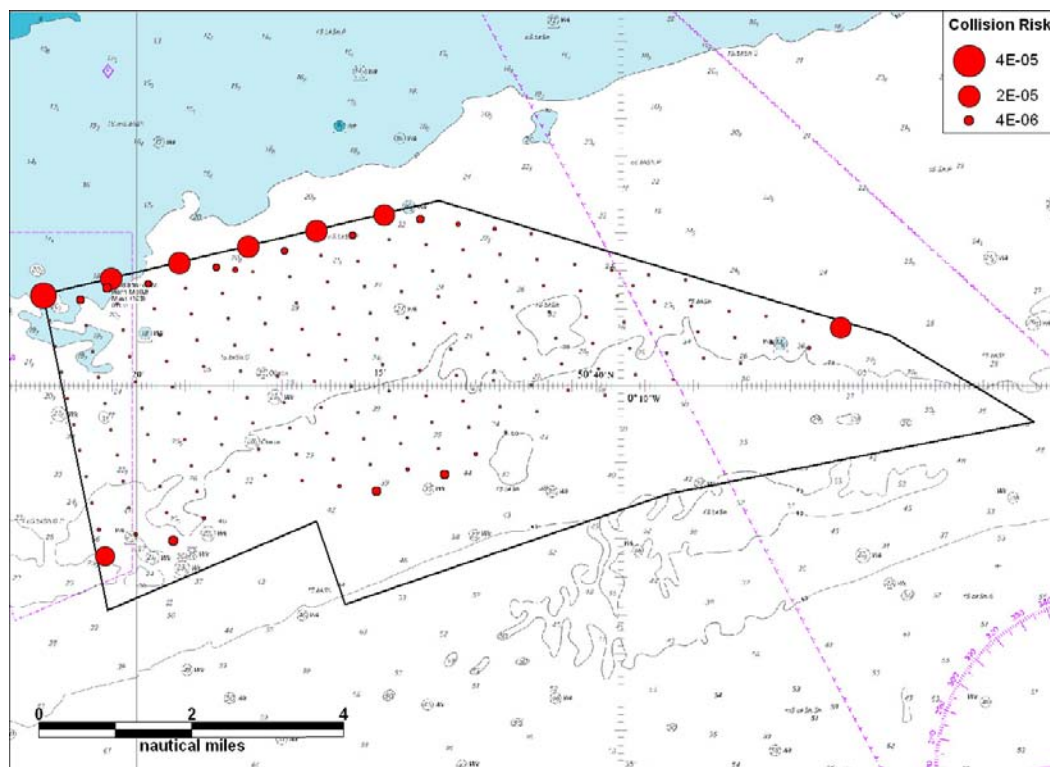


Figure 14.6 Annual Passing Powered Collision Frequency for Scenario 2

Drifting Ship Collision

The risk of a ship losing power and drifting into the proposed wind farm structures was assessed using Anatec's COLLRISK model. This model is based on the premise that propulsion on a vessel must fail before a vessel will drift. The model takes account of the type and size of the vessel, number of engines and average time to repair in different conditions.

The exposure times for a drifting scenario are based on the ship-hours spent in proximity to the proposed wind farm (up to 10nm from perimeter). These have been estimated based on the traffic levels, speeds and revised routeing pattern. The exposure is divided by vessel type and size to ensure these factors, which based on analysis of historical accident data have been shown to influence accident rates, are taken into account within the modelling.

Using this information the overall rate of breakdown within the area surrounding the wind farm was estimated. The probability of a ship drifting towards a structure and the drift speed are dependent on the prevailing wind, wave and tide conditions at the time of the accident.

The following drift scenarios were modelled:

- Wind
- Peak Spring Flood Tide
- Peak Spring Ebb Tide

The probability of vessel recovery from drift is estimated based on the speed of drift and hence the time available before reaching the wind farm structure. Vessels that do not recover within this time are assumed to collide.

Prior to the modelling of the two turbine layouts, the model was run for the proposed development area boundary in order to assess the risk of a vessel drifting into the wind farm site. After modelling the three scenarios (the development area and the two different layouts) it was established that flood tide-dominated drift produced the worst case results in all cases. These results are presented in Table 14.2

Table 14.2 Drifting Ship-to-Structure Collisions – Base Case with Wind Farms

WTG Layout	Annual Collision Frequency	Collision Return Period
Proposed Development Area	5.6E-04	1,800
Scenario 1	8.5E-05	11,700
Scenario 2	1.0E-04	9,600

The frequency of a vessel drifting into the wind farm site has been identified 1 every 1,800 years. This is 5.4 times higher than the worst case drifting collision risk identified for Scenario 2 (one every 9,600 years). Drifting collisions are assessed to be less frequent than powered collisions, which is reflective of historical data. There have been no reported

‘passing’ drifting (‘Not under Command’) ship collisions with offshore installations on the UKCS in over 6,000 operational-years. Whilst a large number of drifting ships have occurred each year in UK waters, most vessels have been recovered in time, e.g., anchored, restarted engines or taken in tow. There have also been a small number of ‘near-misses’.

At the Hazard Review Workshop it was noted that drifting vessels at the exit of the westbound lane of the TSS, to the south of Rampion, are relatively common. Vessels which encounter engine problems within the TSS are likely to continue if possible, but will attempt repairs having left the TSS and prevailing southwest winds may cause the vessel to drift towards the Rampion site if they are unable to anchor.

At the workshop a recent example was cited when the chemical tanker *Amaranth* left the TSS before attempting repairs to the west of the CS1 buoy. The vessel was then towed by the tug vortex to a position approximately 3nm off Shoreham. The tracks of these vessels are presented in Figure 14.7.

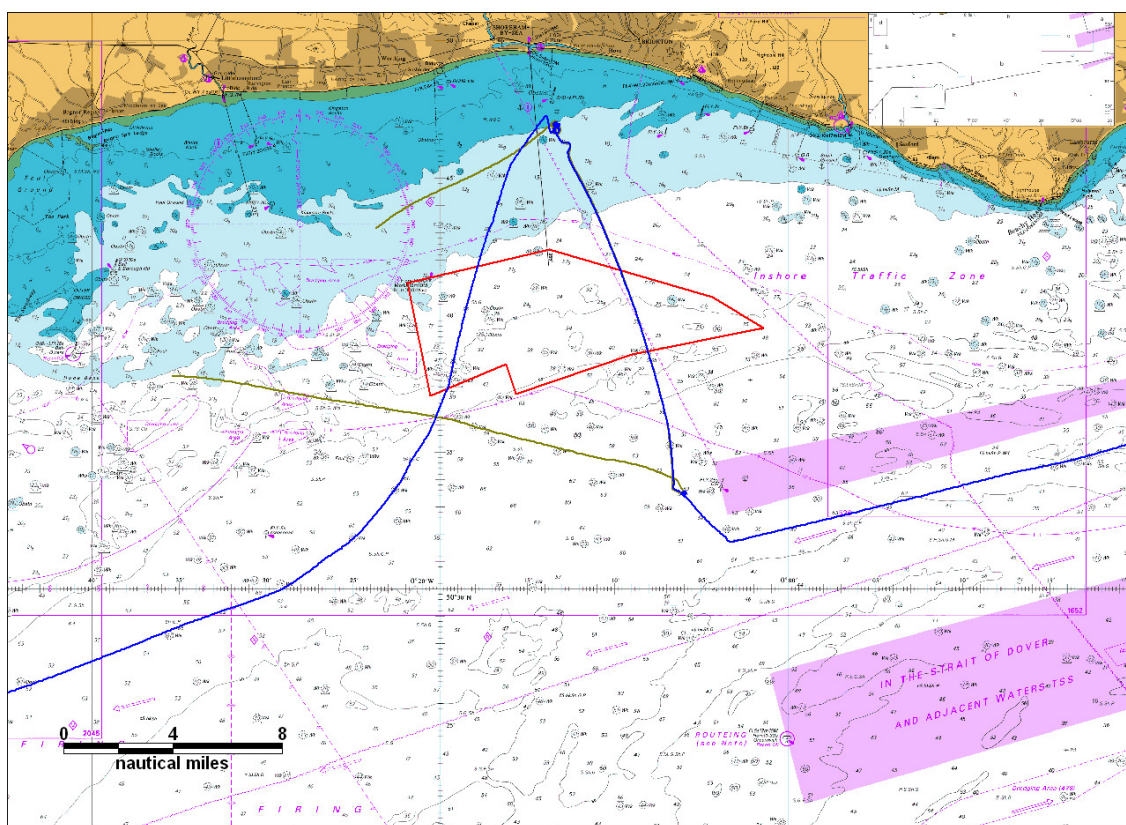


Figure 14.7 Chemical Tanker *Amaranth* and Tug *Vortex* – 20th to 24th December 2011

There is approximately 6.4nm between the exit of the westbound TSS lane and the Rampion site (and approximately 5.3nm between the site and the position of the *Amaranth* to the west of the CS1 buoy). Based on a typical drift speed in moderate conditions (Beaufort 4-7) of 1.5 knots (Ref. xiii) it would take a little over 4 hours for a vessel to drift from the exit of the TSS lane into the wind farm site. In severe conditions, with a drift speed of 3 knots it would take

approximately 2 hours 10 minutes to reach the wind farm. These times would be reduced for a vessel drifting from a point to the west of the CS1 buoy, similar to that used by the *Amaranth*).

The currents in the area set in a generally easterly / north easterly direction on the flood and westerly / south westerly on the ebb, and so whilst a southerly wind may result in a vessel drifting towards Rampion, the speed of drift is not likely to be compounded by currents.

Based on discussions at the Hazard Review Workshop, in the event of a drifting vessel in the vicinity of the wind farm, local harbour tugs may not have the capability to take a large vessel in tow or may not be suitable for towing support in open sea conditions. The nearest powerful tugs to the site are from Southampton (over 50nm passage from the southern part of the site). Therefore, the steaming time for the available tugs to reach Rampion may be too high for a tug to intervene, dependent on the situation of the vessel in trouble and weather and sea conditions.

In the event of a drifting vessel collision with a wind farm structure, the collision energy is likely to be relatively low due to the low speed of the drifting vessel. However, the worst case consequences of such an incident are severe, with the potential for major damage/total loss of the vessel, resulting in multiple fatalities and a major pollution incident. The risk should be mitigated by the development of an advanced Emergency Response Co-operation Plan (ERCoP) for the wind farm. Procedures should be developed for all foreseeable marine events including a drifting vessel in the vicinity of the wind farm, with consideration given to salvage and pollution response.

14.3.3 Fishing Vessel Collision

Anatec's COLLRISK fishing vessel risk model has been calibrated using fishing vessel activity data along with offshore installation operating experience in the UK (oil and gas) and the experience of collisions between fishing vessels and UKCS offshore installations (published by HSE).

The two main inputs to the model are the fishing vessel density for the area and the structure details. The fishing vessel density in the area of the wind farm was based on the number of sightings per patrol in the five year period 2005-09, as these patrols attempt to identify all vessels in the area, unlike the VMS data which is restricted to vessels of 15m length and over. The worst case dimensions for the structures within Scenario 1 and 2 have been used.

Using the above site-specific data as input to the model, the worst case annual fishing vessel collision frequency for the proposed sites was estimated for the two scenarios.

Table 14.3 Fishing Vessel Collisions – Base Case with Wind Farms

WTG Layout	Annual Collision Frequency	Collision Return Period
Scenario 1	1.5E-01	7 years
Scenario 2	1.5E-01	7 years

The worst case fishing vessel collision risk has been identified as to be 1.5×10^{-1} , which corresponds to an average of 1 collision in 7 years for the maximum number of WTG and hence biggest target area. This collision frequency reflects the relatively high density of fishing vessels operating and passing through the area and also gives account to the fact fishing vessels are likely to operate within the project areas following construction of the wind farms.

14.3.4 Recreational Craft Collision

There are two main collision hazards from recreational craft interacting with wind farms:

1. WTG Rotor Blade to Yacht Mast Collision
2. Vessel Collision with Main Structures

Blade-to-Mast Collision

A collision between a WTG rotor blade and the mast of a yacht could result in structural failure of the yacht.

For a blade/mast collision to occur, the air draught of the yacht (from water-line to top of masthead) must be greater than the available clearance under the area swept by the rotating blade.

The planned minimum rotor blade clearance for the WTG is at least 22m above Mean High Water Springs (MHWS), which matches the MCA minimum requirement. This is the clearance when the blade is in its lowest ('6 o'clock') position. The actual clearance at a given time will depend upon the prevailing tide and wave conditions, i.e., lower clearance at high water and rough seas, greater clearance at low water and calm seas.

To determine the extent to which yacht masts could interact with the rotor blades, details on the air draughts of the IRC fleet are provided in Figure 14.8 based on a fleet size of over 3,000 vessels. IRC is a rating (or 'handicapping' system) used Worldwide which allows boats of different sizes and designs to race on equal terms. The UK IRC fleet, although numerically only a small proportion of the total number of sailing yachts in the UK, is considered representative of the range of modern sailing boats in general use in UK waters.

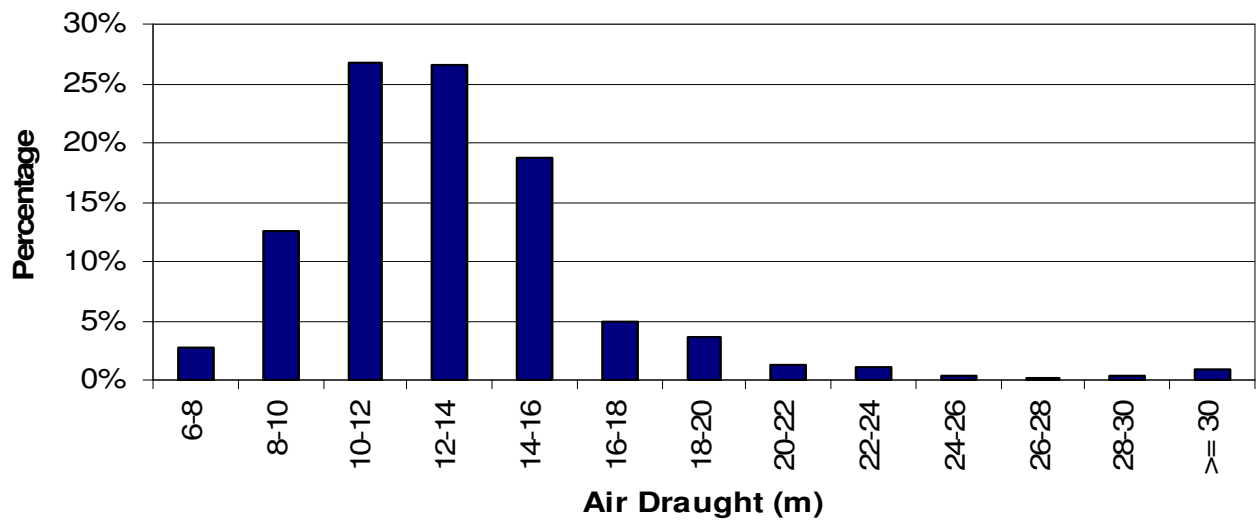


Figure 14.8 Air Draught Data – IRC Fleet (2002)

From this data, just under 3% of boats have air draughts exceeding 22m. Therefore, only a fraction of vessels could potentially be at risk of dismasting if they were directly under a rotating blade in the worst-case conditions.

It is further noted that the wind farm will be designed and constructed to satisfy the requirement of the Maritime & Coastguard Agency in respect of control functions and safety features, as specified in the MCA standards (Ref. ii).

It is noted that very large yachts, which are the only boats that could potentially interact with the rotor blades, are also most likely to be equipped with VHF radio and other safety equipment.

Based on the information presented in this section, the risk of dismasting of a yacht by a rotating blade of a Rampion WTG is assessed to be minimal, and has not been further quantified.

Vessel-to-Structure Collision

In good conditions the wind farm should be visible, especially as most activity occurs during daylight hours. In this case, vessels, if competently skippered, will be able to navigate safely to avoid the structures. Even if a vessel were to get into difficulty, most should be able to keep clear of the structures or anchor or moor if necessary to avoid drifting closer to the wind farm whilst they fix the problem or call for assistance.

The main risk of collision is considered to be in bad weather, especially poor visibility, where a recreational craft could fail to see the wind farm and inadvertently end up closer than intended.

If there were poor visibility combined with adverse weather and/or strong tides, the vessel may not be able to anchor.

The risk of recreational craft being in the area during bad weather is reduced by the fact that most craft are fitted with radio receivers and VHF so will be able to listen to regular broadcasts of the weather forecast by the BBC and Coastguard. It is also standard practice for local clubs to post weather forecasts on notice boards.

In the event of a recreational craft being in proximity to the wind farm in bad weather, a craft unable to make way from the wind farm and at risk of collision may alert the Coastguard using mobile phone, VHF or visual signals such as flares.

To minimise the risk of collision in this worst-case scenario, mitigation in line with regulator guidance will be put in place. It will be ensured, consistent with the requirements of Trinity House, that the structures are marked in such a way as to enhance the prospect of visual observation by passing recreational craft even in adverse conditions.

The Operator will also ensure notification of the development to the recreational craft community is widespread and effective throughout all phases.

These measures mean that whilst the collision risk cannot be completely eliminated it will be reduced to a level as low as reasonably practicable. In terms of consequences, most collisions with the WTGs should be relatively low speed and hence low energy. If the seaworthiness of the recreational craft was threatened by the impact, the WTGs will be equipped with access ladders for use in emergency, placed in the optimum position taking into account the prevailing wind, wave and tidal conditions, as required by the MCA. This should provide a place of safety/refuge until such time as the rescue services arrive.

14.4 Cable Interaction – Anchor and Trawl

All of the subsea cables associated with the wind farm development, both inter-array and export cables, will be buried or trenched where sea bed conditions allow in order to provide protection from all forms of hostile seabed interaction, such as fishing activity, anchoring and dropped objects. There will be periodic inspections/surveys to ensure that the cables do not become exposed. They will be marked on Admiralty Charts, although whether all submarine cables are charted depends on the scale of the chart; in some cases only the export cable may be shown.

The export cable corridor runs from the northern boundary of the Rampion site to the proposed cable landfall at East Worthing. The charted anchorage off Shoreham lies to the east of the proposed cable corridor, following changes made to the corridor in order to minimise the impact on current anchoring practices. Based on analysis of long term AIS data (see Section 8.6) the vast majority of anchoring activity off Shoreham is outside the export cable corridor, in close proximity to the charted anchorage and pilot station. Cable protection and burial should be explored to decrease the likelihood of anchor dragging over or snagging on the export cables.

Fishing activity varies across the cable corridor. In proximity to the Rampion Offshore Wind Farm site the predominant fishing activities are demersal (beam) trawling and scallop dredging, whilst fishing vessels in closer proximity to the shore include gill netters and potters/whelkers. Fishing vessels were also recorded in the area steaming to local ports.

It is therefore assumed that the cable will be suitably protected for the sea bed conditions and principally the fishing methods in the area through burial / trenching, information promulgation, fisheries liaison and periodic inspection.

If it is necessary for cables to be protected by rock berms, concrete mattresses or other protection which lies clear of the surrounding seabed, the impact on navigation and the requirement for appropriate mitigation measures will be assessed. Any reduction in navigable water depth resulting from cable protection measures will be marked with aids to navigation where necessary, in accordance with Trinity House requirements.

14.5 Future Case Level of Risk

14.5.1 Shipping

The main factors that are likely to influence the future levels and composition of shipping in the vicinity of the proposed wind farm are the traffic using the westbound TSS lane and the associated ITZ, and shipping headed to local ports (i.e., Shoreham and Newhaven).

A summary of the main ports and developments which have or are likely to influence future shipping levels within the area are provided below:

- There has recently been an increase in the number of vessels visiting Shoreham Port with new contracts for the import of timber and the export of biomass, as noted in the consultation section (Section 5.6.1).
- It was also noted that the new power station to be built at Shoreham would result in approximately 1 tanker per week bringing waste oil into Shoreham.
- A steel processing plant and distribution facility is under construction at Shoreham Port, and it is expected that steel imports will increase with the opening of the new facility.

The key westbound TSS route passing to the south of the wind farm is used by a number of ship types. A wide range of factors are likely to influence the vessel activity in the area including the global economy/trade of goods, and national/regional offshore developments (i.e. renewable energy projects).

It has been conservatively assumed that over the life of the wind farm development, there will be a 10% increase in shipping movements.

14.5.2 Fishing

The Commercial Fisheries Assessment (Ref. xi) considered the potential changes to the fishing baseline over the life of the development. It is recognised this is a speculative exercise due to numerous unpredictable, direct and indirect factors which can materially affect fisheries.

The future level of activity has been assumed to increase by 10% compared to current levels to demonstrate potential impacts.

14.5.3 Recreational

In terms of recreational craft activity, there are no major developments known of that will increase the activity of these vessels in the area.

It was suggested at the Hazard Review Workshop that the WTGs could attract sport angling and sport diving to the site as the wind farm may protect fish stocks and other marine life. There is also the possibility that the wind farm could attract sightseers, given the proximity to the shore. However, these vessels would likely be local craft from nearby harbours with a degree of local sailing experience.

Based on the discussion presented, the future level of activity has been assumed to increase by 10% compared to the current levels.

14.5.4 Collision Probabilities

The potential increase in vessel activity levels would increase the probability of ship-to-structure collisions (both powered and drifting). Whilst in reality the risk would vary by vessel type, size and route, it is roughly estimated this would lead to a linear 10% increase in the base case collision risks.

The increased activity would also increase the probability of vessel-to-vessel encounters and hence collisions. Whilst this is not a direct result of the proposed wind farm, the increased congestion caused by the site and potential displacement of traffic in the area may have an influence. Again, a 10% overall increase is assumed.

14.6 Risk Results Summary

The base case and future case annual levels of risk without and with the proposed offshore wind farm are summarised in Table 14.4 and Table 14.5. The change in risk is also shown, i.e., the estimated collision risk with the wind farm minus the baseline collision risk without the wind farm (which is zero except for vessel-to-vessel collisions).

Table 14.4 Summary of results – Scenario 1

Collision Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	1.9E-04	1.9E-04	--	2.1E-04	2.1E-04
Passing Drifting	--	8.5E-05	8.5E-05	--	9.4E-05	9.4E-05
Vessel-to-Vessel	1.2	1.2	1.5E-03	1.4	1.4	1.6E-03
Fishing	--	1.5E-01	1.5E-01	--	1.7E-01	1.7E-01
Total	1.2	1.4	1.5E-01	1.4	1.5	1.7E-01

Table 14.5 Summary of results – Scenario 2

Collision Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	2.0E-04	2.0E-04	--	2.2E-04	2.2E-04
Passing Drifting	--	1.0E-04	1.0E-04	--	1.1E-04	1.1E-04
Vessel-to-Vessel	1.2	1.2	7.5E-04	1.4	1.4	8.3E-04
Fishing	--	1.5E-01	1.5E-01	--	1.7E-01	1.7E-01
Total	1.2	1.4	1.5E-01	1.4	1.5	1.7E-01

A summary of the annual collision risk for the two indicative scenarios is presented in Figure 14.9.

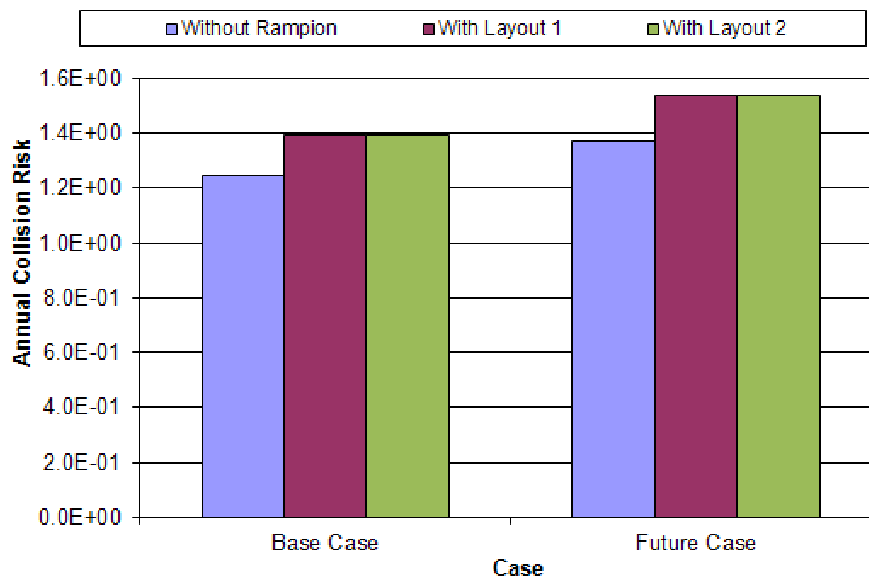


Figure 14.9 Summary of Annual Collision Risk Results

In the worst case (Scenario 1) the overall annual level of collision risk is estimated to increase due to the proposed development by approximately 1 in 7 years (base case) and 1 in 6 years (future case). The vast majority of this risk is from fishing vessel collisions.

14.7 Consequences

The probable outcomes for the majority of hazards are expected to be minor. However, the worst case outcomes could be severe, including events with potentially multiple fatalities.

A collision involving a larger ship is likely to result in collapse of a WTG with limited damage to the ship. Breach of a ship's fuel tank is considered unlikely and in the case of vessels carrying hazardous cargoes, e.g., tanker or gas carrier, the additional safety features associated with these vessels would further mitigate the risk of pollution (for example double hulls). Similarly, in a drifting collision the proposed wind farm structures are likely to absorb the majority of the impact energy, with some energy also being retained by the vessel in terms of rotational movement (glancing blow).

In terms of smaller vessels such as fishing and recreational craft, the worst case scenario would be risk of vessel damage leading to foundering of the vessel and potential loss of life.

A quantitative assessment of the potential consequences of collision due to the proposed wind farms is presented in Appendix B. This applies the site-specific collision frequency results presented above with estimated outcomes in terms of fatalities on-board and oil pollution from the vessel based on research into historical collision incidents (MAIB, ITOPI, etc.). The results are summarised in Table 14.6.

Table 14.6 Annual predicted change in Potential Loss of life (PLL) due to Rampion

	Scenario 1	Scenario 2
Base Case PLL (fatalities per year)	5.3E-03	5.3E-03
Future Case PLL (fatalities per year)	5.8E-03	5.8E-03

For the worst case WTG layout (Scenario 1) the overall increase in PLL estimated due to the development is 5.3×10^{-3} fatalities per year (base case), which equates to one additional fatality in 189 years. This is a small change compared to the MAIB statistics which indicate an average of 29 fatalities per year in UK territorial waters.

In terms of individual risk to people, the incremental increase for commercial ships (in the region of 10^{-8}) is very low compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

Similarly, for fishing vessels, whilst the change in individual risk attributed to the development is higher than for commercial vessels (in the region of 10^{-4}), it is relatively low compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

Therefore, the incremental increase in risk to both people and the environment caused by the proposed wind farm developments is estimated to be low.

15. CONSTRUCTION AND DECOMMISSIONING IMPACTS

15.1 Introduction

This study has primarily focused on the operational and maintenance phase of the proposed Rampion Offshore Wind Farm, however, it is recognised that there will be additional potential impacts during the construction and decommissioning phases of the project.

In general, whilst the same hazards apply as during operational and maintenance, there are additional hazards which are distinctly associated with these phases of the project and require different risk control measures.

15.2 Hazards during Construction/Decommissioning

During the construction/decommissioning phase there will be an increased level of vessel activity within the Rampion wind farm site and along the cable corridor.

The presence of construction vessels within the area is likely to pose an additional navigational risk, although such vessels can also provide on-site response and mitigation. The main hazards associated with construction/decommissioning which have been identified over and above those associated with all phases (i.e., where the same risk control measures and emergency response will apply during all phases) are listed below:

- Construction vessel collision with another vessel on-site;
- Construction vessel collision with structure;
- Construction vessel collision with passing vessel en route to or from site;
- Construction vessel encounters (jack-ups or anchors on) underwater obstruction (e.g., cable, pipeline etc);
- Construction vessel jacks-up or anchors onto unexploded ordnance;
- Man overboard during personnel transfer operations; and
- Dropped object during major lifting operations.

It is noted that to a large extent the hazards will depend on the vessels and procedures which are to be used for these operations. This will not be known in detail until the structures, construction methods and vessels/contractors have been selected. It is therefore planned that hazard/risk assessment workshops be carried out as part of the project-planning process. The objective of the workshops will be to identify all of the different activities which will be taking place and identify any potential hazards as well as appropriate mitigation measures and operating procedures relevant to the selected vessels and construction methods.

An example measure might be that, wherever possible, construction vessels would follow prescribed transit corridors. These corridors would be defined in consultation with local maritime stakeholders.

The suggested compositions for the workshops are as follows:

- Project Team;
- Contractor Representatives (e.g., barges, cable-laying);
- Harbour Representatives;
- HM Coastguard (MCA);
- Fishing Representative;
- Recreational Craft Representative; and
- RNLI Representative.

This process will build mutual understanding of the activities and operating constraints of the different parties involved and allow effective procedures to be developed. Separate workshops should be held for each phase of the project as well as for distinct activities.

It is noted that the construction company appointed will have their own internal health and safety procedures that they will adhere to during the work, providing additional security. Experience and lessons learned from the construction of other offshore wind farm projects will also be considered prior to the Rampion Offshore Wind Farm being constructed. The same process will apply during the decommissioning phase of the project.

15.3 Risk Control/Mitigation during Construction/Decommissioning

Details of risk control/mitigation measures which will apply during these phases of the work are summarised in Section 21.

16. IMPACT ON MARINE RADAR SYSTEMS

16.1 Introduction

In 2004 the MCA conducted trials at the North Hoyle wind farm off North Wales to determine any impact of WTGs on marine communications and navigations systems (Ref. iii).

The trials indicated that there is minimal impact on VHF radio, Global Positioning Systems (GPS) receivers, cellular telephones and AIS. UHF and other microwave systems suffered from the normal masking effect when WTG were in the line of the transmissions.

This trial identified areas of concern with regard to the potential impact on ship borne and shore based Radar systems. This is due to the large vertical extent of the WTG returning Radar responses strong enough to produce interfering side lobe, multiple and reflected echoes (ghosts). This has also been raised as a major concern by the maritime industry with further evidence of the problems being identified by the Port of London Authority around the Kentish Flats offshore wind farm in the Thames Estuary. Based on the results of the North Hoyle trial, the MCA produced a wind farm/shipping route template (see Section 2.2) to give guidance on the distances which should be established between shipping routes and offshore wind farms.

A second trial was conducted at Kentish Flats on behalf of BWEA (Ref. iv). The project steering group had members from BERR, the MCA and the Port of London Authority (PLA). The trial took place between 30 April and 27 June 2006. This trial was conducted in Pilotage waters and in an area covered by the PLA VTS. It therefore had the benefit of Pilot advice and experience but was also able to assess the impact of the generated effects on VTS Radars.

