Inch Cape Offshore Wind Farm

New Energy for Scotland

Offshore Environmental Statement:
VOLUME 2H
Appendix 19A: Navigational Risk Assessment Development Area

REPSOL

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Navigational Risk Assessment
Development Area

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Presented to:	Inch Cape Offshore Limited (ICOL)
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Glossary

Allision	The act of striking or collision of a moving vessel against a stationary object.
Automatic Identification System (AIS)	Automatic Identification System. A system by which vessels automatically broadcast their identity, key statistics e.g. length, brief navigation details e.g. location, destination, speed and current status e.g. survey.
Broadly Acceptable	Risks in this category are 'low risk' and generally regarded as insignificant and suitably controlled. There is not usually a requirement for any further action to be taken for risks in this category.
Cable length	Nautical term; the length of a ship's cable, approximately 600 feet.
Collision	The act or process of colliding (crashing) between two moving objects.
Inch Cape Structures	All of the structures that will be located within the Development Area are referred to as Inch Cape Structures. Includes WTGs, OSPs, Met Masts.
Marine Environmental High Risk Area (MEHRA)	Areas in UK coastal waters where ships' masters are advised of the need to exercise more caution than usual i.e. crossing areas of high environmental sensitivity where there is a risk of pollution from merchant shipping.
Marine Guidance Note	A system of guidance notes issued by the Maritime and Coastguard Agency which provide significant advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.
Mitigation	Actions which may include process or design to avoid/reduce/remedy or compensate for adverse impacts of a development. Avoids or reduces an effect, significant or otherwise.
Not Under Command (NUC)	Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGS), the term "vessel not under command" means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.
Radar	Radio Detection And Ranging - an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.

Safety Zone	A marine zone demarcated for the purposes of safety around a possibly hazardous installation or works/ construction area. It may exclude other vessels.
Tolerable	Risks in this category are ‘intermediate risk’ and risk reduction measures should be put in place to reduce their level of risk. Risks in the ‘tolerable’ category should be periodically reviewed to ensure they are being kept ‘as low as reasonably practicable’ (ALARP).
Unacceptable	Risks in this category are ‘high risk’ and the activity should be ruled out unless modifications can be made to reduce the risk ranking.

Abbreviations and Acronyms

AC	Alternating Current
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
ALB	All-Weather Lifeboat
ARPA	Automatic Radar Plotting Aid
AtoN	Aid to Navigation
ASMS	Active Safety Management System
BERR	Department for Business Enterprise & Regulatory Reform
BWEA	British Wind Energy Association (now RenewableUK)
CA	Cruising Association
CAA	Civil Aviation Authority
CAST	Coastguard Agreement on Salvage and Towage
CBA	Cost Benefit Analysis
CNIS	Channel Navigation Information Service
CoS	Chamber of Shipping
CRT	Coastguard Rescue Teams
dB	Decibels
DC	Direct Current
DECC	Department of Energy and Climate Change
DfT	Department for Transport
DSC	Digital Selective Calling
DWT	Deadweight Tonnage
EIA	Environmental Impact Assessment

EOWDC	European Offshore Wind Deployment Centre
ERCoP	Emergency Response Cooperation Plan
EU	European Union
FSA	Formal Safety Assessment
FTOWDG	Forth and Tay Offshore Wind Developers Group
GCAF	Gross Cost of Averting a Fatality
GIS	Geographical Information System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GRT	Gross Registered Tonnage
HAT	Highest Astronomical Tide
HSE	Health and Safety Executive
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
ITOPF	International Tanker Owners Pollution Federation Limited
kHz	Kilohertz
km	Kilometre
LAT	Lowest Astronomical Tide
LORAN	Long Range Navigation
M	Metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MEHRA	Marine Environmental High Risk Area

MGN	Marine Guidance Note
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MOC	Maritime Operations Centre
MOD	Ministry of Defence
MRCC	Maritime Rescue Co-ordination Centre
MRSC	Maritime Rescue Sub-Centre
MSI	Maritime Safety Information
NLB	Northern Lighthouse Board
nm	Nautical Miles
NOREL	Nautical and Offshore Renewable Energy Liaison
NRA	Navigational Risk Assessment
NUC	Not Under Command
OREI	Offshore Renewable Energy Installations
PEXA	Practice and Exercise Area
PLA	Port of London Authority
PLL	Potential Loss of Life
PLN	Port Letter Number
PPE	Personal Protective Equipment
QHSE	Quality, Health, Security and Environment
RAF	Royal Air Force
REZ	Renewable Energy Zones

RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SAR	Search and Rescue
SPS	Significant Peripheral Structure
STW	Scottish Territorial Waters
TCE	The Crown Estate
THLS	Trinity House Lighthouse Service
UHF	Ultra High Frequency
UK	United Kingdom
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency
VTS	Vessel Traffic Service
WTG	Wind Turbine Generators

Executive Summary

Using regulator guidance, this Navigational Risk Assessment (NRA) identifies and analyses both the base case and future case risk associated with the development of the Wind Farm, in Scottish Territorial Waters (STW). In line with Marine Guidance Note (MGN) 371, impacts on navigation, collision risk and communication were identified and assessed as per principles laid out in the Formal Safety Assessment (FSA) and were found to be within tolerable regions.

The NRA includes an assessment of existing navigational features, metocean data, maritime incidents and a marine traffic survey (Automatic Information System (AIS) and Radar) to identify the baseline environment. The elements of the Design Envelope have then been assessed against the base case to identify areas or activities that may see a change in risk following development of the Wind Farm.

Consultation was undertaken with stakeholders and regular operators identified from the marine traffic survey. In order to address the cumulative issue in the Firth of Forth and Firth of Tay region, Inch Cape Offshore Limited (ICOL) joined The Crown Estate (TCE) and the developers of Neart na Gaoithe (NnG) Offshore Wind Farm (Mainstream Renewable Power Limited) and the Firth of Forth Round 3 Zone (Seagreen Wind Energy Limited) in forming the Forth and Tay Offshore Wind Developers Group (FTOWDG) and consultations were also undertaken collaboratively.

The marine traffic survey identified nine main routes operating within a 10 nautical mile (nm) buffer around the Development Area, with the majority of vessel types transiting on these routes being tankers and cargo vessels. Fishing activity and recreational vessels were also recorded across the Development Area.

Future case deviations for the main routes were identified where required. The maximum transit time increase for any vessel has been calculated as a 29 minute increase.

For the Inch Cape Structures, the collision risk modelling showed an increase of approximately 15 per cent (1 every 695 years) for vessel to vessel collisions and an additional vessel to structure allision risk of 1 every 1,510 years for powered vessels. This report identifies mitigations which will enable these risks to be brought within As Low As Reasonably Practicable (ALARP) principles.

Collision risk was also addressed as part of the Hazard Workshop which included attendance by stakeholders and regulators to assess navigational hazards that could be associated with the construction, operation, maintenance and decommissioning of the Inch Cape Structures. For the most likely consequences identified at the workshop, nineteen of the risks were broadly acceptable and nine were in the tolerable region. When the worst case consequences were assessed, all risks were tolerable. Using mitigations, and following consultation and refinement of the Design Envelope, all risks could be brought within ALARP principles.

Mitigation and safety measures have been identified as suitable for application within the Development Area, appropriate to the level and type of risk that will be determined within the Environmental Impact Assessment (EIA). The specific measures to be employed will be selected in consultation with the Maritime and Coastguard Agency (MCA) Navigation Safety Branch and other relevant statutory stakeholders where required.

19A.1 Introduction

19A.1.1 Background

Anatec was commissioned by Inch Cape Offshore Limited (ICOL) to undertake a navigational risk assessment (NRA) for the Development Area and associated Offshore Export Cable, which are being developed as part of the round of Scottish Territorial Waters (STW) developments.

This report presents information on the development relative to the existing and future case navigational activity for the Development Area and forms part of the Environmental Impact Assessment (EIA). For the purposes of this report the Development Area comprises the following wind farm structures: wind turbine generators (WTGs), offshore substation platforms (OSPs) and meteorological masts and their foundations, and inter-array cabling.

The Offshore Export Cable NRA is presented in Appendix 19B: Navigational Risk Assessment – Offshore Export Cable Corridor.

19A.1.2 Navigational Risk Assessment (NRA) Purpose

Following guidance set out in the Department of Energy and Climate Change (DECC) Methodology (DECC, 2005) and Marine Guidance Note (MGN) 371 (MCA, 2008a), an NRA has been undertaken for the Development Area and includes:

- Overview of base case environment;
- Marine Traffic Survey reporting;
- Implications of wind farm structures;
- Assessment of navigational risk pre and post development of the 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.

19A.2 Guidance and Legislation

19A.2.1 Primary Guidance

The primary guidance documents used during the assessment are listed below:

- Maritime and Coastguard Agency (MCA) Marine Guidance Note 371 (MGN 371 Merchant + Fishing) Offshore Renewable Energy Installations (OREIs) Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MCA, 2008a);
- DECC in Association with MCA Guidance on the Assessment of Offshore Wind Farms - Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms (DECC, 2005); and
- Guidelines for Formal Safety Assessment (FSA) – MSC/Circ. 1023 (IMO, 2002) (as amended).

MGN 371 highlights issues that shall be taken into consideration when assessing the effect on navigational safety from offshore renewable energy developments, proposed within United Kingdom (UK) internal waters, territorial sea or Renewable Energy Zones (REZ).

The MCA require that their methodology is used as a template for preparing NRAs. It is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk (base case and future case) to be judged as broadly acceptable or tolerable.

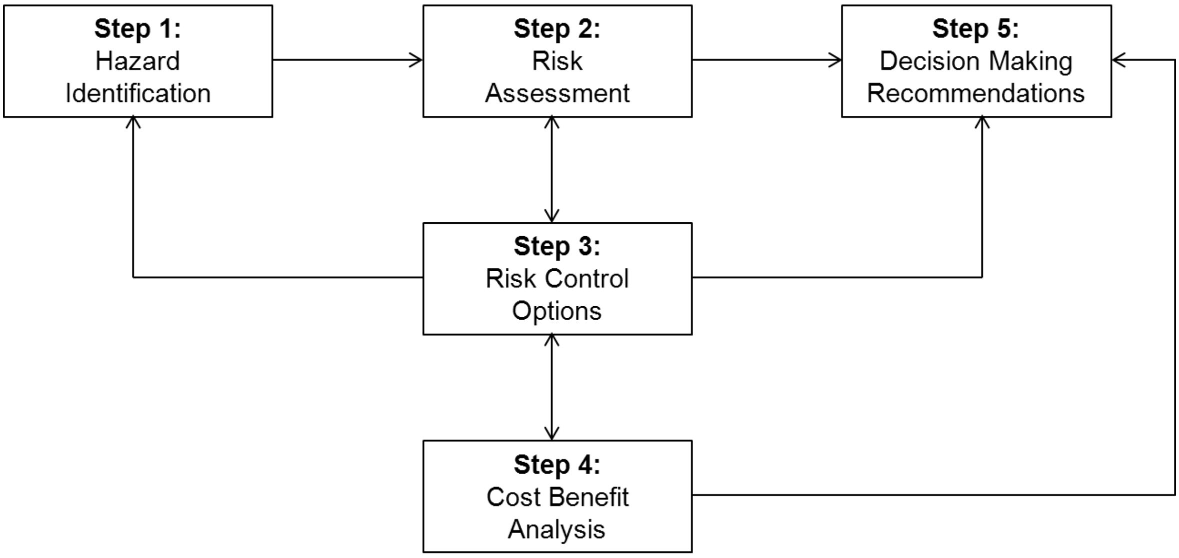
19A.2.2 Formal Safety Assessment Process

The International Maritime Organisation (IMO) Formal Safety Assessment process (IMO, 2002) approved by the IMO in 2002 under MSC/Circ.1023/MEPC/Circ392 has been applied within this study. This is a structured and systematic methodology based on risk analysis and cost benefit analysis (CBA) (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. CBA (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 19A.1 is a flow diagram of the FSA methodology applied.

Figure 19A.1 Formal Safety Assessment Process



19A.2.3 Other Guidance

Other guidance documents used during the assessment are listed below:

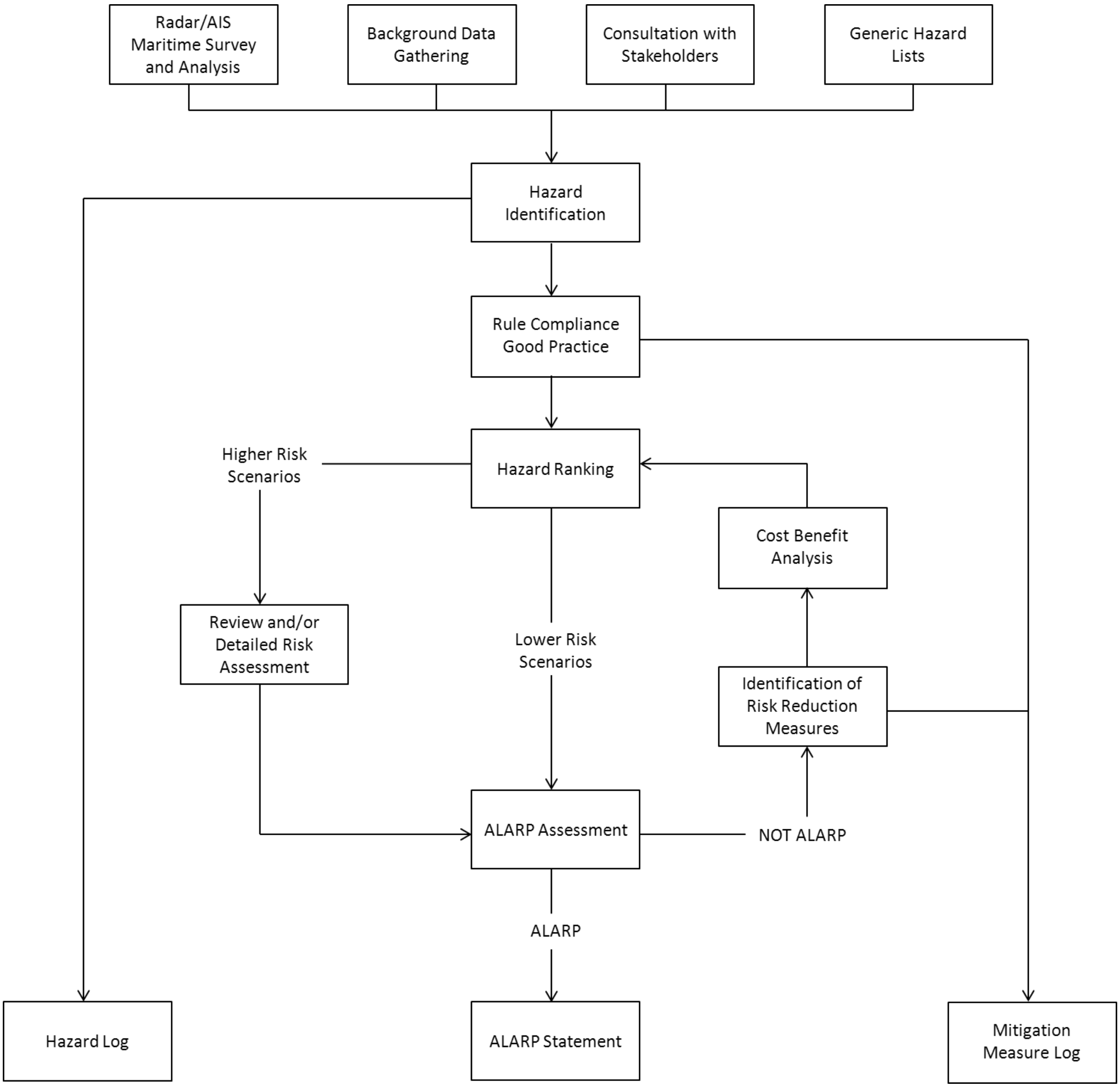
- MCA Marine Guidance Note 372 (MGN 372 M+F) Offshore Renewable Energy Installations (OREIs) Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA 2008b);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) – 0139 the Marking of Man-Made Offshore Structures, Edition 1 (IALA, 2008); and
- Royal Yachting Association (RYA) – The RYA's Position on Offshore Energy Developments (RYA, 2012).

19A.3 NRA Methodology

19A.3.1 Flow Chart for NRA Methodology

Figure 19A.2 shows an overview of the NRA methodology which was used in this study.

Figure 19A.2 Overview of Methodology for Navigational Assessment



19A.3.2 Methodology for Assessing Cumulative Effects

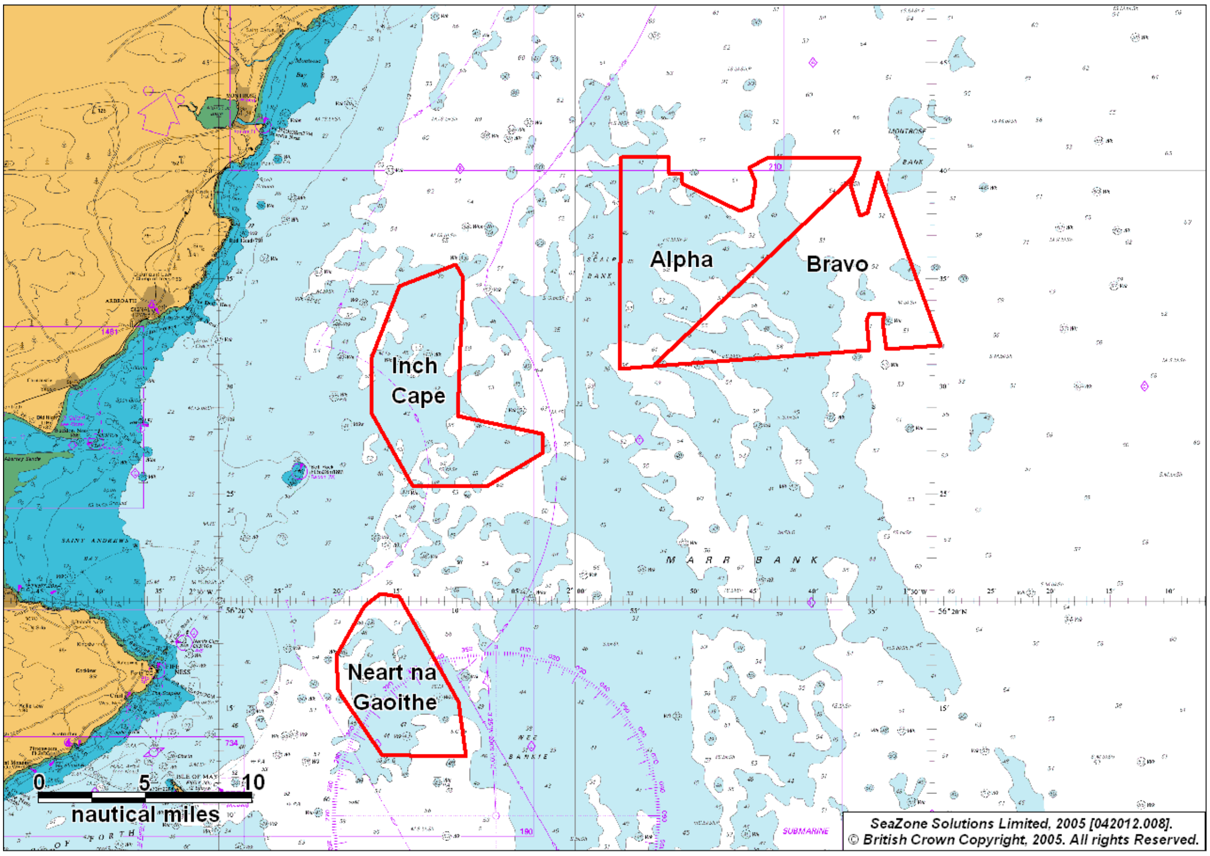
The assessment of cumulative effects includes considering the impacts arising from multiple offshore wind farm development activities and other developments (i.e. non-offshore wind) within the UK North Sea and outer Firth of Forth and Firth of Tay region.

The following subsections review the methodology used for assessing the cumulative effect of the Wind Farm with other offshore installations and activities.

19A.3.2.1 Assessment of Project Boundaries

The site boundaries used for the cumulative assessment are current as of October 2012 and illustrated in Figure 19A.3. For the cumulative assessment, it is assumed that Inch Cape, Neart na Gaoithe (NnG), and the Firth of Forth Phase 1 (Alpha and Bravo) offshore wind farms will be filled to full site capacity. This cumulative approach was agreed with the regulators during consultation meetings. It should be noted that the identification of these boundaries at this stage, and their use within the assessment, does not exclude the potential for any development area modifications or future developments within the Round 3 Firth of Forth Zone as per the terms of their license agreement and future consent applications.