The trial concluded that:

- The phenomena referred to above detected on marine Radar displays in the vicinity of wind farms can be produced by other strong echoes close to the observing ship although not necessarily to the same extent.
- Reflections and distortions by ships structures and fittings created many of the effects and that the effects vary from ship to ship and Radar to Radar.
- VTS scanners static Radars can be subject to similar phenomena as above if passing vessels provide a suitable reflecting surface but the effect did not seem to present a significant problem for the PLA VTS.
- Small vessels operating in or near the wind farm were detectable by Radar on ships operating near the array but were less detectable when the ship was operating within the array.

16.2 Impact on Collision Risk

The potential Radar interference is mainly a problem during periods of bad visibility when mariners may not be able to visually confirm the presence of other vessels in the vicinity (i.e.

those without AIS installed which are usually fishing and recreational craft). It is noted that the Rampion site is in an area of relatively high fishing vessel and recreational craft activity, and that during the maritime traffic surveys, 61% of all vessels tracked with the Rampion site were recorded on Radar only.

Based on the trials carried out to date the onset range from the WTGs of false returns is about 1.5nm, with progressive deterioration in the Radar display as the range closes.

Figure 16.1 and Figure 16.2 present the combined 28 days of survey tracks relative to the proposed site, based on two indicative layouts. 500m, 1.5nm and 2nm buffers have been applied around each WTG location to illustrate current passing distances.

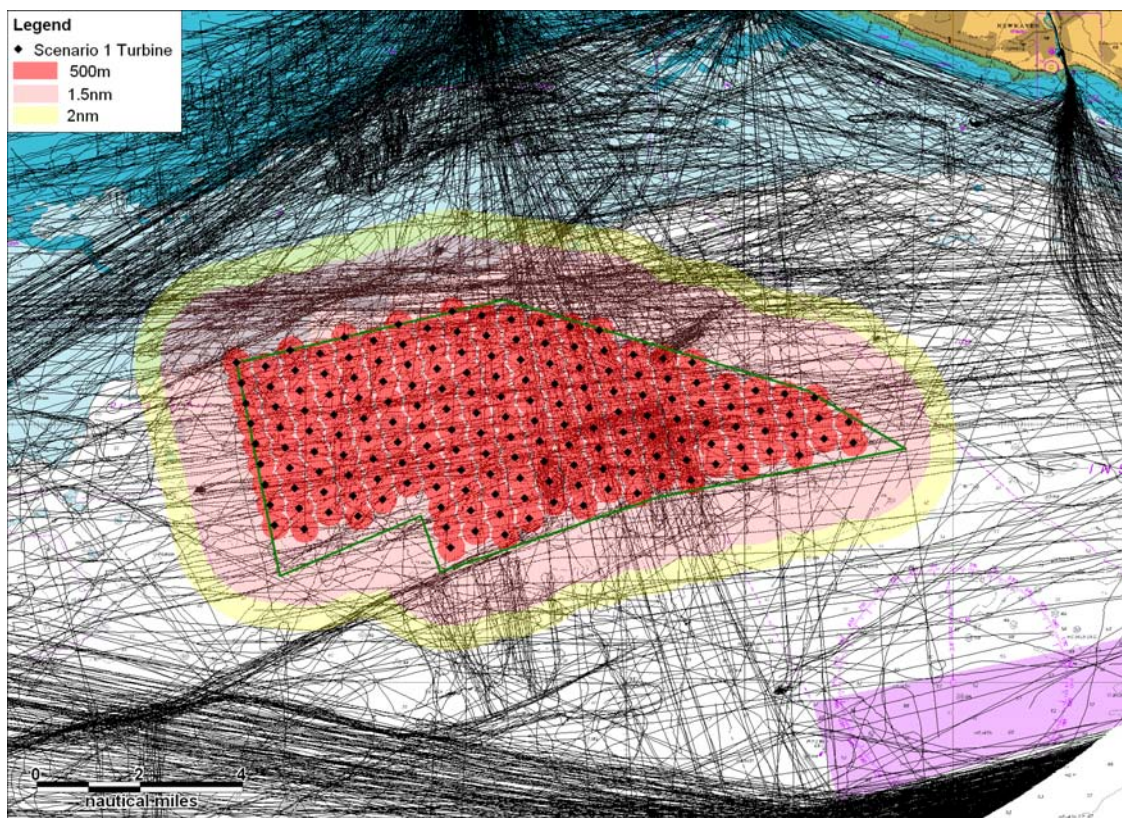


Figure 16.1 Scenario 1 Buffer Zones versus Current Shipping Tracks (28 days)

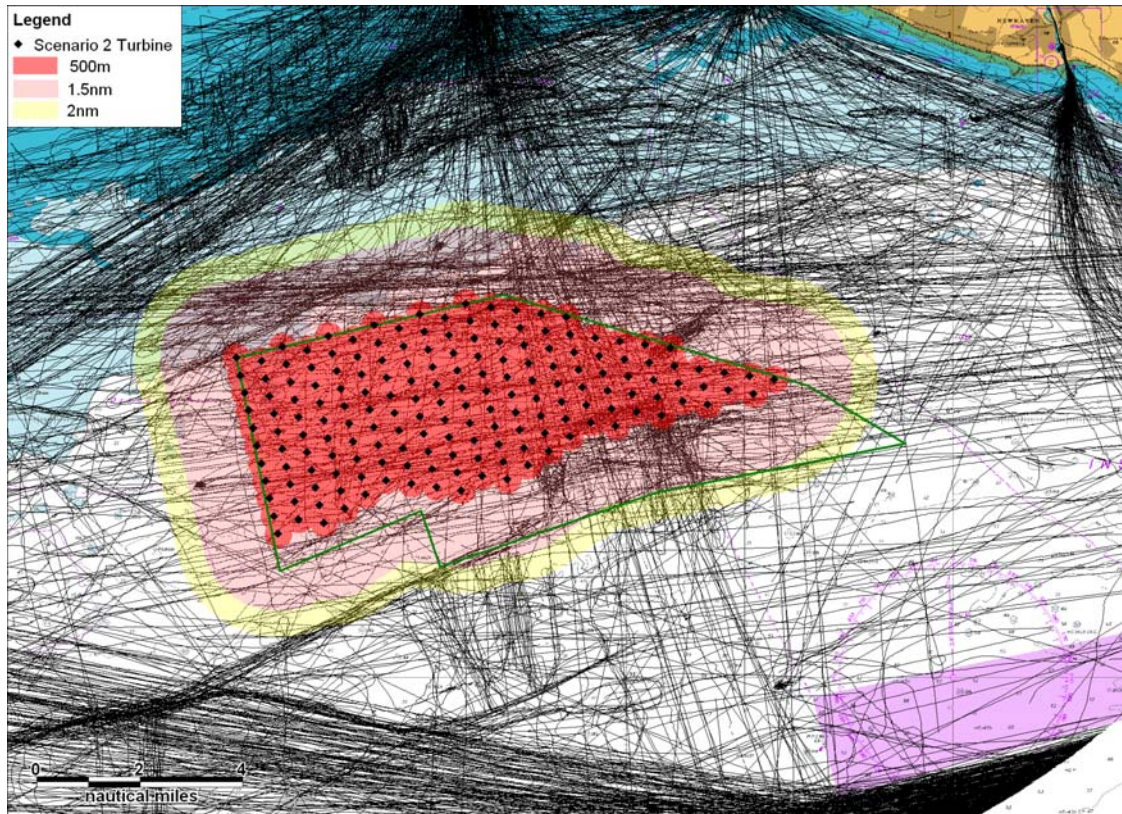


Figure 16.2 Scenario 2 Buffer Zones versus Current Shipping Tracks (28 days)

It can be seen that, at present, a number of fishing vessels and recreational craft, as well as commercial vessels associated with Shoreham, Newhaven and routeing through the inshore Traffic Zone pass inside the 1.5nm range from WTG at which Radar interference could be experienced. It is noted that following the development of the site, commercial vessels are likely to pass 1 to 1.5nm from the wind farm boundary, thereby subject to Radar interference. However, on all sides of the wind farm there is sea room available for vessels to increase their clearance, should they consider it necessary.

In addition, Radar interference could be experienced by dredgers operating at the nearest licensed aggregates dredging areas to the west of the site, as well as any future dredging operations within what is currently a pre application area intersecting the southwest part of the site.

Experienced mariners should be able to suppress the observed problems to an extent and for short periods (a few sweeps) by careful adjustment of the receiver amplification (gain), sea clutter and range settings of the Radar. However, there is a consequent risk of losing targets with a small Radar cross section, which may include buoys or small craft, particularly yachts or Glass Reinforced Plastic (GRP) constructed craft, therefore due care is needed in making such adjustments. The Kentish Flats study observed that the use of an easily identifiable reference target (a small buoy) can help the operator select the optimum Radar settings.

The performance of a vessel's automatic Radar plotting aid (ARPA) could also be affected when tracking targets in or near the wind farm. However, although greater vigilance is required, it appears that during the Kentish Flats trials, false targets were quickly identified as such by the mariners and then the equipment itself.

The evidence from mariners operating in the vicinity of existing wind farms is that they quickly learn to work with and around the effects. The MCA have produced guidance to mariners operating in the vicinity of UK OREIs which highlights Radar issue amongst others to be taken into account when planning and undertaking voyages in the vicinity of offshore renewable energy installations (OREIs) off the UK coast (Ref. xiv).

AIS information can also be used to verify the targets of larger vessels, generally ships above 300 tonnes, however small fishing and recreational craft are increasingly utilising the cheaper Class B AIS units.

Further, Directive 2009/17/EC of the European Parliament and of the council of April 23 2009 amended Directive 2002/59/EC. One of the main amendments made related to the use of AIS on fishing vessels, which is addressed through the insertion of Article 6a:

Use of automatic identification systems (AIS) by fishing vessels.

Any fishing vessel with an overall length of more than 15 metres and flying the flag of a Member State and registered in the Community, or operating in the internal waters or territorial sea of a Member State, or landing its catch in the port of a Member State shall, in accordance with the timetable set out in Annex II, part I (3), be fitted with an AIS (Class A) which meets the performance standards drawn up by the IMO.

Fishing vessels equipped with AIS shall maintain it in operation at all times. In exceptional circumstances, AIS may be switched off where the master considers this necessary in the interest of the safety or security of his vessel.

The timetable set out in Annex II, part 1(3) is as follows:

Fishing vessels with a length of more than 15 metres overall are subject to the carrying requirement laid down in Article 6a according to the following timetable:

- fishing vessels of overall length 24 metres and upwards but less than 45 metres: not later than 31 May 2012,
- fishing vessels of overall length 18 metres and upwards but less than 24 metres: not later than 31 May 2013,
- fishing vessels of overall length exceeding 15 metres but less than 18 metres: not later than 31 May 2014.

New built fishing vessels of overall length exceeding 15 metres are subject to the carrying requirement laid down in Article 6a as from 30 November 2010.'

Beyond this it is noted from a number of surveys Anatec has been carrying out on the United Kingdom Continental Shelf (UKCS) that the number of fishing vessels using AIS has increased significantly over the last two years.

17. CUMULATIVE AND IN-COMBINATION EFFECTS

17.1 Cumulative Effects

The West Isle of Wight Zone (Zone 7) is approximately 40nm to the west of the Rampion site. The proposed Navitus Bay wind farm site lies within the northern part of the zone and is over 50nm from the Rampion site boundary, as shown in Figure 17.1.

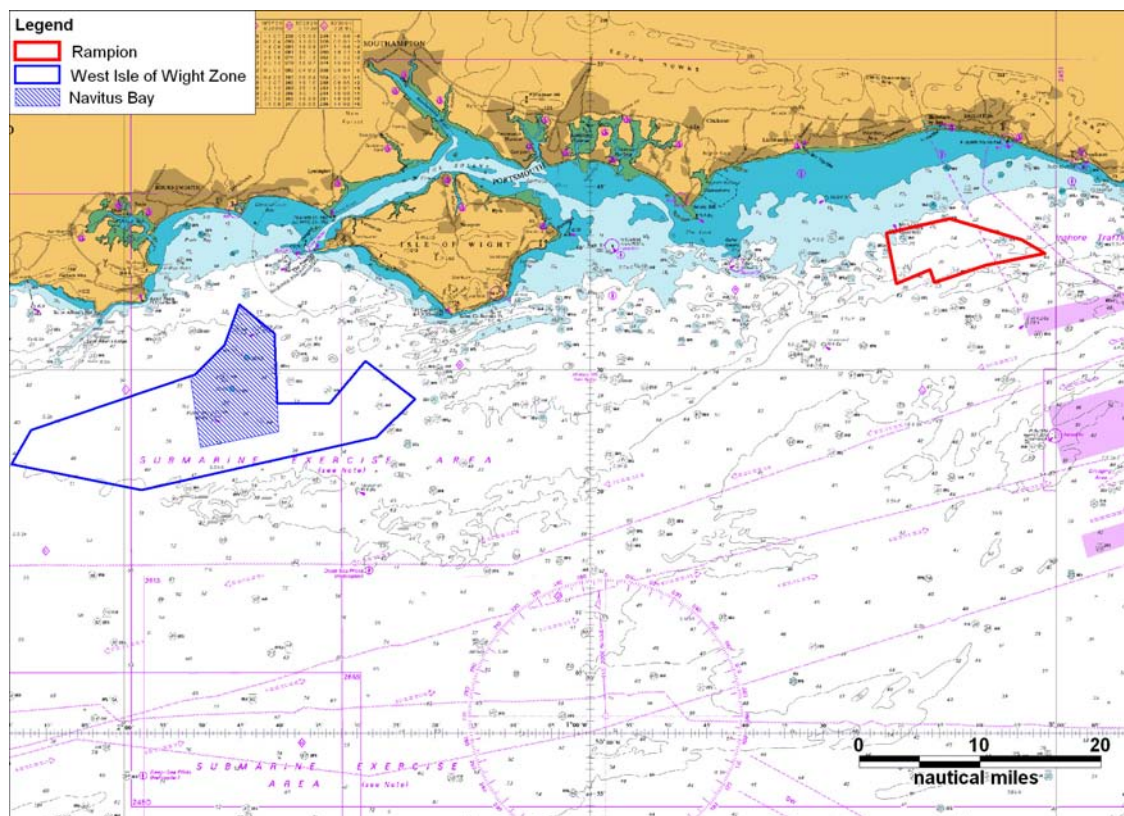


Figure 17.1 Navitus Bay and Rampion Wind Farm Sites

Of the routes identified from the maritime traffic surveys that will be required to deviate from Rampion (Section 9), the traffic routing through the ITZ and passing east/west through Rampion is the route for which there are potential cumulative impacts due to Rampion and Navitus Bay. This route includes vessels associated with the Solent (which will not be impacted by Navitus Bay) and vessels passing south of the Isle of Wight which could be cumulatively impacted.

Seven days of vessel track data (AIS only) from August 2011 for the Rampion and Navitus Bay area is presented in Figure 17.2.

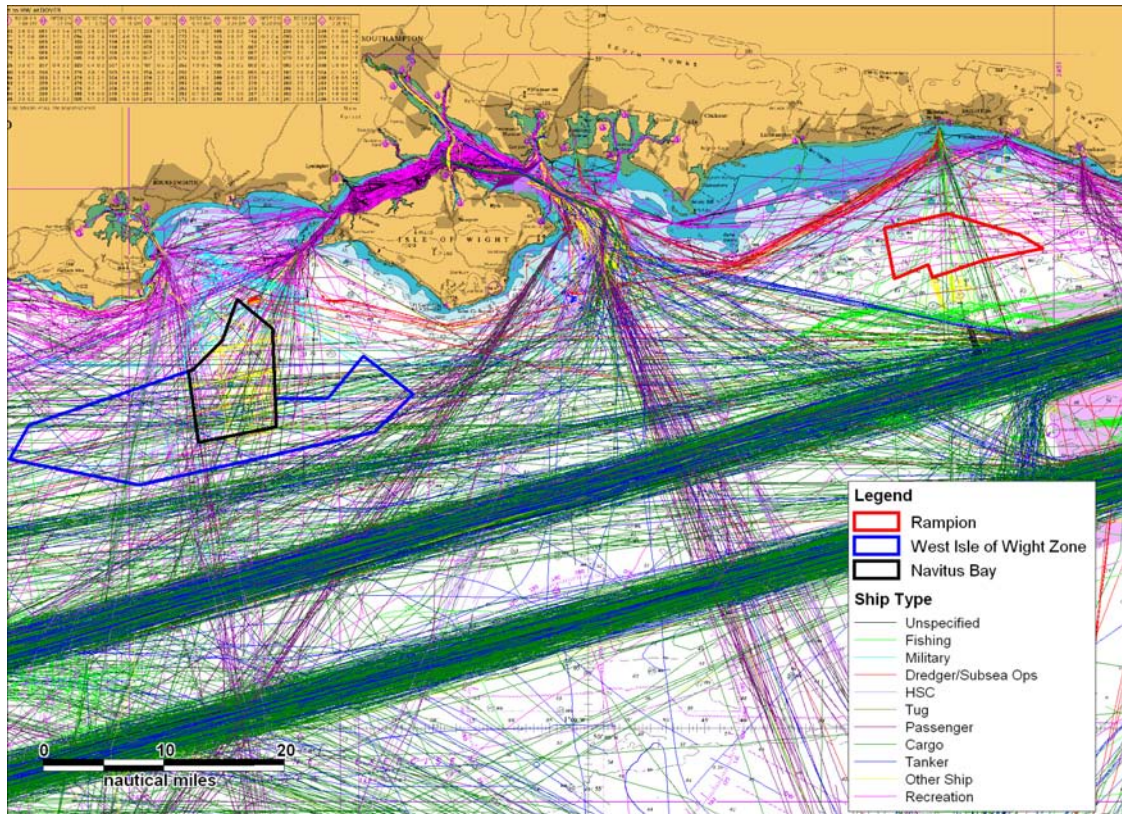


Figure 17.2 AIS Data (7 days – August 2011) relative to Rampion and Navitus Bay

It can be seen that a relatively low level of traffic transits through or in proximity to both sites and will therefore be cumulatively impacted by the two proposed wind farm sites.

A proportion of vessels routeing east / west along the coast are recreational craft. The recreational cruising routes in the area, based on the RYA data are presented in Figure 17.3.

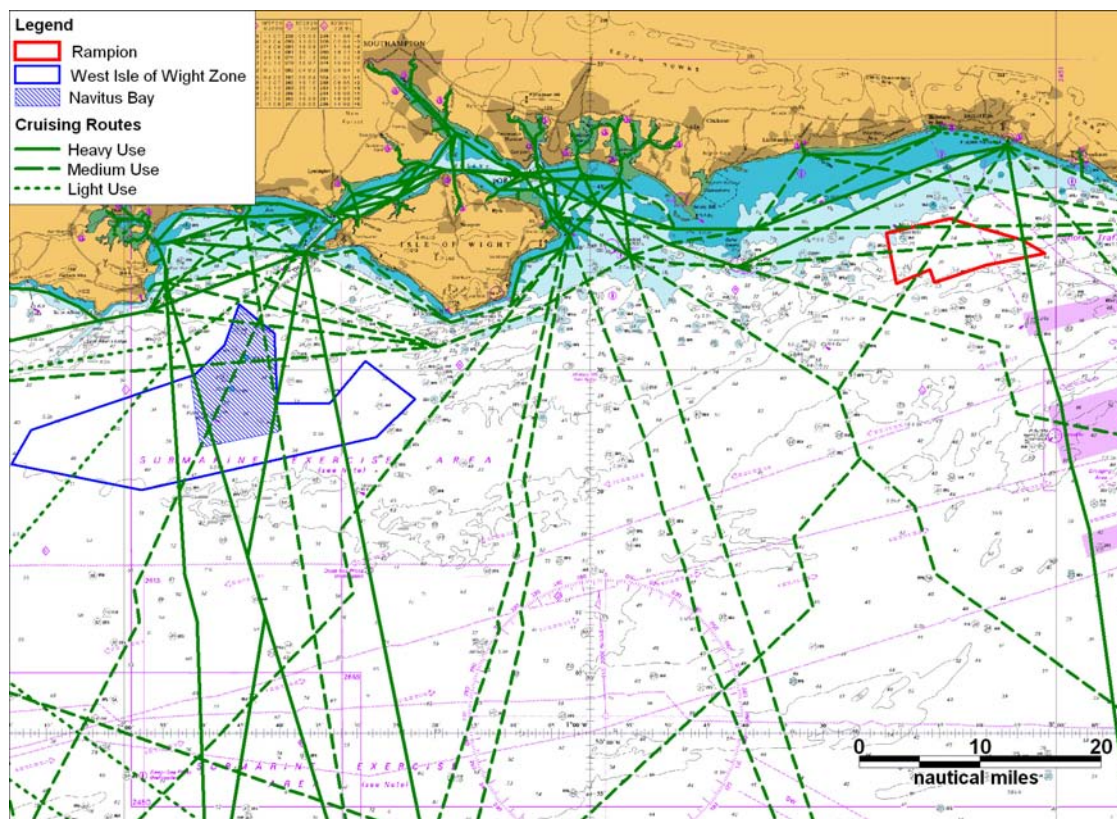


Figure 17.3 RYA Cruising Routes relative to Rampion and Navitus Bay

An average track routeing off Beachy Head, within the ITZ and passing south of the Isle of Wight will be displaced by both wind farm sites. However, assuming vessels will be able to pre-plan their revised passage in advance of encountering the wind farms, it is considered that vessels can route either inshore or offshore of the proposed developments with only a small increase in route length.

Recreational craft routes passing east/west through Rampion and passing to the south of the Isle of Wight could also be cumulatively impacted. As with commercial vessels, recreational craft are likely to be able to route around both sites with only small increases in route lengths. Since recreational craft are likely to be able to navigate between the WTGs within the wind farms, cumulative effects on recreational activities are not considered to be significant.

In addition to the Navitus Bay site, a number of offshore wind farms off the coast of northern France (Le Tréport, Fécamp & Courseulles-Sur-Mer) are in the planning process and have the potential to result in cumulative impacts together with the Rampion Offshore Wind Farm. In terms of commercial vessel routeing, a small proportion of vessels associated with Shoreham routeing north/south through the Rampion site (see Section 9.1) are headed to/from ports in northern France, e.g., Rouen, Fécamp and Le Tréport. There will be additional deviations for vessels routeing between Shoreham and Fécamp or Le Tréport, due to the proposed wind farms off the French coast. However, these are not frequently used routes.

Rampion and the Fécamp wind farm could also result in cumulative impacts on the routing of recreational craft. Cross channel races from Shoreham and Brighton to Fécamp would be displaced by both sites, as it is considered unlikely that any races would pass through the wind farms (based on consultation and the Hazard Review Workshop). It was noted at the workshop that deviations could potentially lengthen the course, leading to races not being completed within the hours of daylight.

17.2 In-Combination Effects

During consultation for the Rampion project, the separation from the southern boundary of the site, TSS lane to the south and the associated reduction in available sea room was noted as an issue for vessels using the Inshore Traffic Route.

A detailed plot showing the vessel tracks recorded during the 14 day maritime traffic survey in July 2011 at the termination point of the ITZ is presented in Figure 17.4. Only the summer survey data is presented since users of the ITZ include recreational craft.

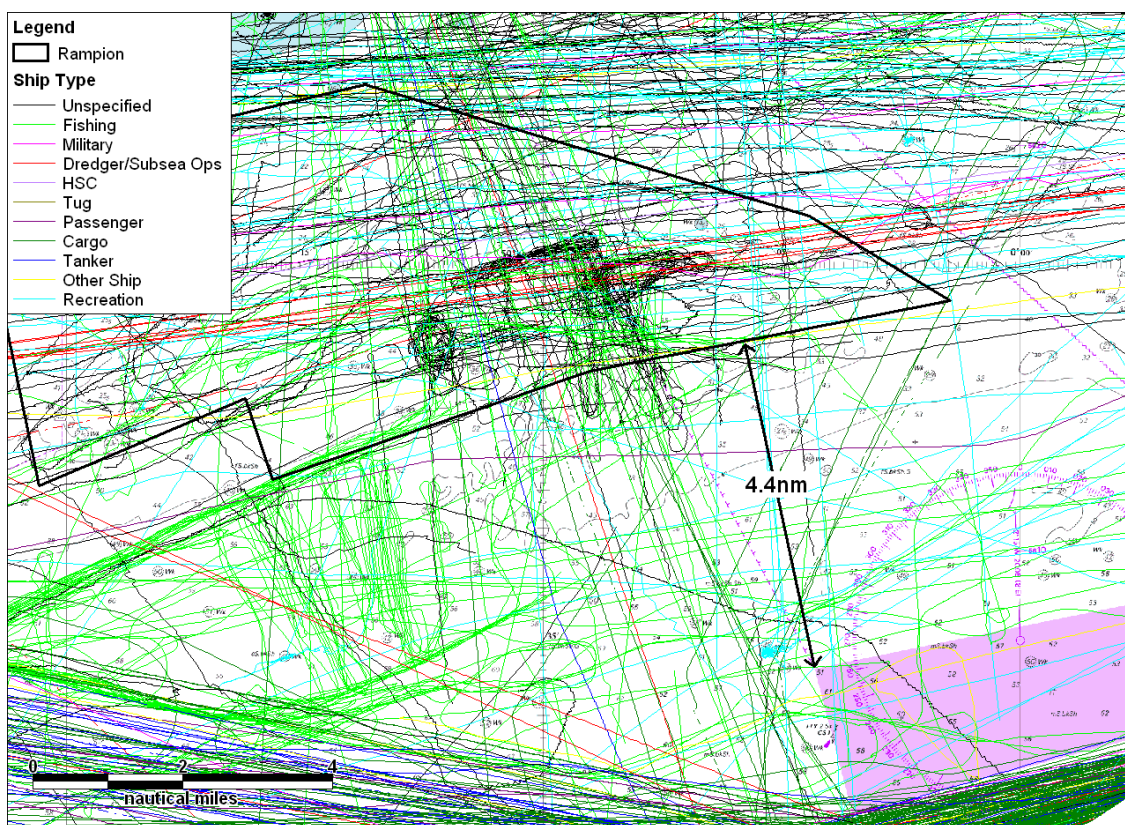


Figure 17.4 AIS and Radar at the Termination Point of the ITZ (14 days, January 2011)

It can be seen that relatively few vessels routing east / west within the ITZ currently pass between the site's southern boundary and the Traffic Separation Zone (an average of 1 to 2 vessels per day). The analysis of vessel to vessel encounters (Section 14.2.1) also showed a low level of encounters in this area.

Following the development of the Rampion site, the number of vessels routeing to the south of the Rampion site is expected to increase as it is anticipated that a proportion of east/west traffic will be displaced to the south of the site (see Section 9.2).

During the summer survey an average of 6 vessels per day routeing east/west within the ITZ passed through the Rampion site, with a proportion of this traffic expected to pass to the south of the site, post development. The resulting increase in the number of vessels routeing to the south of the site could lead to an increase in vessel-to-vessel encounters, and ultimately collisions (the increase in vessel-to-vessel collision risk resulting from the proposed development has been quantified in Section 14.3.1).

The distance between the site and the traffic separation zone (4.4nm) is considered to be adequate for the relatively low level of shipping in the area, and the in-combination impact is therefore considered to be minor. It is noted that the impact of the Rampion site in terms of the reduction in sea room within the ITZ has been mitigated by the change in site boundary described in 3.2.

18. Safety Zones

18.1 Construction/Decommissioning Phases

The NRA assessment was primarily focused on the operational phase of the project. However, it is identified that during the construction and decommissioning phases of the Rampion Offshore Wind Farm there will be large construction vessels, working personnel and support craft in operation within and around the wind farm and export cable. Further, heavy lifting, piling and cable laying operations will be carried out which have inherent dangers.

In addition the cost of operating construction vessels, and the cost of delay can be significant. A means of controlling third party navigation during these periods of high activity is required. Without this it will not be possible to exclude vessels and carry out their offshore operations in a controlled manner.

Therefore, to ensure the personnel carrying out these activities and those navigating in this sea area are not exposed to unnecessary risk, 500m safety zones will be applied for around each WTG or their foundations whilst work is being performed. This will provide a means of regulating the rights of navigation so as to preserve the safety of those working in the wind farm and those on board other vessels that may be navigating in this area.

The safety zones are likely to apply to all vessel types not involved in the wind farm operations. These would be applied for in line with DECC guidance notes (authored whilst under the name of BERR [Department for Business, Enterprise and Regulatory Reform]) (Ref. xv) and the required level of consultation would be held.

During the construction and decommissioning phases, vessels will be nominated to monitor the safety zone(s) and guard against safety zone infringements. Procedures will also be established to ensure that any infringements are formally reported in line with the regulatory requirements.

18.2 Operational Phase

During normal operations the working activities will be limited to general and emergency maintenance work and as such the benefits and requirements for safety zones were reassessed giving account to the working vessels likely to be present within and around the wind farm. These vessels will generally be smaller than those involved in the construction phases of the project, therefore safety zones are not considered necessary by the developer during normal operation.

In terms of third-party vessels, it is considered that the majority of merchant ships would elect not to pass between WTGs due to the limited sea room. However, it is anticipated that a number of recreational craft and fishing vessels may choose to pass between WTGs. It will be up to individual Masters, taking into account the prevailing weather and sea conditions, to decide whether it is safe to navigate, or fish, within the WTG array.

At present no operational safety zones are planned for the Rampion Offshore Wind Farm.

18.3 Summary

The safety zones planned for the project are as follows:

- Construction/Decommissioning:
 - 500m rolling safety zones to prevent vessels not associated with the development work from interfering with the active construction site.
- Operation:
 - No safety zones.

The existence of safety zone will be published electronically and via Notices to Mariners.

19. Search and Rescue (SAR)

19.1 Introduction

This section summarises the existing Search & Rescue resources in the region and the issues being considered in relation to the design of a wind farm site within the Rampion site.

(A detailed review of the historical incidents in the area, including RNLI launches, has been presented in Section 7.)

19.2 SAR Resources

19.2.1 SAR Helicopters

A review of the assets in the area of the Rampion site indicated that the closest SAR helicopter base is located at Lee-on-Solent, operated by the Maritime and Coastguard Agency (MCA), approximately 32.5nm to the WNW of the Rampion site. This base has AW139 helicopters with a maximum speed of 150 mph and a radius of action of approximately 210nm which easily covers the Rampion development. One helicopter is available at 15 minutes readiness between 0730 and 2100 hours. Between 2100 and 0730 hours, one helicopter is held at 45 minutes readiness.

The SAR helicopters are equipped for full day/night all weather operations over sea and limited night overland capability (some limitations exist with regard to freezing conditions, but in general terms the helicopters are all weather capable).

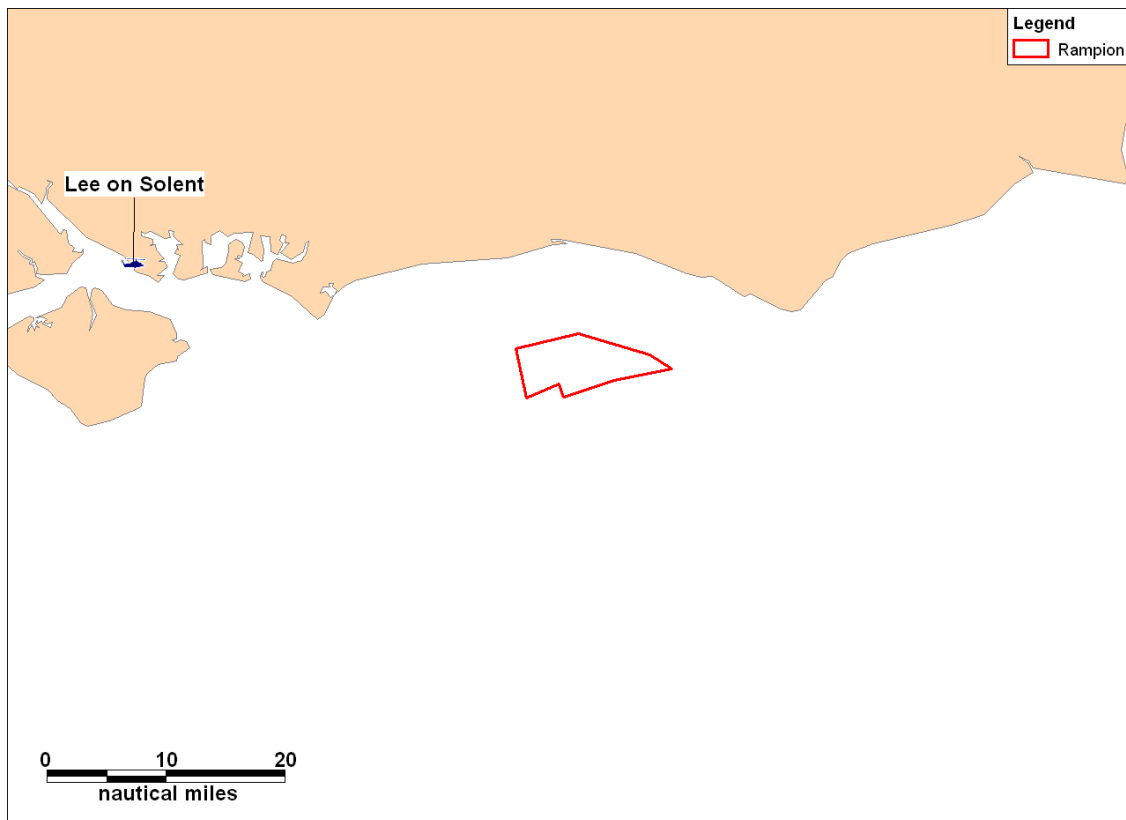


Figure 19.1 SAR Helicopter Bases relative to the Rampion Site

Based on the above information, the day-time response to the wind farm will be approximately 30 minutes. At night time this will increase by 30 minutes to approximately 1 hour due to the additional response time at the base. It is noted that these calculations are based on still air and will vary depending on the prevailing conditions.

19.2.2 RNLI Lifeboats

The Royal National Lifeboat Institution maintains a fleet of over 400 lifeboats of various types at 235 stations round the coast of the UK and Ireland.

The RNLI stations in the vicinity of the Rampion site are presented in Figure 19.2.

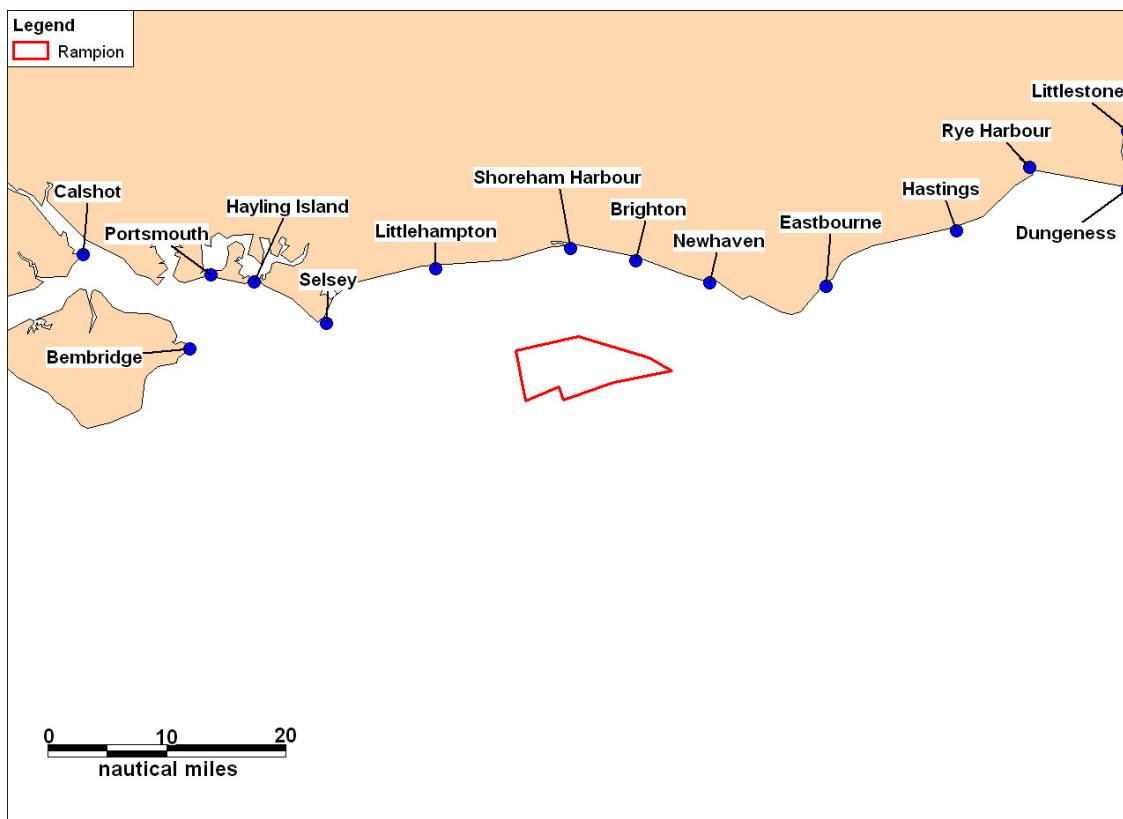


Figure 19.2 RNLI Bases relative to the Rampion Site

At each of these stations crew and lifeboats are available on a 24-hour basis throughout the year. Table 19.1 provides a summary of the facilities at the stations closest to the Rampion site.

Table 19.1 Lifeboats Held at nearby RNLI stations

Station	Lifeboats	ALB Spec	ILB Spec	Distance to Site Boundary
Shoreham Harbour	ALB & ILB	Tamar	D Class	7.4nm
Brighton	ILB	-	B Class	7.4nm
Newhaven	ALB	Severn	-	7.9nm
Littlehampton	ILB (x 2)	-	B Class D Class	9.5nm

Based on the offshore position of the development it is likely that ALBs would respond to an incident within the Rampion site from Shoreham and Newhaven. This is confirmed when reviewing the historical incident data, with ALBs responding to 82% of incidents within the Rampion site from 2001 to 2010 (see Section 7.3).

The Tamar class lifeboat has a maximum speed of 25 knots and a 250nm range. All-weather lifeboats are fitted with the latest in navigation, location and communication equipment, including electronic chart plotter, VHF radio with direction finder, Radar and global positioning systems (GPS).

The Severn class lifeboat is similar to the Tamar class, but is 1m longer in length. This vessel has a maximum speed of 25 knots and a 250nm range.

The B class lifeboat is small and highly manoeuvrable, making it ideal for rescues close to shore in fair to moderate conditions. It has a speed of 35 knots, range of 2.5 hours at maximum speed and is equipped with VHF radio and GPS.

The D class lifeboat, like the B class is small and highly manoeuvrable. It has a range of 3 hours at its maximum speed of 25 knots.

Response times vary but an average declared by RNLI is 14 minutes for all-weather lifeboats and 7 minutes for inshore lifeboats. This is the time from callout, i.e., first contact from the Coastguard to the lifeboat station to launch.

The time for an all-weather lifeboat to reach the Rampion site (taking into account a 14 minute call out time) from the nearest station at Shoreham Harbour would be approximately 32 minutes.

19.2.3 Changes to Coastguard Stations

MCA published a consultation document in December 2010 (Ref. xvi) in order to modernise HM Coastguard. The main part of the document proposes the reduction in the number of Maritime Rescue Co-ordination (MRCC) stations around the UK coastline.

Revised plans were released by the UK Government mid-way through 2011 (Ref. xvii) with a second consultation period from 14th July 2011 to 6th October 2011. Under the revised proposals the MCA intends to:

- Establish a single 24 hour Maritime Operations Centre (MOC) based in the Southampton/Portsmouth area with 96 operational coastguards. The MOC will act as a national strategic centre to manage Coastguard operations across the entire UK network as well as co-ordinating incidents on a day to day basis. The MOC will also generate a maritime picture using information from a variety of sources;
- Dover will be configured to act as a stand-by MOC for contingency purposes. Dover would have 28 staff and would retain its responsibilities for the Channel Navigation Information Service (CNIS);
- In addition to the MOC and Dover, there will be eight further centres, Maritime Rescue Sub-Centres (MRCS), all of which would be connected to the national

network and the MOC. All would be open 24 hours a day with a total staffing of 23 in each. These would be based at the following stations:

- MRSC Aberdeen
- MRSC Shetland
- MRSC Stornoway
- MRSC Belfast
- MRSC Holyhead
- MRSC Milford Haven
- MRSC Falmouth
- MRSC Humber

The station at London will be retained unchanged.

19.2.4 Effect of Changes to Coastguard Stations on the Proposed Site

The proposed wind farm currently lies within the East of England Region with the nearest rescue coordination centre being MRCC Solent. MRCC Solent's area of responsibility provides search and rescue coverage from Beachy Head to the Hampshire/Dorset Border.

The proposed changes to the UK MRCC structure will result in the Rampion site being in the area of responsibility of the MOC based in Southampton/Portsmouth. This will cover a much wider area of the south coast than the current MRCC Solent, and will also be the controlling centre for UK Coastguard operations; however it will continue to respond to any incidents within the Rampion site.

19.2.5 Salvage

Each MRCC holds comprehensive databases of harbour tugs available locally. Procedures are also in place with Brokers and Lloyd's Casualty Reporting Service to quickly obtain information on towing vessels that may be able to respond to an incident.

Emergency tug provision will generally be a contracted agreement between the vessel owners and tug operators. Coastguard Agreement on Salvage and Towage (CAST) will be invoked when owners are either unable or unwilling to engage in a commercial tow contract. MCA will pursue costs through arbitrators on a cost recovery basis.

The Emergency Response Co-operation Plan (ERCoP) for the Rampion wind farm will identify the developers methodology for obtaining towing vessels to assist any damaged/drifted vessels, and will include comprehensive identification of tugs that are capable of assisting and their base port.

19.3 Wind Farm SAR Matters

The wind farm will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site. These are laid out in Annex 5 of MGN 371 (Ref. ii).

This includes the development of an Emergency Response Co-operation Plan (ERCoP) for the wind farm, which will in place pre-construction.

Examples of features to be incorporated are as follows:

Design:

- All WTGs and other OREI individual structures will each be marked with clearly visible unique identification characters which can be seen by both vessels at sea level and aircraft (helicopters and fixed wing) from above.
- The identification characters shall each be illuminated by a low-intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision with it. The size of the identification characters in combination with the lighting will be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer, stationed 3 metres above sea levels, and at a distance of at least 150 metres from the WTG.

Operation:

- The Marine Control Centre, or mutually agreed single contact point, will be manned 24 hours a day.
- All MRCCs (MOC and/or MRCS) will be advised of the contact telephone number of the Central Control Room, or single contact point (and vice versa)
- The control room operator, or single contact point, will immediately initiate the shut-down procedure for WTGs as requested by the MRCC (MOC and/or MRCS), and maintain the WTG in the appropriate shut-down position, as requested by the MRCC (MOC and/or MRCS), until receiving notification from the MRCC that it is safe to restart the WTG.

19.3.1 Impact on SAR Helicopter Operations

There is the potential for the operational phase of the proposed wind farm to impact SAR helicopters, including access for SAR within the WTG arrays.

The wind farm site will be designed to satisfy the following requirements for emergency response in the event of a SAR, operation in or around the wind farms, as per MGN 371 (Ref. ii):

- The WTG shall have high contrast markings (dots or stripes) placed at 10m intervals on both sides of the blades to provide helicopter pilots with a hover-reference point.

- All SAR helicopter bases will be supplied with an accurate chart of all the offshore wind farm structures and their GPS positions.

It is noted that there could be the possibility that SAR response may only be possible from surface units (lifeboats) given restrictions on helicopter access in a wind farm. However, to aid helicopter SAR, there are specific requirements to allow safe helicopter operations within wind farms and close to, or over, WTG:

- Emergency evacuation of persons directly from a WTG nacelle by SAR helicopter is a last resort. It will normally be considered where risk to life is such that the speed of reaction and transfer of survivors to a place of safety or of injured persons directly to shore medical facilities can most effectively be achieved by SAR helicopter.
- If winching is to take place to/from a WTG, the blades will have to be feathered and the rotor brakes applied (where feasible blades should be pinned). The nacelle should be rotated so that the blades are at 90 degrees off the wind with the wind blowing on to the left side of the nacelle e.g., if wind is blowing from 270 degrees, the nacelle will need to be rotated to right so that the hub is facing 360 degrees.
- If winching is to take place to/from a nacelle, wherever possible wind farm personnel should be in the nacelle to assist the winch man.
- In poor visibility or at night, any lighting on WTGs may be required to be switched on or off - at the discretion of the helicopter pilot.
- For SAR helicopter operations, Radar is a prime flight safety tool - especially at night and in bad weather/poor visibility. For safe operation of SAR helicopters within and around wind farms, it is crucial that the WTGs are detectable to airborne Radars (at a safe range) and that the aircraft crew, using Radar, can discriminate between individual WTGs.

In terms of the impact on SAR helicopters, based on the MGN 371 guidance and industry best-practice, including the development of an ERCOP, any impact on SAR helicopter operations can be well managed.

20. ADDITIONAL NAVIGATION ISSUES

20.1 Introduction

There are a number of additional navigational issues identified within MGN 371 (Ref. ii) which require to be addressed by the developer. The following subsections cover additional navigation related issues which have not been covered elsewhere within this report.

20.2 Visual Navigation and Collision Avoidance

20.2.1 Introduction

MGN 371 identifies the potential for visual navigation to be impaired by the location of offshore wind farm structures, based on vessels not being visible to each other (hidden behind structures) and navigational aids and/or landmarks not being visible to shipping.

20.2.2 Visual Impact (Other Vessels)

Based on the position, orientation, number of WTGs and spacing between WTGs it is not considered there will be any significant issue of visual impact between vessels on the main commercial shipping routes in the area.

During the shipping surveys, a relatively high level of recreational craft activity was observed during the summer survey, with fishing activity identified in the general area during both surveys. However, given the comparatively low level of commercial vessel activity in the immediate vicinity of the proposed wind farm (vessels headed to East Solent from the westbound TSS lane pass over 2nm to the south of Rampion, and a frequently used route to/from Shoreham passes over 1.5nm to the northwest of the site) the likelihood of a small vessel emerging from the wind farm towards shipping traffic is low. In addition, a vessel within the wind farm should be visible for the vast majority of the time due to the size of the WTGs relative to the large spacing between them.

20.2.3 Visual Impact (Navigational Aids and/or Landmarks)

It is likely that the proposed Rampion Offshore Wind Farm will form a significant aid to navigation, which will be highly visible to shipping with lights on significant peripheral structures (SPSs), as well as selected intermediate structures (IPSs), in accordance with THLS requirements (see Section 4).

The Rampion site is aligned with the leading lights for approach to Shoreham Port. However, given the distance between Shoreham and the proposed wind farm (7.2nm) it is considered that vessels on the approach to Shoreham Port will still be able to obtain a leading transit using the leading lights.

Therefore, it is not considered that the Rampion site will degrade the ability of ships to navigate in the area through visual impairment of navigation aids or landmarks.

20.3 Potential Effects on Waves and Tidal Currents

Based on a specialist study, it was concluded that there will be no significant or measurable far field impact from the development on local tidal currents. Any impact on the waves will be very localised (in close proximity to the WTGs).

20.4 Impacts of Structures on Wind Masking/Turbulence or Sheer

The offshore WTGs have the potential to affect vessels under sail when passing through the site from effects such as wind shear, masking and turbulence.

From previous studies of offshore wind farms it was concluded that WTGs do reduce wind velocity by the order of 10% downwind of a WTG. The temporary effect is not considered as being significant and similar to that experienced passing a large ship or close to other large structures (e.g. bridges) or the coastline. In addition, practical experience to date from RYA members taking vessels into other sites indicates that this is not likely to be an issue.

20.5 Sedimentation/Scouring Impacting Navigable Water Depths in Area

There is the potential for structures positioned in the tidal stream to produce siltation, deposition of sediment or scouring which could affect the navigable water depths in the wind farm areas or adjacent to the area.

The specialist work carried out as part of the ES has shown that no significant impact on navigation will result from the potential effects of the proposed wind farm sites on the physical environment.

20.6 Structures and Generators affecting Sonar Systems in Area

No evidence has been found to date with regard to existing wind farms to suggest that they produce any kind of sonar interference which is detrimental to the fishing industry, or to military systems. No impact is anticipated for the proposed Rampion Offshore Wind Farm.

20.7 Electromagnetic Interference on Navigation Equipment

Based on the findings of the trials at the North Hoyle Offshore Wind Farm (Ref. iii), the wind farm generators and their cabling, inter-array and onshore, did not cause any compass deviation during the trials. However, it is stated that as with any ferrous metal structure, caution should be exercised when using magnetic compasses close to WTG.

It is noted that all equipment and cables will be rated and in compliance with design codes. In addition the inter-array and export cables associated with the wind farm will be buried and any generated fields will be very weak and will have no impact on navigation or electronic equipment. No significant impact is anticipated for the proposed offshore wind farms and associated cable works.

20.8 Impacts on Communications and Position Fixing

The following summarises the potential impacts of the different communications and position fixing devices used in and around offshore wind farms. The basis for the assessment is the

trials carried out by the MCA at North Hoyle and experience of personnel/vessels operating in and around other offshore wind farm sites.

20.8.1 VHF Communications (including Digital Selective Calling)

Vessels operating in and around offshore wind farms have not noted any noticeable effects on VHF (including voice and DSC communications). No significant impact is anticipated at the site.

20.8.2 Navtex

The Navtex system is used for the automatic broadcast of localised Maritime Safety Information (MSI). The system mainly operates in the Medium Frequency radio band just above and below the old 500 kHz Morse Distress frequency. No significant impact has been noted at other sites and none are expected at the Rampion Offshore Wind Farm.

20.8.3 VHF Direction Finding

During the North Hoyle trials, the VHF direction equipment carried in the lifeboats did not function correctly when very close to WTGs (within about 50m). This is deemed to be a relatively small scale impact and provided the effect is recognised, it should not be a problem in practical search and rescue.

20.8.4 Automatic Identification System (AIS)

In theory there could be interference when there is a structure located between the transmitting and receiving antennas (i.e., blocking line of sight). This was not evident in the trials carried out at the North Hoyle site and no significant impact is anticipated for AIS signals being transmitted and received at the Rampion Offshore Wind Farm.

20.8.5 Global Positioning System (GPS)

No problems with basic GPS reception or positional accuracy were reported during the trials at North Hoyle and this has been confirmed from other vessels which have been inside offshore wind farms. Consideration will require to be given to any potential degradation of DGPS signals being used to position construction equipment when close to a tower.

20.8.6 LORAN-C

LORAN-C is a low frequency electronic position-fixing system using pulsed transmissions at 100 kHz. The absolute accuracy of Loran-C varies from 0.1 to 0.25 nautical miles. Its use is in steep decline, with GPS being the primary replacement. It is mostly used in ships on and near the US coast, although some GPS receivers have built-in Loran C software.

Attempts were made to test a system during the North Hoyle trial, but there were difficulties which were probably attributable to operational errors or lack of a nearby transmitter.

Although a position could not be obtained using LORAN-C in the wind farm area, the available signals were received without apparent degradation. The Rampion Offshore Wind Farm is not expected to have a significant impact on LORAN-C. It is noted that the Department for Transport are funding an enhanced LORAN (eLORAN) service in the UK.

20.9 Noise Impact

20.9.1 Acoustic Noise Masking Sound Signals

The concern which must be addressed under MGN 371 is whether acoustic noise from the wind farm could mask prescribed sound signals. The sound level from a wind farm at a distance of 350m has been estimated to be 35-45 dB and it should therefore be well below a background sound level which is typically 63-68 dB.

The 1972 International Regulations for Preventing Collisions at Sea (1972 COLREGS), ANNEX III, entered into force by the IMO, specifies the technical requirements for sound signal appliances on marine vessels. Frequency range and minimum decibel level output is specified for each class of ship (based on length).

A ship's whistle for a vessel of 75m should generate in the order of 138 dB and be audible at a range of 1.5nm, so this should be heard above the background noise of the Rampion Offshore Wind Farm. Foghorns will also be audible over the background noise of the wind farm.

Therefore, there is no indication that the sound level of the proposed wind farm will have any significant influence on marine safety.

20.9.2 Noise Impacting Sonar

Once in operation it is not believed that the subsea acoustic noise generated by the wind farm sites will have any significant impact on sonar systems.

21. RISK MITIGATION MEASURES & MONITORING

21.1 Mitigation

This section summarises the main industry standard and best practice risk mitigation measures adopted by E.ON for the proposed Rampion Offshore Wind Farm to reduce the navigational impact of the development.

Table 21.1 Mitigation Measures

Type of Mitigation	Mitigation	Description
Industry Standard	Marked on Admiralty Charts	Wind farm will be charted by the UK Hydrographic Office using the magenta WTG chart symbol found in publication 'NP 5011 - Symbols and Abbreviations used in Admiralty Charts'. Submarine cables associated with wind farms will also be charted on the appropriate scale charts.
Industry Standard	Promulgation of Information	Appropriate liaison to ensure information on the wind farm sites and special activities is circulated in Notices to Mariners, VHF broadcasts and other appropriate media.
Industry Standard	Aids to Navigation including lighting and marking	Structures to be marked and lit in-line with THLS and IALA 0-139 guidance. (See Section 4.)
Industry Standard	WTG rotor blade air draught	Lowest point of rotor sweep at least 22m above Mean High Water Springs as per MCA guidance and RYA recommendations.
Industry Standard	Cable burial and protection	Cables will be protected appropriately taking into account fishing and anchoring practices. If it is necessary for cables to be protected by rock berms, concrete mattresses or other protection which lies clear of the surrounding seabed, the impact on navigation and the requirement for appropriate mitigation measures will be assessed. Positions of the cable routes notified to Kingfisher Information Services-Cable Awareness (KIS-CA) for inclusion in cable awareness charts and plotters for the fishing industry.
Industry Standard	Compliance with MCA's Marine Guidance Notice (MGN) 371 including Annex 5	Annex 5 specifies 'Standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around an OREI.'
Industry Standard	Formulation of an Emergency Response Cooperation Plan (ERCoP) as per MCA template	E.ON will use the draft template created by the MCA to formulate an emergency response plan and site Safety Management Systems, in consultation with the MCA.

Type of Mitigation	Mitigation	Description
Best Practice	Guard Vessels	There will be appropriate guard vessel coverage during construction.
Best Practice	Safety Zones	500m zones planned during construction, decommissioning and major maintenance to guard against vessels approaching dangerously close to the vessels working at the site.

Discussions on other measures will continue both pre- and post-construction and during the life of the project with the MCA and other relevant stakeholders.

21.2 Future Monitoring

21.2.1 Safety Management Systems

From a navigation risk perspective, monitoring will take place through the project's Safety Management System (SMS). The Safety Management System will include an incident/accident reporting system which will allow incidents and near misses to be recorded and reviewed to monitor the effectiveness of the risk control measures in place at the site. In addition to this any information gleaned from near misses/accidents at other offshore wind farm sites will be considered with respect to the control measures applied at the Rampion Offshore Wind Farm.

During maintenance, there will regularly be vessels operating in the site which can monitor any third party vessel activity, both visually and on Radar, although this will not be their primary function.

21.2.2 CCTV

CCTV may be installed to enable coverage of the proposed wind farm from key locations either on the WTG structures or the substations. CCTV technology can be adjustable for day / night conditions, and would allow operators in a central control room to identify vessel names from a distance to facilitate radio communications.

21.2.3 Future Monitoring of Marine Traffic

Whilst no Radar monitoring of vessel movements has been proposed for the site, AIS monitoring should be explored to monitor and record the movements of vessels around the Rampion Offshore Wind Farm and associated export cables to shore, as well as wind farm operated vessels working on site.

There will also be vessels regularly operating in the site, including during maintenance, which can monitor any third party vessel activity both visually and on Radar, although this will not be their primary function.

21.2.4 Subsea Cables

The subsea cable routes will be subject to periodic inspection to monitor cable burial depths.

22. CONCLUSIONS

Following a review of the baseline shipping and navigation, a Navigational Risk Assessment for the proposed Rampion Offshore Wind Farm has been undertaken. The assessment has included collision risk modelling and a formal safety assessment for all phases of the project as well as an assessment of cumulative and in combination impacts.

22.1 Consultation

Consultation has been undertaken with regulators and operators, key points include:

- Both MCA and THLS highlighted the need for consideration of the alignment of turbines on the boundary of the site. In addition, THLS, RYA and CA all stated that they would like to see a regular pattern of WTGs;
- Consideration of the deviations for vessels headed to/from Shoreham Port and consultation with the port and individual vessel operators were requested. Shoreham Port and a number of its users raised the issue of a 2nm channel through the site; however, MCA stated that on the evidence provided they do not support the channel option.
- Concerns were raised regarding the possibility of a vessel drifting from the TSS towards the wind farm. In the event of a vessel breakdown and drifting in the vicinity of the site, tug availability was noted as an issue, given the steaming time to the wind farm of the nearest available tugs.
- CoS stated that clearance from the Traffic Separation Scheme was a key issue and available sea room for vessels using the Inshore Traffic Zone.
- Dredging operators stated the need for buffers between aggregate dredging areas and WTGs, with the impact on the routing of dredgers to and from current and future aggregate extraction areas was also raised.
- Promulgation of information to users of the area will be important.

22.2 Collision Risk Modelling and Impact Assessment

An assessment of current vessel to vessel encounters was carried out by replaying (at high-speed) 28 days of AIS and Radar and this showed that the density of encounters in the area is highest in the approaches to ports and within the westbound lane of the Traffic Separation Scheme, with a comparatively low density of encounters within and in close proximity to the Rampion site.

The baseline vessel-to-vessel collision risk level pre-wind farm development is in the order of 1.2 major collisions per year and modelling of the revised traffic pattern, the change in collision frequency due to the wind farm was estimated to be 1.5×10^{-3} per year.

In terms of an errant vessel under power deviating from its route to the extent that it comes into proximity with the Rampion wind farm, it is not considered to be a probable occurrence (worst case collision return period of 1 every 5,100 years).

The worst case drifting collision risk has been identified as 1 every 9,600 years. Not under command collisions are assessed to be less frequent than powered collisions, which is reflective of historical data.

In order to mitigate blade and mast collisions for recreational craft the development of Rampion will adhere to the MCA's guidance on the construction of WTGs including a minimum rotor height clearance above MHWS of 22m.

These guideline measurements mean that whilst the collision risk cannot be completely eliminated it will be reduced to a level as low as reasonably practicable.

With regarding to cable interaction for anchoring and trawling all the subsea cables will be buried or trenched where sea bed conditions allow, providing protection from all forms of hostile seabed interaction, such as fishing activity, dragging of anchors and dropped objects. The proposed export cable corridor was revised to give consideration to the anchoring activity off Shoreham. There will be periodic inspections and surveys to ensure they do not become exposed. They will also be marked on Admiralty Charts, although whether all submarine cables are charted depends upon the scale of the chart; in some cases only the export cable may be shown.

22.3 Visual Navigation and Collision Avoidance

A review of visual navigation and collision avoidance was also undertaken in line with MGN 371. The following identifies the key issues for the Rampion Offshore Wind Farm.

Site Design

Number and location of the Aids to Navigation that will be required for vessels navigating around the site including in occurrences of reduced visibility. Further consultation will be carried out with the regulatory stakeholders, during the selection of the final layout, where aids to navigation including lighting, marking and floating aids will be decided.

Visual Impacts on Small Craft

A small craft emerging from between structures and into shipping routes may not be visible to larger vessels or may become 'cluttered out' of their Radar returns. However, due to the size of the turbines and the relative large spacing between them, this impact is considered unlikely to occur, and therefore considered within tolerable limits.

Impacts of Marine Radar

The MCA shipping template indicates that at 500m the effects on marine Radar become intolerable however due to the open sea room and navigable water depths around Rampion, vessels will be able to safely distance themselves from the turbines to mitigate the impacts including interference and multiple echoes. It was therefore concluded that the effects of wind turbines on marine Radars for Rampion were tolerable when mitigated by measures as indicated in Section 21.

22.4 Formal Safety Assessment

In order to provide expert opinion and local knowledge, a hazard workshop was undertaken to create a hazard log that was project and site specific. The hazard log identified the hazards caused or changed by the introduction of the wind farm, the risk associated with the hazard, the controls put in place and the tolerability of the residual risk.

The log also includes both industry standard and additional mitigation measures required to show that the hazards associated with the wind farm are Broadly Acceptable or Tolerable on the basis of ALARP declarations. For the most likely outcome, six of the risks were in the tolerable region and one (drifting vessel collision with wind farm structure) was assessed to be in the unacceptable region. When the worst case consequences were assessed, as well as the six risks above, two additional hazards were ranked as tolerable based on the worst case outcome.

22.5 Mitigations

Mitigation and safety measures will be applied to the proposed offshore wind farm appropriate to the level and type of risk determined during the EIA. The specific measures to be employed will be selected in consultation with the MCA Navigation Safety Branch and other relevant statutory stakeholders where required.

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Hazard Review Workshop

Rampion Offshore

Wind Farm

(Appendix A)

Prepared by: Anatec Limited
Presented to: E.ON Climate & Renewables
Date: 7 November 2012
Revision No.: 01
Ref.: A2348-EON-NRA-1 App A

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A1. Introduction

This report presents the preliminary Hazard Log for the navigational risks associated with the proposed Rampion Offshore Wind Farm.