Figure 19A.3 Boundaries used in Cumulative Assessment



Other offshore wind farms such as the Beatrice and Moray Firth offshore wind farms and the European Offshore Wind Deployment Centre (EOWDC) at Aberdeen Bay have not been considered in the cumulative assessment due to their distance and therefore lack of cumulative issues with the Development Area. This included assessment of vessel routeing.

The assessment assumes industry standard mitigation measures as per MGN 371 (MCA, 2008a), International Association of Marine Aids to Navigation and Lighthouses (IALA) O-139 (IALA, 2008) and any specific consent conditions that will be put in place within the developments.

19A.3.2.2 Regional Approach (Forth and Tay Offshore Wind Developers Group (FTOWDG))

Cumulative issues have also being addressed as part of the FTOWDG collaborative work. The Crown Estate (TCE) formed FTOWDG to collaboratively identify potential cumulative effects of multiple wind farm developments.

The FTOWDG comprises of:

- ICOL - Inch Cape Offshore Wind Farm, Scottish Territorial Waters Site;
- Mainstream Renewable Power - Neart na Gaoithe (NnG) Offshore Wind Farm, Scottish Territorial Waters Site; and
- Seagreen Wind Energy Limited- Firth of Forth - Round 3 Zone Two (outwith 12 nm).

The regional report for these developments (produced September 2011 and updated in February 2012) was commissioned by the FTOWDG to review the shipping and navigational aspects of the offshore wind farms on a regional level. This ensured that the individual developments are carried out in a coherent manner and cumulative issues relating to shipping and navigation (for both vessels transiting through the developments and those vessels transiting in close proximity to sites) are considered within EIA. The regional report also highlighted that further assessment would be required at a project and cumulative level as further project information became available. This report reflects updated information presented in the Firth of Forth Phase 1 Environmental Statement and the Neart na Gaoithe Environmental Statement.

From the regional review undertaken, the potential impacts on navigation from the regional developments (for both vessels transiting through the wind farms, and those vessels transiting in close proximity to all three development areas) were assessed for cumulative impacts.

Key conclusions of the report included:

- Based on Anatec's experience, the levels of shipping in this area are generally low and as a result any changes in risk are also likely to be low. Attention is placed around Bell Rock; however vessel numbers appear to be acceptable which is in line with feedback received from the main users in this area.
- Ship density and ship-to-ship collision models ran pre- and post-wind farm development showed that there will be an increase in ship density east and west of the developments; however the overall increase in ship-to-ship collision frequency following re-routeing vessels was negligible.
- The requirement for re-routeing of vessels will often result in increased mileage to the users. The feedback did not raise this as a serious concern overall, but some did

highlight this fact stating that re-routes would require some extra time, costs and fuel to be used.

- Fishing activity was more apparent from the satellite data, with demersal trawling recorded off Dunbar and scallop dredging occurring off Arbroath to the north of the region. Vessels heading to/from fishing grounds and home ports may require small deviations of route, however smaller vessels could pass between structures.
- In general there is limited recreational vessel activity outside the Firth of Forth and Tay and off coastal areas. Vessels using cruising routes further offshore may be impacted by structures, however with an assumed maximum blade clearance, vessels could pass between structures.
- Turbine alignment could also be an issue, if clear routes are not available for recreational craft to navigate between the WTGs.
- Adverse weather may further impact the alternative routes identified within this report. Further work should be undertaken on this at a project and cumulative level, when more information is available on site locations.
- Forth Ports stated general concern regarding smaller vessels being pushed further offshore and the impact on them being further east and hence out in heavier weather. However, the feedback from the other stakeholders did not highlight this.
- Forth Ports felt the impact could be reduced by having a route through the middle of the Forth Zone between Neart na Gaoithe and Inch Cape for the deviated route from both Forth and Dundee. This point was also raised by the Chamber of Shipping.

19A.4 Consultation

19A.4.1 Equity to Stakeholders

There are a variety of stakeholder types:

- **Risk Imposer** is whose actions or policies result in risk and need action;
- **Risk Taker** is whose action or inaction results in a risk;
- **Risk Beneficiary** benefits from imposing or taking the risk;
- **Risk Payer** pays for the management of the risk;
- **Risk Sufferer** suffers the consequence of a risk; and
- **Risk Observer** is aware of the risk but it does not affect them directly.

In order to ensure that all stakeholders and their relevant equities were included within the NRA process, a review of the stakeholders' types was undertaken in line with the baseline study. Stakeholders have been represented by organisations that have different roles including:

- Proposers who are proposing the development;
- Approvers who are responsible for giving a development its consent;
- Advisors who are formally consulted by the approvers;
- Commentators who are not formally consulted by the approvers but who may provide input to them; and
- Observers.

19A.4.2 Stakeholders Consulted as Part of NRA Process

Key marine and navigational stakeholders have been consulted as part of the NRA. The following stakeholders have been consulted:

- MCA;
- Department for Transport (DfT);
- Northern Lighthouse Board (NLB);
- Chamber of Shipping (CoS);
- RYA Scotland;
- Montrose Port; and
- Forth Ports Ltd.

19A.4.3 FTOWDG Consultation

The following stakeholders and regular operators were consulted as part of the FTOWDG:

- CoS;
- Forth Ports Ltd;
- NLB;

- DfT;
- MCA;
- RYA;
- Solstad (offshore vessels);
- Transmarine Management ApS (tankers bound for Dundee);
- SAGA Cruises (cruise vessels);
- Fred Olsen Cruises (cruise vessels);
- James Fisher Everard (coastal tankers bound for Forth, Tay and Northern Ports); and
- Armac Marine Management Ltd (cargo vessels bound for Montrose).

19A.4.4 Regular Operators Consulted as Part of the NRA Process

Regular operators transiting through the Development Area were identified during the maritime survey. The regular operators listed in Table 19A.1 were all initially contacted in August 2012 regarding the development and invited to comment on the impact that the site could have on the routeing of their vessels. More details can be found in Annex 19A.1 Regular Operator Consultation.

Table 19A.1 Regular Operators

Regular Operator	Email/Letter Sent	Follow up Email/Phone Call
James Fisher (Shipping Services) Limited	Email 21/08/12	✓
Faversham Ships Ltd	Email 21/08/12	✓
V Ships Limited	Email 21/08/12	✓
Clipper Tankers A/S	Email 21/08/12	✓
Fehn Bereederungs GmbH & Co. KG	Email 21/08/12	✓
Frederiet AB	Letter 21/08/12	No contact number available.
Government of the UK	Email 21/08/12	✓
Spliethoff's Bevrachtingskantoor B.V.	Email 21/08/12	✓
Torbulk Ltd	Email 21/08/12	✓

19A.5 Data Sources

This section summarises the main data sources used in assessing the baseline shipping activities relative to the Project.

The main data sources used in this assessment are listed below:

- AIS and Radar data;
- Fishing Surveillance Satellite Data (2009) and Observation Data (2005-09) shown as density grids;
- Maritime Incident Data from the Marine Accident Investigation Branch (MAIB) (2001-2010) and Royal National Lifeboat Institution (RNLI) (2001-2010);
- Admiralty Sailing Directions;
- UK Admiralty Charts;
- UK Coastal Atlas of Recreational Boating, 2009 and 2010 Geographical Information System (GIS) Shape Files; and
- Stakeholder consultation responses/comments.

19A.5.1 AIS and Radar Data

28 days of Automatic Identification System (AIS) and Radar data (February to March 2012 and July to August 2012) were collected from two survey vessels. This data demonstrates seasonal variation. Further details of the vessel surveys are given in Section 19A.7.

19A.5.2 Fishing Satellite and Sightings Data

Data on fishing vessel sightings were obtained from Marine Management Organisation (MMO), who ensure the fishing industry's compliance with UK, European Union (EU) and international fisheries laws through the deployment of patrol vessels, surveillance aircraft and the sea fisheries inspectorate. Each patrol logs the positions and details of all fishing vessels (UK and non-UK) within the Rectangle being patrolled. Data were obtained for the five-year period 2005 to 2009.

Fishing satellite vessel monitoring is also carried out by MMO as part of the sea fisheries enforcement programme, to track the positions of fishing vessels in UK waters. It is also used to track all UK registered fishing vessels globally. Data were analysed for UK and non-UK vessels (2009).

19A.5.3 Maritime Incident Data

All UK-flagged commercial vessels are required to report accidents to the MAIB. Non-UK flagged vessels do not have to report unless they are within a UK port/harbour or within UK 12 nm territorial waters and carrying passengers to or from a UK port (including those in inland waterways). However, the MAIB will record details of significant accidents of which they are notified by bodies such as the Coastguard, or by monitoring news and other information sources for relevant accidents. The MCA, harbour authorities and inland waterway authorities also have a duty to report accidents to MAIB. Data have been analysed for the 10 year period 2001-2010.

The RNLI maintains an active fleet of over 300 lifeboats (of various types ranging from 5 m to 17 m in length) and a relief fleet of around 100 boats at 235 stations round the coast of the UK and Ireland. Data on RNLI lifeboat responses in the vicinity of the offshore export cable corridor in the ten-year period between 2001 and 2010 have been analysed.

19A.5.4 Admiralty Sailing Directions

The principal navigational features and ports/harbours are those listed in Admiralty Sailing Directions for the area.

19A.5.5 UK Admiralty Charts

Admiralty charts have been used to consider approaches and entrances to ports and harbours in the area. The charts also include data on water depths (chart datum), coastline, buoyage, land and underwater contour lines, seabed composition (for anchoring), hazards, tidal information ("tidal diamonds"), traffic separation schemes, lights, and in short anything which could assist navigation in this area to ensure it is fully considered within this regional work. The following are the main charts used in this study:

- 1407-0 Montrose to Berwick-upon-Tweed
- 734-0 Firth of Forth Isle of May to Inchkeith

19A.5.6 UK Coastal Atlas of Recreational Boating

The RYA, supported by the Cruising Association (CA), have identified recreational cruising routes, general sailing and racing areas around the UK in the Coastal Atlas (RYA, 2009). 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.

19A.6 Lessons Learnt

There is considerable benefit in the sharing of lessons learned to developers within the offshore industry. This NRA, and in particular the hazard assessment, includes general consideration of lessons learned and expert opinion gathered in relation to previous offshore wind farm developments and other sea users. Lessons learned data sources include:

- RYA & CA. Sharing the Wind – identification of recreational boating interests in the Thames Estuary, Greater Wash and North West (Liverpool Bay). Southampton: (RYA, 2004);
- DfT. Results of the electromagnetic investigations. 2nd ed. Southampton: MCA and QinetiQ (DfT, 2004);
- British Wind Energy Association (BWEA). Guidelines for Health & Safety in the Wind Energy Industry – British Wind Energy Association. London: (BWEA (now RUK), 2008);
- MCA. Offshore Wind Farm Helicopter Search and Rescue – Trials Undertaken at the North Hoyle Wind Farm Report of helicopter SAR trials undertaken with Royal Air Force Valley 'C' Flight 22 Squadron on March 22nd 2005. Southampton: (MCA, 2005);
- Nautical and Offshore Renewable Energy Liaison (NOREL, 2005). A Report compiled by the Port of London Authority based on experience of the Kentish Flats Wind Farm Development. Norel Work Paper, WP4 (2nd NOREL); and
- TCE. Strategic assessment of impacts on navigation of shipping and related effects on other marine activities arising from the development of Offshore Wind Farms in the UK REZ. TCE and Anatec (TCE, 2012); and
- Moray Offshore Renewables Limited. Project co-developed by EDP Renewables and Repsol Nuevas Energias UK. Lessons learnt from this project are fed into the Inch Cape Project and vice versa.

19A.7 Marine Traffic Survey Methodology

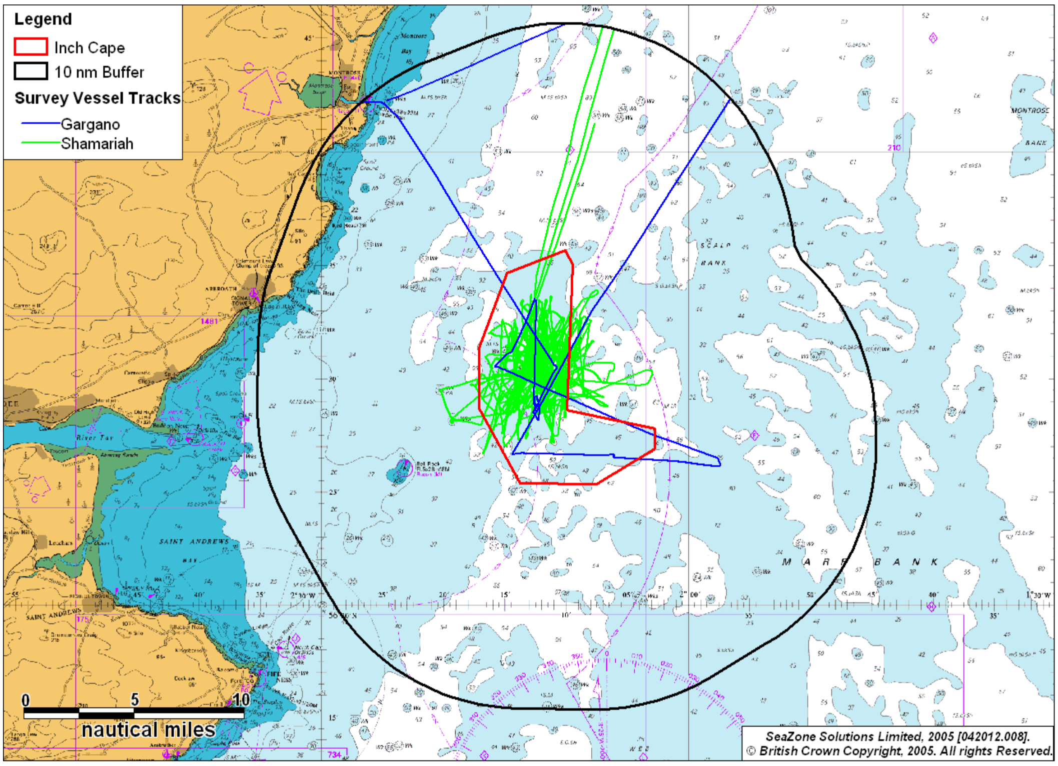
This section describes the survey methodology used when recording shipping survey data for the Development Area.

19A.7.1 Survey Methodology

Baseline shipping activity was assessed using AIS and Radar track data. The period of data collection encompassed seasonal fluctuations in shipping activity. This included February and March 2012 collected from the *Gargano* (piggyback) and July and August 2012 collected from the *Shamariah* (dedicated survey vessel), and also accounted for a range of tidal conditions.

The operational areas of the survey vessels used for the AIS data collection (within a 10 nm buffer) are presented in Figure 19A.4. The 10 nm buffer was placed around the Development Area to provide a sample area in which to undertake data analysis.

Figure 19A.4 Survey Vessel Tracks (28 Days)



19A.7.2 AIS and Radar Coverage

AIS is required on board all vessels of more than 300 gross tonnage (GT) engaged on international voyages, cargo vessels of more than 500 GT not engaged on international voyages and passenger vessels irrespective of size built on or after 1 July 2002. At the time of the *Gargano* survey in February/March 2012, fishing vessels of 45 m length and over were required to carry AIS under EU Directive. This requirement changed to 24 m on 31 May 2012, therefore meaning that fishing vessels of 24 m length and over were tracked on AIS in the *Shamariah* survey in July/August 2012. By 31 May 2014, the requirement to carry AIS will apply to all fishing vessels of 15 m length and over.

Non-AIS vessels (mainly recreational vessels and smaller fishing vessels) were also recorded during the *Gargano* and *Shamariah* surveys from an Automatic Radar Plotting Aid (ARPA). These Radar track data were supplemented by manual observations of vessels within visual range to obtain vessel type and size information. It is noted that a proportion of smaller vessels also carry AIS voluntarily.

The marine traffic survey data used for the baseline navigation review of the assessment area included two sets of AIS data (10 days in February/March 2012 and 18 days in July/August 2012) and two datasets of Radar data from the same periods. These data were recorded from the survey vessels *Gargano* (February/March 2012) and *Shamariah* (July/August 2012) working at the site during the given periods. The survey vessels are pictured in Figure 19A.5 and Figure 19A.6.

Figure 19A.5 Survey Vessel *Gargano*

Figure 19A.6 Survey Vessel *Shamariah*

19A.7.3 Recreational Activity

The RYA and the Cruising Association (CA) represent the interests of recreational users including yachting and motor cruising. In 2005 the RYA , supported by Trinity House Lighthouse Service (THLS) and the CA, compiled and presented a comprehensive set of charts which defined the cruising routes and general sailing and racing areas used by recreational craft around the UK coast. This information was published as the UK Coastal Atlas of Recreational Boating and has been subsequently updated (RYA, 2009). The latest addition of GIS Shape files from 2010 showing cruising routes, sailing and racing areas has been used in this assessment.

The RYA has also developed a detailed position statement (RYA, 2012) based on analysed data for common recreational craft; this, along with extensive consultation, were used to inform the NRA.

In addition, recreational vessel data was extracted from the AIS and Radar survey tracks recorded during the shipping surveys in February/March 2012 and July/August 2012.

19A.7.4 Fishing Activity

Fishing vessel data were extracted from the AIS and Radar tracks recorded during the shipping surveys (10 days in February/March 2012 and 18 days in July/August 2012).

In addition, fishing vessel sightings and satellite vessel monitoring data were obtained from the MMO and presented in density grids to validate the survey data presented in the baseline assessment.

Sightings data were analysed from the 2005 to 2009 period (full annual analyses). These data have been collected through the deployment of patrol vessels, surveillance aircraft and the sea fisheries inspectorate. Each patrol logs the position and details of fishing vessels within the area being patrolled. All vessels are logged, irrespective of size, provided they can be identified by their Port Letter Number (PLN).

Satellites record the positions of fishing vessels of 15 m length a minimum of every two hours. Data from 2009 (all nationalities) have been analysed on a full annual basis.

19A.8 Other Offshore Users

19A.8.1 Navigational Features

Navigational features such as Ministry of Defence (MOD) Practice and Exercise Areas (PEXAs) have been considered based on information shown on Admiralty charts.

19A.9 Design Envelope

The scope of this NRA reflects the Design Envelope defined in ES Chapter 7. The following section details the projected maximum extents of the Development Area 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 jacket (steel framed structure) foundation due to the larger water line dimensions compared to other scenarios being considered for the Wind Farm. The NRA considers that the Development Area will be filled with WTGs to capacity.

19A.9.1 Development Area

The Development Area is located approximately 15-22 km east of the Angus coastline, in the outer Firth of Tay region and within STW. The total area of the Development Area is approximately 44 nm^2 (150 km^2). Water depths (below chart datum) within the Development Area range from approximately 35 m to 63 m.

The Development Area is presented in Figure 19A.7 and the corner co-ordinates are presented in Table 19A.2.