The workshop was held in Brighton on 20th January 2012 attended by local maritime stakeholders, as outlined in Table 1.1. Other marine stakeholders such as Trinity House, Chamber of Shipping and a number of shipping operators were also invited but could not attend. However, shipping and navigational issues were represented by the local representatives who attended the meeting.

Table 1.1 Hazard Review Workshop Attendees

Attendee	Position	Company/Organisation
Stuart Carruthers	Cruising Manager	Royal Yachting Association (RYA)
Ted Osborn	RATS Committee	Cruising Association (CA)
Peter Burry	RATS Committee	Cruising Association (CA)
Laurence Woodhams	Director	Sussex Yacht Club
Roland McKie	Staff Officer Maritime Operations	Maritime and Coastguard Agency (MCA)
Lee Fisher	Operations Manager	Solent Coastguard
Mike O'Sullivan	Offshore Industry Liaison Officer	Solent Coastguard
Mike Tubb	Operations Manager	Newhaven Lifeboat Station
Philip Smith	Marine Safety and Environment	Department for Transport
Julian Seaman	Harbour Master	Shoreham Port
Dave Collins-Williams	Harbour Master	Newhaven Port & Properties Ltd
Nigel Griffiths	Principal Resources Manager	Hanson Aggregates marine Ltd
Graham Singleton	Resource and Systems Manager	CEMEX UK Marine Ltd
David McCluskey	Marine and Crew Manager	Westminster Dredging Company Ltd
Robert Clark	Deputy Chief Fisheries and Conservation Officer	Sussex Inshore Fisheries and Conservation Authority
David Guy	Fisheries Liaison	Newhaven Fish & Flake Ice Society

Attendee	Position	Company/Organisation
Eleri Owen	Consents Manager	E.ON Climate & Renewables
Ali MacDonald	Senior Risk Analyst	Anatec
Peter Carey	Risk Analyst	Anatec

The approach taken in this assessment is in line with the “Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms” produced by The Department of Energy and Climate Change (DECC), in association with the Maritime and Coastguard Agency (MCA) and the Department for Transport (DfT). This provides a template for developers in preparing their navigation risk assessments. The methodology is centred on risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions.

The key maritime hazards associated with the wind farm development were identified and associated scenarios prioritised by risk level. Within each scenario, vessel types were considered separately to ensure the risk levels were assessed for each and the control options were identified on a type-specific basis, e.g., risk control measures for fishing vessels differ to those for commercial vessels.

The ranking of the risks associated with the various hazards was carried out both during and following the workshop, using a risk matrix with the frequency and consequence categories shown below.

Other general hazards associated with the construction, decommissioning and maintenance phases, such as dropped object and man overboard, were also identified for the site but were not discussed in detail, with the ranking of these hazards carried out after the workshop.

A2. Hazard Log Methodology

The hazards were recorded systematically using Anatec's Hazard Management software. The main information logged by the system is presented in Table 2.1.

Table 2.1 Hazard Log Field Description

Category	Definition
Hazard ID	Unique Hazard Identification number generated by the software.
Title	Title of hazardous event.
Date Recorded	Date the hazard was logged in the system.
Responsible Person	Person with responsibility to manage the hazard.
Review Period	Minimum time period that hazard should be reviewed.
Event Description	Description of the hazardous event.
Category	General hazard category, e.g., General Navigational Safety.
Sub-Category	Hazard sub-category, e.g., collision.
Area	Location of Hazardous event, e.g., Inside or Outside of wind farm
Phase	Phase(s) of operation e.g. Pre-Installation, Construction, Operation, Maintenance and Decommissioning. (Can be more than one.)
Causes	List all the potential causes of the hazard.
Probable Outcome Description	Description of the probable (or most likely) outcome should the hazard occur.
Worst Credible Outcome Description	Description of the 'worst credible' outcome should the hazard occur.
Frequency (Probable Outcome)	Estimates the frequency of the probable outcome occurring.
Frequency (Worst Credible Outcome)	Estimates the frequency of the worst credible event occurring.
Consequence (Probable Outcome)	Estimates the probable outcome should the event occur in terms of consequence to People, Environment, Asset, Business and overall average.
Consequence (Worst Credible Outcome)	Estimates the worst credible outcome should the event occur in terms of consequence to People, Environment, Asset, Business and overall average.
Risk Estimate (Probable Outcome)	Combines the frequency and (average) consequence to estimate the risk level for probable event.
Risk Estimate (Worst Credible Outcome)	Combines the frequency and (average) consequence to estimate risk level for the worst credible event.

Category	Definition
Risk Reduction Measures	Documents the potential mitigation measures which will aid in the reduction of risk or in the management of the hazardous event.

The following frequency and consequence categories were applied.

Table 2.2 Frequency Bands

Rank	Description	Definition
1	Negligible	< 1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

Table 2.3 Consequence Bands

Rank	Description	Definition			
		People	Property	Environment	Business
1	Negligible	No injury	<£10k	<£10k	<10k
2	Minor	Slight injury(s)	£10k-£100k	Tier 1 Local assistance required	£10k-£100k
3	Moderate	Multiple moderate or single serious injury	£100k-£1M	Tier 2 Limited external assistance required	£100k-£1M Local publicity
4	Serious	serious injury or single fatality	£1M-£10M	Tier 2 Regional assistance required	£1M-£10M National publicity
5	Major	More than 1 fatality	>£10M	Tier 3 National assistance required	>£10M International publicity

The four consequence scores were averaged and multiplied by the frequency to obtain an overall ranking (or score) ranking which determined the hazard's position within the risk matrix shown below.

Table 2.4 Risk Matrix

Consequence	5					
	4					
	3					
	2					
	1					
		1	2	3	4	5
		Frequency				

where:

	Broadly Acceptable Region (Low Risk)	Generally regarded as insignificant and adequately controlled. None the less the law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
	Tolerable Region (Intermediate Risk)	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate control measures are in place, residual risks are as low as is reasonably practicable (ALARP) and that risks are periodically reviewed to see if further controls are appropriate.
	Unacceptable Region (High Risk)	Generally regarded as unacceptable whatever the level of benefit associated with the activity.

As well as ranking the hazard by expected risk, based on the estimated frequency versus consequence, the worst case risk was also ranked in order to capture scenarios with a particularly high worst-case risk. The worked example below illustrates the method of ranking hazards:

Hazard Title	Attendant vessel collision with wind farm structure.
Possible Causes	Poor Visibility; Manoeuvring error; Machinery Failure; Lack of Passage Planning; Lack of experience; Lack of awareness; Human error; Fatigue; Engine Failure/ Blackout; Bad weather.
Probable Consequence	Minor bump leading to minor damage to vessel and structure. Vessel most likely to be damaged.
Frequency of Probable Outcome	Reasonably probable (1 to 10 years) based on experience of attendant vessel collisions visiting offshore platforms.
Worst Credible Consequences	Moderate speed collision with significant damage to vessel, holed and vessel sinks, potential fatalities, damage to tower.
Frequency of Worst Credible Outcome	Extremely unlikely (100 to 10,000 years) in terms of significant consequences, i.e., loss of vessel with fatalities.

The following table present the risk ranking of this hazard for the probable (most likely) outcome.

Table 2.5 Risk Matrix: Attendant Vessel Collision with Structure (Probable Outcome)

Consequence (People)	5						Consequence (Property)	5					
	4							4					
	3							3					
	2					X		2				X	
	1							1					
		1	2	3	4	5			1	2	3	4	5
		Frequency							Frequency				
Consequence (Environment)	5						Consequence (Business)	5					
	4							4					
	3							3					
	2							2				X	
	1					X		1					
		1	2	3	4	5			1	2	3	4	5
		Frequency							Frequency				

The risk for the hazard is calculated by averaging the four consequences, i.e., $(2+2+1+2)/4 = 1.75$) and multiplying by the frequency, i.e., 4, to obtain a risk ranking of 7 (i.e. 1.75×4). A score of 7 puts this hazard in the Tolerable region.

The worst credible risk was also ranked using a similar methodology.

The potential mitigation measures for this event were logged as follows:

- Adverse weather working policy and procedures;
- Control of work procedures;
- Fenders/bumper bollards installed on turbines;
- Emergency Response Cooperation Plan;
- Marine Coordinator on site during works;
- Marine operating procedures;
- Marking and lighting;
- Passage plan to and from the site;
- Planning of major activities;
- Site personnel trained in fire fighting, first aid and offshore survival;
- Safety Management Systems for all vessels working in the site;
- Sharing of information within the industry.

A3. Results

The following list of hazards were reviewed, with the information recorded using Anatec's Hazard Log Software.

- Fishing vessel collision with wind farm structure;
- Commercial vessel (powered) collision with wind farm structure;
- Recreational vessel collision with wind farm structure;
- Dredger collision with wind farm structure;
- Drifting vessel collision with wind farm structure;
- Fishing gear interaction with subsea equipment (within the wind farm);
- Fishing gear interaction with export cable;
- Vessel anchoring on or dragging anchor over subsea equipment/cables;
- Vessel-to-vessel collision due to avoidance of site or work vessels in area;
- Deliberate unauthorised boarding or mooring to structure (and damage to device);
- Attendant vessel collision with structure;
- Man overboard during work activities at site; and
- Dropped object during work activities at site.

The overall breakdown by tolerability region was assessed for the identified hazards and is presented in Figure 1.

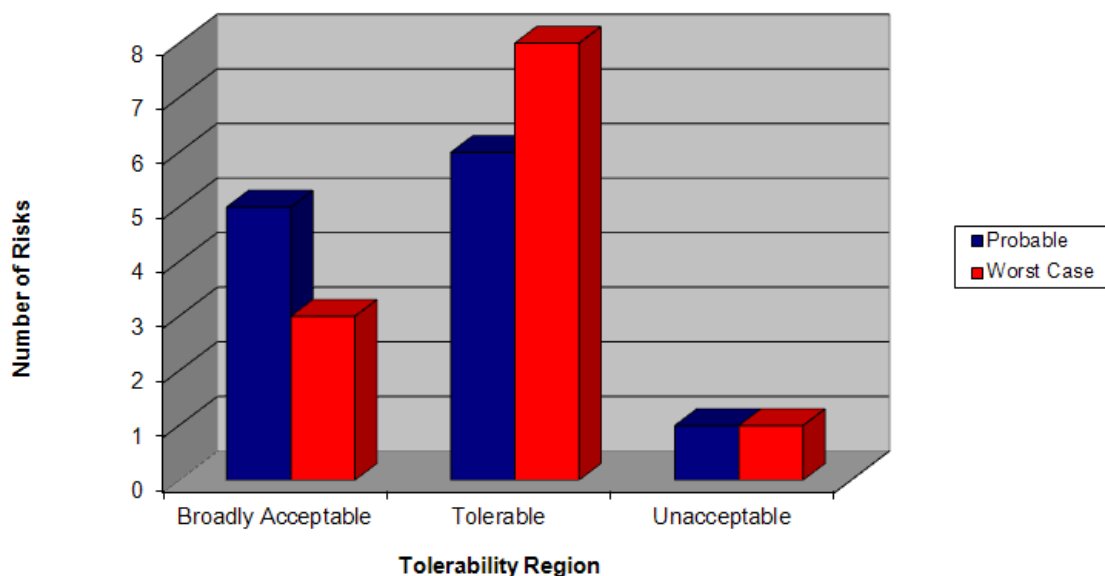


Figure 1 Rampion Offshore Wind Farm Risk Ranking Results

Based on the most likely outcomes assessed at the Hazard Workshop, one risk, drifting vessel collision with the wind farm structure, was ranked as unacceptable. It was identified at the workshop that the consequences of such a collision were uncertain, and would depend on a number of factors, including the vessel type (for example, the environmental consequences could be more serious for a tanker compared with other vessel types), impact type (head-on or glancing) and impact point on the vessel.

A significant factor in the potential frequency of drifting vessel collisions with wind farm structures was considered to be the Traffic Separation Scheme (TSS) to the south of the site. Based on the local knowledge provided at the workshop, a drifting vessel at the termination point of the westbound TSS lane is a relatively frequent occurrence as vessels attempt engine repairs having left the TSS.

It is noted that the drifting vessel collision with wind farm structure scenario will be subject to quantitative risk assessment within the NRA.

Five risks were ranked within the broadly acceptable region based on the probable outcome whilst six were ranked as tolerable. In addition, the attendees were unable to reach a decision on the ranking of one hazard, vessel-to-vessel collision due to avoidance of the site or work vessels in the area, due to navigational safety.

The hazards ranked as tolerable based on probable outcome were:

- Commercial vessel powered collision with wind farm structure;
- Dredger collision with wind farm structure;
- Fishing vessel collision with wind farm structure;
- Anchor on or dragging over subsea equipment;
- Attendant vessel collision with wind farm structure; and
- Man overboard during transfer to/from turbine or working alongside turbine.

As well as the six hazards above, two additional hazards were ranked as tolerable based on worst case outcome:

- Recreational vessel collision with wind farm structure; and
- Dropped object during work activities at the site.

Full details of the logged and ranked hazards are summarised in Table 3.1, sorted by descending order of risk ranking (probable followed by worst credible outcome).

Project: A2348
Client: E.ON Climate & Renewables
Title: Navigation Risk Assessment – Rampion (Appendix A)

Table 3.1 Rampion Offshore Wind Farm Hazard Ranking Results

ID	Phase	Category	Hazard Title	Hazard Detail	Possible Causes	Most Likely Consequence	Worst Case Consequence	Most Likely				Worst Case				Potential Risk Reduction	Remarks / Questions		
								People	Property	Business	Frequency	Risk	People	Property	Business			Frequency	Risk
1	All	Navigation	Drifting vessel collision with wind farm structure	Vessel loses power and drifts with wind and/or side into turbines/substations. Fouled propellers for fishing vessels.	Steering Gear Failure; Machinery Failure; Lack of awareness; Fire/Explosion; Engine Failure/Blackout; Dragged anchor; Bad weather	Significant damage to wind farm structure, and significant hull damage to vessel. Possible pollution and injuries to crew.	Potential collapse of tower. Major damage to vessel, potentially sinks with fatalities and pollution.	2	5	5	4	4	10	5	5	5	5	3	15
2	All	Navigation	Commercial Vessel Powered Collision with wind farm structure	Commercial vessel, e.g., cargo vessel, ferry or tanker, powered collision with the turbines or offshore substation.	Machinery Failure; Displacement of traffic; Failure to comply with Colregs; Fatigue; Fire/Explosion; Human error; Lack of awareness; Bad weather; Lack of Passage Planning; Watchkeeper failure; Manoeuvring error; Navigational Aid Failure; Poor Visibility; Radar interference; Steering Gear Failure; Vessels attracted to site - curiosity; Lack of experience	Significant damage to wind farm structure, and significant hull damage to vessel. Possible pollution and injuries to crew.	Tower collapse, vessel holed and sinks. Potential fatalities and pollution.	2	5	5	4	3	12	5	5	5	5	2	10
3	All	Navigation	Dredger collision with wind farm structure	Dredger working in close proximity to site collides with turbine.	Watchkeeper failure; Steering Gear Failure; Poor Visibility; Navigational Aid Failure; Manoeuvring error; Machinery Failure; Human error; Fire/Explosion; Fatigue; Engine Failure/Blackout	Dredger drifts and collides with turbine resulting in damage to vessel and structure.	Significant damage to the vessel's hull, and serious injuries to the crew of the vessel. Significant damage to the wind farm structure.	2	2	4	4	3	9	4	3	5	4	2	8
4	All	Navigation	Fishing vessel collision with wind farm structure	Fishing vessel collides with wind turbine and/or offshore substations whilst fishing in area or steaming in transit.	Watchkeeper failure; Uncharted obstruction on seabed; Steering Gear Failure; Poor Visibility; Navigational Aid Failure; Manoeuvring error; Machinery Failure; Lack of awareness; Human error; Gear snapping; Fishing vessels attracted to site; Fatigue; Engine Failure/Blackout; Bad weather.	Fishing vessel collides with structure with minor damage to vessel.	Vessel collides with structure and this results in vessel being holed and sinking resulting in men overboard and potential fatalities.	2	2	3	1	4	8	5	2	5	5	3	12.8
5	All	Navigation	Anchor on or dragging over subsea equipment	Vessel drops anchor over subsea equipment or a nearby vessel drags anchor over a subsea cable. Vessel may drop anchor over cable(s) in an emergency, i.e. machinery failure when changing over engines when approaching port.	Structural Failure; Steering Gear Failure; Poor Holding Ground; Machinery Failure; Lack of awareness; Human error; Fire/Explosion; Engine Failure/Blackout; Dragged anchor; Bad weather.	Damage to cable(s).	Serious damage to cable(s) and therefore major business disruption. Loss of vessels anchor.	1	1	4	4	3	7.5	3	2	5	5	2	7.5
6	All	Navigation	Attendant vessel collision with wind farm structure	Vessels will be working in proximity to the structures, e.g., during construction and maintenance. Misjudgment, weather or equipment failure could lead to a collision due to limited time to take preventative action.	Poor Visibility; Manoeuvring error; Machinery Failure; Lack of Passage Planning; Lack of experience; Lack of awareness; Human error; Fatigue; Engine Failure/Blackout; Bad weather.	Minor bump leading to minor damage to vessel and structure. Vessel most likely to be damaged.	Moderate speed collision with significant damage to vessel, holed and vessel sinks, potential fatalities, damage to tower.	2	1	2	2	4	7	5	2	4	4	2	7.5
7	All	Marine Renewables	Man overboard during work activities at the site	Man overboard during transfer to/from turbine or working alongside turbine.	Personal injury (slips, trips, falls, heart attack); Manoeuvring error; Lack of experience; Lack of awareness; Human error; Fatigue; Communication failure; Bad weather.	Person in water recovered by transfer boat and crew.	Loss of life. Person lost at sea.	3	1	1	2	4	7	4	1	1	4	3	7.5
8	All	Navigation	Recreational vessel collision with wind farm structure	Recreational vessel collides with wind turbine or offshore substation.	Manoeuvring error; Engine Failure/Blackout; Fatigue; Human error; Lack of awareness; Lack of experience; Bad weather; Machinery Failure; Yacht becalmed; Navigational Aid Failure; Personal injury (slips, trips, falls, heart attack); Poor Visibility; Steering Gear Failure; Vessels attracted to site - curiosity; Watchkeeper failure; Lack of Passage Planning	Vessel collides with structure with minor damage to vessel.	Vessel collides with structure and results in vessel being holed and sinking resulting in men overboard and possible fatalities	2	1	2	1	4	8	5	1	3	4	3	8.75

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Client: E.ON Climate & Renewables
Title: Navigation Risk Assessment – Rampion (Appendix A)

ID	Phase	Category	Hazard Title	Hazard Detail	Possible Causes	Most Likely Consequence	Worst Case Consequence	Most Likely				Worst Case				Potential Risk Reduction	Remarks / Questions				
								People	Environment	Property	Business	Frequency	Risk	People	Environment			Property	Business	Frequency	Risk
9	All	Marine Renewables	Dropped object during work activities at the site	Dropped object during construction, decommissioning or major maintenance	Personal injury (slips, trips, falls, heart attack); Manoeuvring error; Machinery Failure; Lack of experience; Human error; Fatigue; DP failure; Communication failure; Bad weather	Dropped object into sea, falling onto seabed. Financial loss, potential for damaging structure	Dropped object onto vessel with fatality of persons working on operation. Damage to vessel	2	1	2	1	4	6	4	1	2	4	3	8.25	Safety Management System; Procedures for all vessels working in the site; Planning of major activities; Personnel Training; Personal Protective Equipments (PPE); Independent Verification; Emergency Response Cooperation Plan; Control of Work Procedure.	
10	Operation	Marine Renewables	Deliberate unauthorised boarding of mooring to structure and damage to device	Structures designed to allow access for inspection, maintenance and repair. There is potential for trespassers to attempt to moor to or board a structure. This has the potential to lead to a member of the public falling into the sea or being stranded on a structure.	Vandalism; Protest; Misadventure	Vessel moors alongside the structure in good weather and no damage. Possible for person to get stranded on structure or take part in protest requiring the emergency services. Potential for minor vandalism, e.g., graffiti	Person is stranded / maintains protest on structure or falls into the sea as a result of climbing on the structure resulting in a fatality. Potential for more serious vandalism such as equipment damage	3	1	1	1	3	4.5	4	1	2	3	2	5	Safety Management System; Promulgation of information to local users; Inspection and maintenance procedures; Emergency Response Cooperation Plan	Mooring to wind farm structure considered reasonably likely, but it is more doubtful that anyone would attempt to climb onto the tower. Wind farm may be out of range of certain craft, such as jet ski.
11	All	Navigation	Fishing gear interaction with subsea equipment (within wind farm)	Fishing vessel gear is snagged on subsea equipment or J-hub.	Uncharted obstruction on seabed; Structural Failure; Steering Gear Failure; Personal injury (slips, trips, falls, heart attack); Manoeuvring error; Machinery Failure; Lack of experience; Lack of awareness; Installation not planned or carried out properly; Human error; Gear snagging; Fishing vessels attracted to site; Fatigue; Cable becomes exposed (unprotected cable)	Fishing vessel capsizes with loss of life, loss of vessel and pollution	Fishing vessel capsizes with loss of life, loss of vessel and pollution	5	3	5	5	1	4.5	5	3	5	5	1	4.5	Website showing sea obstructions by region; Promulgation of information to local users; Notices to Fishermen; Marking and Lighting; Kingfisher publications; Installation procedures; Inspection and maintenance procedures; Guard Vessel during Construction; Fisheries Liaison; Exclusion zone during construction; Emergency Response Cooperation Plan; Chart Markings; Cable protection, e.g., burial; Abandon gear; parallel inter-array cabling.	As long as cabling is buried to 1.5m then frequency of snagging is negligible. Single handed fishing unlikely to be as far out as Rampion. Abandoning gear is only a last resort. Kingfisher notifications are not generally used in the area (but away boats may use them). Should be done in conjunction with Sealfish.
12	All	Navigation	Fishing gear interaction with export cable	Fishing vessels drag gear over export cable(s), e.g., scallop dredger or trawler.	Uncharted obstruction on seabed; Structural Failure; Steering Gear Failure; Personal injury (slips, trips, falls, heart attack); Manoeuvring error; Machinery Failure; Lack of experience; Lack of awareness; Installation not planned or carried out properly; Human error; Gear snagging; Fishing vessels attracted to site; Fatigue; Cable becomes exposed (unprotected cable)	Fishing vessel capsizes with loss of life, loss of vessel and pollution	Fishing vessel capsizes with loss of life, loss of vessel and pollution	5	3	5	5	1	4.5	5	3	5	5	1	4.5	Website showing sea obstructions by region; Promulgation of information to local users; Notices to Fishermen; Marking and Lighting; Kingfisher publications; Installation procedures; Inspection and maintenance procedures; Guard Vessel during Construction; Fisheries Liaison; Exclusion zone during construction; Emergency Response Cooperation Plan; Chart Markings; Cable protection, e.g., burial; Abandon gear.	As long as cabling is buried to 1.5m then frequency of snagging is negligible. Single handed fishing nearer the coast so personal injury is a possible cause.
13	All	Navigation	Vessel-to-vessel collision due to avoidance of site or work vessels in area	Displaced traffic increases congestion outside of the site. This can lead to an increase in vessel-to-vessel encounters and ultimately collisions.	Watchkeeper failure; Radar interference; Poor Visibility; Navigational Aid Failure; Manoeuvring error; Lack of Passage Planning; Lack of experience; Lack of awareness; Human error; Fatigue; Failure to comply with COLREGs; Displacement of traffic; Communication failure; Bad weather.	Damage to vessel(s) and possible injuries to crew(s).	Loss of vessel(s); pollution and potential loss of life.	As a group, the attendees were unable to reach a decision on the ranking of this hazard				This scenario will be subject to Quantitative Risk Assessment within the Navigation Risk Assessment				Work vessel display appropriate lights / marks; Routing Measures - New or Amended; Promulgation of information to local users; Passage Planning by Shipping; Passage plan to and from site; Notices to Fishermen; Notice to Mariners; Marking and Lighting; Marine Operating Procedures; Emergency Response Cooperation Plan; Compliance with COLREGs; AIS Monitoring.		IT2 will become more congested. May result in the formation of pinch points with a number of vessels aiming for the same areas as they route around the wind farm. Wind farm may lead to reduction in encounters between small and large vessels, as the small vessels can route through the turbines. Traffic displaced inshore of the wind farm, into areas used by smaller fishing vessels.			



Consequences Assessment Rampion Offshore Wind Farm (Appendix B)

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B1. Introduction

This Appendix presents an assessment of the consequences of collision incidents, in terms of people and the environment, due to the impact of the proposed Rampion Offshore Wind Farm.

The significance of the impact of the proposed Rampion Offshore Wind Farm is also assessed based on risk evaluation criteria and comparison with historical accident data in the UK waters¹.

B2. Risk Evaluation Criteria

2.1 Risk to People

With regard to the assessment of risk to people two measures are considered, namely;

- Individual Risk
- Societal Risk

2.1.1 Individual Risk (per Year)

This measure considers whether the risk from an accident to a particular individual changes significantly due to the wind farm. Individual risk considers not only the frequency of the accident and the consequence (likelihood of death), but also the individual's fractional exposure to that risk, i.e., the probability of the individual of being in the given location at the time of the accident.

The purpose of estimating the Individual Risk is to ensure that individuals, who may be affected by the presence of the wind farm, are not exposed to excessive risks. This is achieved by considering the significance of the change in individual risk resulting from the presence of the wind farm, relative to the background individual risk levels.

Annual individual risk levels to crew (i.e., the annual fatality risk of an average crew member) for different ship types are presented in Figure 2.1 (Ref.i). The figure also highlights the risk acceptance criteria as suggested in International Maritime Organisation (IMO) Marine Safety Committee (MSC) 72/16.

¹ In this technical note, UK waters means the UK Exclusive Economic Zone and UK territorial waters means within the 12 nautical miles limit.

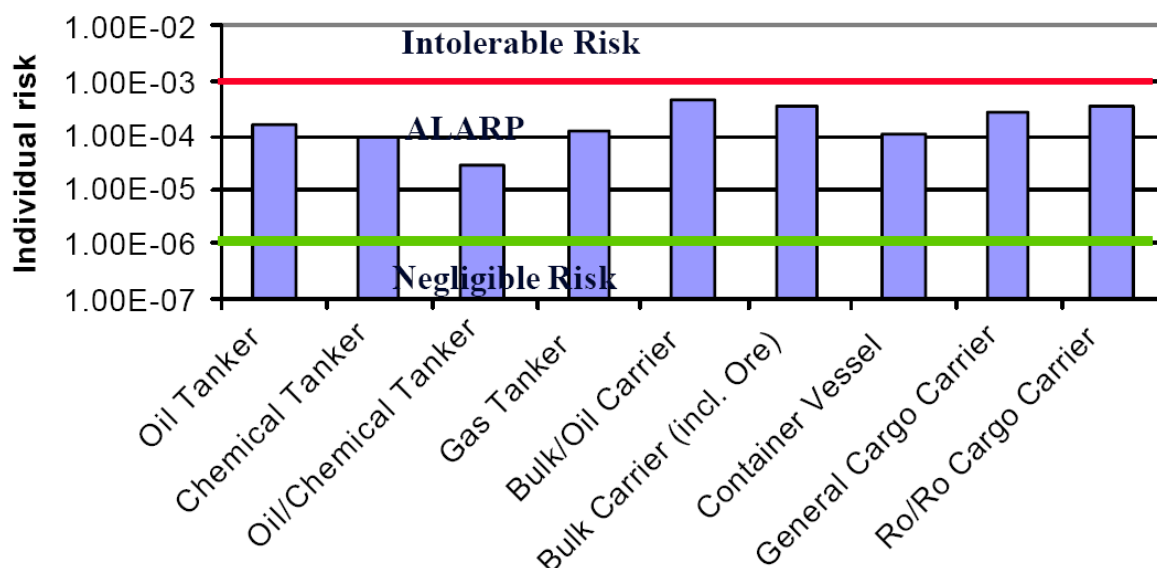


Figure 2.1 Individual Risk Levels and Acceptance Criteria per Ship Type

Typical bounds defining the As Low As Reasonably Practicable (ALARP) regions for decision making within shipping are as follows.

Table 2.1 Individual Risk ALARP Criteria

Individual	Lower Bound for ALARP	Upper Bound for ALARP
To crew member	10^{-6}	10^{-3}
To passenger	10^{-6}	10^{-4}
3 rd party	10^{-6}	10^{-4}
New ship target	10^{-6}	Above values reduced by one order of magnitude

On a UK basis, the Maritime and Coastguard Agency (MCA) website presents individual risks for various UK industries based on Health and Safety Executive (HSE) data for 1987-91 (Ref. ii). The risks for different industries are compared in Figure 2.2.

The individual risk for sea transport of 2.9×10^{-4} per year is consistent with the worldwide data presented in Figure 2.1, whilst the individual risk for sea fishing of 1.2×10^{-3} per year is the highest across all of the industries listed.

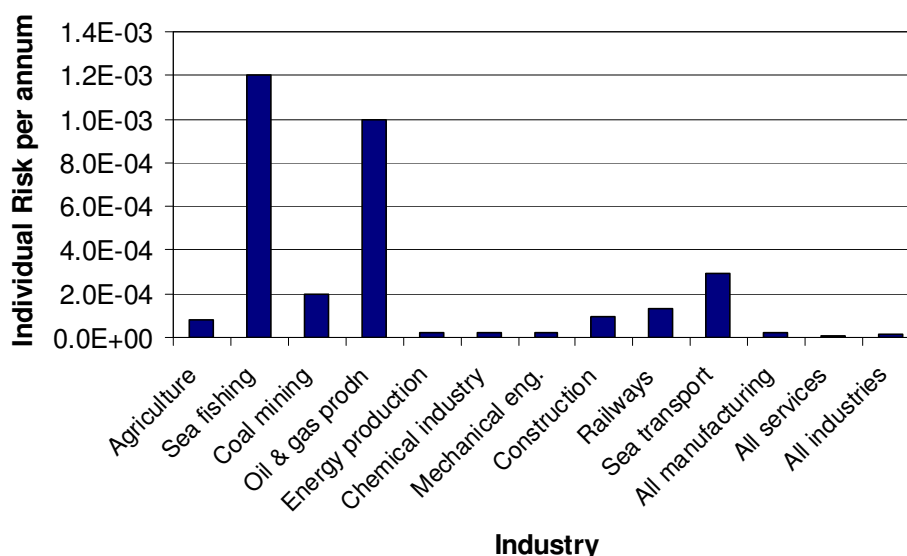


Figure 2.2 Individual Risk per Year for various UK Industries

2.1.2 Societal Risk

Societal Risk is used to estimate risks of accidents affecting many persons, e.g., catastrophes, and acknowledging risk averse or neutral attitudes. Societal Risk includes the risk to every person, even if a person is only exposed on one brief occasion to that risk. For assessing the risk to a large number of affected people, societal risk is desirable because individual risk is insufficient in evaluating risks imposed on large numbers of people.

Within this assessment societal risk (navigational based) can be assessed for the proposed Rampion Offshore Wind Farm giving account to the change in risk associated with each accident scenario caused by the introduction of the structures. Societal risk may be expressed as:

- Annual fatality rate: frequency and fatality are combined into a convenient one-dimensional measure of Societal Risk. This is also known as Potential Loss of Life (PLL).
- FN-diagrams showing explicitly the relationship between the cumulative frequency of an accident and the number of fatalities in a multi-dimensional diagram.

When assessing societal risk this study focuses on PLL, which takes into account the number of people likely to be involved in an incident (which is higher for passenger ferries, for example), and assesses the significance of the change in risk compared to background risk levels for the UK.

2.2 Risk to Environment

For risk to the environment the key criteria considered in terms of the effect of the proposed Rampion Offshore Wind Farm is the potential amount of oil spilled from the vessel involved in an incident.

It is recognised there will be other potential pollution, e.g., hazardous containerised cargoes, however, oil is considered the most likely pollutant and the extent of predicted oil spills will provide an indication of the significance of pollution risk due to the proposed Rampion Offshore Wind Farm compared to background pollution risk levels for the UK.

B3. MAIB Incident Analysis

3.1 All Incidents

All UK commercial vessels are required to report accidents to Marine Accident Investigation Branch (MAIB). Non-UK vessels do not have to report unless they are in a UK port or are in 12 nautical mile territorial waters and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report accidents to MAIB, however, a significant proportion of these incidents are reported and investigated by the MAIB.

A total of 19,130 accidents, injuries and hazardous incidents were reported to MAIB between 1 January 1994 and 27 September 2005 involving 21,140 vessels (some incidents such as collisions involved more than one vessel). 72% of incidents were in UK waters with 28% reported in foreign waters.

The locations² of incidents reported in the vicinity of the UK are presented in Figure 3.1, colour-coded by type.

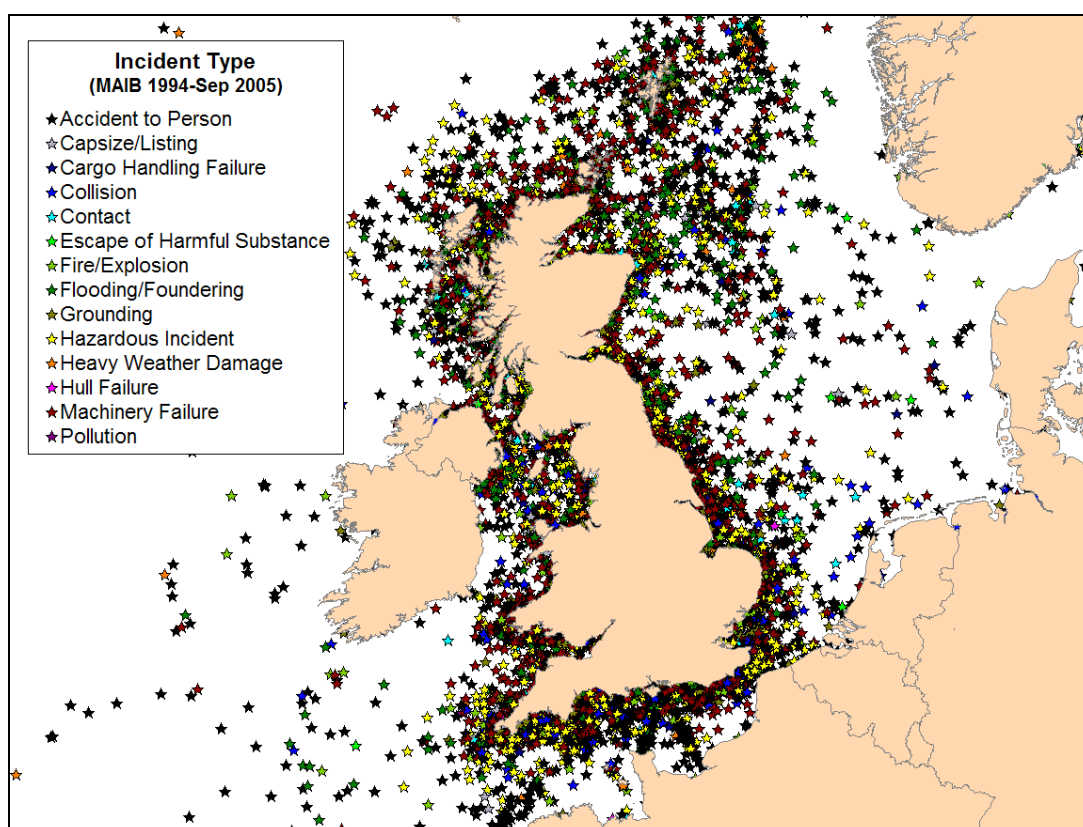


Figure 3.1 Incident Locations by Type (MAIB 1994-Sep 2005)

² MAIB aim for 97% accuracy in reporting the locations of incidents.

The distribution of incidents by year is presented in Figure 3.2.

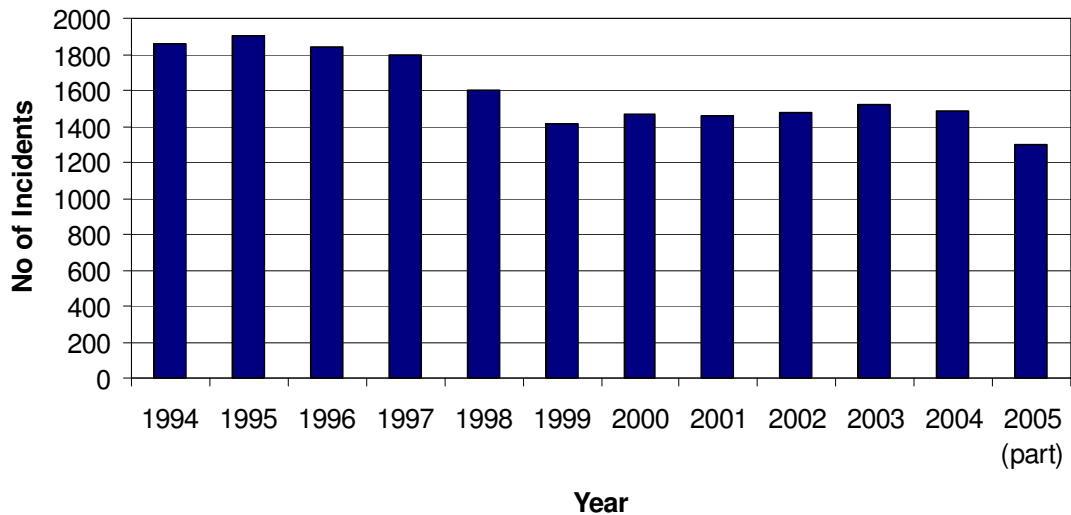


Figure 3.2 Incidents per Year (MAIB 1994-Sep 2005)

The average number of incidents per year, excluding 2005 which is a part-year, was 1,621. There is a declining trend in incidents.

The distribution by incident type is presented in Figure 3.3.

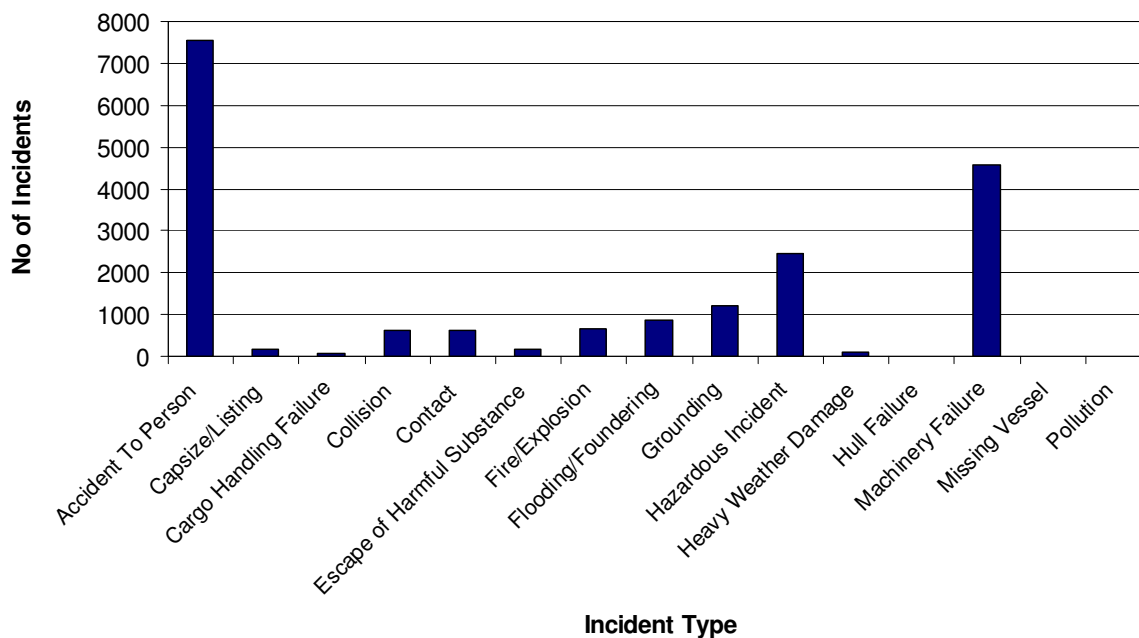


Figure 3.3 Incidents by Incident Type (MAIB 1994-Sep 2005)

Therefore, the most common incident types were Accident to Person³ (40%), Machinery Failure (24%) and Hazardous Incident (13%). Collisions and Contacts each represented 3% of total incidents.

The distribution of vessel type categories involved in incidents is presented in Figure 3.4.

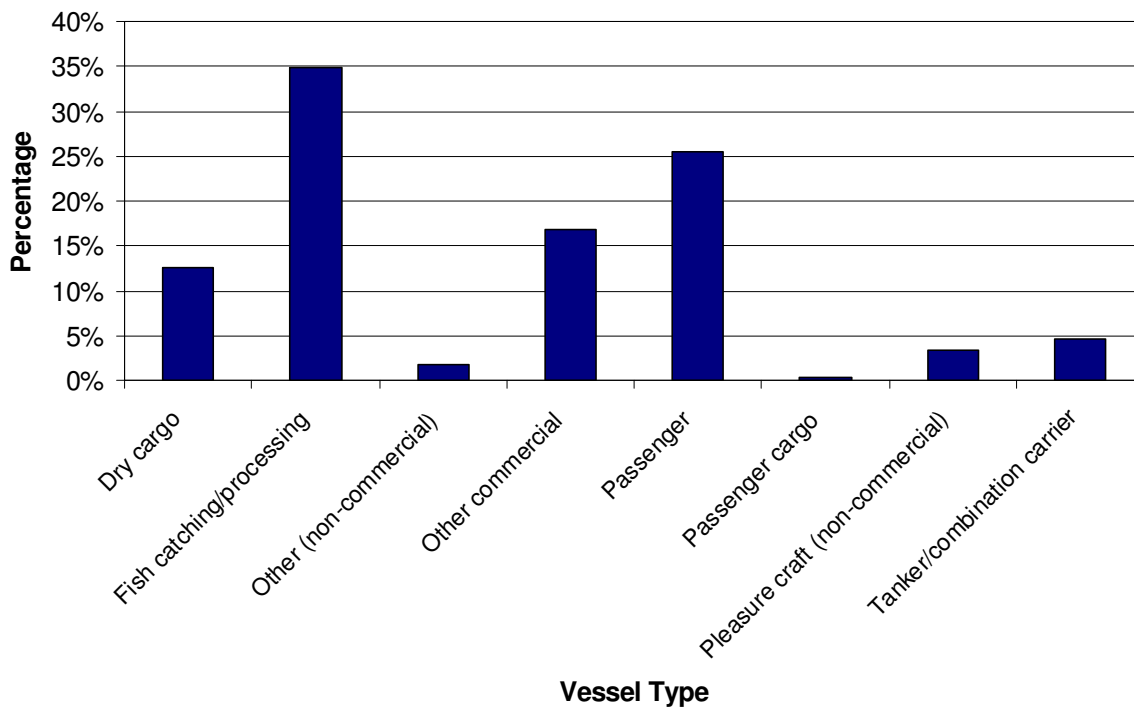


Figure 3.4 Incidents by Vessel Type (MAIB 1994-Sep 2005)

The most common vessel types involved in incidents were fishing vessels (35%), passenger vessels (25%) and other commercial vessels (17%), which includes offshore industry vessels, tugs, workboats and pilot vessels.

The total number of fatalities per year (divided into crew, passenger and other) reported in the MAIB incidents is presented in Figure 3.5.

³ Where the incident is an accident to a vessel, e.g., collision or machinery failure, it would be reported under this vessel accident category.

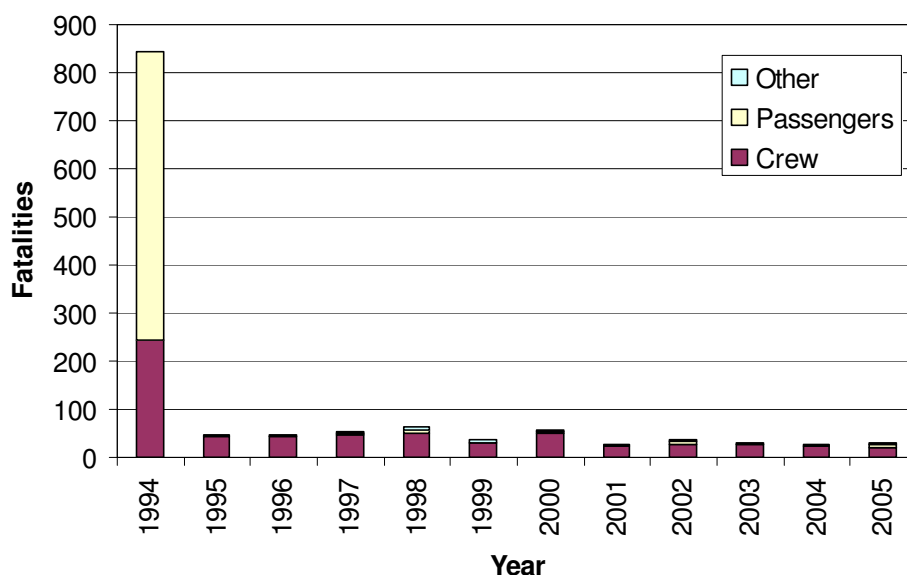


Figure 3.5 Number of Fatalities (MAIB 1994-Sep 2005)

The average number of fatalities per year, excluding 2005 which is a part-year, was 115. The sinking of the ‘Estonia’ passenger ferry in the Baltic Sea in 1994, which resulted in a reported 852 fatalities, dominates the figures. If 1994 were excluded, the average number of fatalities per year would drop to 42.

Considering only the incidents reported to have occurred in UK territorial waters, the number of fatalities per year is presented in Figure 3.6.

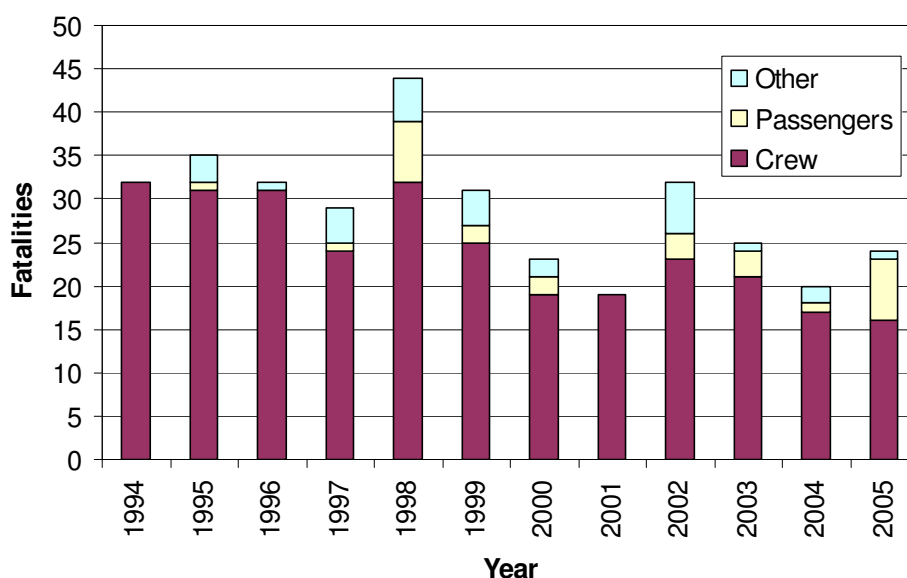


Figure 3.6 Number of Fatalities for Incidents in UK Waters (MAIB 1994-Sep 2005)

Therefore, the average number of fatalities per year in UK territorial waters between 1994 and 2004 was 29.

The distribution of fatalities in UK waters by vessel type and person category is presented in Figure 3.7.

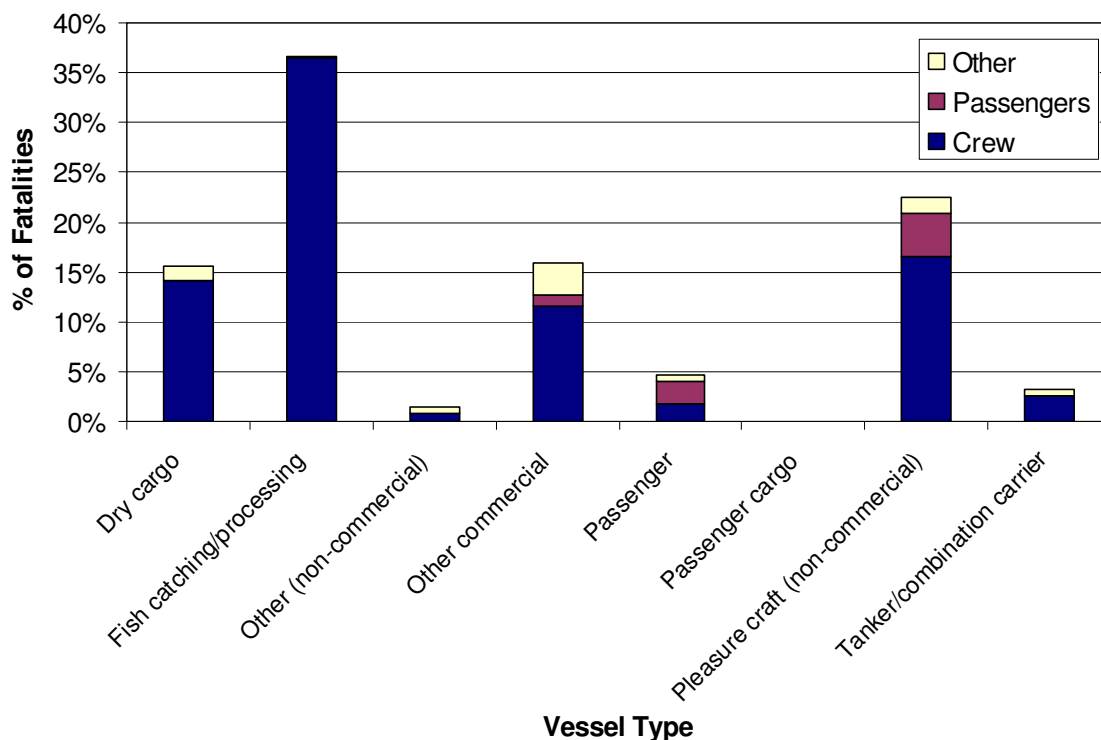


Figure 3.7 Fatalities by Vessel Type for Incidents in UK (MAIB 1994-Sep 2005)

It can be seen that the majority of fatalities in the UK occurred to fishing vessels and pleasure craft, with crew members the main people involved.

3.2 Collision Incidents

MAIB define a collision incident as “vessel hits another vessel that is floating freely or is anchored (as opposed to being tied up alongside).”

A total of 623 collisions were reported to MAIB between 1 January 1994 and 27 September 2005 involving 1,241 vessels (in a handful of cases the other vessel involved was not logged).

The locations of collisions reported in the vicinity of the UK are presented in Figure 3.8.

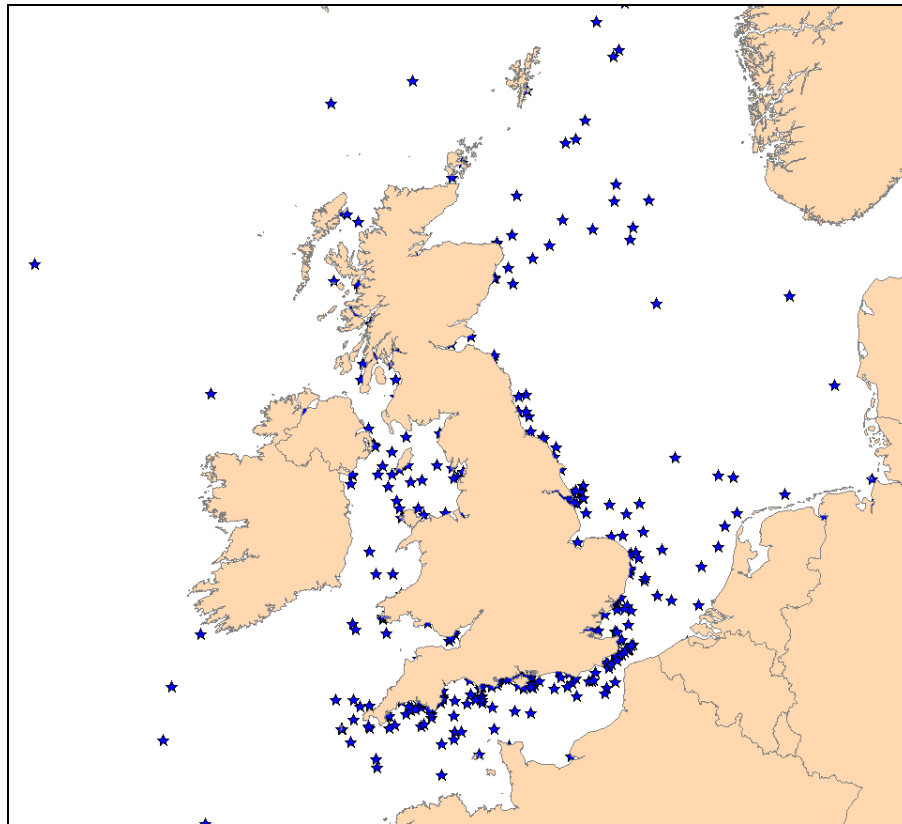


Figure 3.8 Collision Incident Locations (MAIB 1994-Sep 2005)

The distribution of all collision incidents by year is presented in Figure 3.9.

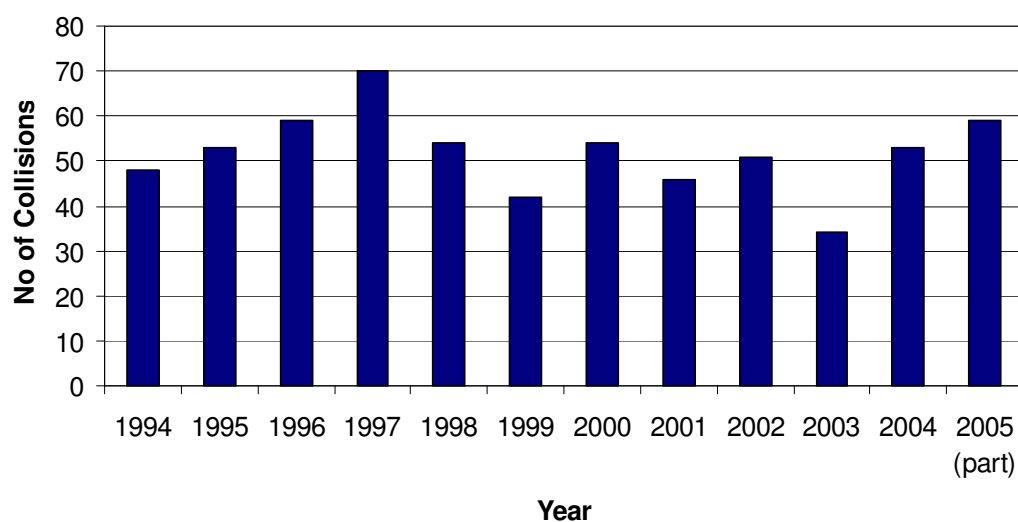


Figure 3.9 Collisions per Year (MAIB 1994-Sep 2005)

The average number of collisions per year, excluding 2005 which is a part-year, was 51.

The distribution of vessel types involved in collisions is presented in Figure 3.10.

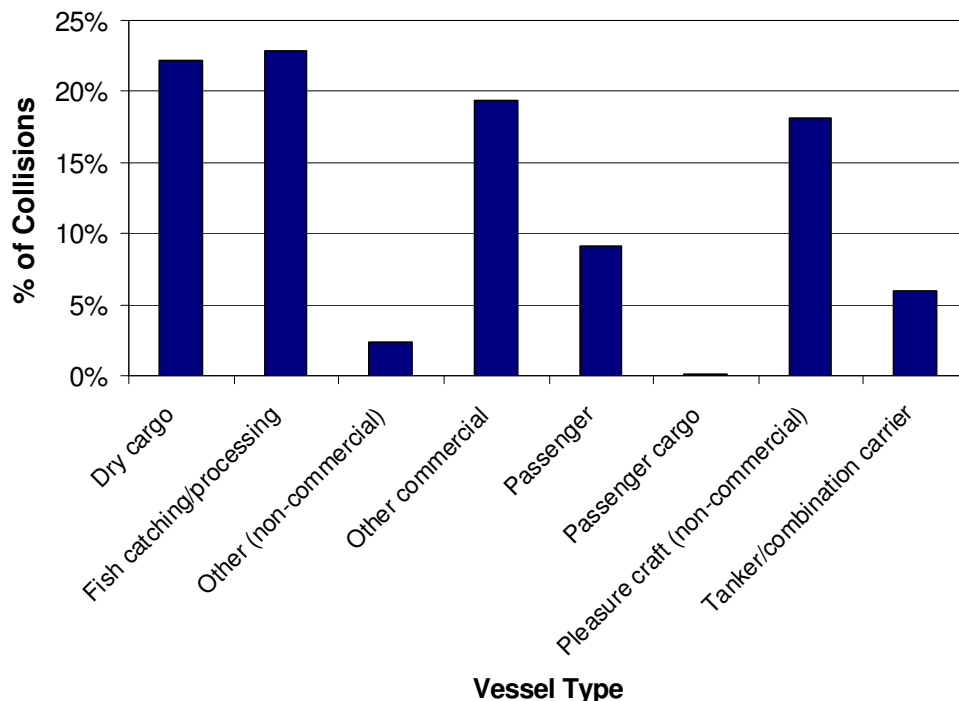


Figure 3.10 Collisions by vessel Type (MAIB 1994-Sep 2005)

Therefore, the most common vessel type involved in collisions were fishing vessels (25%), dry cargo vessels (22%), other commercial vessels (19%) and non-commercial pleasure craft (18%).

Finally, the total number of fatalities per year (divided into crew and passenger) reported in all MAIB collisions is presented in Figure 3.11.

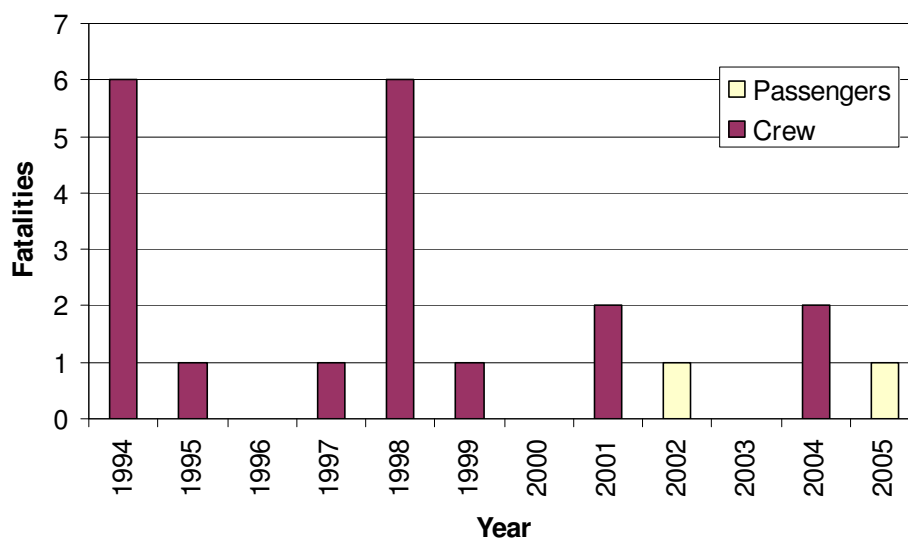


Figure 3.11 Fatalities from Collisions (MAIB 1994-Sep 2005)

The average number of fatalities per year, excluding 2005 which is a part-year, was 1.8.

Details on the 12 incidents reported by MAIB that involved fatalities are presented in Table 3.1. In each case the first vessel listed suffered the losses. It can be seen that most incidents involved fishing vessels and recreational craft.

Table 3.1 Fatal Collision Incidents (MAIB 1994-Sep 2005)

Date	Description	Fatalities
Nov 1994	Beam trawler collision with bulk carrier Foreign waters, high seas, moderate visibility and sea state	6
Jun 1998	Seine netter collision with container ship Foreign waters, high seas, good visibility, moderate seas	5
Feb 1995	Stern trawler collision with supply ship Foreign waters, river/canal, good visibility, moderate seas	1
Mar 1997	Stern trawler collision with other fishing vessel Foreign waters, good visibility, calm seas	1
Jun 1998	RIB collision with other RIB UK territorial waters, river/canal	1
Mar 1999	Fishing vessel collision with container ship Foreign waters, coastal waters, good visibility	1
Aug 2001	Pleasure craft collision with small commercial motor vessel UK territorial waters	1
Oct 2001	General cargo vessel collision with chemical tanker	1

Date	Description	Fatalities
	UK territorial waters, coastal waters, good visibility	
Aug 2002	Speed craft collision with another speed boat UK waters, unspecified location, good visibility, calm seas	1
May 2004	Port service tug collision with passenger ferry (during towing) Foreign waters, coastal waters	1
Jun 2004	Pleasure craft collision with other pleasure craft Foreign waters, river/canal	1
Jul 2005	Pleasure craft collision with (1 passenger fatality) UK territorial waters, coastal waters, good visibility, calm seas	1

A more detailed description of the two incidents which resulted in multiple fatalities is provided below:

- Collision between bulk carrier and beam trawler in eastward lane of Terschelling - German Bight Traffic Separation Scheme (TSS). Both vessels were on passage. Visibility was about 5 miles. Collision caused extensive damage to beam trawler and vessel rapidly flooded and sank with loss of her 6 crew, all of whom were Dutch nationals. Collision was primarily caused by Master of bulk carrier failing to take early and substantial action when complying with his obligation to keep out of the way.
- The fishing vessel was on an easterly course while on passage from Firth of Forth to Esbjerg, and the container ship was on a north-westerly course from Hamburg to Gothenburg. The fishing vessel was the give-way vessel but did not alter course and speed, the cause of which could not be established. The chief officer of the container ship did not alter course until it was too late and the two vessels collided. The fishing vessel foundered so quickly that all hands were trapped inside the accommodation and the container ship was so badly damaged that she had to use Esbjerg as a port of refuge.