Figure 19A.7 Chart Overview of the Development Area

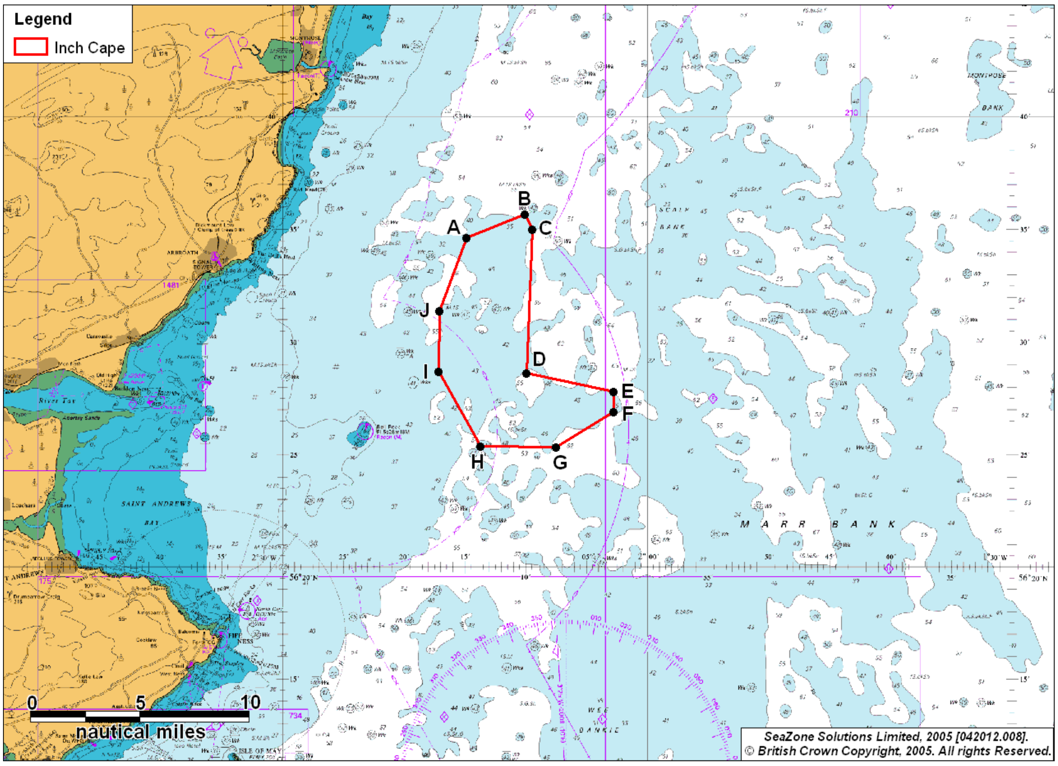


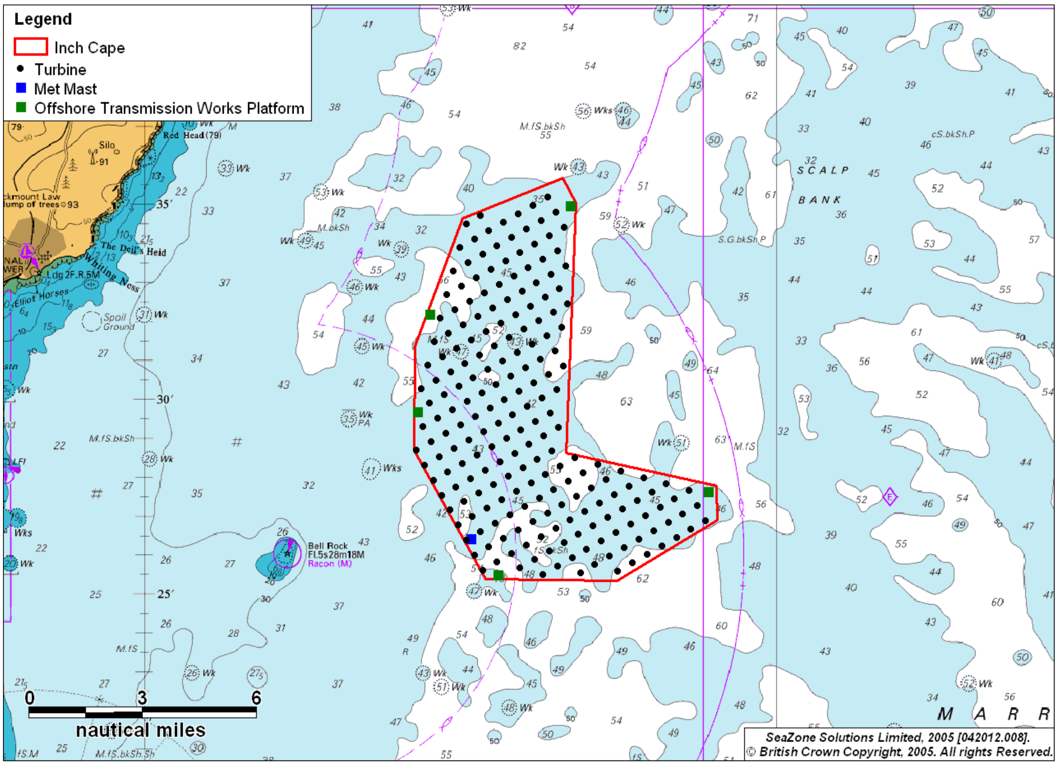
Table 19A.2 Corner Co-ordinates of the Development Area (WGS 84 UTM 30N)

Corner	Latitude	Longitude
A	56° 34' 39.81" N	002° 14' 55.69” W
B	56° 35' 40.88" N	002° 10' 08.22” W
C	56° 35' 02.52" N	002° 09' 30.10” W
D	56° 28' 38.12" N	002° 10' 00.10” W
E	56° 27' 47.95" N	002° 02' 50.31” W
F	56° 26' 53.70" N	002° 02' 48.79” W
G	56° 25' 20.54" N	002° 07' 33.43” W
H	56° 25' 23.02" N	002° 13' 48.47” W
I	56° 28' 41.91" N	002° 17' 13.68” W
J	56° 31' 23.16" N	002° 17' 10.65” W

19A.9.2 Wind Turbine Generators (WTGs) Numbers

The indicative worst case layout considers 213 WTGs within the Development Area. This layout is presented in Figure 19A.8.

Figure 19A.8 Overview of Turbine and Structure Layout



19A.9.3 WTG Design

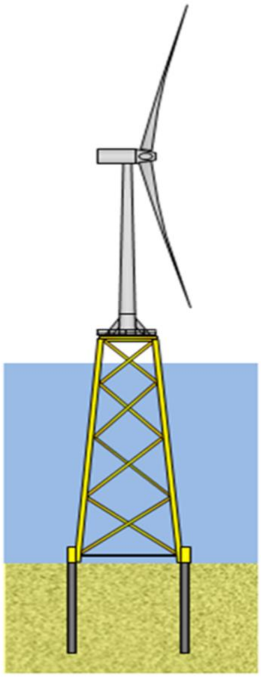
The potential dimensions of three different size WTGs are presented in Table 19A.3.

Table 19A.3 WTG Measurements – Worst Case

Measurement	Small WTGs	Medium WTGs	Large WTGs
Approximate Maximum Hub Height (m. Lowest Astronomical Tide (LAT))	92	109	129
Rotor Diameter (m)	120	154	172
Minimum Air Draught (m. Highest Astronomical Tide (HAT))	22	22	22
Maximum Tip Height (m. LAT)	152	186	215

For the worst case collision risk modelling, jacket (steel framed structure) foundations with dimensions of 30 x 30 m at sea level have been assumed. An example jacket foundation is pictured in Figure 19A.9.

Figure 19A.9 Jacket Foundation



19A.9.3.1 Other Foundation Types

Other foundation types under consideration are concrete gravity bases (Figure 19A.10) and hybrid foundations (Figure 19A.11).

Figure 19A.10 Concrete Gravity Base Foundations

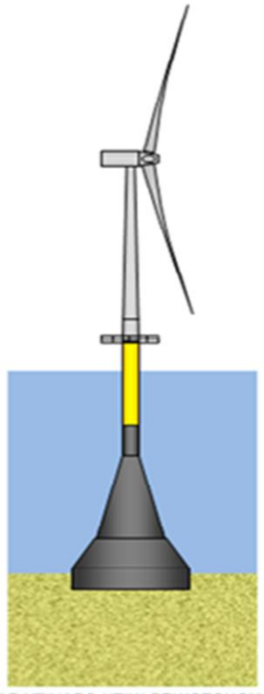
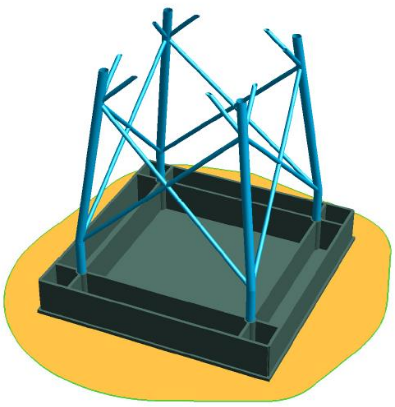


Figure 19A.11 Hybrid Foundation



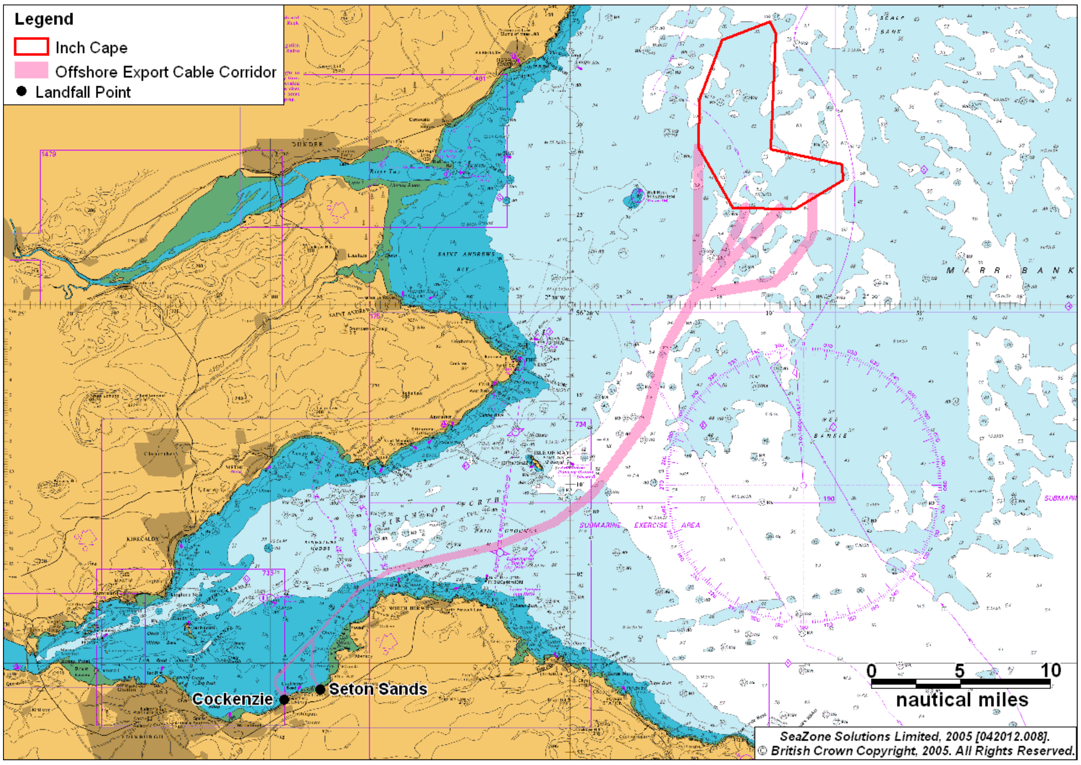
19A.9.4 Other Structures within Inch Cape

In addition to the WTGs, up to three met masts will also be sited to gather data on meteorological conditions in the Development Area. Up to five OSPs will also be sited within the Development Area. The actual number will depend on whether the AC or DC option is chosen by ICOL for energy transmission. All of the structures will be located within the Development Area and are referred to as Inch Cape Structures. An indicative worst case layout considers five OSPs and is presented in Figure 19A.8.

19A.9.5 Offshore Export Cable Corridor

The Offshore Export Cable Corridor runs from the Development Area to landfall options at Cockenzie and Seton Sands, East Lothian. The Offshore Export Cable Corridor is presented in Figure 19A.12. The Offshore Export Cable is assessed fully in a separate NRA which can be found in Appendix 19B.

Figure 19A.12 Offshore Export Cable Corridor



19A.9.6 Definition of Worst Case Scenario

For the worst case collision risk modelling, the following structures and dimensions have been used (Table 19A.4):

Table 19A.4 Structure Dimensions and Numbers

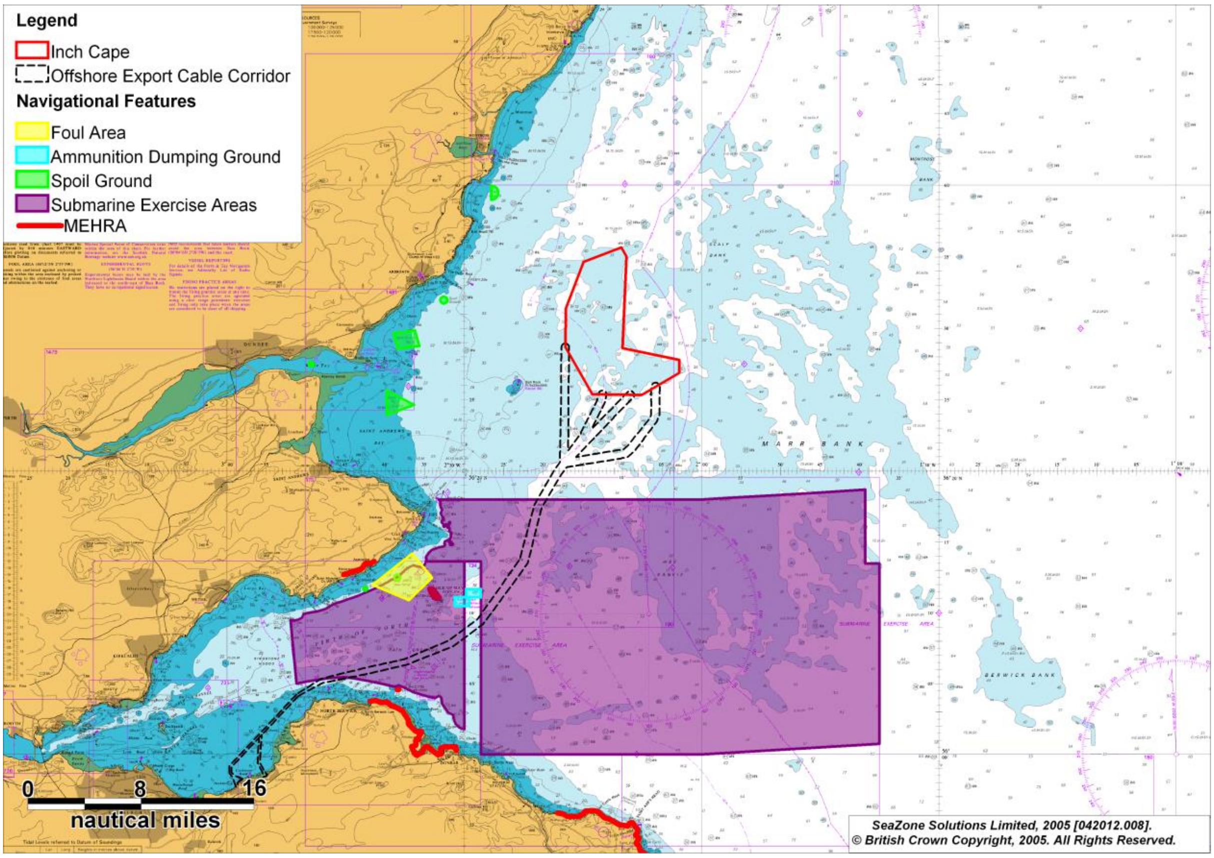
Structure	Dimensions at Sea Level	Maximum Number
Wind Turbine Generators (with jacket foundation)	30 m x 30 m	213
Met Mast	12.5 m x 12.5 m	3
Offshore Substation Platforms	100 m x 100 m	5

19A.10 Baseline Environment

19A.10.1 Navigational Features

Figure 19A.13 presents an overview of the navigational features in proximity to the Development Area and the Offshore Export Cable Corridor.

Figure 19A.13 Navigational Features in Proximity to the Development Area and Offshore Export Cable Corridor



There are four charted spoil grounds located approximately 9 nm west of the Development Area, towards the coast. There is a foul area (foul areas are defined as having a hazard to shipping on the seabed such as lost anchor cable) approximately 17 nm south west of the Development Area. Vessels are cautioned from anchoring or fishing within this area due to the existence of foul areas and obstructions on the seabed. There are two disused dumping grounds for ammunition and boom defense gear to the east of the Isle of May, approximately 16 nm south west of the Development Area.

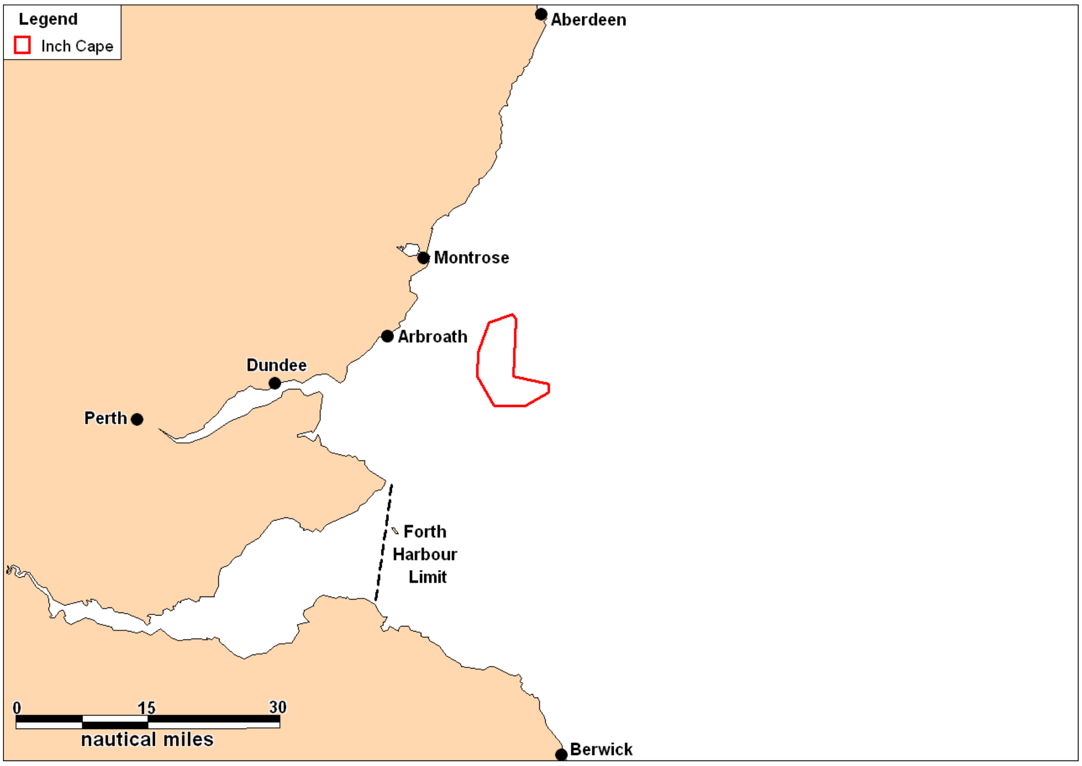
There is a submarine exercise area approximately 7 nm south of the Development Area.

19A.10.2 Ports and Auxiliary Functions

19A.10.2.1 Ports in Proximity

An overview of the main ports relative to the Development Area is presented in Figure 19A.14.

Figure 19A.14 Overview of Main Ports Relative to the Development Area



There are also a number of harbour facilities and ports located within the Firth of Forth and Firth of Tay, with smaller harbours (mainly fishing and recreational) located along the Fife and East Lothian coastlines.

19A.10.2.2 Forth and Tay Navigation Service/Pilotage

Forth and Tay Navigation Service is manned 24 hours a day (all year) by personnel who include Vessel Traffic Service (VTS) Operators. The service they provide includes Radar, AIS and in some areas Closed Circuit Television (CCTV) surveillance of the Forth Estuary from the Eastern Port Limit (Tantallon Castle on the south shore to Fife Ness on the north shore) and of the Tay Estuary from the Abertay Outer Buoy to a position just west of the Tay Rail Bridge.

The Forth and Tay VTS is a Marine Traffic Organisation Service. A traffic organisation service concerns the operational management of traffic and the forward planning of vessel movements to prevent congestion and dangerous situations, and is particularly relevant in times of high traffic density or when the movement of special transports may affect the flow of other traffic.

The Forth and Tay Navigation Service duties also include enforcement of the Forth Byelaws and general directions for Navigation and the Byelaws for the Port of Dundee. This ensures safety and efficient passage of all shipping passing through the Forth Ports and Harbour limits. Forth Ports has five Radars covering the Forth Estuary; at Gullane, Leith, Burntisland, Port Edgar and Grangemouth and one Radar at Buddon Ness on the Tay.