3.3 Contact Incidents

MAIB define a contact incident as “vessel hits an object that is immobile and is not subject to the collision regulations e.g. buoy, post, dock (too hard), etc. Also, another ship if it is tied up alongside. Also floating logs, containers etc.”

A total of 609 contacts were reported to MAIB between 1 January 1994 and 27 September 2005 involving 663 vessels.

The locations of contacts reported in the vicinity of the UK are presented in Figure 3.12.

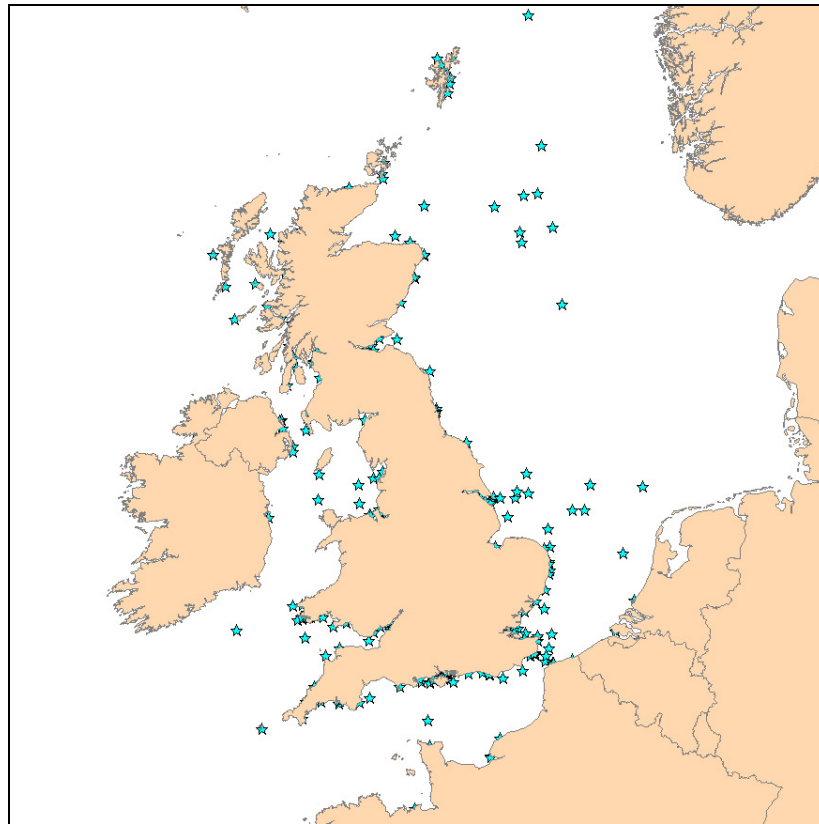


Figure 3.12 Contact Incident Locations (MAIB 1994-Sep 2005)

The distribution of contact incidents by year is presented in Figure 3.13.

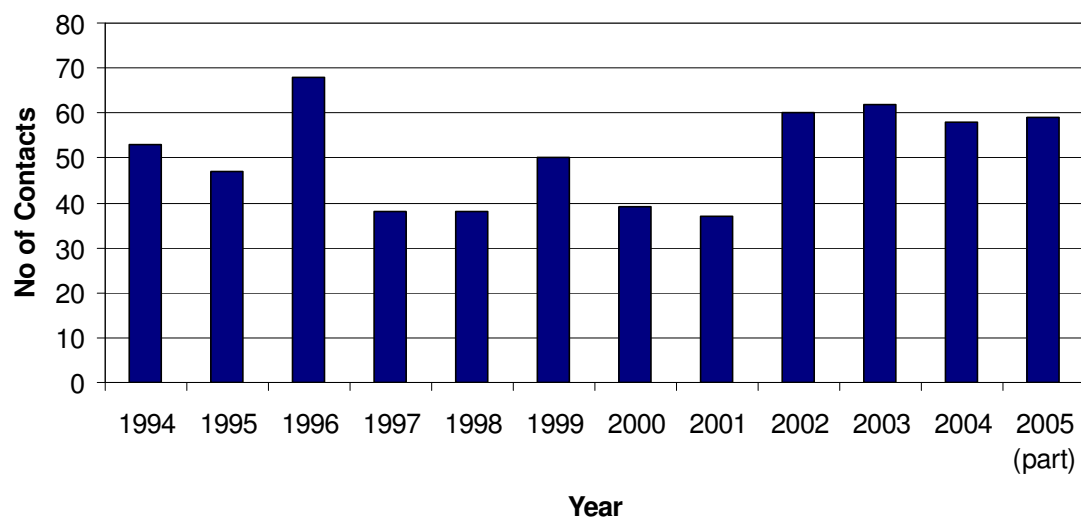


Figure 3.13 Contact Incidents per Year (MAIB 1994-Sep 2005)

The average number of contacts per year, excluding 2005 which is a part-year, was 50.

The distribution of vessel types involved in contacts is presented in Figure 3.14.

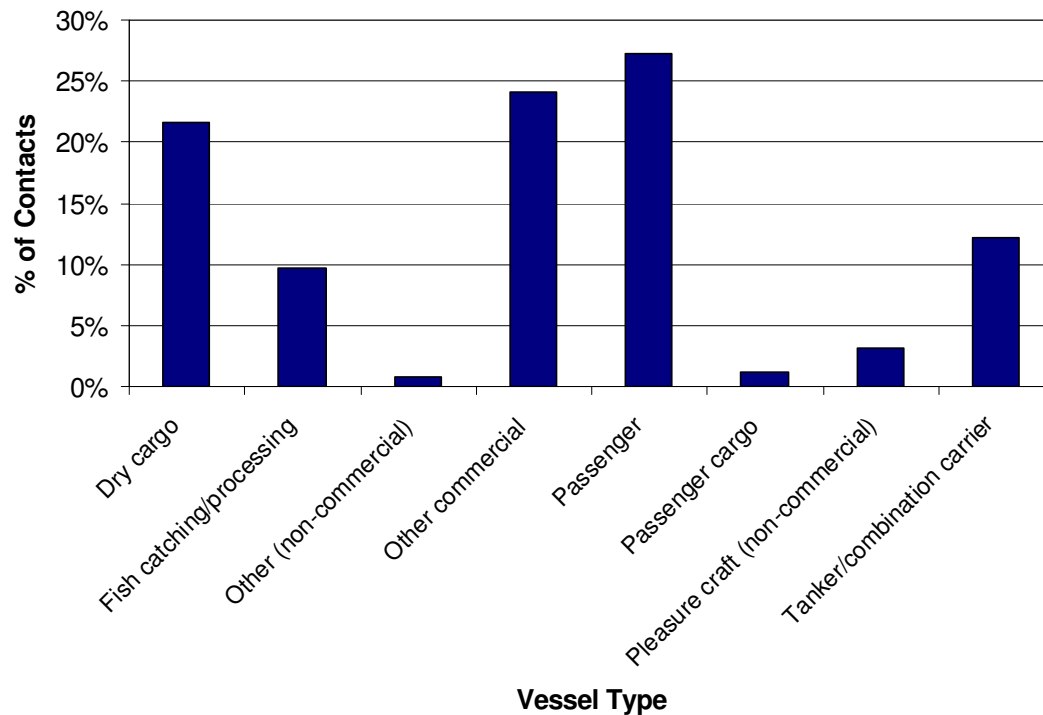


Figure 3.14 Contacts by Vessel Type (MAIB 1994-Sep 2005)

Therefore, the most common vessel type involved in contacts were passenger ferries (27%), other commercial vessels (24%) and dry cargo vessels (22%).

There were no fatalities in any of the contact incidents recorded by MAIB.

B4. Fatality Risk

4.1 Introduction

This section uses the MAIB incident data along with information on average manning levels per vessel type to estimate the probability of fatality in a marine incident associated with the proposed Rampion Offshore Wind Farm development.

The proposed Rampion Offshore Wind Farm is assessed to have the potential to affect the following incidents:

- Passing Powered Collision with Wind Farm Structure;
- Passing Drifting Collision with Wind Farm Structure;
- Vessel-to-Vessel Collision; and
- Fishing Vessel Collision with Wind Farm Structure.

Of these incidents, only vessel-to-vessel collisions match the MAIB definition of collisions and hence the fatality analysis presented in Section 3.2 is considered to be directly applicable to these types of incidents.

The other scenarios of passing powered, passing drifting and fishing vessel collisions with the wind farm structures are technically contacts, i.e., vessel hits an immobile object in the form of a turbine or substation. From Section 3.3 it can be seen that none of the 609 contact incidents reported by MAIB between 1994 and 2005 resulted in fatalities.

However, as the mechanics involved in a vessel contacting a wind turbine may differ in severity from hitting, for example, a buoy, quayside or moored vessel, the MAIB collision fatality risk rate has also been conservatively applied for these incidents.

4.2 Fatality Probability

Twelve of the 623 collision incidents reported by MAIB resulted in one or more fatalities. This represents a 2% probability that a collision will lead to a fatal accident. A total of 21 fatalities resulted from the collision incidents.

To assess the fatality risk for personnel on-board a vessel, either crew, passenger or other, the number of persons involved in the incidents needs to be estimated. From an ILO survey of seafarers during 1998-99 (Ref. iii), the average commercial vessel had a crew of 17. For other (non-commercial vessels) such as naval craft and Royal National Lifeboat Institute (RNLI) lifeboats the average crew has been estimated to be 20. On-board fishing vessels and pleasure craft the average crew has been estimated to be 5. Finally, for passenger vessels it is estimated that the average number of passengers carried, in addition to crew, is 300 (based on UK sea passenger movements on principal ferry routes, Ref. iv).

It is recognised these numbers can be substantially higher or lower on an individual vessel basis depending on size, subtype, etc., but applying reasonable averages is considered sufficient for this analysis.

Using the average number of persons carried along with the vessel type information involved in collisions reported by MAIB (see Figure 3.10), gives an estimated 50,000 personnel on-board the ships involved in the collisions.

Based on 21 fatalities, the overall fatality probability in a collision for any individual on-board is approximately 4.3×10^{-4} per collision (0.04%).

It is considered inappropriate to apply this rate uniformly as the statistics clearly shown that the majority of fatalities tend to be associated with smaller craft, such as fishing vessels and recreational craft. Therefore, the fatality probability has been subdivided into two categories of vessel as presented in Table 4.1.

Table 4.1 Fatality Probability per Incident per Vessel Category

Vessel Category	Sub Categories	Fatalities	People Involved	Fatality Probability
Commercial	Dry cargo, passenger, tanker, etc.	3	46,200	6.5E-05
Non-Commercial	Fishing, pleasure, etc.	18	3,120	5.8E-03

From the above table it can be seen the risk is approximately two orders of magnitude higher for people on-board non-commercial vessels.

4.3 Fatality Risk due to the Proposed Rampion Offshore Wind Farm

The base case and future case annual collision frequency levels without the Rampion Offshore Wind Farm and with both of the proposed turbine layouts are summarised below.

Table 4.2 Summary of Annual Collision Frequency Results – Scenario 1

Collision Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	1.9E-04	1.9E-04	--	2.1E-04	2.1E-04
Passing Drifting	--	8.5E-05	8.5E-05	--	9.4E-05	9.4E-05
Vessel-to-Vessel	1.2	1.2	1.5E-03	1.4	1.4	1.6E-03
Fishing	--	1.5E-01	1.5E-01	--	1.7E-01	1.7E-01
Total	1.2	1.4	1.5E-01	1.4	1.5	1.7E-01

Table 4.3 Summary of Annual Collision Frequency Results – Scenario 2

Collision Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	2.0E-04	2.0E-04	--	2.2E-04	2.2E-04
Passing Drifting	--	1.0E-04	1.0E-04	--	1.1E-04	1.1E-04
Vessel-to-Vessel	1.2	1.2	7.5E-04	1.4	1.4	8.3E-03
Fishing	--	1.5E-01	1.5E-01	--	1.7E-01	1.7E-01
Total	1.2	1.4	1.5E-01	1.4	1.5	1.7E-01

For the local vessels operating in the area of the site, the average manning/persons on-board (POB) has been estimated as follows.

Table 4.4 Vessel types, incidents and average persons exposed

Vessel Type	Collision Incidents	Average Manning/ POB
Cargo/Dredger	Passing powered, passing drifting, vessel-to-vessel.	17
Tanker	Passing powered, passing drifting, vessel-to-vessel.	20
Passenger Ferry	Passing powered, passing drifting, vessel-to-vessel.	1,000

Vessel Type	Collision Incidents	Average Manning/ POB
Fishing Vessel	Vessel-to-vessel and fishing.	6
Recreational Craft	Vessel-to-vessel.	4

From the detailed results of the collision frequency modelling, the distribution of the predicted change in collision frequency by vessel type due to the proposed Rampion Offshore Wind Farm layouts are presented in the following figures.

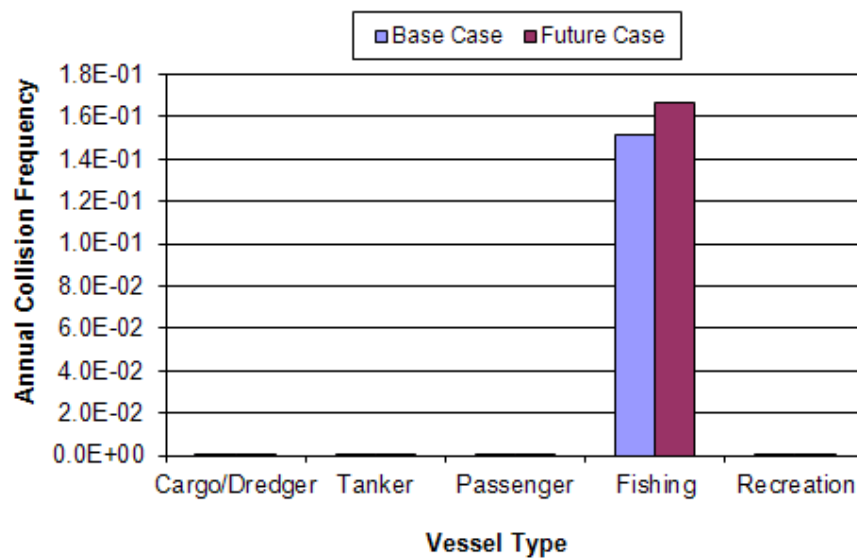


Figure 4.1 **Change in Collision Frequency by Vessel Type Estimated for the Proposed Rampion Offshore Wind Farm (Scenario 1)**

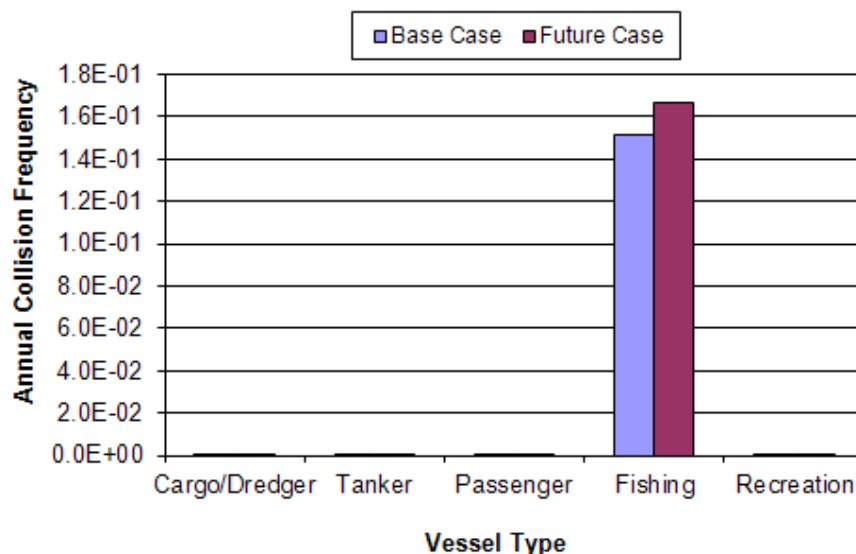


Figure 4.2 Change in Collision Frequency by Vessel Type Estimated for the Proposed Rampion Offshore Wind Farm (Scenario 2)

It can be seen that for both of the proposed turbine layouts the change in collision frequency is dominated by fishing vessels. The change in frequency is lowest for commercial vessels (cargo/dredger, tankers and ferries) and recreational craft.

Combining the collision frequency, the estimated number of persons onboard each vessel type (Table 4.4) and the estimated fatality probability for that vessel category (Table 4.1), the annual increase in Potential Loss of Life (PLL) due to the impact of the proposed Rampion Offshore Wind Farm is estimated to be as follows:

Table 4.5 Potential Loss of Life due to Rampion Offshore Wind Farm

	Layout 1	Layout 2
Base Case PLL (fatalities per year)	5.3E-03	5.3E-03
Future Case PLL (fatalities per year)	5.8E-03	5.8E-03

For the worst case turbine layout (Scenario 1) the estimated base case PLL increase equates to an average of one additional fatality in 189 years, whilst the future case PLL increase corresponds to an average of one additional fatality in 172 years.

For both of the proposed turbine layouts, the predicted incremental increases in PLL due to the wind farm, distributed by vessel type for the base and future cases, are presented in Figure 4.3 and Figure 4.4.

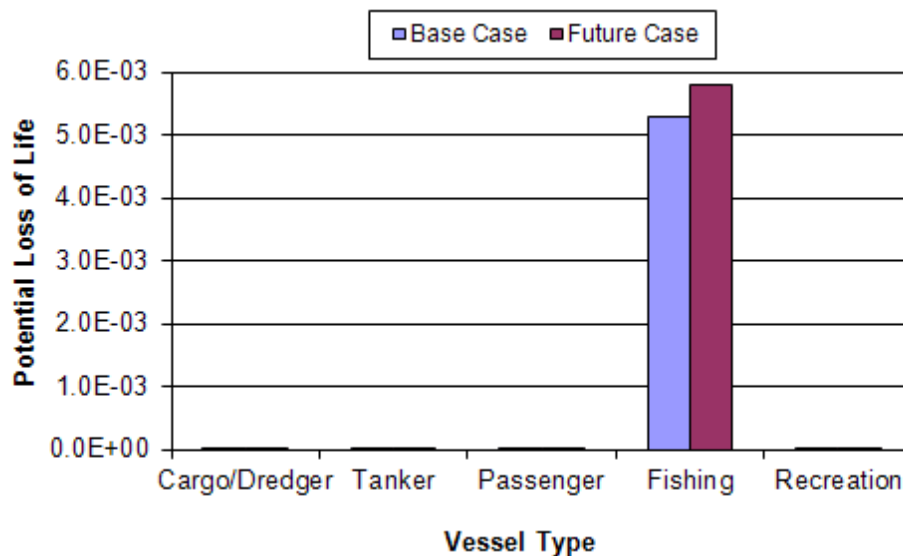


Figure 4.3 Estimated Change in Annual PLL by Vessel Type due to the Proposed Rampion Offshore Wind Farm (Scenario 1)

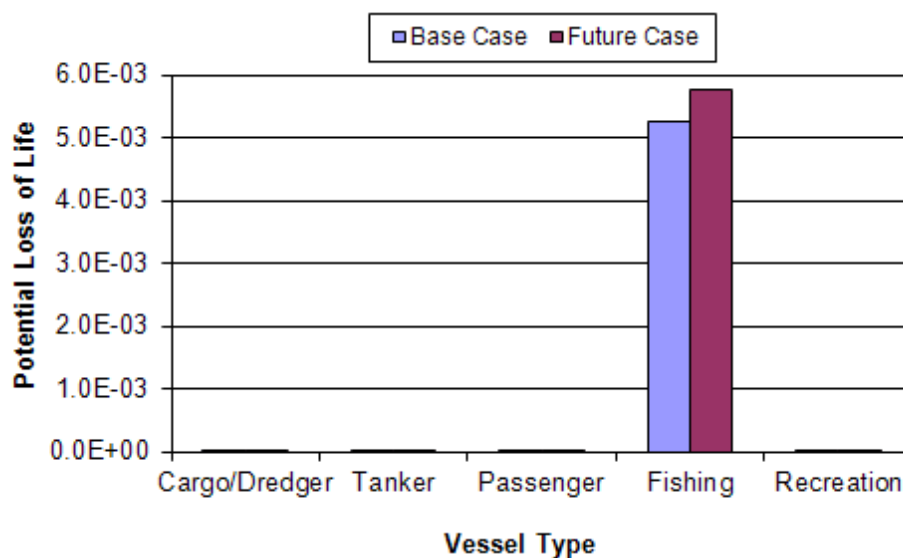


Figure 4.4 Estimated Change in Annual PLL by Vessel Type due to the proposed Rampion Offshore Wind Farm (Scenario 2)

Therefore, it can be seen that the fatality risk is dominated by fishing vessels, which historically have a higher fatality probability per incident than merchant vessels.

Converting the PLL to individual risk based on the average number of people exposed by vessel type, the results are presented in Figure 4.5 and Figure 4.6.

This calculation assumes that for cargo/offshore vessels, tankers, fishing and recreational craft, the risk is shared between 10 vessels of each type, which is considered to be conservative based on the number of different vessels operating in the vicinity of the site.

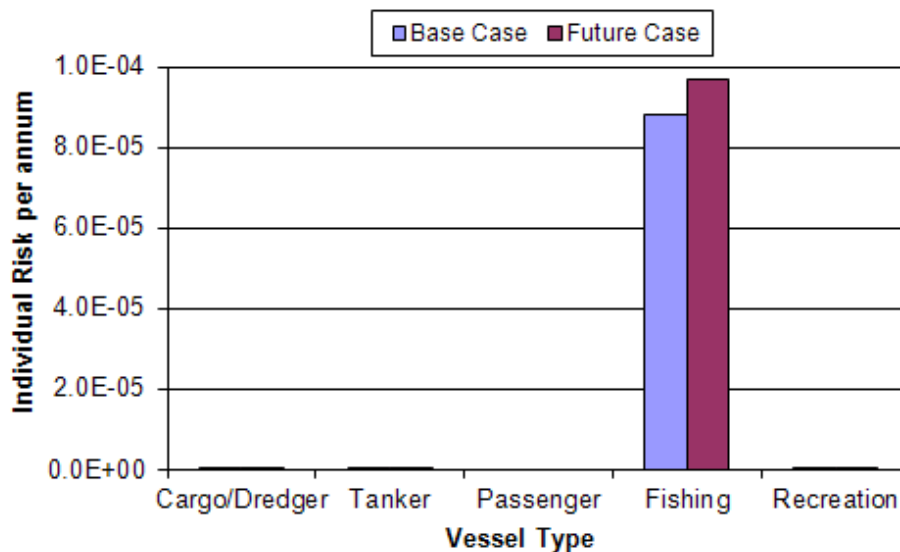


Figure 4.5 Estimated Change in Individual Risk by Vessel Type due to the Proposed Rampion Offshore Wind Farm (Scenario 1)

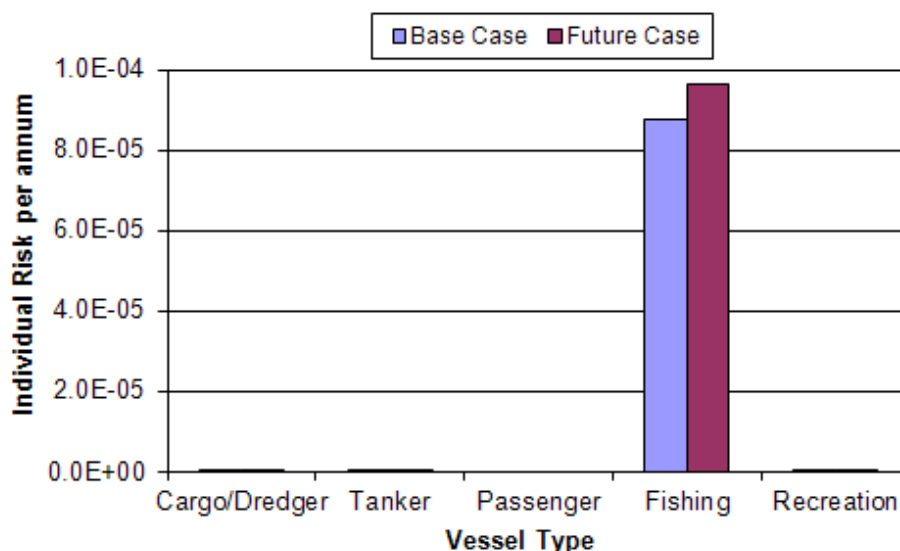


Figure 4.6 Estimated Change in Individual Risk by Vessel Type due to the Proposed Rampion Offshore Wind Farm (Scenario 2)

Therefore, individual risk is highest for people on fishing vessels, which is related to the higher probability of fatalities occurring in the event of an incident and the greater change in collision frequency for fishing vessels.

4.4 Significance of Increase in Fatality Risk – Rampion Offshore Wind Farm

The worst case overall increase in PLL estimated due to the development is 5.3×10^{-3} fatalities per year for turbine Scenario 1 (base case), which equates to one additional fatality in 189 years. This is a small change compared to the MAIB statistics which indicate an average of 29 fatalities per year in UK territorial waters.

In terms of individual risk to people, the incremental increase for commercial ships (in the region of 10^{-8}) is very low compared to the background risk level for the UK sea transport industry of 2.9×10^{-4} per year.

Similarly, for fishing vessels, whilst the change in individual risk attributed to the development is higher than for commercial vessels (in the region of 10^{-4}), it is relatively low compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

B5. Pollution Risk

5.1 Historical Analysis

The pollution consequences of a collision in terms of oil spill depend on the following:

- Spill probability (i.e., likelihood of outflow following an accident)
- Spill size (amount of oil)

Two types of oil spill are considered:

- Fuel oil spills from bunkers (all vessel types)
- Cargo oil spills (laden tankers)

The research undertaken as part of the DfT's Marine Environmental High Risk Areas (MEHRAs) project (Ref. v) has been used as it was comprehensive and based on worldwide marine spill data analysis.

From this research, the overall probability of a spill per accident was calculated based on historical accident data for each accident type as presented in Figure 5.1.

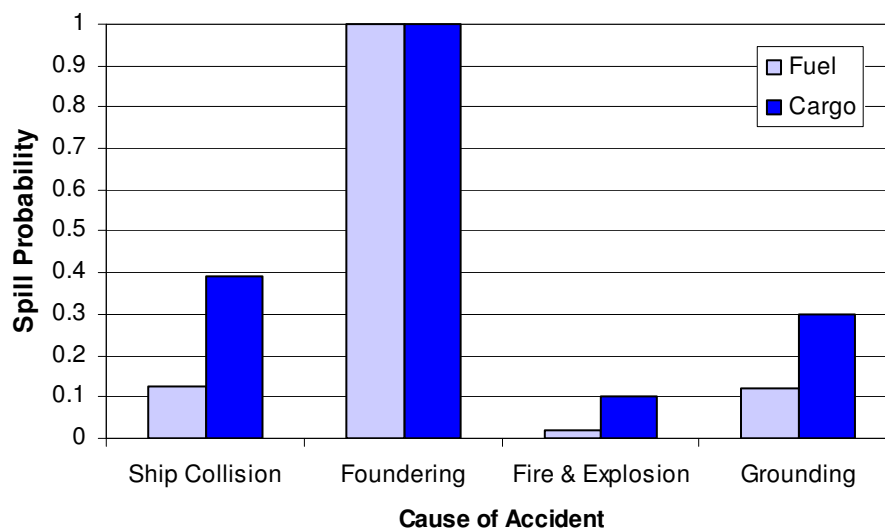


Figure 5.1 Probability of an Oil Spill Resulting from an Accident

Therefore, it was estimated that 13% of ship collisions result in a fuel oil spill and 39% of collisions involving a laden tanker result in a cargo oil spill.

In the event of a bunker spill, the potential outflow of oil depends on the bunker capacity of the vessel. Historical bunker spills from ships have generally been limited to a size below 50% of the bunker capacity, and in most incidents much lower. For the types and sizes of

ships exposed to the site, an average spill size of 100 tonnes of fuel oil is considered to be a conservative assumption.

For cargo spills from laden tankers, the spill size can vary significantly. International Tanker Owners Pollution Federation limited (ITOPF) report the following spill size distribution for tanker collisions between 1974 and 2004.

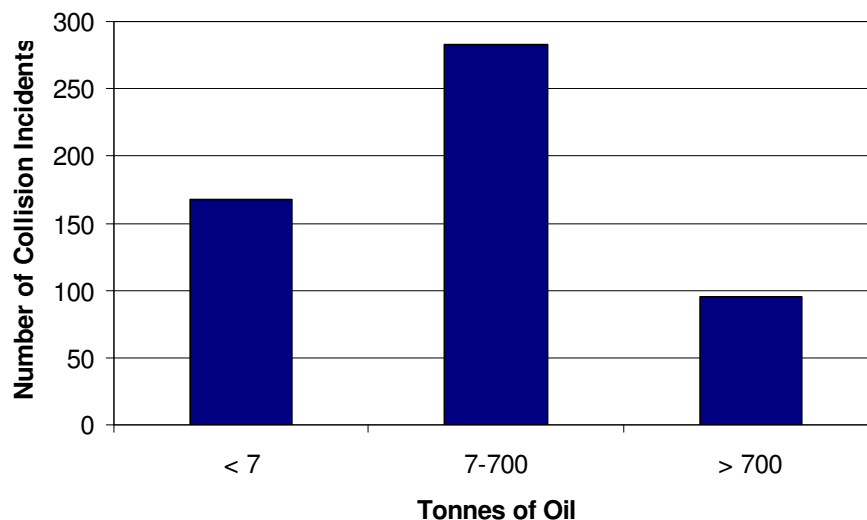


Figure 5.2 Spill Size Distribution in Tanker Collision Incidents (ITOPF 1974-2004)

31% of spills are below 7 tonnes, 52% are between 7 and 700 tonnes and 17% are greater than 700 tonnes. Based on this data and the tankers transiting the area in proximity to the proposed Rampion Offshore Wind Farm, an average spill size of 400 tonnes is considered conservative.

For fishing and recreational craft collisions, comprehensive statistical data is not available so it is conservatively assumed that 50% of all collisions involving these vessels will lead to oil spill with the quantity spilled being an average of 5 tonnes for fishing vessels and 1 tonne for recreational craft.

5.2 Pollution Risk – Rampion Offshore Wind Farm

Applying the above probabilities to the collision frequency by vessel type presented in Figure 4.1 to Figure 4.2, and the average spill size per vessel, the amount of oil spilled per year due to the impact of the development is estimated to be as follows:

Table 5.1 Annual Oil Spilled due to Rampion Offshore Wind Farm

	Layout 1	Layout 2
Base Case (tonnes of oil per year)	0.40	0.39
Future Case (tonnes of oil per year)	0.44	0.43

The predicted increases in tonnes of oil spilled distributed by vessel type for the two proposed turbine layouts are presented in Figure 5.3 to Figure 5.4.

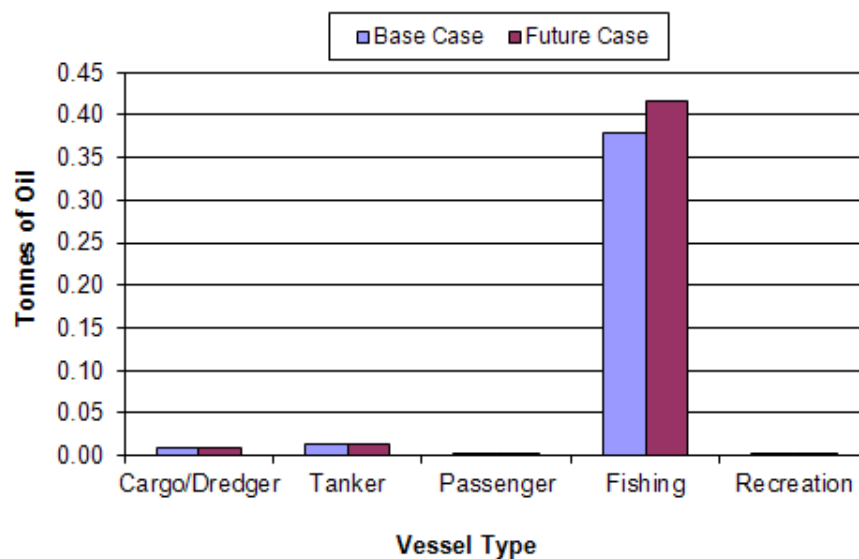


Figure 5.3 Estimated Change in Pollution by Vessel Type due to the proposed Rampion Offshore Wind Farm (Scenario 1)

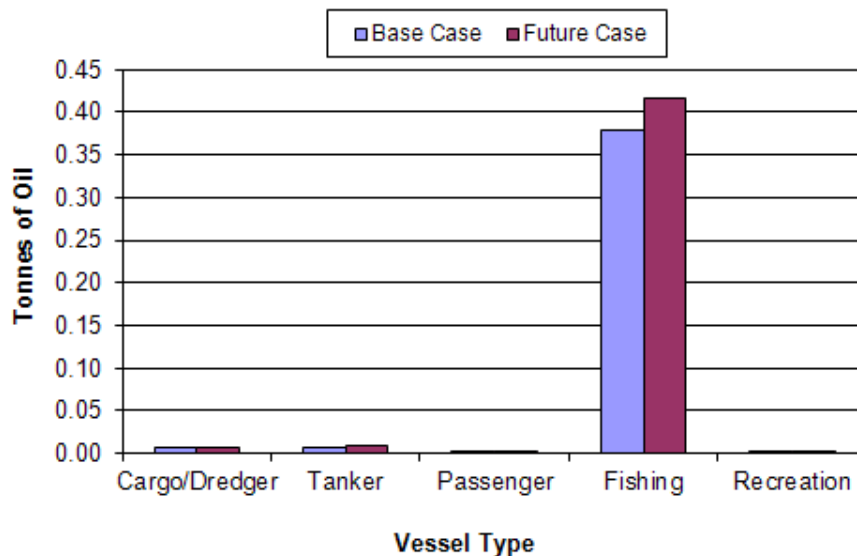


Figure 5.4 Estimated Change in Pollution by Vessel Type due to the proposed Rampion Offshore Wind Farm (Scenario 2)

It can be seen that fishing vessels contribute the vast majority of the overall risk of oil spill, given the high annual collision frequency for the proposed development.

5.3 Significance of Increase in Pollution Risk

To assess the significance of the increased pollution risk from marine vessels caused by the proposed Rampion Offshore Wind Farm, historical oil spill data for the UK has been used as a benchmark.

From the MEHRAs research (Ref. v); the average annual tonnes of oil spilled in the waters around the British Isles due to marine accidents in the 10-year period from 1989-98 was 16,111. This is based on a total of 146 reported oil pollution incidents of greater than 1 tonne (smaller spills are excluded as are incidents which occurred within port and harbour areas or as a result of operational errors or equipment failure). Merchant vessel spills accounted for approximately 99% of the total while fishing vessel incidents accounted for less than 1%.

The overall increase in pollution estimated due to the development is very low compared to the historical average pollution quantities from marine accidents in UK waters (approximately 0.0025% for Scenario 1, the worst case).

B6. Conclusions

The quantitative risk assessment indicates that the impact of the proposed Rampion Offshore Wind Farm on people and the environment is relatively low compared to background risk levels in UK waters.

However, it is recognised that there is a degree of uncertainty associated with numerical modelling. For example, the model does not consider the potential radar interference from turbines which may have an influence on the risk of vessel-to-vessel collisions, especially in reduced visibility where one or both of the vessels involved is not carrying Automatic Identification System (AIS). Therefore, conservative assumptions have been applied in this analysis and the overall project is being carried out based on the principle of ALARP to ensure the risks to people and the environment are managed to a level that is as low as reasonably practicable.

It should also be noted that this is the localised impact of a single project and there will be additional maritime risks associated with other offshore wind farm projects on the south coast of England and the UK as a whole.

B7. References

- i IMO Maritime Safety Committee, 74th Edition, Agenda Item 5 (MSC 74/5/X), Bulk Carrier Safety – Formal Safety Assessment, 2001.
- ii MCA “Safety Information – FSA, Statistical Data” web page.
- iii International Labour Organisation, The Impact on Seafarers’ Living and Working Conditions of Changes in the Structure of the Shipping Industry, Geneva 2001, JMC/29/2001/3.
- iv Department for Transport Maritime Statistics 2004.
- v Department for Transport, Identification of Marine Environmental High Risk Areas (MEHRA’s) in the UK, 2001.



MCA MGN 371

Checklist

Rampion Offshore

Wind Farm

(Appendix C)

Prepared by: Anatec Limited

Presented to: E.ON Climate & Renewables

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C1. Introduction

This Appendix presents the Maritime and Coastguard Agency (MCA) checklist based on the requirements set out in Marine Guidance Note (MGN) 371 which was the guidance set by the MCA.

Reference notes/remarks are made within the table based on which sections of the Navigational Risk Assessment (NRA), or other documents, address the issue noted in the MGN 371 checklist.

C2. MGN 371 Compliance Checklist

Table 1 MGN 371 Compliance Checklist for the Rampion Offshore Wind Farm

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
Annex 1 : Considerations on Site Position, Structures and Safety Zones			
1. Site and Installation Co-ordinates: Developers are responsible for ensuring that formally agreed variations in the co-ordinates of site perimeters and individual OREI structures are made available, on request, to interested parties at all project stages, including application for consent, development, array variation, operation and decommissioning. This should be supplied as authoritative Geographical Information System (GIS) data, preferably in Environmental Systems Research Institute (ESRI) format. Metadata should facilitate the identification of the data creator, its date and purpose, and the geodetic datum used. For mariners' use, appropriate data should also be provided in latitude/ longitude formats.			
2. Traffic Survey			
All vessel types	✓		Section 8: Maritime Traffic Surveys – 8.2: Survey Details. <i>Tracking of all vessel types was achieved by recording AIS and Radar data.</i>
Four weeks duration, within 12 months prior to submission of the Environmental Statement	✓		Section 8: Maritime Traffic Surveys – 8.2: Survey Details. <i>Survey period comprised two 14 day shore based AIS/Radar surveys during January 2011 and July 2011.</i> <i>Coastal AIS data collection carried out from January 2011 onwards.</i>
Seasonal variations	✓		Section 8: Maritime Traffic Surveys – 8.2: Survey Details. <i>Surveys have been carried out during January and July 2011, encompassing winter and summer seasonal variations.</i> <i>Coastal AIS data collection from January 2011 onwards encompasses seasonal variations in traffic patterns.</i>
Recreational and fishing vessel organisations	✓		Section 8: Maritime Traffic Surveys. <i>Winter and summer surveys were undertaken to take account</i>

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			seasonal variations in fishing and recreational traffic patterns.
Port and navigation authorities	✓		Section 5: Consultation – 5.6: Local Ports. Shoreham Port stated that the number of vessels using the port increased significantly after the survey in January 2011. It was noted in consultation with Newhaven Port that dredgers associated with Newhaven were not recorded in the two 14 day surveys, as the plant in Newhaven was shut down. Periods of AIS data used in the assessment of vessels using Shoreham port (Section 9: Impact on Commercial Shipping Navigation.) and dredgers associated with Newhaven (Section 8: Maritime Traffic Surveys – 8.3.2: Dredgers and Underwater Operations Vessels) were chosen considering these points.
Assessment			
a. Proposed OREI site relative to areas used by any type of marine craft.	✓		Section 8: Maritime Traffic Surveys. Summarises the results of the Maritime Traffic Surveys. Section 9: Impact on Commercial Shipping Navigation. Considers the impact on commercial shipping navigation based on the Maritime Traffic Surveys. Section 10: Impact on Aggregates Dredging. Considers the impact on marine aggregates dredgers. Section 11: Recreational Craft Activity. Examines recreational craft activity in the area based on the Maritime Traffic Survey and available desktop information. Section 12: Fishing Vessel Activity. Reviews fishing vessel activity in the area based on the

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			<i>Maritime Traffic Surveys.</i>
b. Numbers, types and sizes of vessels presently using such areas	✓		Section 8: Maritime Traffic Surveys. Summarises the results of the Maritime Traffic Surveys, including the numbers and types (8.3: Shipping Levels and Types) and sizes (8.4: Ship Length and Draught Information) of vessels. Section 11: Recreational Craft Activity. Examines recreational craft activity in the area based on the Maritime Traffic Survey and available desktop information. Section 12: Fishing Vessel Activity. Reviews fishing vessel activity in the area based on the Maritime Traffic Surveys, and sightings and satellite data.
c. Non-transit uses of the areas, e.g. fishing, day cruising of leisure craft, racing, aggregate dredging, etc.	✓		Section 12: Fishing Vessel Activity. Reviews fishing vessel activity in the area based on the Maritime Traffic Surveys, sightings and satellite data. Section 11: Recreational Craft Activity. Examines recreational vessel activity in the area based on the Maritime Traffic Survey and available desktop information. Section 6: Existing Environment – 6.8: Aggregates Dredging. Investigates the proximity of the site to marine aggregate dredging areas. Section 8: Maritime Traffic Surveys – 8.3.2: Dredgers and Underwater Operations Vessels. Examines aggregates dredger activity, based on the Maritime Traffic Surveys.
d. Whether these areas contain transit routes used by coastal or deep-draught vessels on passage.	✓		Section 8: Maritime Traffic Survey – 8.4: Ship Length and Draught Information. Determines whether these areas contain transit routes used by coastal or deep-

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			<i>draught vessels on passage, by examination of draught details in Maritime Traffic Survey data.</i>
e. Alignment and proximity of the site relative to adjacent shipping lanes	✓		Section 8: Maritime Traffic Surveys, and Section 9: Impact on Commercial Shipping Navigation. <i>Studies alignment and proximity of the site relative to adjacent shipping lanes, by analysis of Maritime Traffic Survey data.</i>
f. Whether the nearby area contains prescribed routing schemes or precautionary areas	✓		Section 6: Existing Environment – 6.4: Routing Measures. <i>States whether the area contains prescribed routing schemes or precautionary areas, from analysis of Hydrographic Charts.</i>
g. Whether the site lies on or near a prescribed or conventionally accepted separation zone between two opposing routes	✓		Section 6: Existing Environment – 6.4: Routing Measures. <i>States whether the site lies on or near a prescribed or conventionally accepted separation zone between two opposing routes, from analysis of Hydrographic Charts.</i>
h. Proximity of the site to areas used for anchorage, safe haven, port approaches and pilot boarding or landing areas.	✓		Section 6: Existing Environment – 6.3: Chartered Anchorages and Section 8: Maritime Traffic Surveys – 8.6: Anchored Vessels. <i>Examines the proximity of the site to areas used for anchorage, from analysis of Hydrographic Charts, the Admiralty Sailing Directions for the area and AIS data.</i> 6.2: Port Facilities/Services. <i>Examines the proximity to pilot boarding or landing areas.</i>
i. Whether the site lies within port limits, etc. jurisdiction of a port and/or navigation authority.	✓		Section 6: Existing Environment – 6.2: Port Facilities/Services. <i>Examines whether the site lies within the limits of jurisdiction of a port and/or navigation authority, by information from Hydrographic Charts.</i>
j. Proximity of the site to existing fishing grounds, or to routes used by fishing	✓		Section 12: Fishing Vessel Activity. <i>Reviews the fishing vessel</i>

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
vessels to such grounds.			<i>activity at the site based on the maritime traffic surveys, and sightings and satellite data for the area.</i>
k. Proximity of the site to offshore firing/bombing ranges and areas used for any marine military purposes.	✓		Section 6: Existing Environment – 6.9: Exercise areas. <i>Analysis of SeaZone Hydrographic GIS files and Hydrographic Charts to determine proximity to military areas.</i>
l. Proximity of the site to existing or proposed offshore oil / gas platform, marine aggregate dredging, marine archaeological sites or wrecks, or other exploration/exploitation sites	✓		Section 6: Existing Environment – 6.8: Aggregates Dredging. <i>Analyses GIS files from the Crown Estate to determine proximity to marine aggregate dredging sites.</i> 6.7: Wrecks. <i>Considers the locations of wrecks in the area, from analysis of hydrographic charts.</i>
m. Proximity of the site relative to any designated areas for the disposal of dredging spoil	✓		Section 6: Existing Environment – 6.8: Aggregates Dredging. <i>Examines the proximity of the site to spoil grounds from analysis of hydrographic charts.</i>
n. Proximity of the site to aids to navigation and/or Vessel Traffic Services (VTS) in or adjacent to the area and any impact thereon.	✓		Section 6: Existing Environment – 6.5: Aids to Navigation. <i>Examined Hydrographic Charts and Admiralty Sailing Directions for the area for positions of navigational aids and to determine proximity to VTS.</i>
o. Researched opinion using computer simulation techniques with respect to the displacement of traffic and, in particular, the creation of ‘choke points’ in areas of high traffic density.	✓		Section 14: Risk Assessment. <i>Used computer simulation techniques to assess present-day vessel activity and future-case with wind farm activity, with vessels being displaced following construction.</i> <i>Examined encounters, vessel-to-vessel collisions, vessel collision with structure, fishing vessel and recreational craft collision with structure.</i>
p. Type(s) of simulation used in analysis	✓		Section 13: Formal Safety

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
Limitation of system(s)			Assessment – 13.4: Risk Analysis. Discusses simulations used in the analysis. All the quantified risk assessments were carried out using Anatec's COLLRISK software which conforms to the DECC methodology as outlined in Annex D3 in the Guidance. In line with this, Anatec makes the declaration that the models used within this work have been validated and are appropriate for the intended use.
3. OREI Structures			
a. Whether any features of the OREI, including auxiliary platforms outside the main generator site and cabling to the shore, could pose any type of difficulty or danger to vessels underway, performing normal operations, or anchoring.	✓		Section 3: Rochdale Envelope – 3.3: Structure Details. Outlines the Rochdale Envelope, including the number of OREI structures and auxiliary platforms. 3.4: Offshore Inter Array and Export Cable Routes. Examines options for cabling to shore. Section 9: Impact on Commercial Shipping Navigation. Considers the impact of the OREI on vessels steaming on passage. Section 10: Impact on Aggregates Dredging. Considers the impact of the OREI on marine aggregates dredgers. Section 11: Recreational Craft Activity – 11.4: Recreational Craft Impact Assessment. Assesses the impact of the OREI on vessels engaged in recreational activities. Section 12: Fishing Vessel Activity – 12.5: Fishing Vessel Impact Assessment. Assesses the impact of the OREI on vessels engaged in fishing or transiting to fishing grounds. Section 14: Risk Assessment – 14.3: With Wind Farm Risk (Base

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			<i>Case). Assesses the impact that the OREI will have upon vessel-to-vessel collisions, vessel collision with structure (powered and drifting) fishing vessel collisions with structure and recreational vessel collisions with structure.</i> 14.4: Cable Interaction – Anchor and Trawl. Examines impact that cabling to the shore will have on vessels. 14.5: Future Case Level of Risk. Discusses potential increases in future shipping levels. 14.6: Risk Results Summary and 14.7 Consequences. Present a summary of results from modelling used to assess whether any features of the OREI could pose any type of difficulty or danger to vessels underway, performing normal operations, or anchoring.
Clearances of wind turbine blades above the sea surface <i>not less than 22 metres</i>	✓		Section 3: Rochdale Envelope – 3.3: Structure Details. Minimum clearances between sea level conditions at MHWS and wind turbine rotors will be not less than 22m and will meet MCA guidance.
Least depth of current turbine blades	✓		Not applicable.
The burial depth of cabling	✓		Section 3: Rochdale Envelope – 3.4: Offshore Inter Array and Export Cable Routes. The export and inter-array cables will be buried and/or protected (burial target depth of 1m below the seabed superficial deposits). Section 14: Risk Assessment – 14.4: Cable Interaction – Anchor and Trawl. Assessment of cable route. Cables will be buried / protected appropriately taking into account fishing and anchoring practices.
b. Whether any feature of the installation	✓		Section 19: Search and Rescue

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
could create problems for emergency rescue services, including the use of lifeboats, helicopters and emergency towing vessels (ETVs)			(SAR). Summarises the SAR features of the area. 19.2.1: SAR Helicopters. Summarises the SAR helicopter assets in the vicinity of the site. 19.2.2: RNLI Lifeboats. Summarises RNLI lifeboat stations in the vicinity and response times of their vessels to the site. 19.2.5: Salvage. Examines options for salvage in the of the project. 19.3: Wind Farm SAR Matters. Determines whether the installations could create problems for emergency rescue services.
c. With respect to specific OREI devices, how rotor blade rotation, other exposed moving mechanical parts and/or power transmission, etc., will be controlled by the designated services when this is required in an emergency.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. States that the wind farm will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of this being required in an emergency.
4. Assessment of Access to and Navigation Within, or Close to , an OREI: To determine the extent to which navigation would be feasible within the OREI site itself by assessing whether:			
a. Navigation within or close to the site would be safe:			
i. by all vessels, or ii. by specified vessel types, operations and/or sizes. iii. in all directions or areas, or iv. in specified directions or areas. v. in specified tidal, weather or other conditions	✓ ✓ ✓ ✓ ✓		Section 9: Impact on Commercial Shipping Navigation. Assesses whether navigation within or close to the site would be safe for commercial vessels. Section 10: Impact on Aggregates Dredging. Assessed whether navigation within or close to the site would be safe for aggregates dredgers. Section 11: Recreational Craft Activity – 11.4: Recreational Craft

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			Impact Assessment. Assesses whether navigation within or close to the site would be safe for recreational craft, including passing between turbines. Section 12: Fishing Vessel Activity – 12.5: Fishing Vessel Impact Assessment. Assesses whether navigation within or close to the site would be safe for fishing vessels, including passing between turbines. Section 14: Risk Assessment. Uses a variety of models to assess whether navigation within or close to the site would be safe for all vessels and fishing vessels and recreational craft. The models take into account tidal and weather conditions. Section 15: Construction and Decommissioning Impacts. Assesses whether navigation within or close to the site would be safe for all vessels during construction and decommissioning phases of the Project.
b. Navigation in and/or near the site should be:			
i. prohibited by specified vessels types, operations and/or sizes.	✓		Section 9: Impact on Commercial Shipping Navigation. Assesses whether navigation within or close to the site should be prohibited or recommended to be avoided by commercial vessels. Section 11: Recreational Craft Activity – 11.4: Recreational Craft Impact Assessment. Assesses whether navigation within or close to the site should be prohibited or recommended to be avoided by recreational craft. Section 12: Fishing Vessel Activity – 12.5: Fishing Vessel
ii. prohibited in respect of specific activities,	✓		
iii. prohibited in all areas or directions, or	✓		
iv. prohibited in specified areas or directions, or	✓		
v. prohibited in specified tidal or weather conditions, or simply	✓		
vi. Recommended to be avoided.	✓		

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			Impact Assessment. Assesses whether navigation within or close to the site should be prohibited or recommended to be avoided by fishing vessels. Section 14: Risk Assessment. Uses a variety of models to assess whether navigation within or close to the site should be prohibited or recommended to be avoided by all vessels and fishing vessels and recreational draft. The models take into account tidal and weather conditions.
c. Exclusion from the site could cause navigational, safety or routeing problems for vessels operating in the area. eg by causing a vessel or vessels to follow a less than optimum route	✓		Section 9: Impact on Commercial Shipping Navigation. Assesses whether exclusion from the site could cause navigation, safety or routeing problems for commercial vessels operating in the area. Section 9.3: Dredging Transit Routes and Section 10: Impact on Aggregates Dredging. Assesses whether exclusion from the site could cause navigation, safety or routeing problems for aggregates dredgers. Section 11: Recreational Craft Activity – 11.4: Recreational Craft Impact Assessment. Assesses whether exclusion from the site could cause navigation, safety or routeing problems for recreational craft operating in the area. Section 12: Fishing Vessel Activity – 12.5: Fishing Vessel Impact Assessment. Assesses whether exclusion from the site could cause navigation, safety or routeing problems for fishing vessels operating in the area.
Relevant information concerning a decision to seek a “safety zone” for a particular site during any point in its	✓		Section 18: Safety Zones. Presents relevant information concerning a decision to seek a

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
construction, operation or decommissioning should be specified in the Environmental Statement accompanying the development application			<i>'safety zone' for the Project during any point in its construction, operation or decommissioning.</i>
Annex 2 : Navigation, collision avoidance and communications			
1. The Effect of Tides and Tidal Streams : It should be determined whether:			
i. Current maritime traffic flows and operations in the general area are affected by the depth of water in which the proposed installation is situated at various states of the tide i.e. whether the installation could pose problems at high water which do not exist at low water conditions, and vice versa.	✓		Section 3: Rochdale Envelope – 3.2: Rampion Site Boundary. States the depth of water in which the proposed installation is situated. Section 6: Existing Environment – 6.10: Metocean Data. Examines various states of the tide in the area. Section 8: Maritime Traffic Surveys. Assesses current maritime traffic flows and operations in the general area. Surveys accounted for a range of tidal conditions. Section 14: Risk Assessment. Models take into account tides in the vicinity.
ii. The set and rate of the tidal stream, at any state of the tide, has a significant effect on vessels in the area of the OREI site.	✓		Section 6: Existing Environment – 6.10: Metocean Data. Examines various states of the tide in the area. Section 14: Risk Assessment. Models take into account tides in the vicinity.
iii. The maximum rate tidal stream runs parallel to the major axis of the proposed site layout, and, if so, its effect.	✓		Section 6: Existing Environment – 6.10: Metocean Data. Assesses tidal streams in the area.
iv. The set is across the major axis of the layout at any time, and, if so, at what rate.	✓		Section 6: Existing Environment – 6.10: Metocean Data. Assesses tidal streams in the area.
v. In general, whether engine failure or other circumstance could cause vessels to be set into danger by the tidal stream.	✓		Section 6: Existing Environment – 6.10: Metocean Data. Assesses tidal streams in the area. Section 14: Risk Assessment – 14.3.2: Ship Collision with Structure. Drifting vessel collision

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			<i>models take into account tides in the area.</i>
vi. The structures themselves could cause changes in the set and rate of the tidal stream.	✓		Section 20: Additional Navigational Issues – Section 20.3: Potential Effects on Waves and Tidal Currents. Summarises study to assess changes in the set and rate of the tidal stream.
vii. The structures in the tidal stream could be such as to produce siltation, deposition of sediment or scouring, affecting navigable water depths in the wind farm area or adjacent to the area	✓		Section 20: Additional Navigational Issues – Section 20.5: Sedimentation/Scouring Impacting Navigable Water Depths in Area. Summarises study to assess potential for siltation, deposition of sediment or scouring, affecting navigable water depths in the wind farm area or adjacent to the area.
2. Weather: It should be determined whether:			
i. The site, in normal, bad weather, or restricted visibility conditions, could present difficulties or dangers to craft, including sailing vessels, which might pass in close proximity to it.	✓		Section 6: Existing Environment – 6.10: Metocean Data. Presents Metocean statistics in the area. Section 8: Maritime Traffic Survey. Assesses routeing of vessels which might pass in close proximity to the site. Section 9: Impact on Commercial Shipping Navigation. Assesses whether the site in normal, bad weather or restricted visibility conditions could present difficulties or dangers to commercial vessels which might pass in close proximity to it. Section 10: Impact on Aggregates Dredging. Assesses whether the site in normal, bad weather or restricted visibility conditions could present difficulties or dangers to marine aggregates dredgers. Section 11: Recreational Craft Activity – 11.4: Recreational Craft Impact Assessment. Assesses

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			<i>whether the site in normal, bad weather or restricted visibility conditions could present difficulties or dangers to sailing vessels which might pass in close proximity to it.</i> Section 12: Fishing Vessel Activity – 12.5: Fishing Vessel Impact Assessment. <i>Assesses whether the site in normal, bad weather or restricted visibility conditions could present difficulties or dangers to fishing vessels which might pass in close proximity to it.</i> Section 14: Risk Assessment. <i>Models take into account weather in the vicinity.</i> Section 20: Additional Navigation Issues. <i>Assesses a number of additional ways that the site could present difficulties or dangers to craft which might pass in close proximity to it.</i>
ii. The structures could create problems in the area for vessels under sail, such as wind masking, turbulence or sheer.	✓		Section 20: Additional Navigation Issues – 20.4: Impacts of Structures on Wind Masking/Turbulence or Sheer. <i>Assesses whether wind masking, turbulence or sheer could create problems in the area for vessels under sail.</i>
iii. In general, taking into account the prevailing winds for the area, whether engine failure or other circumstances could cause vessels to drift into danger, particularly if in conjunction with a tidal set such as referred to in 2.1 (v) above	✓		Section 14: Risk Assessment – 14.3.2: Ship Collision with Structure. <i>Drifting vessel collision. Model assesses whether vessels could drift into danger.</i>
3. Visual Navigation and Collision Avoidance: It should be determined whether:			
i. The structures could block or hinder the view of other vessels under way on any route.	✓		Section 20: Additional Navigation Issues – 20.2.2: Visual Impact (Other Vessels). <i>Assesses whether the structures could block or hinder other vessels' view.</i>

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
ii. The structures could block or hinder the view of the coastline or of any other navigational feature such as aids to navigation, landmarks, promontories, etc	✓		Section 20: Additional Navigation Issues – 20.2.3: Visual Impact (Navigational Aids and/or Landmarks). Assesses whether the structures could block or hinder the view of navigational aids or landmarks.
4. Communications, Radar and Positioning Systems : To provide researched opinion of a generic and, where appropriate, site specific nature concerning whether:			
i. The structures could produce radio interference such as shadowing, reflections or phase changes, with respect to any frequencies used for marine positioning, navigation or communications, including Automatic Identification Systems (AIS), whether ship borne, ashore or fitted to any of the proposed structures.	✓		Section 20: Additional Navigation Issues – 20.8: Impacts on Communications and Position Fixing. Assesses impact of structures upon VHF communications, Navtex, VHF direction finding, AIS, GPS and Loran C.
ii. The structures could produce radar reflections, blind spots, shadow areas or other adverse effects: a. Vessel to vessel; b. Vessel to shore; c. VTS radar to vessel; d. Racon to/from vessel.	✓ ✓ ✓ ✓		Section 16: Impact on Marine Radar Systems. Determines whether the structures could produce Radar reflections, blind spots, shadow areas or other adverse effects.
iii. The OREI, in general, would comply with current recommendations concerning electromagnetic interference.	✓		Section 20: Additional Navigation Issues – 20.7: Electromagnetic Interference on Navigation Equipment. Noted that the OREI would comply with current recommendations concerning electromagnetic interference.
iv. The structures and generators might produce sonar interference affecting fishing, industrial or military systems used in the area.	✓		Section 20: Additional Navigation Issues – 20.6: Structures and Generators Affecting Sonar Systems in Area. Indicates no evidence has been found regarding sonar interference.
v. The site might produce acoustic noise which could mask prescribed sound signals.	✓		Section 20: Additional Navigation Issues – 20.9: Noise Impact. Determines acoustic noise masking sound signals from the site.
vi. Generators and the seabed cabling	✓		Section 20: Additional Navigation

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
within the site and onshore might produce electro-magnetic fields affecting compasses and other navigation systems.			Issues – 20.7: Electromagnetic Interference on Navigation Equipment. States no impact is anticipated.
5. Marine Navigational Marking : It should be determined:			
i. How the overall site would be marked by day and by night taking into account that there may be an ongoing requirement for marking on completion of decommissioning, depending on individual circumstances.	✓		Section 4: Marine Navigational Markings. Outlines how the overall site will be marked.
ii. How individual structures on the perimeter of and within the site, both above and below the sea surface, would be marked by day and by night.	✓		Section 4: Marine Navigational Markings – 4.3: Marking of Individual Structures and 4.4: Proposed Markings. Describes how individual structures will be marked.
iii. If the specific OREI structure would be inherently radar conspicuous from all seaward directions (and for SAR and maritime surveillance aviation purposes) or would require passive enhancers	✓		Large surface structures, therefore not applicable.
iv. If the site would be marked by one or more radar beacons (Racons)	✓		Section 4: Marine Navigational Markings. Describes marking of site. Any additional Aids to Navigation, such as Racons, will be agreed in consultation with Trinity House once the final wind turbine layout has been selected.
v. If the site would be marked by an Automatic Identification System (AIS) transceiver, and if so, the data it would transmit.	✓		Section 4: Marine Navigational Markings. Describes marking of site. Any additional Aids to Navigation will be agreed in consultation with Trinity House once the final wind turbine layout has been selected.
vi. If the site would be fitted with a sound signal, and where the signal or signals would be sited	✓		Section 4: Marine Navigational Markings. Describes marking of site. Any additional Aids to Navigation will be agreed in consultation with Trinity House once the final wind turbine layout has been selected.