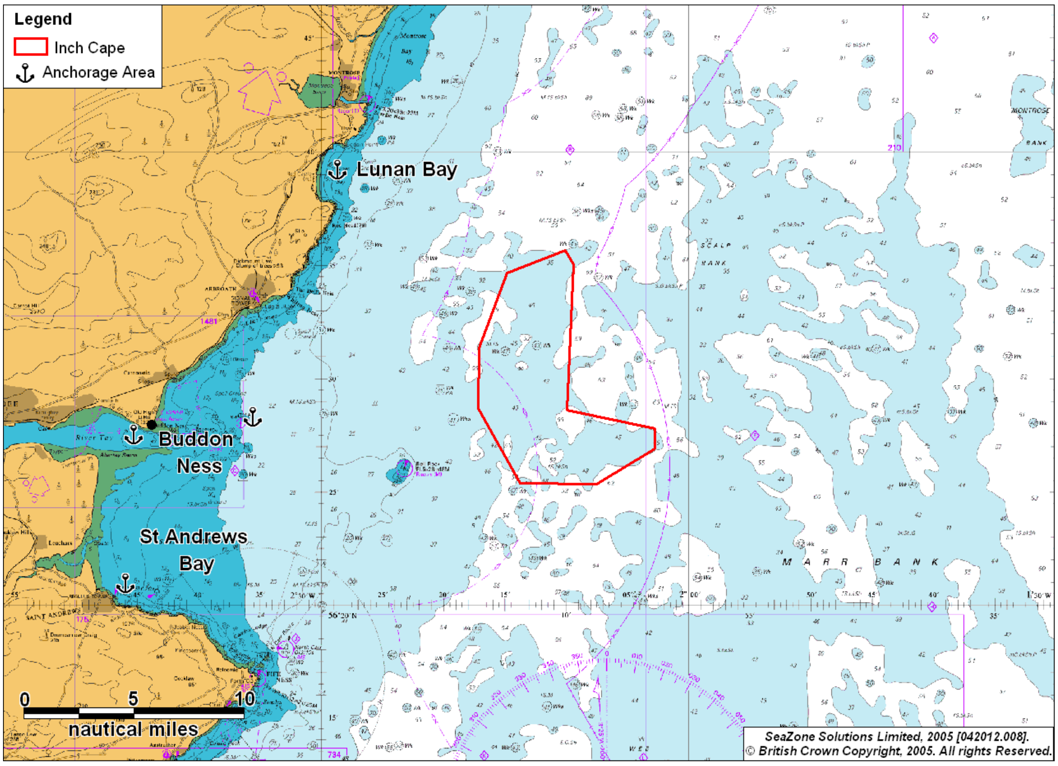
Forth Ports Ltd. exercises compulsory pilotage for passenger-carrying vessels and for other vessels in Forth Deep Water Channel and its immediate vicinity and in the firth/river as a whole (west of 3°, 15.4 minutes W). Pilotage is also compulsory for vessels over 8,000 Dead Weight Tonnage (DWT) bound for Leith and vessels using the Eastern Channel lying within Grangemouth Docks. However vessels bound for a closed dock, lock or other closed limits, are generally excluded from compulsory pilotage.

Pilotage is compulsory in the Dundee Pilotage District, which extends to the port limits south by south west of the Fairway Light-buoy. In terms of pilotage in the inner River Tay, this is not compulsory however masters are strongly advised to make use of the services of a local pilot which will be arranged by the Perth Harbour Master.

19A.10.2.3 Anchoring

Anchorage areas in the vicinity of the Development Area, which have been identified from charts and the pilot book for the area, are presented in Figure 19A.15.

Figure 19A.15 Anchorage Areas Relative to the Development Area



From north to south, the following anchorage areas have been identified:

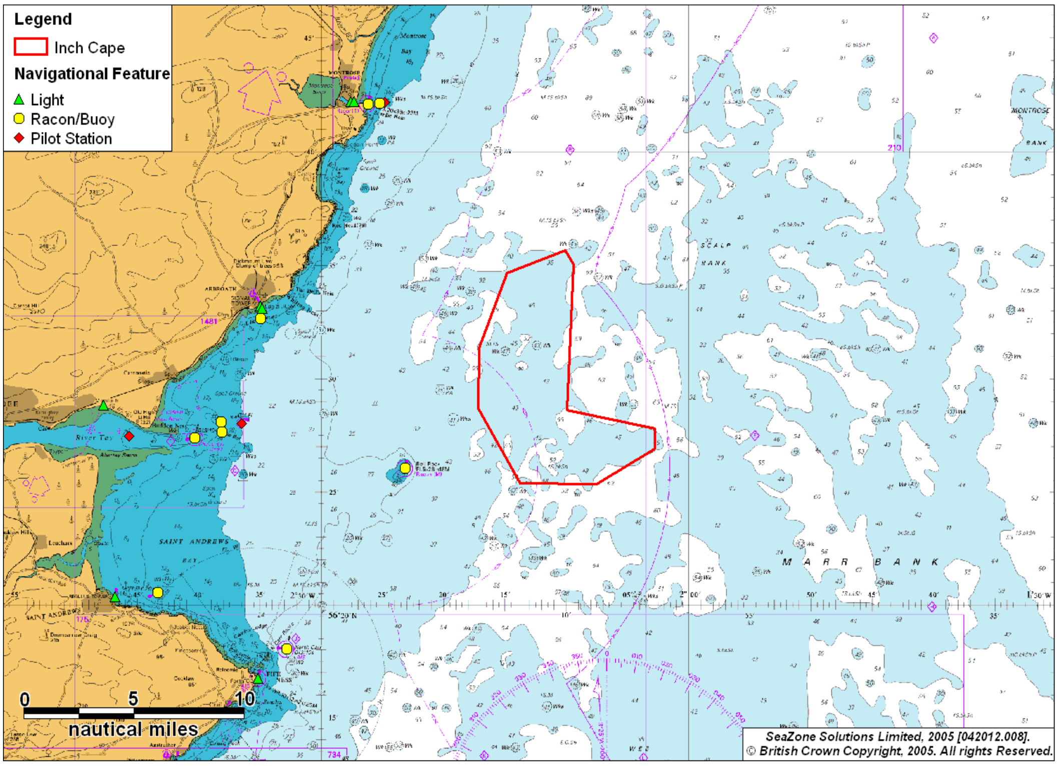
- Lunan Bay, which lies between Boddin Point and Red Head, is sandy and free from dangers, apart from the rocky ledges off the Point and Head. There is a good anchorage in the bay 1 nm east of the ruins of Red Castle in depths of 14 m where the seabed type is sand over clay;
- An anchorage is available approximately 4.5 nm east of Buddon Ness in the vicinity of the Fairway Light Buoy where the water depth is around 20 m;
- There is also an anchorage 0.6 nm west south west of Buddon Ness where the water depth is approximately 6 m; and
- There is a charted anchorage in St Andrews Bay, approximately 0.8 nm from the coast in a water depth of around 8 m.

An analysis of anchoring within 10 nm of the Development Area is presented in Section 19A.15.4. It is noted that there are no restrictions on anchoring outside of these areas just that these areas are preferred or noted areas where vessels regularly anchor.

19A.10.3 Aids to Navigation (AtoN)

A plot of the main navigational aids in the vicinity of the Development Area is presented in Figure 19A.16.

Figure 19A.16 Aids to Navigation Relative to the Development Area



The main navigational feature in the area is the Racon transmitting Morse letter 'M' located on Bell Rock, approximately 4 nm from the Development Area. The light on Bell Rock is a flashing light every 5 seconds, at a height of 28 m above height datum with a range of 18 m.

19A.10.4 Sailing Directions

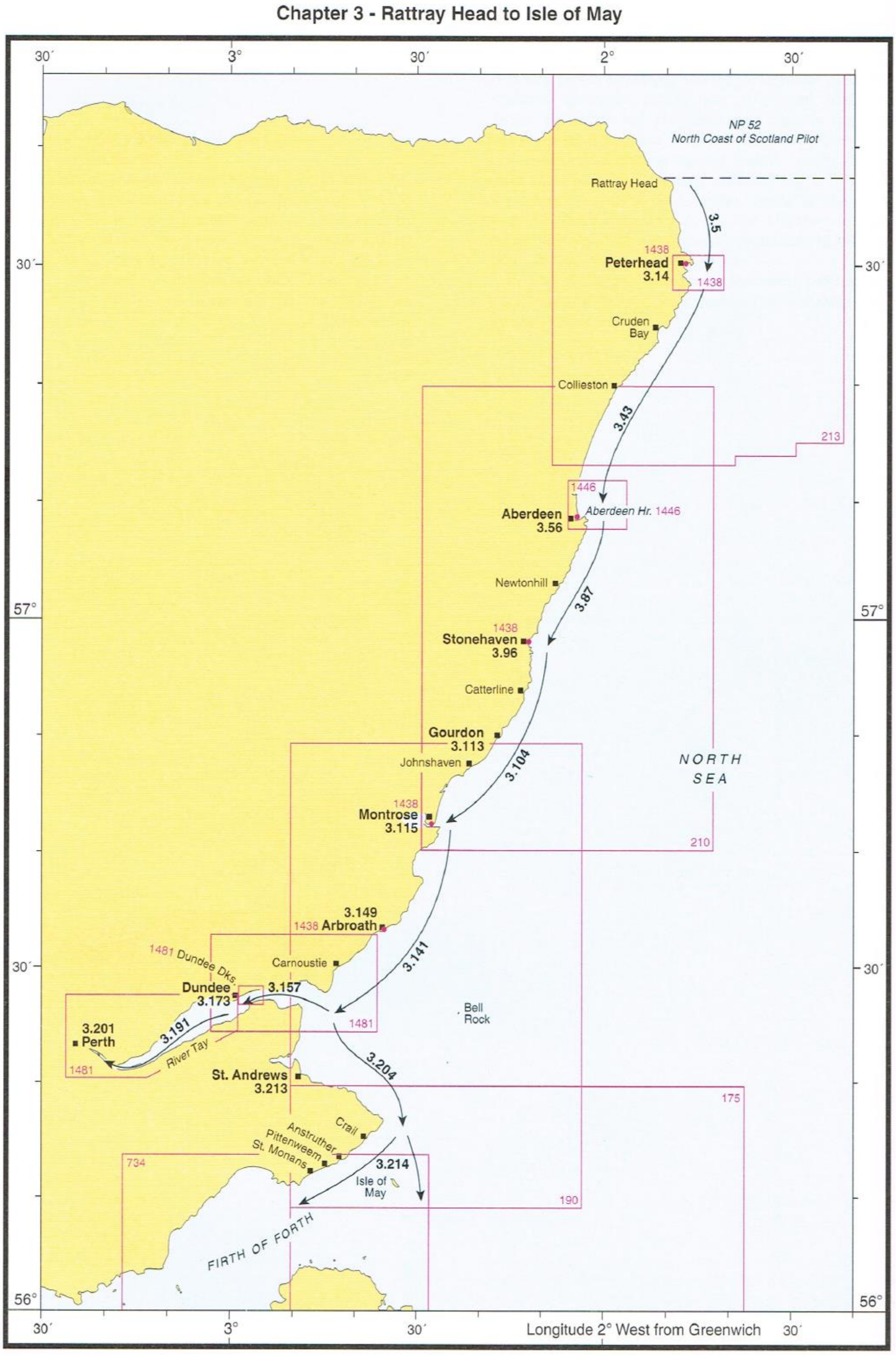
Sailing directions for the area are presented in the North Sea (West) Pilot (UKHO, 2009). A plot of the routes for vessels bound from Rattray Head and Isle of May is presented in Figure 19A.17.

The arrows are not accurate if superimposed on a chart but they illustrate the general passages used by ships. A description of the route passing from the entrance of the River Tay to Fife Ness (passing the Development Area) is given below.

- (3.147) From a position east of Scurdie Ness (56° 42' N, 2° 26'W) the coastal passage runs south by south west to the vicinity of the Fairway Light Buoy off the entrance to the River Tay, passing (with positions referenced from Whiting Ness (56° 34' N, 2° 33'W)):
    - East by south east of Boddin Point (7.3 nm north by north east), thence: east by south east of Red Head (4 nm north by north east), a perpendicular cliff of 79 m high. Lunan Bay lies between Boddin Point and the north east extremity of Red Head.
    - Thence; east by south east of a pair of former measured distance beacons (1.5 nm north by north east) and a single beacon a mile farther south standing the Deil's Head.

  - Thence; east by south east of Whiting Ness and east by south east of an unmarked dangerous wreck (8 cables south by south east).
  - Thence; east by south east of Arbroath (1 nm west by south west) and east by south east of Elliot Horses (2.3 nm south west), a shoal patch with a depth of 0.2 m. Elliot Water, marked by a prominent chimney, reaches the sea on the coast 4 cables north west of Elliot Horses.
  - Thence; west by north west of Bell Rock (9.5 nm south by south east), a reef with a lighthouse on it. There is a shoal patch with a depth of 4.4 m two cables north and one 2.8 cables south with a depth of 2.5 m.
  - Thence; east by south east of Carnoustie (6 nm south west) and east of the Fairway Light Buoy (safe water) (5.5 nm south west) off the entrance to the River Tay.
- (3.210) From the vicinity of the Fairway Light-Buoy (56° 28’ 3N, 2° 36’ 6W) off the entrance to the River Tay, the coastal route is south by south east to Fife Ness, passing (with positions from Fife Ness):
  - East by north east of Saint Andrew Bay (7 nm west by north west), with the town of Saint Andrews at its head. The west coast of the bay is fronted by shoal water with depths of less than 5 m. Targets and target buoys may be moored off Tentsmuir Sands and there are range beacons ashore.
  - Thence: east by north east of North Carr Rocks (1 nm north by north east), which dry. The rock has a prominent beacon (red column on a stone base, globe top-mark, all supported by six metal stays) and lies at the northeast extremity of foul ground extending 1 nm north east of Fife Ness. North Carr Light-Buoy (East cardinal) is moored 1 nm northeast of North Carr Rocks, which are also covered by the red sector (197 degrees – 217 degrees) of Fife Ness light.
  - Thence: east by north east of Fife Ness, a dark cliff, 10 m high, above a rocky foreshore.

Figure 19A.17 Routes from Rattray Head to Isle of May (UKHO, 2009)



19A.10.5 Oil and Gas Infrastructure

There are no oil or gas surface platforms located in the vicinity of the Development Area. The nearest existing offshore surface installations are within the Buzzard Oil and Gas Field, 83 nm north east of the Development Area.

There is an exploration well 12.8 nm from the eastern boundary of the Development Area, in the previously licensed United Kingdom Continental Shelf (UKCS) block 26/12, originally drilled by Cluff Oil Plc. in October 1985. This well was plugged and abandoned.

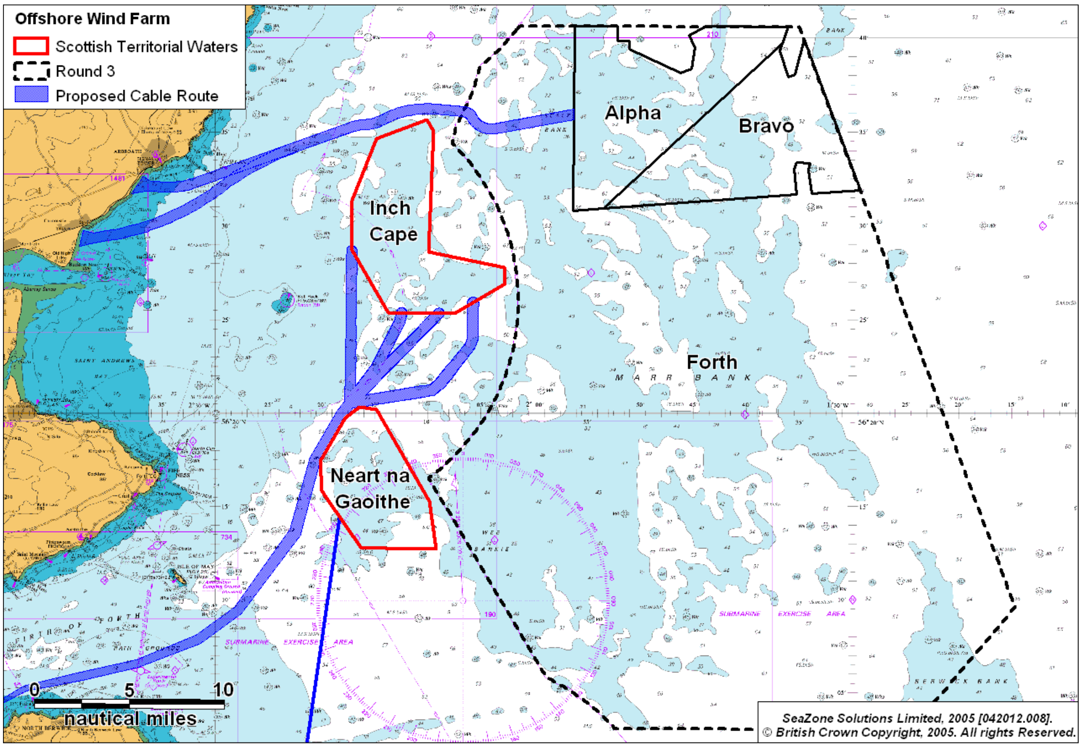
19A.10.6 Aggregates Dredging Areas

The only aggregate dredging license in Scotland was located within the Firth of Forth; however the ten year lease between Westminster Gravels Ltd and TCE ended in January 2011. Therefore the impact of the Development Area on dredging activities was screened out of the NRA.

19A.10.7 Other Wind Farm Developments

The offshore wind farm developments and associated cable routes in the vicinity of the Development Area and Offshore Export Cable Corridor are presented in the following figure (Figure 19.18).

Figure 19A.18 Offshore Wind Farms and Associated Offshore Export Cable Corridors

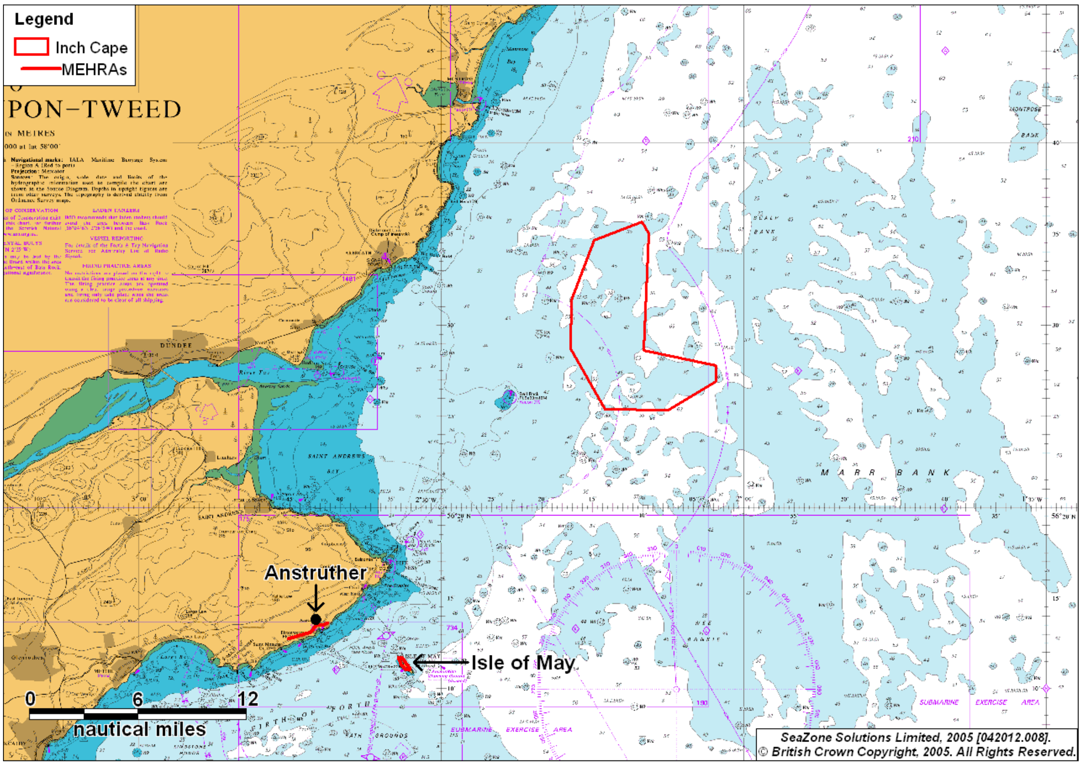


19A.10.8 Marine Environmental High Risk Areas (MEHRAS)

MEHRAs are areas that have been identified by the UK Government, as 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.

MEHRAs are located within 18 nm of the Development Area along the cliffs of the Isle of May and at Anstruther, as presented in Figure 19A.19. Both MEHRAs have been designated on wildlife, landscape and geological grounds.