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
vii. If the structure(s) would be fitted with aviation marks, and if so, how these would be screened from mariners or potential confusion with other navigational marks and lights resolved	✓		Section 4: Marine Navigational Markings – 4.4: Proposed Markings. Considers aviation marks.
viii. Whether the proposed site and/or its individual generators would comply in general with markings for such structures, as required by the relevant General Lighthouse Authority (GLA) or recommended by the Maritime and Coastguard Agency, respectively.	✓		Section 4: Marine Navigational Markings. Considers compliance with markings as required by GLA / MCA.
ix. The aids to navigation specified by the GLAs are being maintained such that the ‘availability criteria’, as laid down and applied by the GLAs, is met at all times. Separate detailed guidance is available from the GLAs on this matter.	✓		Section 4: Marine Navigational Markings – 4.5: Superintendence and Management. Considers markings as required by GLA.
x. The procedures that need to be put in place to respond to casualties to the aids to navigation specified by the GLAs, within the timescales laid down and specified by the GLAs.	✓		Section 4: Marine Navigational Markings – 4.5: Superintendence and Management. Considers markings as required by GLA.
6. Hydrography: In order to establish a baseline, detailed and accurate hydrographic surveys are required to IHO Order 1a standard multibeam bathymetry with final data being supplied as a digital full density data set, and erroneous soundings flagged as deleted but include in the data set. A full report detailing survey methodology and equipment should accompany the surveys.			
Annex 3: MCA template for assessing distances between wind farm boundaries and shipping routes			
Annex 4: Safety and mitigation measures recommended for OREI during construction, operation and decommissioning.			
Mitigation and safety measures will be applied to the OREI development appropriate to the level and type of risk determined during the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the Maritime and Coastguard Agency and will be listed in the developer’s Environmental Statement (ES). These will be consistent with international standards contained in, for example, the Safety of Life at Sea	✓		Section 18: Safety Zones. Discusses promulgation of safety zone information, safety zones for the Project, and infringement of safety zones. Section 19: Search and Rescue (SAR). Discuss emergency response related safety and mitigation measures, and ERCoP (19.3: Wind Farm SAR Matters). Section 21: Risk Mitigation Measures and Monitoring.

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
(SOLAS) Convention - Chapter V, IMO Resolution A.572 (14)3 and Resolution A.671(16)4 and could include any or all of the following:			<i>Presents list of mitigation measures and monitoring.</i>
i. Promulgation of information and warnings through notices to mariners and other appropriate media.	✓		Section 21: Risk Mitigation Measures and Monitoring. <i>Mitigation measure adopted by Project.</i>
ii. Continuous watch by multi-channel VHF, including Digital Selective Calling (DSC).	✓		Section 21: Risk Mitigation Measures and Monitoring. <i>Discusses future monitoring under consideration.</i>
iii. Safety zones of appropriate configuration, extent and application to specified vessels	✓		Section 18: Safety Zones. <i>Discusses safety zones for the Project.</i>
iv. Designation of the site as an area to be avoided (ATBA).	✓		<i>Not applicable.</i>
v. Implementation of routeing measures within or near to the development.	✓		<i>Not applicable.</i>
vi. Monitoring by radar, AIS and/or closed circuit television (CCTV).	✓		Section 20: Risk Mitigation Measures and Monitoring – 21.2: Future Monitoring. <i>Discusses future monitoring under consideration.</i>
vii. Appropriate means to notify and provide evidence of the infringement of safety zones or ATBA's.	✓		Section 18: Safety Zones. <i>Discusses infringement of safety zones.</i>
viii. Any other measures and procedures considered appropriate in consultation with other stakeholders.	✓		Section 21: Risk Mitigation Measures and Monitoring. <i>Details mitigation measures adopted and under consideration.</i>
ix. Creation of an Emergency Response Cooperation Plan with the relevant Maritime Rescue Coordination Centre (from construction phase onwards)	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. <i>ERCoP will be in place pre-construction.</i>
Annex 5: Standards and procedures for wind turbine generator shutdown in the event of a search and rescue, counter pollution or salvage incident in or around a wind farm.			
1. Design Requirements: The OREI should be designed and constructed to satisfy the following design requirements for emergency rotor shut-down in the event of a search and rescue (SAR), counter pollution or salvage operation in or around a wind farm or other OREI site:			
i. All wind turbine generators (WTGs)	✓		Section 4: Marine Navigational

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
and other OREI individual structures will each be marked with clearly visible unique identification characters which can be seen by both vessels at sea level and aircraft (helicopters and fixed wing) from above.			Markings. Describes marking of WTGs and other OREI individual structures. Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. List of design features to be incorporated.
ii. The identification characters shall each be illuminated by a low-intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid a collision with it. The size of the identification characters in combination with the lighting should be such that, under normal conditions of visibility and all known tidal conditions, they are clearly readable by an observer, stationed 3 metres above sea levels, and at a distance of at least 150 metres from the turbine. It is recommended that lighting for this purpose be hooded or baffled so as to avoid unnecessary light pollution or confusion with navigation marks. (Precise dimensions to be determined by the height of lights and necessary range of visibility of the identification numbers)	✓		Section 4: Marine Navigational Markings. Describes identification characters and lighting. Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. List of design features to be incorporated.
iii. For aviation purposes, OREI structures should be marked with hazard warning lighting in accordance with CAA guidance and also with unique identification numbers (with illumination controlled from the site control centre and activated as required) on the upper works of the OREI structure so that aircraft can identify each installation from a height of 500ft (150 metres) above the highest part of the OREI structure.	✓		Section 4: Marine Navigational Markings. Considers aviation marks. CAA guidance will be followed.
iv. Wind Turbine Generators (WTG) shall have high contrast markings (dots or stripes) placed at 10 metre intervals on both sides of the blades to provide SAR helicopter pilots with a hover reference	✓		Section 19: Search and Rescue (SAR) – 19.3.1: Impact on SAR Helicopter Operations. Design will meet MCA requirements.

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
point.			
v. All OREI generators and transmission systems should be equipped with control mechanisms that can be operated from the OREI Central Control Room or through a single contact point.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. Discusses OREI Central Control Room.
vi. Throughout the design process for an OREI, appropriate assessments and methods for safe shutdown should be established and agreed, through consultation with MCA Navigation safety Branch, Search and rescue Branch and other emergency support services.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. Discusses shutdown methods. Section 21: Risk Mitigation Measures and Monitoring. Details mitigation measures adopted and under consideration.
vii. The OREI control mechanisms should allow the Control Room Operator to fix and maintain the position of the WTG blades, nacelles and other appropriate OREI moving parts to configurations determined by the Maritime Rescue Co-ordination Centre (MRCC). This same operator must be able to immediately effect the control of offshore substations and export cables.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. Discusses shutdown methods.
viii. Nacelle hatches and other OREI enclosed spaces in which personnel are working should be capable of being opened from the outside. This will allow rescuers (e.g. helicopter winch-man) to gain access to the tower if tower occupants are unable to assist and when sea-borne approach is not possible.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. Design will meet MCA requirements. Section 21: Risk Mitigation Measures and Monitoring. Details mitigation measures adopted and under consideration.
ix. Access ladders, although designed for entry by trained personnel using specialised equipment and procedures for turbine maintenance in calm weather, could conceivably be used, in an emergency situation, to provide refuge on the turbine structure for distressed mariners. This scenario should therefore be considered when identifying the optimum position of such ladders and take into account the prevailing wind, wave and tidal conditions.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. Design will meet MCA requirements. Section 21: Risk Mitigation Measures and Monitoring. Details mitigation measures adopted and under consideration.

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
x. Although it may not be feasible for mariners in emergency situations to be able to use wave or tidal generators as places of refuge, consideration should nevertheless be given to the provision of appropriate facilities	✓		No applicable.
2. Operational Requirements			
i. The Central Control Room, or mutually agreed single point of contact, should be manned 24 hours a day.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. Operational feature of the project.
ii. The Central Control Room, or mutually agreed single point of contact, should have a chart indicating the Global Positioning System (GPS) position and unique identification numbers of each of the WTGs in the wind farm, or individual devices in other types of OREI.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. States that the Project will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.
iii. All MRCCs will be advised of the contact telephone number of the Central Control Room, or mutually agreed single point of contact.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. Operational feature of the project.
iv. All MRCCs will have a chart indicating the GPS position and unique identification number of each of the WTGs in all wind farms or all devices in other types of OREI.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. States that the Project will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.
v. All search and rescue helicopter bases will be supplied with an accurate chart of all the OREI and their GPS positions.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. States that the Project will meet the MCA's requirements in terms of standards and

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
			<i>procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.</i>
vi. The Civil Aviation Authority shall be supplied with accurate GPS positions of all OREI structures for civil aviation navigation charting purposes	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. <i>States that the Project will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.</i>
3. Operational Procedures			
i. Upon receiving a distress call or other emergency alert from a vessel which is concerned about a possible collision with a WTG or is already close to or within the wind farm, or when the MRCC receives a report that persons are in actual or possible danger in or near a wind farm and search and rescue aircraft and/or rescue boats or craft are required to operate over or within the wind farm, the MRCC/SC will establish the position of the vessel and the identification numbers of any WTGs which are visible to the vessel. This information will be passed immediately to the Central Control Room, or single contact point, by the MRCC. A similar procedure will be followed when vessels are close to or within other types of OREI site.	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. <i>States that the Project will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.</i>
ii. The control room operator, or single point of contact, should immediately initiate the shut-down procedure for those WTGs as requested by the MRCC and maintain the WTG in the appropriate shut-down position, again as requested	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. <i>States that the Project will meet the MCA's requirements in terms of standards and procedures for generator</i>

Issue: OREI RESPONSE	Yes	No	Reference notes/Remarks
by the MRCC, or as agreed with MCA Navigation Safety Branch or Search and Rescue Branch for that particular installation, until receiving notification from the MRCC that it is safe to restart the WTG.			<i>shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.</i>
iii. The appropriate procedure to be followed in respect of other OREI types, designs and configurations will be determined by these MCA branches on a case by case basis, in consultation with appropriate stakeholders, during the Scoping and Environmental Impact Assessment processes	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. <i>States that the Project will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.</i>
iv. Communication procedures should be tested satisfactorily at least twice a year. Shutdown and other procedures should be tested as and when mutually agreed with the MCA	✓		Section 19: Search and Rescue (SAR) – 19.3: Wind Farm SAR Matters. <i>States that the Project will meet the MCA's requirements in terms of standards and procedures for generator shutdown and other operational requirements in the event of a search and rescue, counter pollution or salvage incident in or around the site.</i>

Offshore Renewable Energy Installations

Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (Compliance with recommended DTI Methodology)

General Comments:

Section	Yes	No	Reference notes/Remarks
A1: Overview and guidance on navigation safety issues.	✓		Section 2: Regulations and Guidance.
A2: Overview of FSA.	✓		Section 13: Formal Safety Assessment.
A3: Lessons learned.	✓		Entire NRA takes into account Lessons Learned within the offshore industry.
B1: Base case traffic densities and types.	✓		Section 8: Maritime Traffic Surveys. Summarises the results of the Maritime Traffic Surveys. Section 11: Recreational Craft Activity. Examines recreational craft activity in the area based on the Maritime Traffic Surveys and available desktop information. Section 12: Fishing Vessel Activity. Reviews fishing vessel activity in the area based on the Maritime Traffic Surveys and surveillance (sightings and satellite) data.
B2: Future traffic densities and types.	✓		Section 14: Risk Assessment – 14.5: Future Case Level of Risk. Assesses possible future traffic levels.
B3: The marine environment :			
B3.1 Technical & operational analysis	✓		Section 3: Rochdale Envelope.
B3.2 Generic TOA	✓		Section 1.2: Scope of the Assessment and Methodology.
B3.3 Potential accidents	✓		Section 13: Formal Safety Assessment.
B3.4 Affected navigational activities	✓		Section 13: Formal Safety Assessment.
B3.5 Effects of wind farm structures	✓		Section 13: Formal Safety Assessment.
B3.6 Development phases	✓		Section 13: Formal Safety Assessment.
B3.7 Other structures & features	✓		Section 13: Formal Safety Assessment.
B3.8 Vessel types involved	✓		Section 13: Formal Safety Assessment.
B3.9 Conditions affecting	✓		Section 13: Formal Safety Assessment.

Section	Yes	No	Reference notes/Remarks
navigation			
B3.10 Human actions	✓		Section 13: Formal Safety Assessment.
C1: Hazard Identification	✓		Section 13: Formal Safety Assessment and Appendix A: Hazard Log Report. <i>Hazards identified.</i>
C2: Risk Assessment	✓		Section 13: Formal Safety Assessment and Appendix A: Hazard Log Report. <i>Presents details of possible risks identified.</i> Section 14: Risk Assessment. <i>Reviews navigational hazards associated with the development.</i>
C3: Hazard log	✓		Appendix A: Hazard Log Report.
C4: Level of risk	✓		Section 13: Formal Safety Assessment and Appendix A: Hazard Log Report.
C5: Influences on level of risk	✓		Section 13: Formal Safety Assessment and Appendix A: Hazard Log Report.
C6: Tolerability of residual risk	✓		Section 13: Formal Safety Assessment and Appendix A: Hazard Log Report.
D1 : Appropriate risk assessment	✓		Section 13: Formal Safety Assessment and Appendix A: Hazard Log Report.
D2 : MCA approval for assessment tools and techniques	✓		Section 13: Formal Safety Assessment. <i>All the quantified risk assessments were carried out using Anatec's COLLRISK software which conforms to the DECC methodology as outlined in Annex D3 in the Guidance. In line with this, Anatec makes the declaration that the models used within this work have been validated and are appropriate for the intended use.</i>
D3: Demonstration of results	✓		Appendix A: Hazard Log Report.
D4 : Area traffic assessment	✓		Section 8: Maritime Traffic Surveys. Section 11: Recreational Craft Activity. Section 12: Fishing Vessel Activity.
D5 : Specific traffic assessment	✓		Section 8: Maritime Traffic Surveys. Section 11: Recreational Craft Activity. Section 12: Fishing Vessel Activity.
E1 : Risk control log	✓		Appendix A: Hazard Log Report.
E2 : Cost benefit assessment	✓		<i>Cost benefit assessment will be carried out if required.</i>
E3 : Assessment of equity to stakeholders	✓		<i>Assessment of equity to stakeholders will be carried out if required.</i>
F1: Tolerability of risk claim	✓		Section 13: Formal Safety Assessment

Project: A2348
Client: E.ON Climate & Renewables
Title: Navigation Risk Assessment - Rampion (Appendix C)

Section	Yes	No	Reference notes/Remarks
			<i>and Appendix A: Hazard Log Report.</i>
G1 : Hazard identification checklist	✓		<i>Appendix A: Hazard Log Report.</i>
G2 : Risk control checklist	✓		<i>Appendix A: Hazard Log Report.</i>
G3 : MCA MGN 371 compliance checklist	✓		<i>Appendix C.</i>



Hazard Review Workshop

Rampion Offshore Wind Farm

Minutes of Meeting

(Appendix D)

Prepared by: Anatec Limited
Presented to: E.ON Climate & Renewables
Date: 7 November 2012
Revision No.: 01
Ref.: A2348-EON-NRA-1 App D

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D1. Background

These minutes summarise the main points from the Rampion Offshore Wind Farm and associated export cable route Hazard Review Workshop held in Brighton on 20th January 2012.

The purpose of the workshop was to identify and review the potential navigational hazards associated with the proposed Rampion Offshore Wind Farm development off the Sussex coast in the south of England. The results form part of the Navigation Risk Assessment (NRA) for proposed offshore wind farm.

D2. Attendees

The following table presents information on the navigational review workshop attendees.

Table 1 List of Attendees for Rampion Hazard Review Workshop

Attendee	Position	Company/Organisation
Stuart Carruthers	Cruising Manager	Royal Yachting Association (RYA)
Ted Osborn	RATS Committee	Cruising Association (CA)
Peter Burry	RATS Committee	Cruising Association (CA)
Laurence Woodhams	Director	Sussex Yacht Club
Roland McKie	Staff Officer Maritime Operations	Maritime and Coastguard Agency (MCA)
Lee Fisher	Operations Manager	Solent Coastguard
Mike O’Sullivan	Offshore Industry Liaison Officer	Solent Coastguard
Mike Tubb	Operations Manager	Newhaven Lifeboat Station
Philip Smith	Marine Safety and Environment	Department for Transport
Julian Seaman	Harbour Master	Shoreham Port
Dave Collins-Williams	Harbour Master	Newhaven Port & Properties Ltd
Nigel Griffiths	Principal Resources Manager	Hanson Aggregates marine Ltd
Graham Singleton	Resource and Systems Manager	CEMEX UK Marine Ltd
David McCluskey	Marine and Crew Manager	Westminster Dredging Company Ltd
Robert Clark	Deputy Chief Fisheries and Conservation Officer	Sussex Inshore Fisheries and Conservation Authority
David Guy	Fisheries Liaison	Newhaven Fish & Flake Ice Society
Eleri Owen	Consents Manager	E.ON Climate & Renewables
Ali MacDonald	Senior Risk Analyst	Anatec
Peter Carey	Risk Analyst	Anatec

D3. Minutes

The key notes from the shipping and navigation hazard workshop for the Rampion Offshore Wind Farm and associated export cable route are summarised in the following sub-sections.

3.1 General

- An overview of the project and the schedule for consent application was given by Eleri Owen.
- Ali MacDonald presented an overview of the baseline shipping data collected in the area as well as the key navigational features and issues in the region and for the zone.
- Attendees requested that the co-ordinates of the Rampion Zone boundary and the meteorological mast be distributed.
- A question was raised as to what the minimum spacing between the turbines would be. It was stated that the minimum distance between turbines would be 600m. In addition, attendees requested that the turbine spacings for the indicative layouts presented be sent out to attendees.
- Cruising Association stated that, regardless of the final turbine spacing and numbers, they would like to see a uniform turbine layout.
- The question was raised as to whether all cabling will be buried/protected, including close to the shore where small vessels anchor and navigate close to the shore. It was stated by the project that this will be the case. It was asked what the cable route will be based on, and whether choosing a route which enables cable burial will be a priority. The project stated that this was of mutual benefit as damage to the cable would have commercial implications.
- It was asked how many export cables there will be. The project stated that there will be 4 cables, 2 from each offshore substation, and that they will go into the same cable corridor.
- It was asked whether the cable landfall will be marked with a pair of posts indicating the export cable direction, and attendees considered that it would be useful if this was the case. E.ON will confirm this.
- It was asked whether the site will be monitored by CCTV. It was stated that this may be possible but not confirmed as yet.

3.2 Search and Rescue / Emergency Response

- It was stated by Solent Coastguard that drifting vessels at the exit of the westbound lane of the TSS, to the south of Shoreham, are relatively common, because if vessels encounter engine problems within the TSS, they are likely to continue if possible, but they will then attempt repairs having left the TSS. With prevailing SW winds they may drift towards the Rampion site if they cannot anchor. A recent example was cited, when the chemical tanker *Amaranth* drifted north from the termination point of the TSS (through the Rampion site) during December 2011. Anatec will investigate this further.
- An incident was discussed when a large container vessel had suffered engine problems off the Thanet windfarm when changing over from heavy fuel oil to diesel

oil for the last part of its transit to port. The ship was taken under tow by some nearby tugs just in time to prevent it from drifting into the windfarm.

- It was noted that, in the event of a vessel drifting towards the wind farm, tug availability is an issue. It was noted that local harbour tugs may not have the capability to take a large vessel in tow and the steaming time to the windfarm may make it a too late intervention option. It was stated that the nearest powerful tugs would be from Southampton. As above, the steaming time to Rampion may be too high for a tug from Southampton to intervene, dependent on the situation of the vessel in trouble and weather and sea conditions. Whilst it is possible that there may be tugs of opportunity in the area in the event of a drifting vessel, there can no guarantee of this.
- MCA stated that the effects of a pollution event on the windfarm operations need to be considered, as well as the possible need for clean-up operations within, and in proximity to, the windfarm.
- AIS monitoring was discussed, and the MCA stated that, in the future, HM Coastguard will monitor AIS equipped vessels and, where vessel behaviour appears unusual, they will make contact to ask their intentions. This may provide an early intervention opportunity but may still not prevent an accident, if the intervention is at a late stage. It was noted that unusual behaviour may occur at a late stage following what had previously been normal activity and so, due to the closeness of a vessel to an obstacle, it may be too late to prevent an accident.
- The MCA stated that as per the EU Vessel Traffic Monitoring Directive they will use AIS monitoring to try to intervene to prevent vessel-to-vessel collisions by looking for vessels on a potential collision course in abnormal situations. It was noted by other attendees that the wind farm would result in certain points (for example, SW of the wind farm) becoming waypoints for a number of vessels, potentially making vessels headed for the same area a normal occurrence. In addition, it was noted that not all recreational craft are equipped with AIS, and therefore AIS cannot necessarily be used to monitor close-quarter situations between all commercial vessels and recreational craft.

3.3 Offshore Safety Zones

- It was asked whether the site will be open to fishing activity. It was stated by the project that this is not finalised, but it is likely that some activities (certain types of trawling and anchoring) may be excluded from the site but there is no precedent for complete exclusion from the site. Indeed, MCA stated that they are against total exclusion from the wind farm.
- The issue of safety zones during the wind farm construction was raised and it was noted that ‘rolling’ safety zones generally apply although this will depend on the plans for constructing the site. It was stated that it is not currently known how much of the zone vessels will be excluded from at any one time during construction.

3.4 Fishing Related Issues

- In terms of the fishing data presented, the difficulty in obtaining representative data, due to issues such as changes in quotas, was noted. In addition, it was stated that the

type information available from VMS data could be misleading, as vessels may not be engaged in their primary fishing method.

- It was noted that it is not just local vessels fishing working in the area, with vessels from the Scottish, Dutch and French fleets amongst those fishing in the area.
- It was stated that although there are single-handed inshore fishing boats working in the region, they will rarely be as far out as the wind farm site, however, they will operate in the export cable route area. A typical beam trawler in the Rampion area has a crew of 5.
- If the export and inter-array cables are to be buried to a depth of 1.5m then this would be seen as sufficient to prevent gear snagging on the cables. It was stated that the likely seabed penetration of fishing gear is around 1 inch, with a greater penetration (3 inches) for scallop dredging. It was not considered likely that repeated scallop dredging in an area could lead to the cable becoming exposed.
- It was stated that parallel inter-array cabling would reduce the risk of gear interaction, with NE to SW being identified as the preferred direction.
- It was asked whether, in areas where the cable can't be buried, it would be preferable to have rock dumping or mattresses from a fishing perspective, but it was concluded that this was uncertain at the current time and will be looked into.
- It was noted that Kingfisher notifications are not generally used in this area (although the Scottish boats may use them), but it was noted that this may change with offshore renewables developments becoming more prominent. It was noted that notifications to fishermen should be done in conjunction with other publications, such as Seafish. In addition, it was agreed that a website showing offshore obstructions by sea area would be of benefit.

3.5 Dredging Related Issues

- It was noted that, although the survey data presented shows the routing of dredgers involved in beach replenishment works at Pevensey, such works occur at other locations in the area, which would therefore give rise to different routing by the vessels involved.
- It was stated by Newhaven Port that in the survey data presented there is under representation in terms of dredgers, as the plant at Newhaven was shut down at the time. It was noted that the plant re-opened in October 2011, and that therefore the dredging activity from Newhaven can be assessed from on-going AIS collection from Shoreham. It was stated by the port that dredgers operating out of Newhaven generally operate in the Nab and OWERS dredge areas.
- It was asked whether dredgers dredge on anchors, it was stated that the majority trail their suction pipe while dredging. It was stated that, during dredging operations, there are generally 2 or 3 people on the bridge.
- The need for buffer zones between turbines and dredging areas were discussed and it was concluded that these need to be considered on a site specific basis, giving consideration to factors such as tides and wind.
- The risk of a drifting dredger dragging its pipe along the seabed and snagging on cabling was discussed. It was stated that parallel inter-array cables, in the direction of likely drifting, could mitigate this risk. It was identified that the procedures in the

event of a drifting vessel dragging its pipe need to be identified on a site specific basis, i.e., should the vessel anchor, and this will be dependent on cable burial depths.

- It was stated that tug availability is an issue, with the nearest at Southampton/ Fawley. It was concluded that, given the proximity of the dredging areas to the site, the available tugs are too far from the site with correspondingly high response times and so would not have time to intervene in the event of a dredger drifting towards the site.
- The possibility of fenders on wind farm structures was discussed, and it was noted that these may be of benefit in the event a dredger drifts into a turbine. It was stated by the project that it is not decided whether fenders will be used.

3.6 Aids to Navigation

- It was asked whether the wind farms will be marked with AIS as an Aid to Navigation. It was stated that this will need discussion with Trinity House. The possibility of the use of virtual Aids to Navigation was also raised by attendees.
- The lighting of wind farms was discussed. CA commented that they would like to see more powerful lights, particularly on Significant Peripheral Structures, although there was not a consensus on this among the attendees. It was noted that this is an issue for discussion with Trinity House and generic issue of wind farms around the UK.

3.7 Local Information and Weather

- It was stated that the Rampion site is outside the VTS coverage of Dover and Southampton, but in the future could be covered. Rampion is in a 'blind spot' in radar coverage from Dover due to Beachy Head.
- Severe weather was raised as an issue. Containers and other cargo adrift is relatively frequent in the area. This may be exacerbated by the wind farm, as vessels will at times be prevented from taking the optimum course, potentially putting them beam on to the wind.
- A recent incident, when a barge under tow broke tow in severe weather and drifted from the Isle of Wight to Beachy Head, through the Rampion site, was discussed.
- The issue was raised as to whether the turbines will result in sport angling and sport diving within the site, as wind farm may protect fish stocks and other marine life and may afford protection to the anchored vessel from passing large vessels. It was noted that this could also result in lines of crab / lobster pots within the site.
- The issue of the Marine Conservational Zones (MCZs) in the area and how they will be changed as a result of the wind farm was raised as an issue.
- The issue was raised of the location of the proposed Sink One 4 Sussex project relative to the site. It was stated that this is to the northeast of the site boundary.

3.8 Port Information and Issues

- The issue of a shipping lane through the Rampion zone was raised by Shoreham Port. It was noted that in recent consultation, the Navigational Safety Branch of the MCA had stated that, in principle, they are not in favour of a channel through the site.
- The MCA's statement that vessels approaching Shoreham can route through the ITZ and that therefore the issue is for departing vessels was discussed, with attendees

raising issues of traffic being channelled into the ITZ, as well as the possibility, in the future, of laden tankers passing off Newhaven when routeing to Shoreham. Also, with the wind in the southerly quarter, a vessel routeing to Shoreham through the ITZ will be beam on to the weather inducing the vessel to roll and this may have an effect on the vessels machinery.

- Shoreham port stated that since the cable route is to the west of the port, then the cable route does not pose an issue for vessels anchoring off Shoreham. Therefore, emergency anchoring was considered to be the only issue.
- The question was raised as to whether the cable corridor will become a no anchor zone. It was stated that it will not be an official no anchor zone, but that the cable will be marked on charts and therefore it would be good practice not to anchor in close proximity.
- In the context of anchor interaction with the cable, it was asked how quickly power can be shut down since it is a live cable. E.ON stated that this will be looked into and confirmed.
- The *Young Lady* incident off Teesside was discussed, where the vessel dragged anchor at speeds of up to 4 knots in a Force 8 and resulted in pipeline damage.

3.9 Recreational Craft / Activities

- It was stated that the busiest months for recreational activity in the area are May and August. Sussex Yacht Club stated that there are 300-500 transits through Rampion per year, due to vessels associated with organised events from Shoreham.
- Sussex Yacht Club stated that in the shallower waters close to the cable landfall the seabed is very flat and therefore they would like to see a flat bottom over the buried cable, with no 'hump'. It was stated that this would also be preferable from a fisheries perspective for drift netters.
- The need for clarity on the classification of recreational craft was raised. It was noted that a recreational craft is defined as any boat of any type intended for sports and leisure purposes of hull length from 2.5 to 24m, regardless of the means of propulsion.
- It was stated that vessels need to be considered by leisure activity, e.g., cruising, sport diving, recreational fishing, as certain leisure activities may be more hazardous than others in the vicinity of a wind farm. It was stated that the different activities should be considered separately within the Navigation Risk Assessment.
- The difference in the behaviour of vessels racing as opposed to leisure cruising was discussed, with Sussex Yacht Club stating that those in a race will take greater risks, possibly leading to a higher rate of collisions, although RYA stated that racing risk is predominantly boat-to-boat and/or collisions with buoys. In addition, the differing issues for different types of craft (sailing, sailing with auxiliary engine, and motorboats) was raised.
- It was asked whether wind turbines have been found to affect wind shear. It was stated that experience to date in other sites indicates that this is not likely to be an issue.
- It was stated by Sussex Yacht Club that in addition to single-handed recreational craft, a number of recreational craft in the area will have two people on board, with one

being the more competent sailor. In the event the ‘competent’ sailor becomes incapacitated, e.g. personal injury, the other person may be unable to effectively handle the craft. It is noted that RYA stated disagreement with this proposition as a general statement and its relevance to wind farms.

- The implications of the Rampion wind farm on racing were discussed. It was stated that it was unlikely any races would pass through the site after construction of the wind farm. This would result in deviations for races, such as those to Fecamp, potentially lengthening the course and hence races not being completed within the hours of daylight.
- The increase in the use of AIS (Class B) by recreational craft was noted, and it was stated that through AIS monitoring, MCA could potentially intervene when vessel are observed headed towards the wind farm.
- Sussex Yacht Club suggested that recreational craft collisions with wind farm structures may be more likely than for other vessel types as recreational users do not require any qualifications. However, it is noted that attendees, including RYA, expressed disagreement with this statement as a general matter of fact.

3.10 Vessel Displacement Issues

- Attendees considered that the 28 days shipping data presented was from relatively quiet times for Shoreham and Newhaven ports, as well as recreational activity, but did show significant vessel activity across the Rampion site, which would be displaced by the windfarm.
- It was noted that the Rampion wind farm will result in the ITZ becoming more congested.
- The potential for the formation of ‘pinch points’ with larger numbers of vessels aiming for a particular area as they route around the wind farm (e.g., to the SW, NW and NE of the windfarm) was raised as a concern.
- Vessels routeing to the Solent from the westbound TSS lane passing the southwest corner of the site, and traffic from Shoreham routeing around the site were noted as concerns. It was noted that the rhumb line is to the southwest of the site.
- The displacement of vessels inshore of the wind farm, into areas used by smaller fishing vessels, was noted as a concern.
- It was noted that there is no evidence of significant impact of wind turbines on communication equipment, AIS or VHF, but there are radar effects and these are dependent on the location of the radar relative to the superstructure.
- The possibility that the wind farm could result in a reduction in encounters between small and large vessels was raised. This could result from the separation of traffic with smaller vessels passing through the wind farm whilst larger vessels route around the site. However, it was noted that there is no certainty of this and, as a group, the attendees were unable reach a decision due to navigational safety.
- It was noted that vessels taking evasive action in order to avoid, for example, a fishing vessel working on the periphery of the site, is a possible cause of a vessel colliding with a turbine.

3.11 Cumulative Issues

- A general point was made that, due to the distance from Rampion to other wind farm sites, cumulative issues are not considered to be significant.