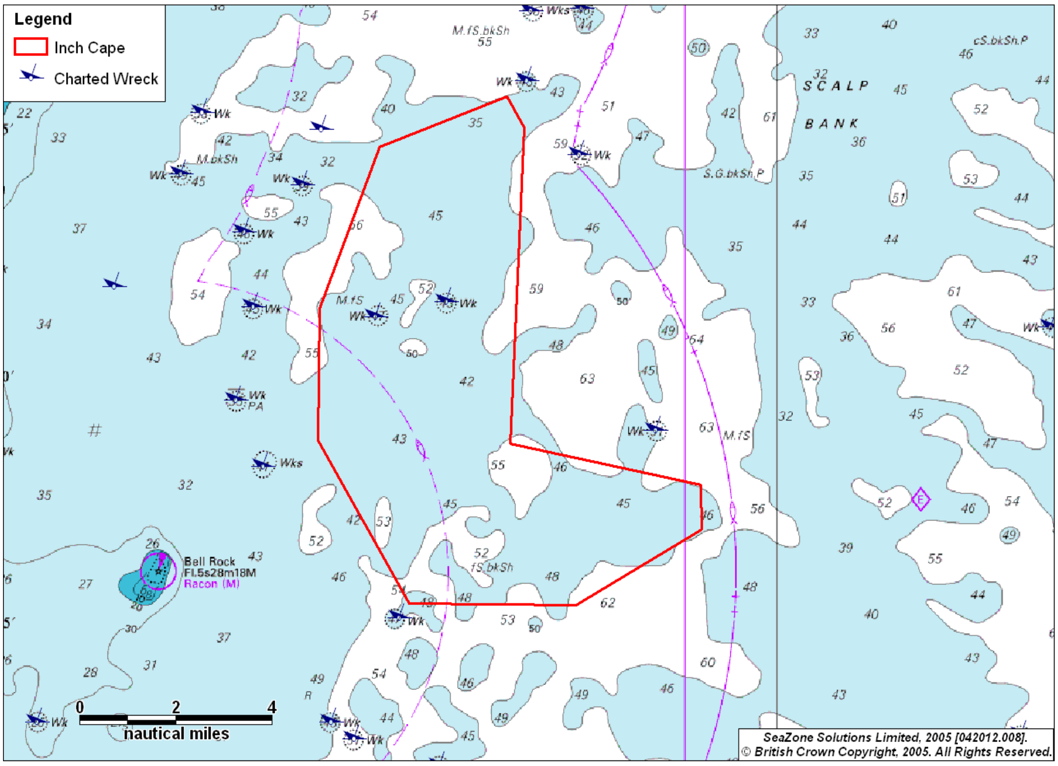
Figure 19A.19 MEHRAs Relative to the Development Area



19A.10.9 Wrecks

Based on Admiralty charts of the area, the locations of wrecks in the vicinity of the Development Area are presented in Figure 19A.20.

Figure 19A.20 Charted Wrecks in Proximity to the Development Area



There are two charted wrecks (charted due to potential impacts on navigational safety) within the Development Area. The chart also shows a number of wrecks in close proximity to the Development Area, with a relatively high concentration of wrecks inshore of the Development Area.

There are no protected wrecks within the Development Area.

See ES Chapter 17: Marine Archaeology and Cultural Heritage for more details of wrecks in the vicinity of the Development Area.

19A.11 Metocean Data

19A.11.1 Introduction

This section presents nearby meteorological and oceanographic statistics for the Development Area which have been used as input to the risk assessment.

According to the Admiralty Sailing Directions (UKHO, 2009), the west North Sea region enjoys a generally mild climate. Winds blow from between the south and north west most usually, and are often fresh or strong. Gales are more common in the winter months, although they still may occur during the summer.

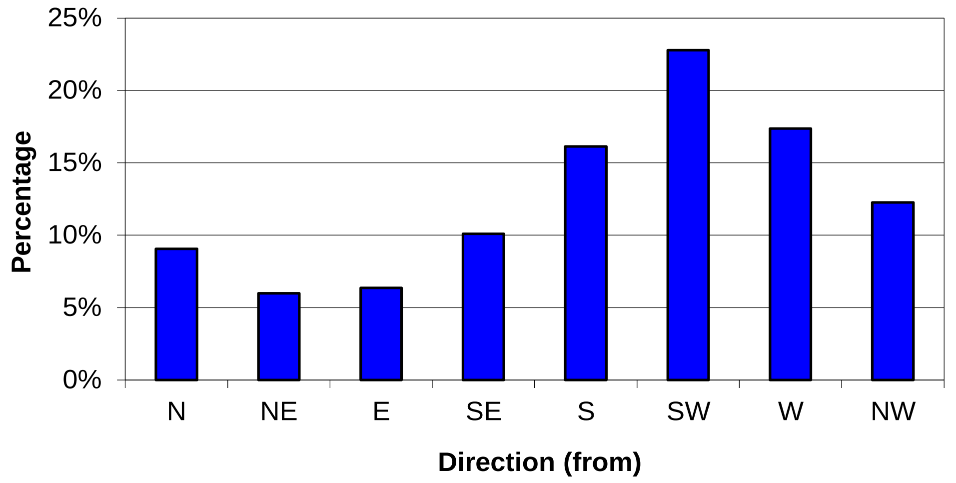
Rainfall is not considerable, and there is little variation throughout the year. It is frequently cloudy throughout the year; however, the winter months are more susceptible to overcast skies. Fog (or haar) occasionally affects the east coast of the UK, particularly in the north.

Metocean data recorded at the Development Area and the surrounding area is presented from the Wind and Wave Frequency Distributions for sites around the British Isles Offshore Technology Report (HSE, 2001).

19A.11.2 Wind

The wind data for the site has been taken from recordings made approximately 21 nm north east of the Development Area. The wind direction distribution is presented in Figure 19A.21. It can be seen that the wind direction is predominantly from a south westerly direction.

Figure 19A.21 Average Annual Wind Direction Distribution



19A.11.3 Visibility

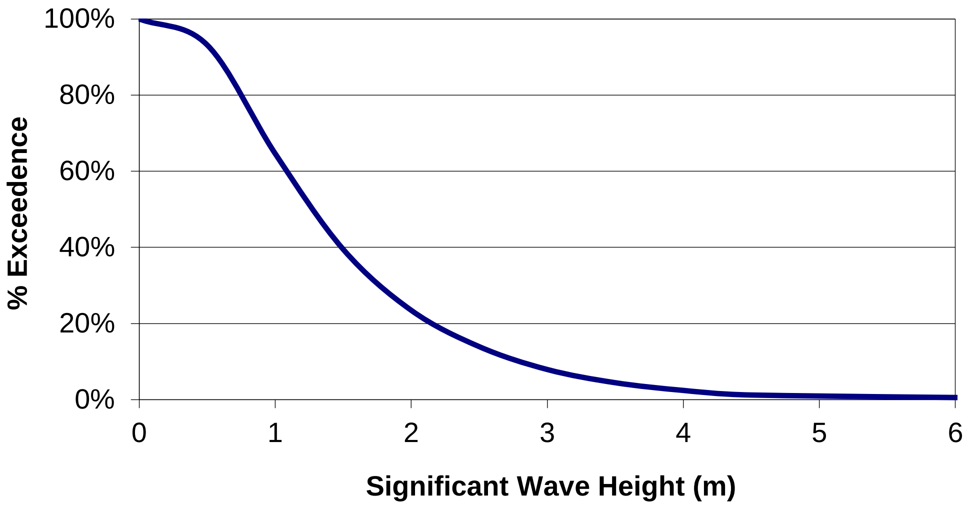
Historically, visibility has been shown to have a major influence on the risk of ship collision. The annual average probability of bad visibility (defined as less than 1 km) for the UK North Sea is approximately 0.03, i.e., an average of 3 per cent of the year.

Sea haar and poor visibility can occur in the Development Area during an easterly sea breeze and this is most common during March to May.

19A.11.4 Wave Height

The wave height data taken from recordings made approximately 21 nm north east of the Development Area is presented below (Figure 19A.22).

Figure 19A.22 Average Wave Height



The large majority of the wave heights recorded were under 4 m, with approximately 4 per cent of the year recording a significant wave height over 4 m.

19A.11.5 Tide

A description of the tidal streams in the general area is provided below (UKHO, 2009):

> *"The offshore stream runs generally north and south from Rattray Head to Bell Rock.*
>
> *South of Bell Rock, clear of the land and in the outer part of Firth of Forth the tidal streams are weak, spring rate at 1 knot, but run in various directions throughout the tidal cycles."*

Chart Datum and Ordnance Datum for the Development Area based on values recorded at Arbroath are presented below in Table 19A.5.

Table 19A.5 Chart Datum and Ordnance Datum Figures for the Development Area

Tidal Level	Height above Chart Datum
Mean High Water Neaps (MHWN)	4.2 m
Mean High Water Springs (MHWS)	5.3 m
Mean Low Water Springs (MLWS)	0.8 m
Mean Low Water Neaps (MLWN)	2.0 m

Admiralty Chart 1407 (Tidal Diamond “B” approximately 4.4 nm north of the Development Area, and “E” approximately 4.5 nm to the east) indicates that currents in the area are set in a generally south by south west direction on the ebb and north by north east direction on the flood, with a peak spring tidal rate of 1.2 knots and peak neap rate of 0.6 knots (Table 19A.6). Note that for tidal diamonds “B” and “E”, tidal streams refer to high water at Leith.

Figure 19A.23 presents the locations of charted tidal diamonds relative to the Development Area.

Figure 19A.23 Tidal Stream Data for the Development Area (Tide Diamonds B and E)

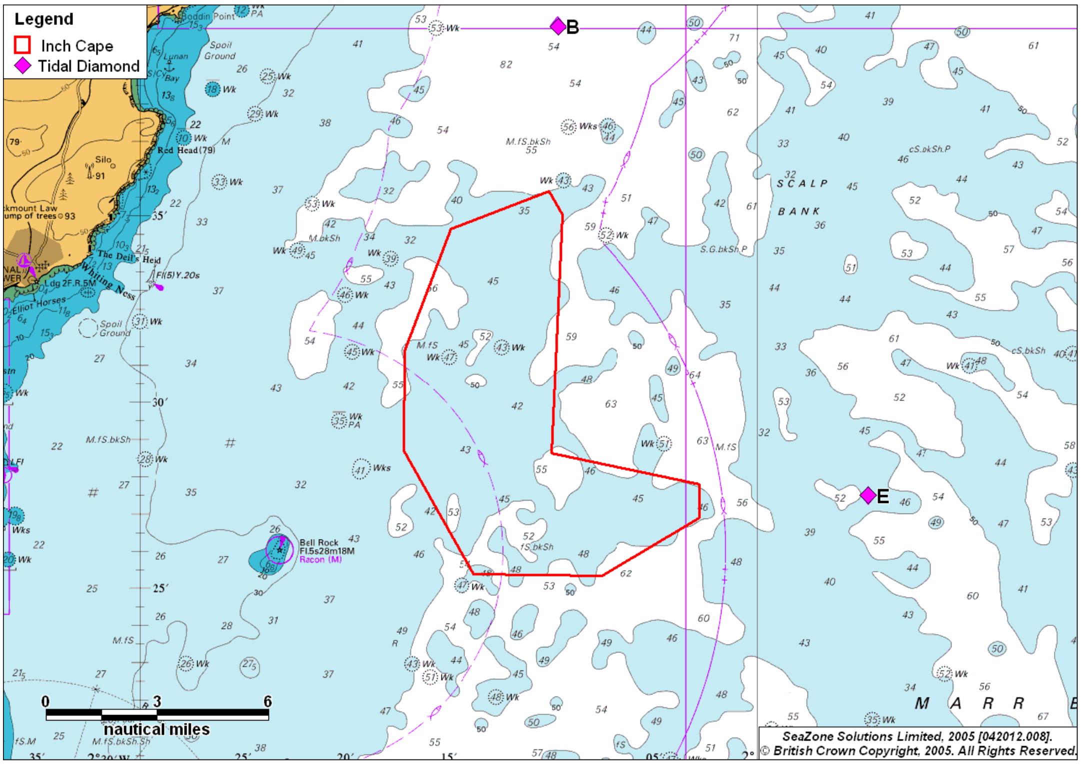


Table 19A.6 Tidal Diamonds "B" and "E" (Referred to High Water at Leith)

Hours		Tidal Diamond B			Tidal Diamond E		
		Directions of streams (degrees)	Rates at spring tides (knots)	Rates at neap tides (knots)	**Directions of streams (degrees)**	Rates at spring tides (knots)	Rates at neap tides (knots)
Before High Water	**6**	**016**	0.8	0.4	**027**	0.7	0.4
	5	**020**	0.3	0.1	**018**	0.2	0.1
	4	**184**	0.4	0.3	**201**	0.4	0.2
	3	**194**	0.8	0.4	**193**	0.9	0.5
	2	**194**	1.0	0.5	**199**	1.1	0.5
	1	**191**	1.2	0.6	**211**	1.1	0.6
High Water		**194**	1.0	0.5	**213**	0.9	0.5
After High Water	**1**	**208**	0.4	0.2	**221**	0.4	0.2
	2	**348**	0.3	0.1	**350**	0.2	0.1
	3	**009**	0.7	0.3	**015**	0.6	0.3
	4	**014**	1.0	0.5	**024**	1.1	0.5
	5	**016**	1.2	0.6	**032**	1.2	0.6
	6	**018**	0.9	0.4	**028**	0.9	0.5

19A.12 Search and Rescue Overview and Assessment

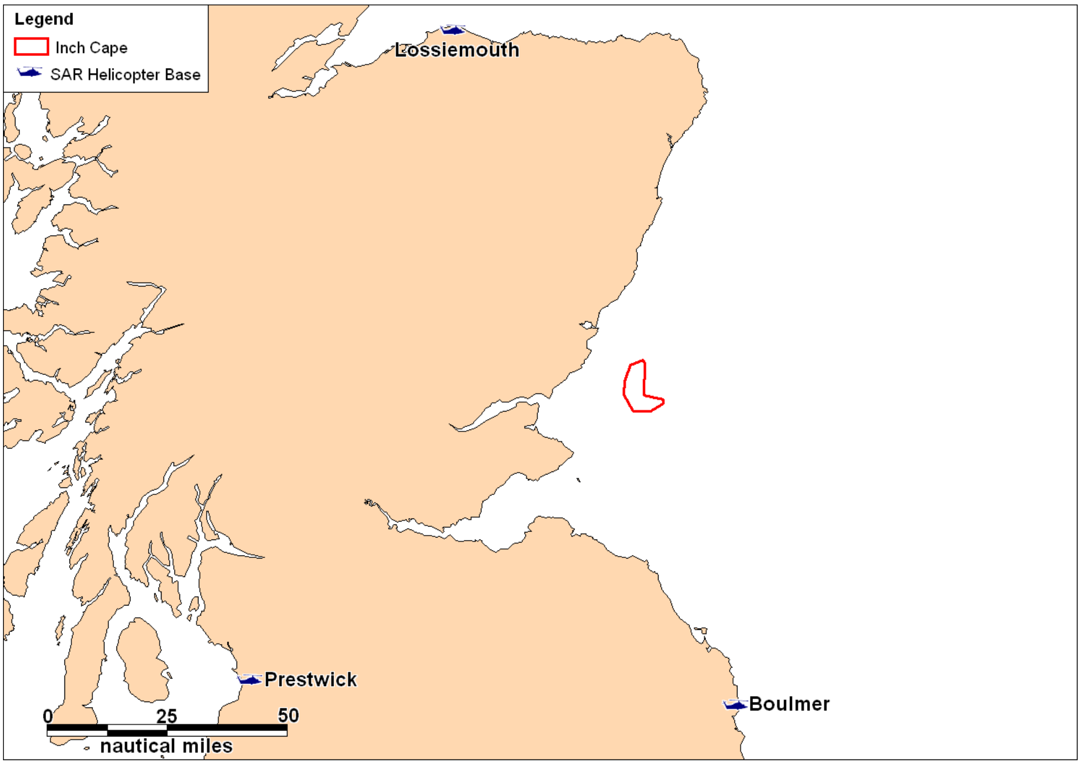
This section summarises the existing SAR resources in the region and the issues being considered in relation to the design of the project.

19A.12.1 SAR Resources

19A.12.1.1 SAR Helicopters

A review of the SAR helicopter bases in the vicinity of the Development Area (see Figure 19A.24) indicated that the closest SAR helicopter bases are located at Boulmer and Lossiemouth, both of which are operated by the Royal Air Force (RAF). Due to the fact that SAR operations at RAF Boulmer are scheduled to be phased out, the following section will describe the facilities available at RAF Lossiemouth. RAF Lossiemouth is situated approximately 76 nm north by north west of the site. This base has Sea King helicopters with a maximum endurance of 6 hours and speed of 110 mph giving a radius of action of approximately 250 nm which is well within the range of the Development Area. One helicopter is available at 15 minutes readiness between 0800 and 2200 hours. Between 2200 and 0800 hours, one helicopter is held at 45 minutes readiness.

Figure 19A.24 SAR Helicopter Bases Relative to the Development Area



Based on the above information, the day-time response to the centre of the Development Area from RAF Lossiemouth would be in the order of 1 hour and 5 minutes. At night time this will increase by 30 minutes to approximately 1 hour 35 minutes 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.

19A.12.1.2 Royal National Lifeboat Institution (RNLI) Lifeboats

The RNLI maintains an active fleet of over 300 lifeboats (of various types ranging from 5 m to 17 m in length) and a relief fleet of around 100 boats at 235 stations round the coast of the UK and Ireland (RNLI, 2010).

The RNLI stations in the vicinity of the wind farm are presented in Figure 19A.25.

Figure 19A.25 RNLI Bases in Proximity to the Development Area

At each of these stations, crew and lifeboats are available on a 24-hour basis throughout the year. Table 19A.7 provides a summary of the facilities at the stations closest to the Development Area.

Table 19A.7 Lifeboats Held at Nearby RNLI stations

Station	Lifeboats	All-Weather Lifeboat (ALB) Spec	Inshore Lifeboat (ILB) Spec	Distance to Centre of Development Area
Montrose	ALB & ILB	Tyne (Shannon-class at this station after 2013)	D Class	15 nm
Arbroath	ALB & ILB	Mersey	D Class	14 nm
Broughty Ferry	ALB & ILB	Trent	D Class	24 nm
Anstruther	ALB & ILB	Mersey	D Class	25 nm

Based on the offshore position of the development it is likely that All-Weather Lifeboats (ALBs) from Montrose or Arbroath would respond to an incident within the sites. This is confirmed when reviewing the historical incident data (see Section 19A.13.2).

19A.12.1.3 Coastguard Stations

HM Coastguard, a division of the MCA, is responsible for requesting and tasking SAR resources made available by other authorities and for co-ordinating the subsequent SAR operations (unless they fall within military jurisdiction).

At the time of writing, HM Coastguard co-ordinates SAR through a network of 18 Maritime Rescue Co-ordination Centres (MRCC). A corps of over 3,100 volunteer Auxiliary Coastguards around the UK coast form over 380 local Coastguard Rescue Teams (CRT) involved in coastal rescue, searches and surveillance.

All of the MCA's operations, including SAR, are divided into three geographical regions. The East of England Region covers the east and south coasts of England from the Scottish border down to the Dorset/Devon border. The Wales and West of England Region extends from Devon and Cornwall to cover the coast of Wales, North West England and the Solway Firth. The Scotland and Northern Ireland Region covers the remainder of the UK coastline including the Western Isles, Orkney and Shetland, and therefore covers the area around the Development Area.

Each region is divided into six districts with its own MRCC, which co-ordinates the Search and Rescue response for maritime and coastal emergencies within its district boundaries (East of England Region includes an additional station, London Coastguard, for co-ordinating Search and Rescue on the River Thames). The nearest rescue coordination centre to the Development Area is the Forth MRCC.

The MCA published a consultation document (MCA, 2010) in December 2010 and updated in 2011 (MCA, 2011) to modernise HM Coastguard. The main part of the document proposes the reduction in the number of Maritime Rescue Co-ordination stations around the UK coastline.

Revised plans were released by the UK Government mid-way through 2011 (MCA, 2011) 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, 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:

    - Maritime Rescue Sub-Centre (MRSC) Aberdeen
    - MRSC Shetland
    - MRSC Stornoway
    - MRSC Belfast
    - MRSC Holyhead
    - MRSC Milford Haven
    - MRSC Falmouth
    - MRSC Humber

Note that at the time of writing, there is no further published information on the outcome of the consultation.

The Development Area currently lies within the Scotland and Northern Ireland region with the nearest rescue coordination centre being MRCC Forth. MRCC Forth's area or responsibility provides search and rescue coverage from the Scottish/English Border to East coast of Scotland at Doonie Point (just south of Aberdeen).

The changes to the UK MRCC structure will see the closure of MRCC Forth, resulting in the closest centre to the Development Area being MRSC Aberdeen. This will cover a much wider area than the current MRCC Forth, but will continue to respond to any incidents within the Development Area.

19A.12.1.4 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.

There are various tugs in the vicinity of the Development Area. Briggs Marine and Environmental Services operate four tugs and two anchor handlers that work out of Burntisland, Fife. There are also tugs are on stand-by at the Hound Point / Braefoot Bay marine terminals. Finally, tug assistance may be available from offshore support vessels passing through the area.

19A.13 Maritime Incidents

This section reviews maritime incidents that have occurred in the vicinity of the Development Area in the ten year period between 2001 and 2012.

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

Data from the following sources have been analysed:

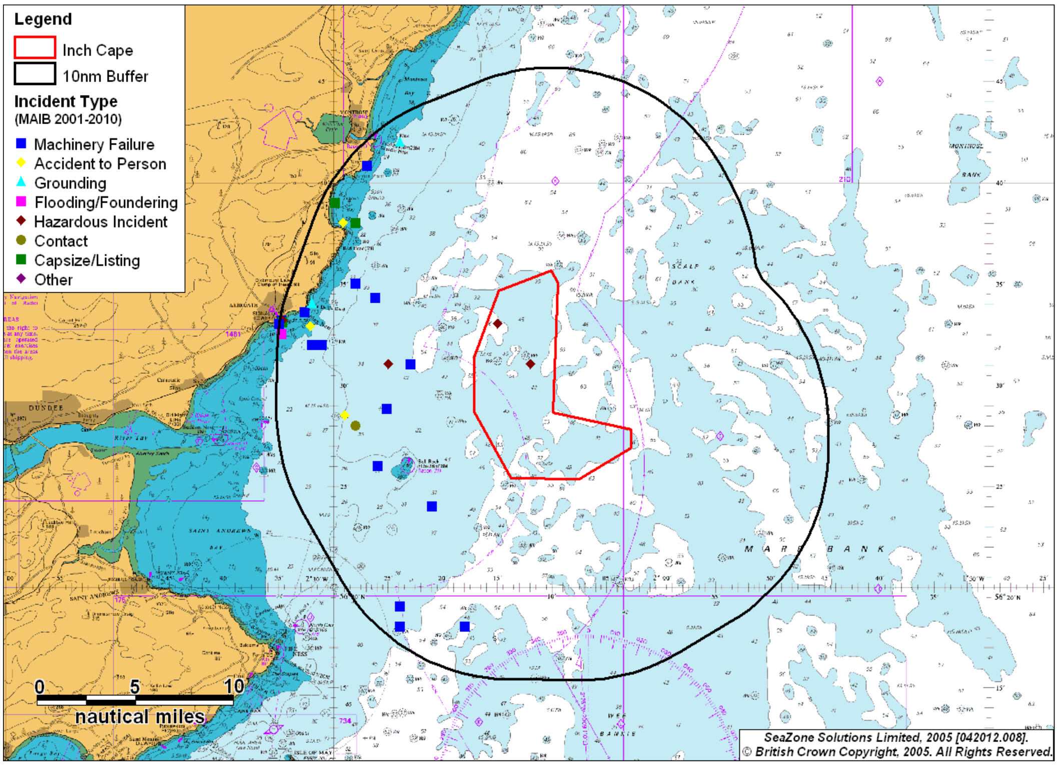
- MAIB
- RNLI

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

19A.13.1 Marine Accident Investigation Branch (MAIB)

The locations of accidents, injuries and hazardous incidents reported to MAIB within 10 nm of the Development Area for a ten year period (January 2001 to December 2010) are presented in Figure 19A.26, colour-coded by type.

Figure 19A.26 MAIB Incident Locations by Type within 10 nm of the Development Area



It should be noted that the MAIB aim for 97 per cent accuracy in reporting the locations of incidents.

A total of 31 unique incidents involving 34 vessels were reported within 10 nm of the Development Area, corresponding to 3 to 4 incidents per year (excluding incidents in port/harbour areas). Two incidents (both hazardous incidents) were recorded within the Development Area, one of which involved a UK-registered fishing vessel (September 2011) and another which involved a cruise vessel (August 2007).

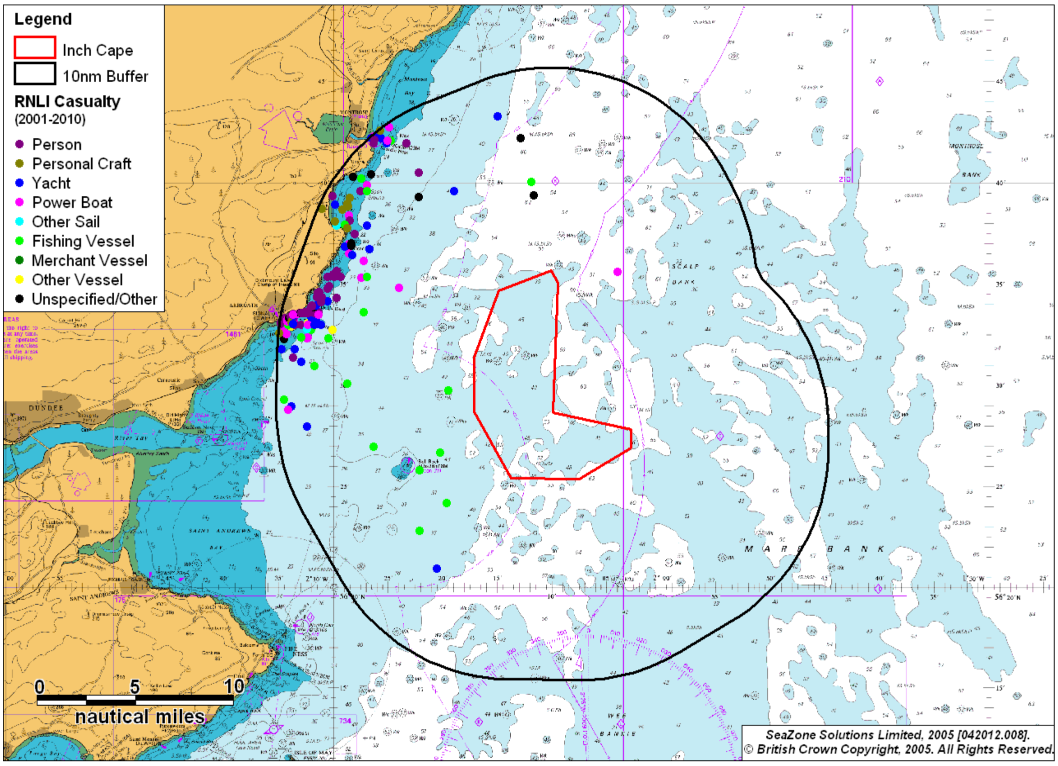
Hazardous incidents have been defined by the MAIB as *"unspecified events which might have led to an accident, eg, near misses stemming from failure of procedures in shipboard operations, material defects, fatigue and human failures"*.

19A.13.2 RNLI

Data on RNLI lifeboat responses within 10 nm of the Development Area in the ten-year period between 2001 and 2010 have been analysed.

A total of 178 unique incidents were recorded by the RNLI (excluding hoaxes and false alarms), corresponding to an average of between 17 and 18 incidents per year. Figure 19A.27 presents the geographical location of incidents colour-coded by casualty type.

Figure 19A.27 RNLI incidents by Casualty Type within 10 nm of the Development Area



No incidents were recorded within the Development Area in the 10 years analysed. The closest incident was recorded approximately 1.3 nm west of the Development Area. The incident involved a large fishing vessel in July 2002 and was caused by a fouled propeller. Arbroath ALB assisted the vessel.

The vast majority of incidents were responded to by lifeboats from either Arbroath (76 per cent) or Montrose (23 per cent). The incidents further offshore, including those in close proximity to the Development Area, tended to be responded to by ALBs as opposed to ILBs.

19A.14 Overview of Key Consultation

19A.14.1 ICOL Consultation

Consultation on navigational issues has been carried out with stakeholders throughout the NRA process. Table 19A.8 summarises the key points from consultations and from the Marine Scotland Scoping Opinion.

Table 19A.8 Stakeholder Consultation Responses

Stakeholder	Overview of Key Points
MCA (Scoping Opinion)	• The ES should supply detail on the possible impact on navigational issues for both Commercial and Recreational craft. • The traffic survey should include all vessel types and cover a period of at least 28 days to take seasonal variations in traffic patterns into account. • The NRA should be submitted in accordance with MGN 371 (and 372) and the DTI/DfT/MCA Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms. • Particular attention should be paid to cabling routes and burial depth. • Reference should be made to any MEHRAs established on adjacent coastlines. • Cumulative and in-combination effects require serious consideration (particularly those arising from adjacent wind farm proposals). • Casualty information from the MAIB and RNLI is a good data source for establishing the risk profile for the area. • Radar and manual observations should be included in addition to AIS data to ensure that vessels of less than 300 Gross Tonnage (GT) are captured. • Consideration must be given to SAR resources, Emergency Response Co-operation Plans (ERCOP) and guard vessel provision. • The effects of WTGs on ship's Radars need to be assessed on a site specific basis.

Stakeholder	Overview of Key Points
NLB (Scoping Opinion)	• Notices to Mariners, Radio Navigation Warning and publication in appropriate bulletins will be required, stating the nature and timescale of work being carried out. • Marking and lighting will be based on IALA Recommendation O-139. All marking and lighting will require the statutory sanction of NLB prior to deployment. • NRA should be undertaken in accordance with MGN 371. • The accuracy of the NRA will be enhanced by gathering data regarding small craft. • The risk assessment should include a workshop approach to hazard identification and mitigation.
RYA (Scoping Opinion)	• The 'RYA Position Statement on Offshore Renewable Energy Development' should be consulted for the RYA's concerns on offshore energy developments and recreational boating.
Ports and Harbours (Scoping Opinion)	• The site is placed in a busy shipping channel and the NRA should fully explore the impacts associated with diverted shipping. • Particular attention should be paid to the cumulative and in-combination effects as there are several other offshore wind farms in the area.
CoS (Scoping Opinion)	• The location is in direct conflict with shipping traffic/movement and the Wind Farm could pose a serious threat to safety and trade. • Any development would have to ensure that no direct or indirect route is blocked as a result. • Navigation safety is of paramount importance when considering the development of a wind farm. Guidance documents should be applied in consultation with the CoS. • The traffic survey should incorporate AIS and Radar covering at least 28 days in the 12/24 months before submission. • Effects on navigation of auxiliary OREI structures should be considered. • The assessment should cover visual navigation and collision avoidance. • The potential for cumulative effects will have to be carefully assessed. • Mitigations need to be considered so that the development has minimal impact on shipping operations and safety of mariner.
Scottish Canoe Association (Scoping Opinion)	• Given the distance out to sea, this is not an area where sea kayakers would venture into. • The development should not have any significant impact on tidal flows and sediment deposition close to shore where small recreational boats such as kayaks could be affected.

Stakeholder	Overview of Key Points
Forth Ports Ltd June 2012	• ICOL confirmed that cables will be buried or protected depending on seabed conditions. • Forth Ports expressed no concerns with the cable passing to the north or the south of the anchorage berths. • Emergency anchoring should be considered but this is not a concern if the cable is protected or buried. • No concerns were raised over the inshore export cable route option. Any disruption to port operations during installation should be discussed with Forth Ports prior to operations being carried out.
NLB October 2012	• No concerns were raised on turbine selection for the site. A decommissioning plan will have to consider the removal of large gravity base foundations if used. • Extreme peripheral structures should be avoided. The eastern most tip of the site should aid navigational safety. • NLB are content with the cumulative assessment for the area. The 5 nm gap between Forth Phase 1 (Alpha and Bravo) and the Inch Cape is a suitable distance for safe navigation. • Lighting and marking will be defined once a final turbine layout has been decided. • Buoyage will be considered for construction but is unlikely for operation.
Montrose Port September 2012	• Following consultation with NLB, consultation was sought to identify any hazardous traffic movements within the area. • Montrose confirmed that no gas carriers visit the port and the only vessel carrying large hazardous liquids was the Big Orange, a well stimulation vessel. • Montrose Port expressed no concerns over the Project.
CoS October 2012	• CoS had no comments on the data presented. • Concerns were raised over the way that cumulative assessments would be undertaken. It was confirmed that the Firth of Forth Round 3 Zone Phase 1 (Alpha and Bravo), Neart na Gaoithe and Inch Cape offshore wind farms will be considered within the NRA. • The CoS would like to see the eastern boundary flattened or sloped to reduce the area sterilized by the site (to the north of the foot). If this is not possible, then other mitigations should be considered. • It is preferential to leave a navigable gap between any developments within the Firth of Forth Round 3 Zone and Development Area for deviations.

Stakeholder	Overview of Key Points
MCA October 2012	• MCA confirmed that blade clearance would remain at 22 metres MHWS but encourages developers to achieve HAT where possible. • MCA stated that mixed arrays could cause visual confusion for the Mariner. • MCA noted that traffic levels in the area were low, when compared to other areas around the UK. • MCA raised issue which recently occurred where cable protection used significantly reduced water depths. ICOL confirmed that navigational safety would be considered when considering burial and/or protection methods. • MCA was shown the cumulative scenario that ICOL would consider within the NRA (NnG, Inch Cape and Forth Alpha and Bravo). GP confirmed that he was comfortable with this scenario being assessed and agreed it was not possible at this stage to consider developments that hadn't yet been defined within Forth Round 3 Zone. • Overall MCA considered that the Development Area including consideration of this cumulative scenario had no significant issues. • MCA noted that management of local issues was important.
RYA Scotland October 2012	• ICOL showed the cumulative scenario to be considered within the NRA to SRYA, who confirmed it was a realistic scenario to consider and didn't present any significant issues for recreational craft. (NnG, Inch Cape and Forth Alpha & Bravo). • SRYA noted main recreational route likely to pass through the area was vessels transiting to form the Caledonian Canal via Peterhead and Blyth. GR stated that the development would be another consideration for vessels passage planning. • SRYA noted that site layout was important but that alignment was less so. Worst case is considered to be random patterns.

19A.14.2 FTOWDG Consultation

Consultation on navigational issues was carried out during the FTOWDG regional work to gather input from the marine community. It was carried out using three different methods as follows:

1. Meetings

Meetings were held with, and presentations made, to the following:

- CoS;
- Forth Ports Ltd;
- NLB;
- DfT; and
- MCA.

2. Remote Consultation

Regular vessels using the area were identified and provided with an information pack detailing the proposals. The pack requested feedback on the proposals and also invited further consultation should the stakeholder consider this necessary.

3. Other Presentations

A dedicated presentation was also given to:

- RYA.

A summary of the main feedback from the FTOWDG consultation relevant to the Project is provided in Table 19A.9.

Table 19A.9 FTOWDG Consultation Responses

Stakeholder	Feedback
CoS January 2011	• Ship to ship transfers which take place near the entry of the Firth of Forth need to be considered. These ships have deeper draughts (up to 23 m) and must be considered in the FTOWDG assessment. Post consultation note: a regulation was implemented by the UK Government preventing ship-to-ship transfers outside of port/harbour waters. • For shipping passing through Inch Cape and the Forth of Forth Round 3 Zone from Montrose to Holland, there are merging traffic issues (tankers and cargo affected). In the alternative route scenario presented (vessels will pass west of developments/inshore) there is an increased density of shipping along an existing shipping route east and west of Bell Rock. Safety concerns raised by the CoS. Should also consider alternative route between Inch Cape and Neart na Gaoithe.

Stakeholder	Feedback
	• In general discussion the CoS stated that even one vessel per day on any given route could be strategically important and must therefore be given due consideration in the regional shipping and navigation study.
Forth Ports Ltd and NLB January 2011	• Forth ports have 20-22 movements a day (in 24 hour period). They stated that this is not that busy in terms of the number of movements, but is significant in terms of tonnage. • Oil and gas accounts for 80%-90% of Forth Ports business and around 60 cruise liners visit in the summer. • Regarding coastal tankers routeing to/from Grangemouth, BP lost the contract in 2011, hence the 'Border' vessels now mainly work out of Immingham, and these vessels now pass further east of the coast when supplying fuel to ports around Scotland. • It was noted that no ship-to-ship transfers take place in the Forth area as government regulations only permit ship-to-ship transfers inside their port limits. In addition, it was stated that anchorages are generally further inshore as depicted on admiralty charts. • No major tidal variation. The vessels will sit at anchor as opposed to slowing down in the North Sea. • It was thought that it is probably personal preference as to why vessels go East/West of Bell Rock. It could be that smaller vessels go closer to the coast for shelter. • General concerns were expressed regarding smaller vessels being pushed further offshore and the impact on them being further east and hence out in heavier weather. • Forth Ports felt the impact could be reduced by having a route through the middle between Neart na Gaoithe and Inch Cape for the deviated route from both Forth and Dundee. • Future developments in the Forth include the potential for three to four biomass plants, which if constructed could bring in an increased number of large bulk carriers.
MCA and DfT January 2011	• For vessels on the route between Montrose and various ports such as Immingham and Brunsbuttel in Germany, the MCA suggested that this solution (as shown in FTOWDG) would create more congestion around Bell Rock and near the mouth of the Firth of Forth and that alternatives should be considered. Stakeholders are likely to be uncomfortable with this change. A route south of Inch Cape, north of Neart ne Gaoithe and west of the Zone or a route to the north of Inch Cape and the Zone could also be considered.

Stakeholder	Feedback
	• For vessels heading north out of Forth Ports, the MCA suggested that further investigation was made into the patterns and reasons behind vessel movements around Bell Rock. • Overall the MCA was supportive of the approach taken in the regional assessment, however they are of the opinion that the majority of stakeholders are likely to be uncomfortable with many of the route change proposals, especially those around Bell Rock. Without stakeholder support, the MCA would be unable to support the route changes. • MCA requested further analysis to understand the percentage of traffic in the area that comprises regular running vessels as this would help to identify the appropriate stakeholders to meet/consult. • It was emphasised that the assessment must consider what hazards are created by the suggested route changes and that reference be made to potential impacts of WTGs on Radar and how this is impacted on the route changes. • The MCA suggested that when looking at all the routes in and around Bell Rock, an assessment needs to be made on the increase in shipping densities and encounters. • DfT asked that offshore accommodation, maintenance, SAR were considered by the developers later in the individual projects.
Shipping Operator – Solstad (Offshore Vessels)	• The regional developments will not affect their operations. In general, port callings are to Aberdeen or Peterhead. If vessels pass through the region following construction of wind farms, Solstad indicated that they would not have any problems navigating through the wind farms.
Shipping Operator – Transmarine Management ApS (tankers bound for Dundee)	• Initial findings are that when Transmarine Management ApS ships are bound to Dundee (in-ward) the developments are not a problem, but when leaving Dundee for direction Skaw (Skagen), Denmark they will require re-routeing.
Shipping Operator – SAGA Cruises (cruise vessels)	• In general the proposals do not pose a safety risk to SAGA Cruise vessels.
Shipping Operator – Fred Olsen Cruises (cruise vessels)	• Fred Olsen Cruises transit the area, especially during the summer months, however they have no concerns regarding the impact on operations.

Stakeholder	Feedback
Shipping Operator - James Fisher Everard (coastal tankers bound for Forth, Tay and Northern Ports)	• No comments were supplied during the regional work.
Shipping Operator - Armac Marine Management Ltd (cargo vessels bound for Montrose)	• Some routes will be affected but provided that the constructions are adequately marked and correctly charted, Armac Marine Management Ltd does not have any concerns regarding safe navigation, (the opinion of several Masters in the company).

19A.14.3 Regular Operators Consultation

Nine regular operators that would be required to deviate following the development of the Wind Farm were identified and consulted via electronic or hardcopy mail. The email or letter issued gave an overview of the work to date and an opportunity to request further information or individual consultation meetings if required.

Section 19A.4.1.4 lists the regular operators consulted and Table 19A.10 below presents the response received. Other stakeholders were contacted again following the initial contact, but did not provide a response.

Table 19A.10 Regular Operator Consultation Response

Regular Operator	Response
Scottish Government	*"There are multiple surveys conducted by Marine Scotland and other internationally coordinated surveys that transect the development area, not only during the 28 day AIS assessment period but at various specific periods throughout each year. With vessel access restrictions to the development area there will be reduced biological information and time series data available from this area to the Scottish Government and International Council for the Exploration of the Seas (ICES) which will impact on biological assessments.* *Any exclusion zone would impose increased sailing times along with the increased associated fuel burn. Early notification of works would be advantageous in the event that Marine Scotland can rework survey design where practicable* *There would be no specific operational safety issues caused to Marine Scotland by the installation of the development."*

19A.15 Marine Traffic Survey

19A.15.1 Introduction

This section presents marine traffic survey data within 10 nm of Inch Cape recorded by AIS and Radar (28 days comprising 10 days in February/March 2012 and 18 days in July/August 2012). The surveys were carried out within the Development Area by the *Gargano* during geotechnical work and the *Shamariah* which was a dedicated survey vessel.

The majority of vessels were recorded on AIS. AIS is now fitted on all commercial ships operating in UK waters over 300 GT engaged on international voyages, over 500 on domestic voyages, passenger vessels carrying 12 or more persons and fishing vessels over 45 m (this had changed to 24 m by the time of the summer survey). Small vessels not carrying AIS have been captured by Radar and visual observations where possible.

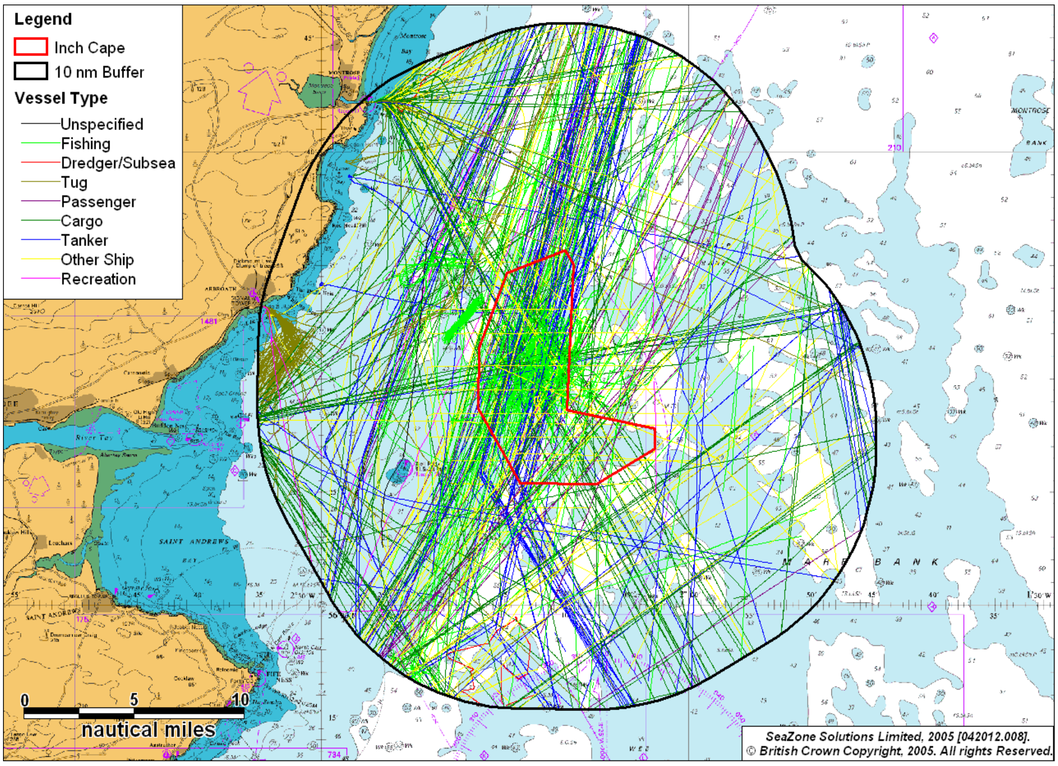
The proceeding charts show vessel tracks within 10 nm of the Development Area.

19A.15.2 Survey Analysis

A plot of the AIS vessel tracks recorded during 28 days in February/March 2012 and July/August 2012, colour coded by vessel type, is presented in Figure 19A.28.

This figure includes tracks of the survey vessels *Gargano* and *Shamariah* as well as other temporary traffic.

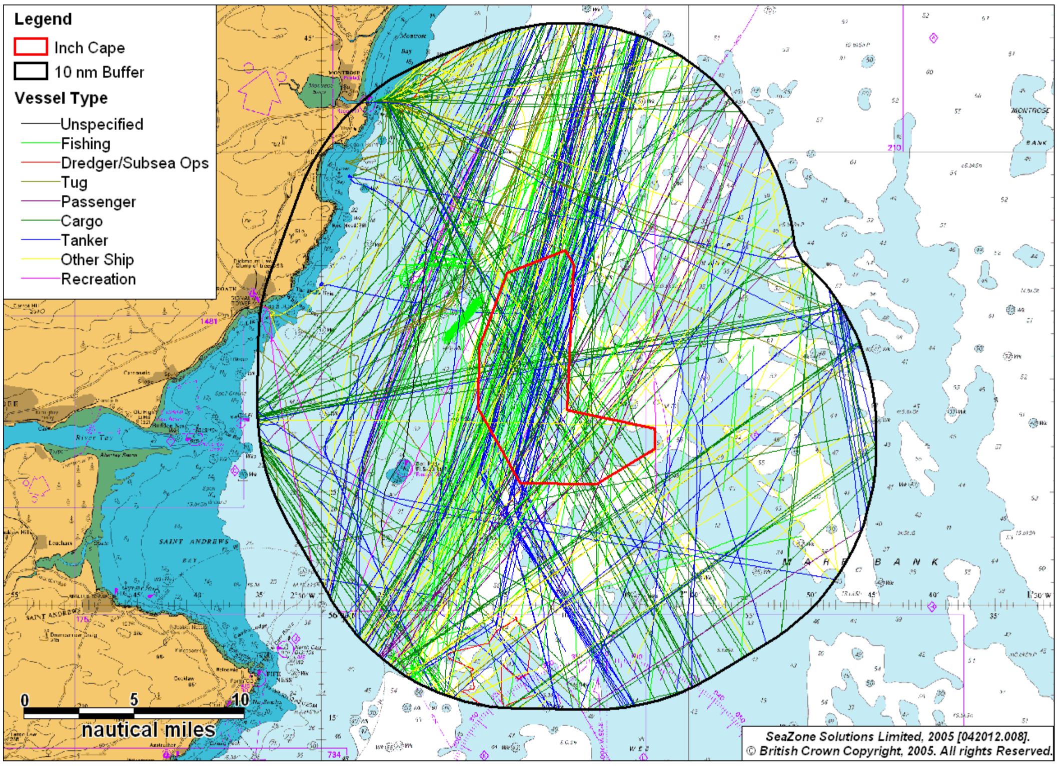
Figure 19A.28 AIS Data of All Tracks (28 Days)



A number of tracks recorded during the survey periods were classified as temporary (non-routine), such as the tracks of the survey vessels themselves and traffic associated with other surveys and work of a temporary nature. These tracks have therefore been excluded from further analysis.

A plot of the AIS vessel tracks recorded during the survey periods, colour-coded by vessel type and excluding temporary traffic, as mentioned above, are presented in Figure 19A.29.

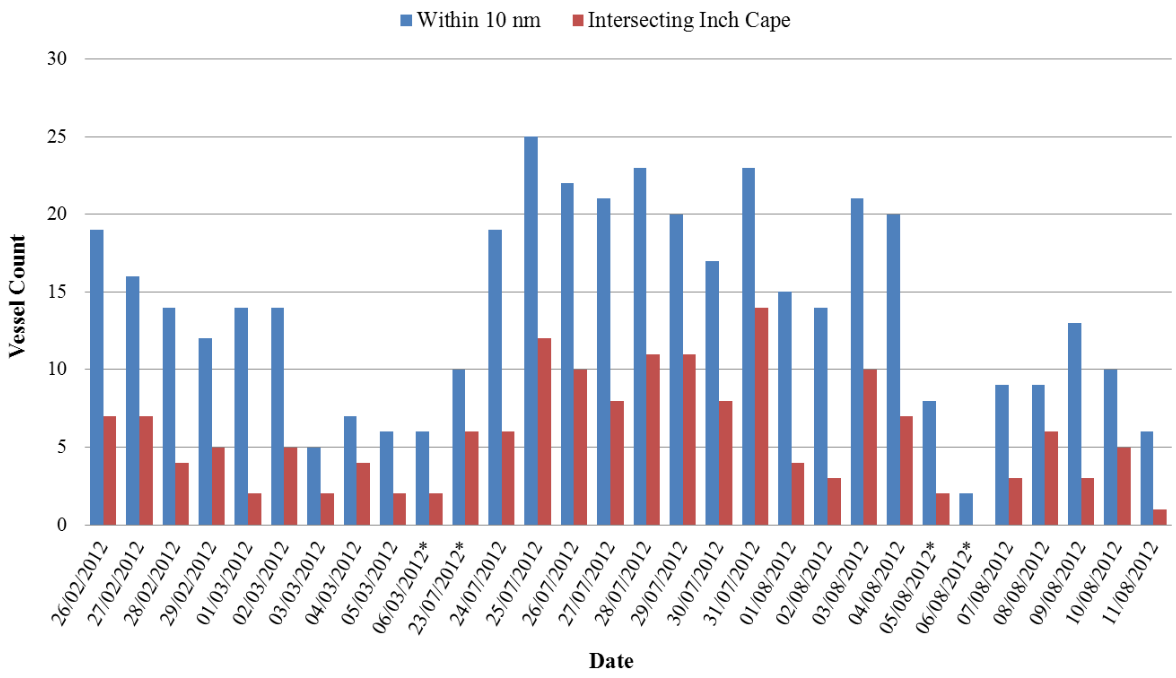
Figure 19A.29 AIS Data Excluding Temporary Traffic (28 Days)



During the surveys, an average of 14 unique vessels were recorded on AIS per day passing within 10 nm of the Development Area. In terms of vessels actually intersecting the Development Area, there were an average of approximately six vessels per day.

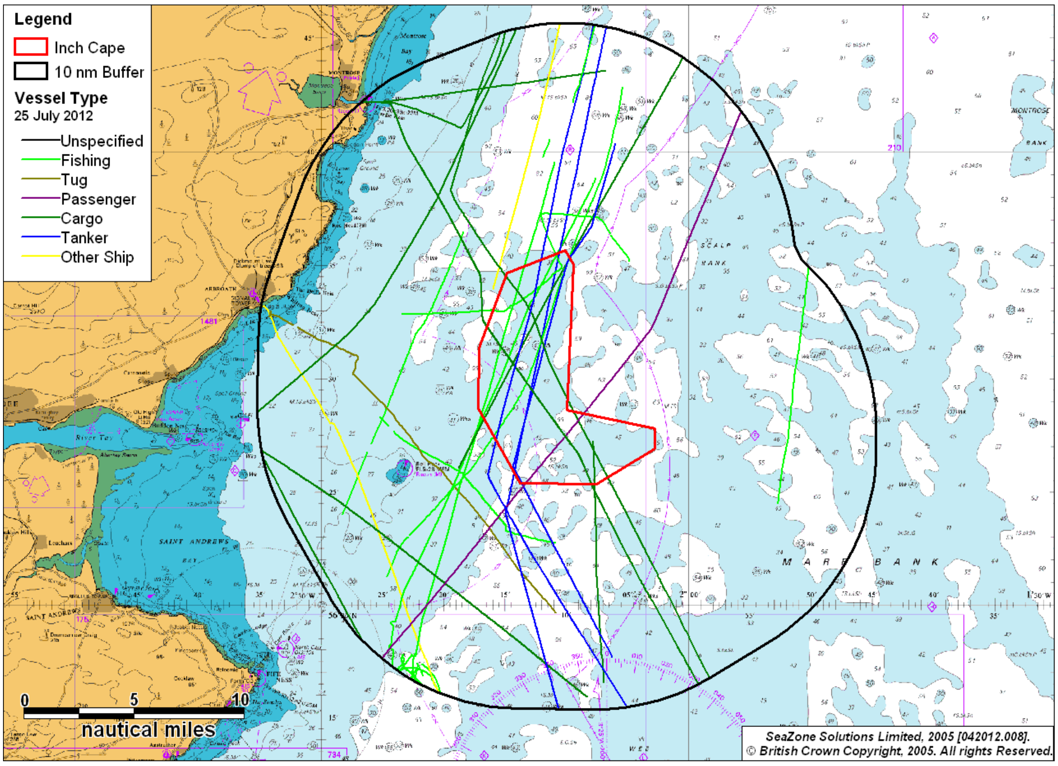
Figure 19A.30 shows the daily number of unique vessels passing through the 10 nm buffer and intersecting the Development Area during the survey periods. Note that some days were not full 24 hour survey days and these have been marked by *.

Figure 19A.30 Number of Unique Vessels Per Day



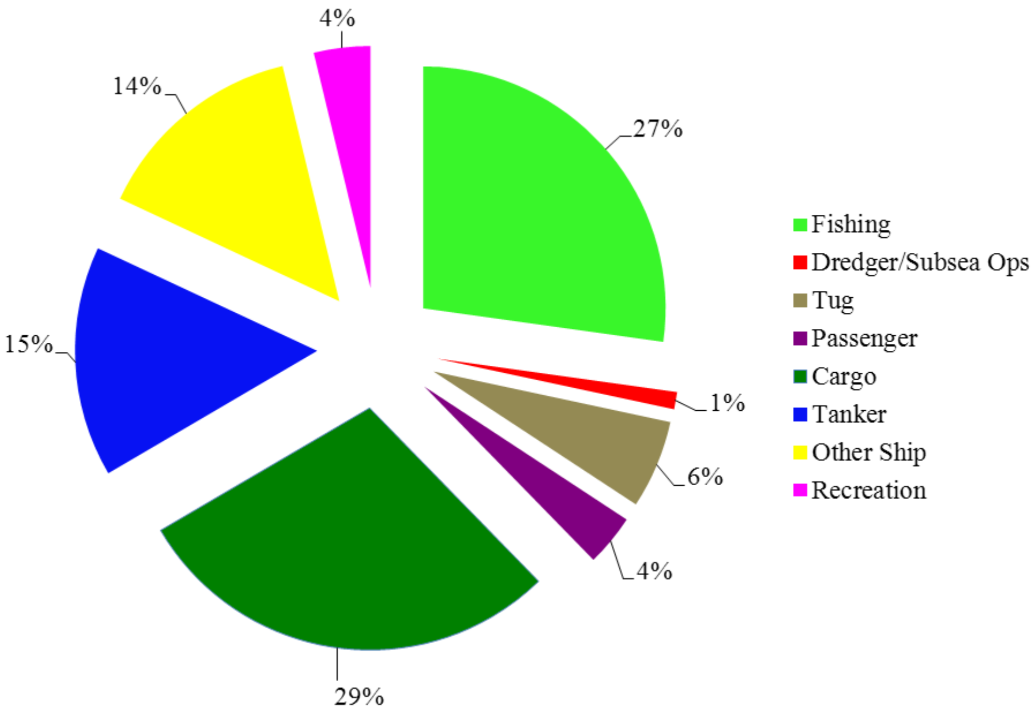
The busiest day during the 28 day survey periods was 25 July 2012 when 25 unique vessels were recorded within 10 nm of the Development Area. Vessel tracks recorded on the busiest day are presented in Figure 19A.31.

Figure 19A.31 Busiest Day (25 July 2012)



Analysis of the vessel types recorded within the 10 nm buffer around the Development Area during the survey periods are presented in Figure 19A.32.

Figure 19A.32 Vessel Types Identified Within 10 nm Buffer (28 Days)



During the combined survey periods, the majority of tracks were cargo vessels (29 per cent) and fishing vessels (27 per cent). Tankers and 'other' vessels made up 15 per cent and 14 per cent of the traffic recorded respectively. Figure 19A.33 to Figure 19A.36 present plots of cargo vessels, fishing vessels, tankers and passenger vessels recorded during the 28 days when surveying was undertaken.

Figure 19A.33 Cargo Vessels (28 Days)

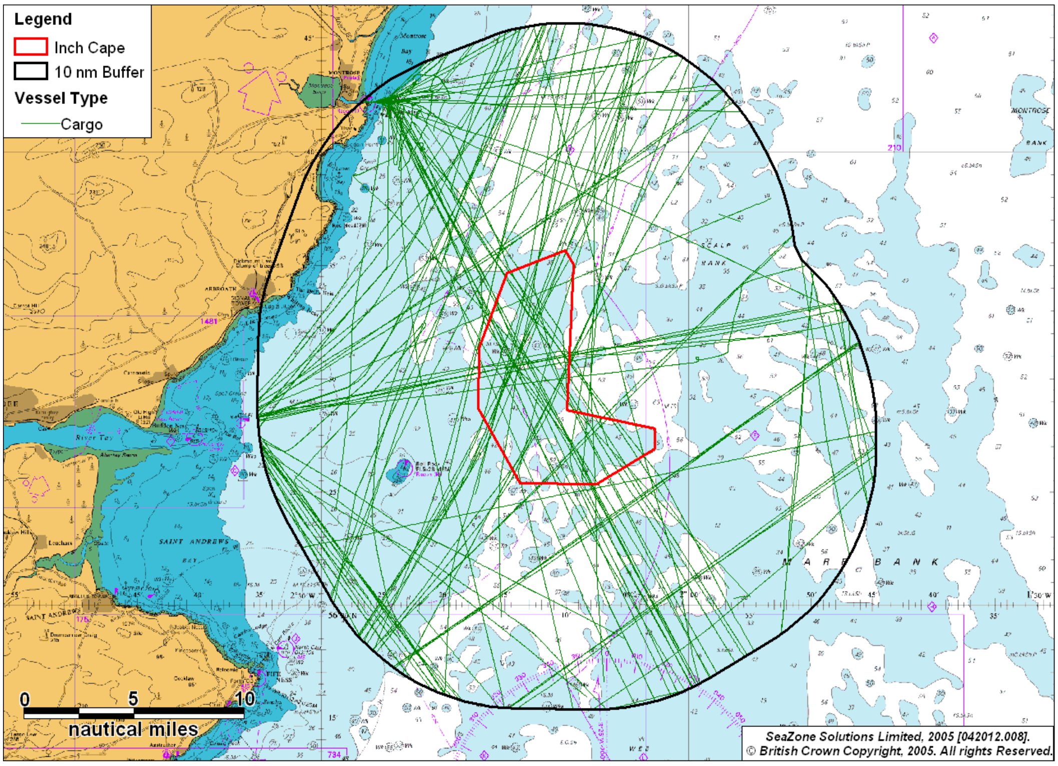


Figure 19A.34 Fishing Vessels (28 Days)

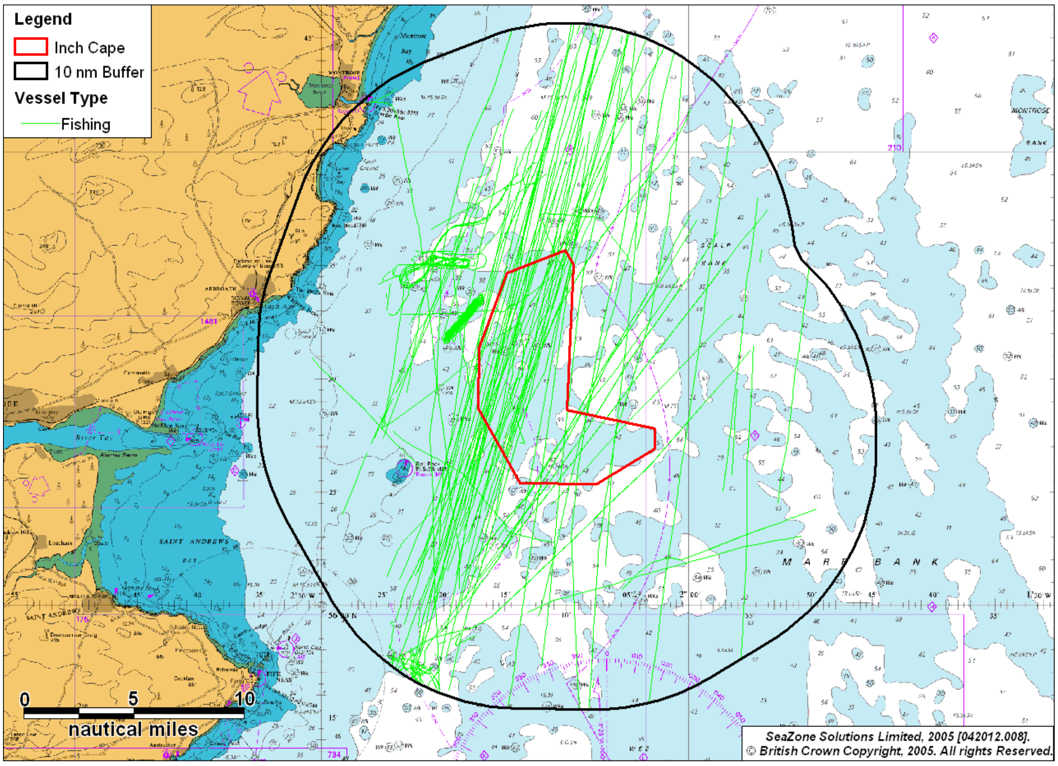


Figure 19A.35 Tankers (28 Days)

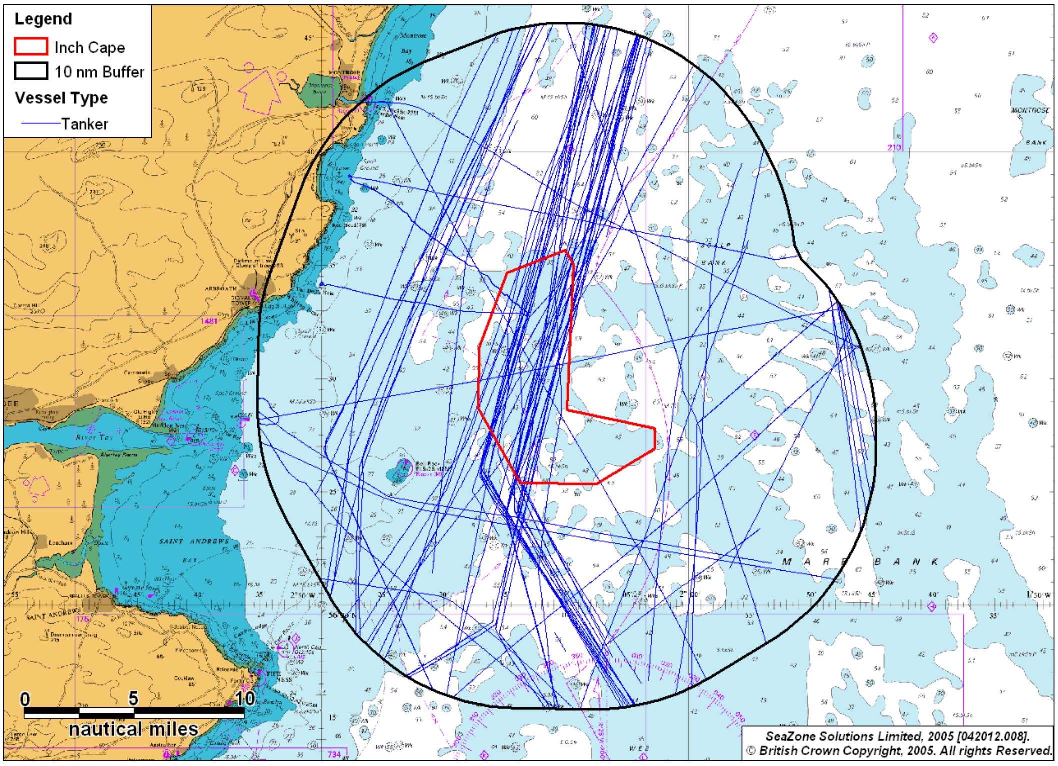
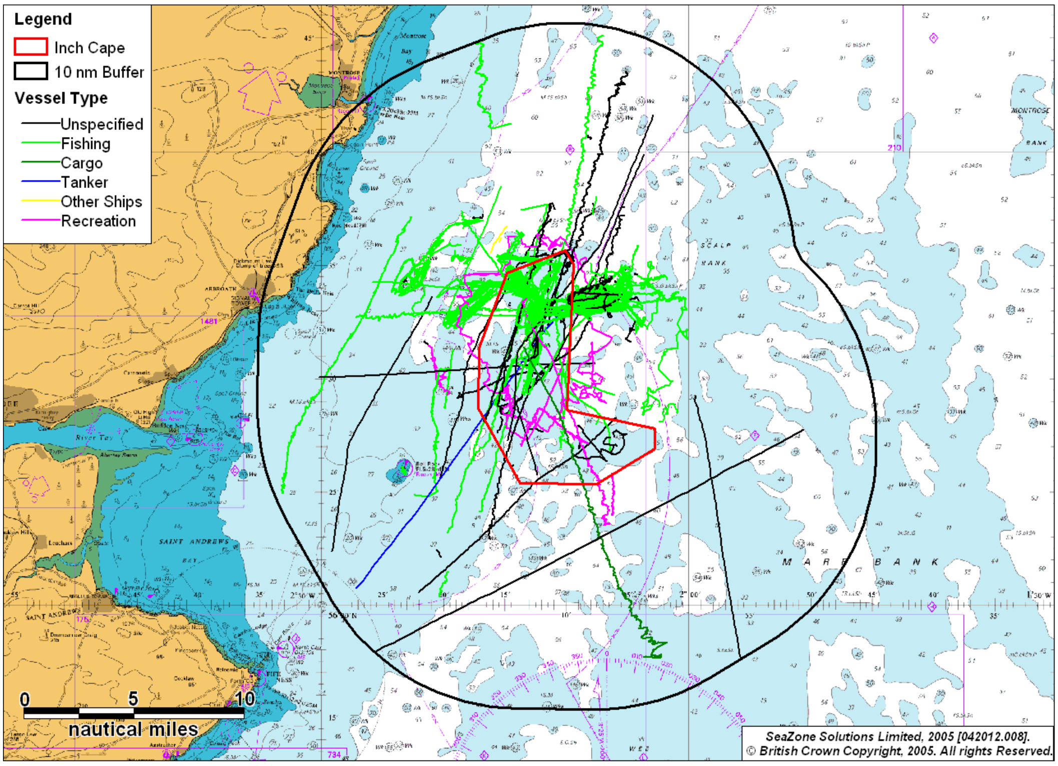


Figure 19A.36 shows a distinct transit preferred by James Fisher Tankers on a north south east route, this significant alteration is assumed to be associated with using Bell Rock as a way point.

Figure 19A.36 Passenger Vessels (28 Days)

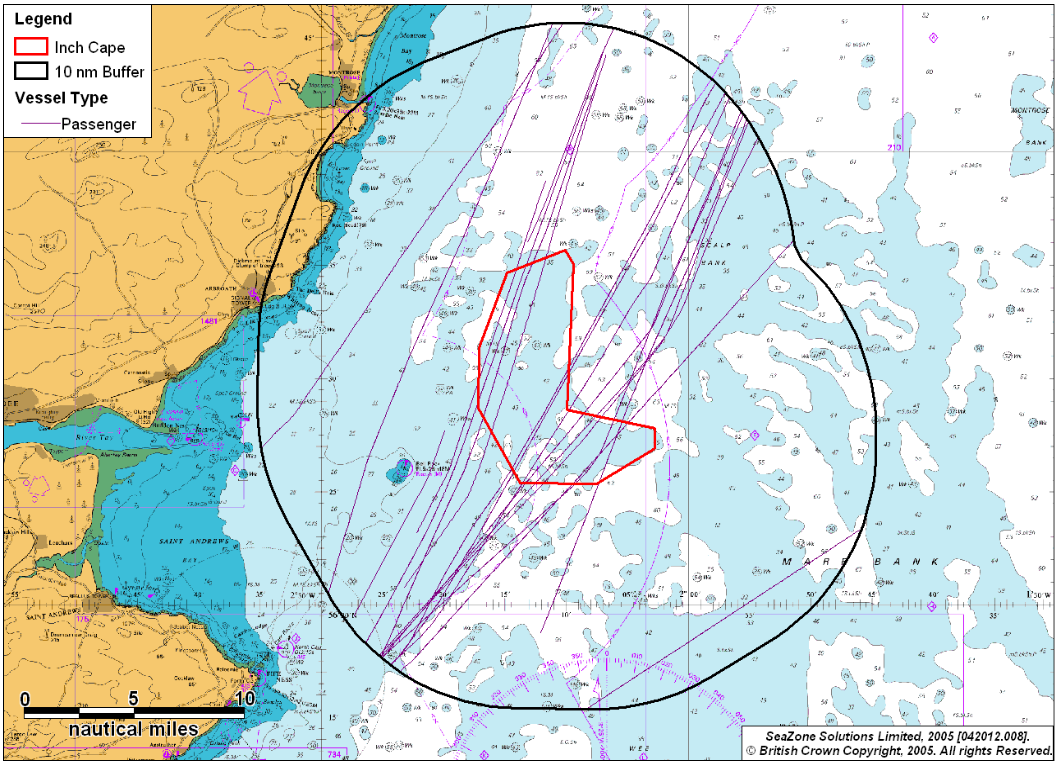


The passenger vessels in the vicinity of the Development Area were all cruise vessels, the majority of which were headed in and out of the Firth of Forth.

19A.15.3 Radar Data

Figure 19A.37 presents Radar data for 10 days in February/March 2012 and 18 days in July/August 2012. It can be seen that the vast majority of vessels which could be specified were fishing vessels or recreational vessels.

Figure 19A.37 Radar Data (28 Days)

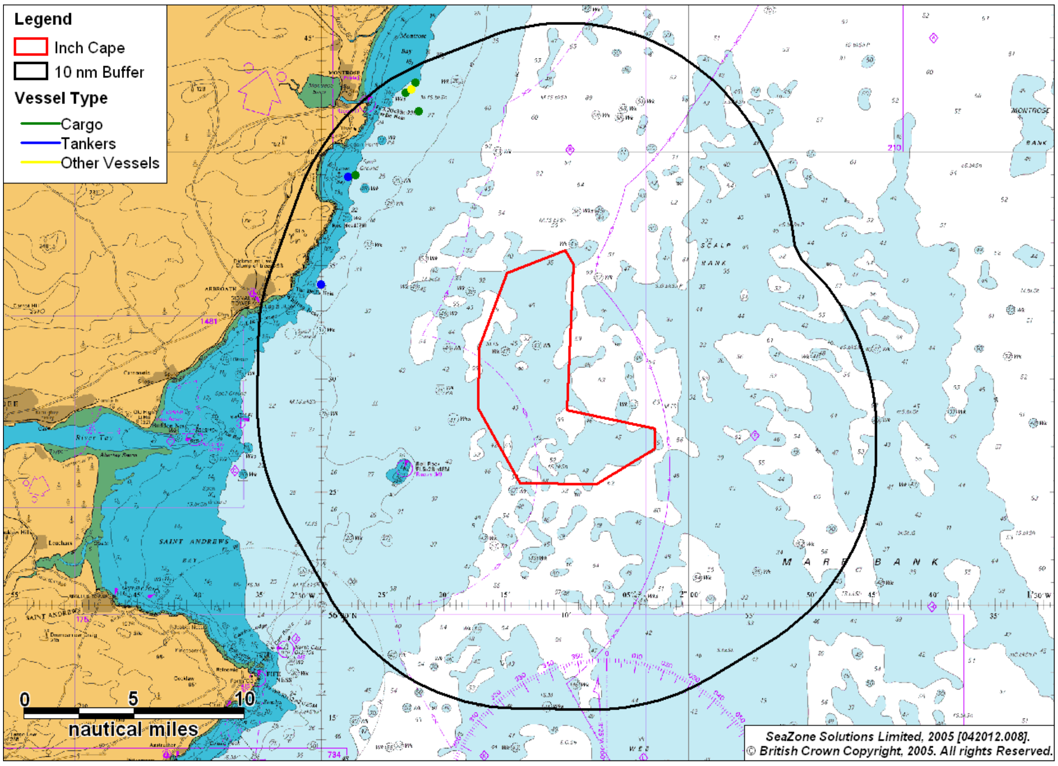


19A.15.4 Anchored Vessels

Anchored vessels can be identified based on the AIS navigational status which is set on the AIS transmitter on board a vessel. Information is manually entered into the AIS; therefore it is common for vessels not to update the navigational status if they are anchored for only a short period of time. For this reason, those vessels which travelled at a speed of less than 1 knot for more than 30 minutes were assumed to also be at anchor and were analysed for this study.

No vessels were recorded at anchor within the Development Area during the survey period. Figure 19A.38 presents a plot of anchored vessels within the 10 nm buffer.

Figure 19A.38 Anchored Vessels (28 Days)

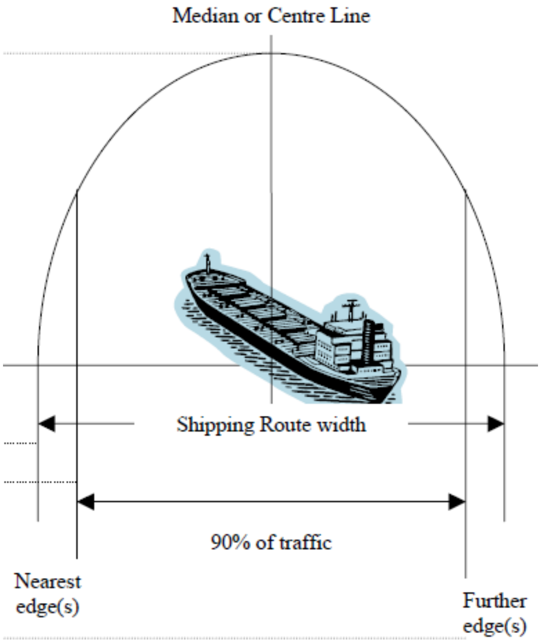


It can be seen that vessels mainly anchored towards the coast where water depths are reduced and in the designated anchorage at Lunan Bay.

19A.15.5 Definition of a Route

Main routes have been identified by principles set out in MCA guidance MGN 371 (MCA 2008a). AIS data are assessed and vessels transiting at similar headings and locations are identified as a route. To help clarify routes, AIS data can also be interrogated to show vessels (by name and/or operator) that frequently transit those routes identifying ‘regular runner/operator’ routes. The shipping route width is then calculated using the 90th percentile rule from the median line of the potential shipping route as shown in Figure 19A.39.

Figure 19A.39 Illustration of Route Calculation



19A.15.6 Base Case Main Routes

Main route identification was undertaken for the Development Area. Nine main commercial vessel routes have been identified as transiting within 10 nm of the Development Area. Plots of the main routes and 90th percentiles are presented in Figure 19A.40 and Figure 19A.41 and a description of the main routes is given in Table 19A.11.

It should be note that a wide percentile does not indicate a dense route but that there is significant variation in the exact course that vessels take on that route.

Figure 19A.40 Main Routes

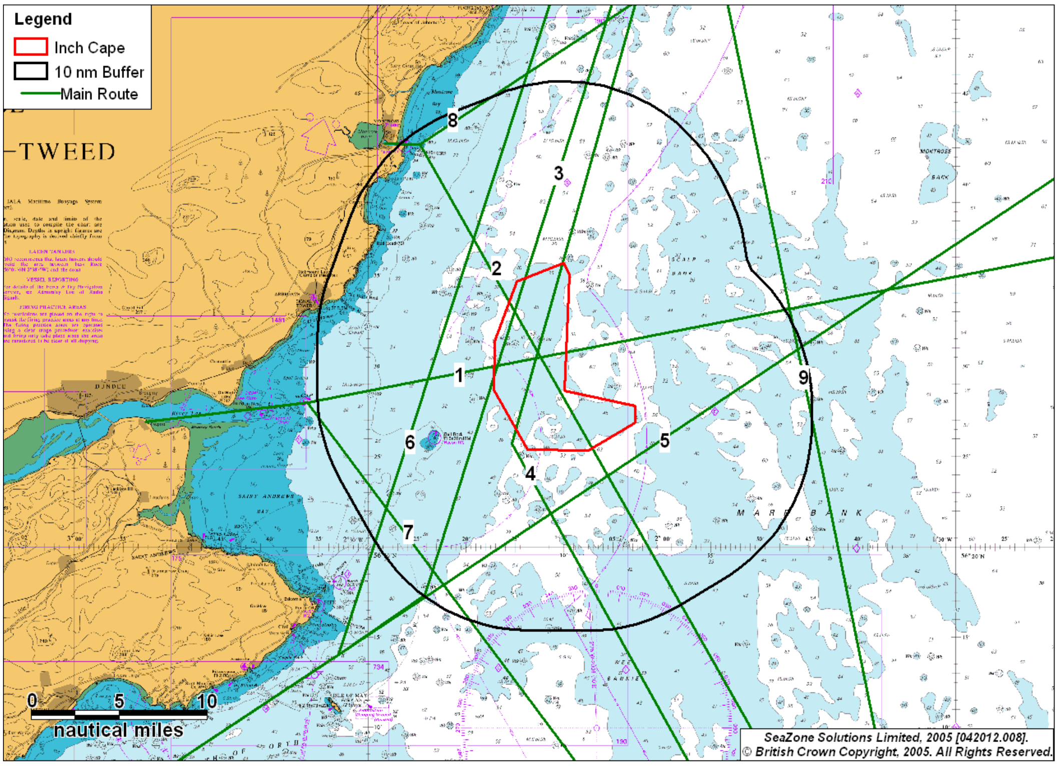


Figure 19A.41 90th Percentiles

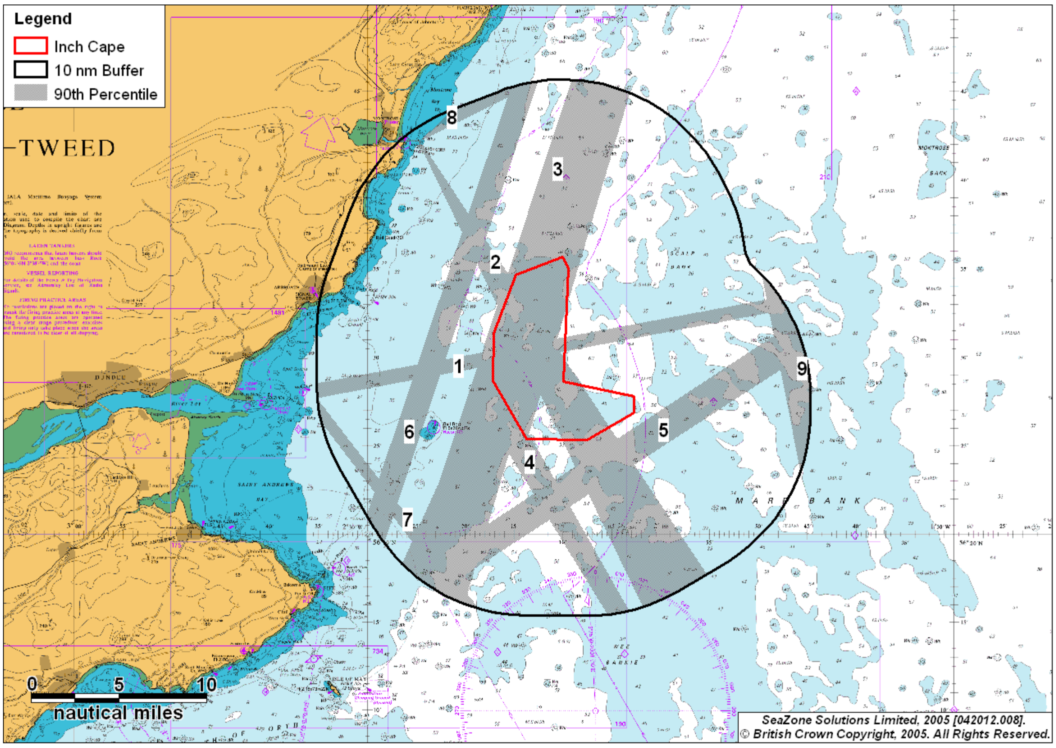


Table 19A.11 Description of Main Routes

Route Number	Route Description	Vessel Numbers	Main Vessel Types
1	River Tay Ports to Ports in Northern Europe	1 vessel every 4 days	Cargo and Tankers
2	Montrose to European Ports	1 vessel every 2 days	Cargo
3	Forth to Northern Scotland	2.5 vessels every day	Cargo, Fishing and Tanker
4	Immingham to Northern Scotland	1 vessel every 2 days	Tankers
5	Forth to Ports in Northern Europe	1 vessel every 4 days	No Specific Usage
6	Forth to Northern UK Coastal Routes	1 vessel every 2 days	No Specific Usage
7	River Tay Ports to Ports in Northern Europe	1 vessel every 2 days	Cargo
8	Montrose to Northern UK Coastal Routes	1 vessel every 3 days	No Specific Usage
9	Aberdeen to Immingham	1 vessel every 3 days	Tankers

19A.15.7 Recreational Vessel Activity

This section reviews recreational vessel activity at the Development Area based on information published by the RYA, as well as AIS and Radar tracking of recreational vessels during the maritime traffic surveys.

19A.15.7.1 Survey Tracks

Recreational vessel activity was recorded during the AIS and Radar surveys, as presented in Figure 19A.42 and Figure 19A.43. The majority of vessels were recorded during the summer survey (July/August 2012) rather than in the February/March 2012 survey.

Figure 19A.42 Recreational Vessels Recorded on AIS (28 Days)

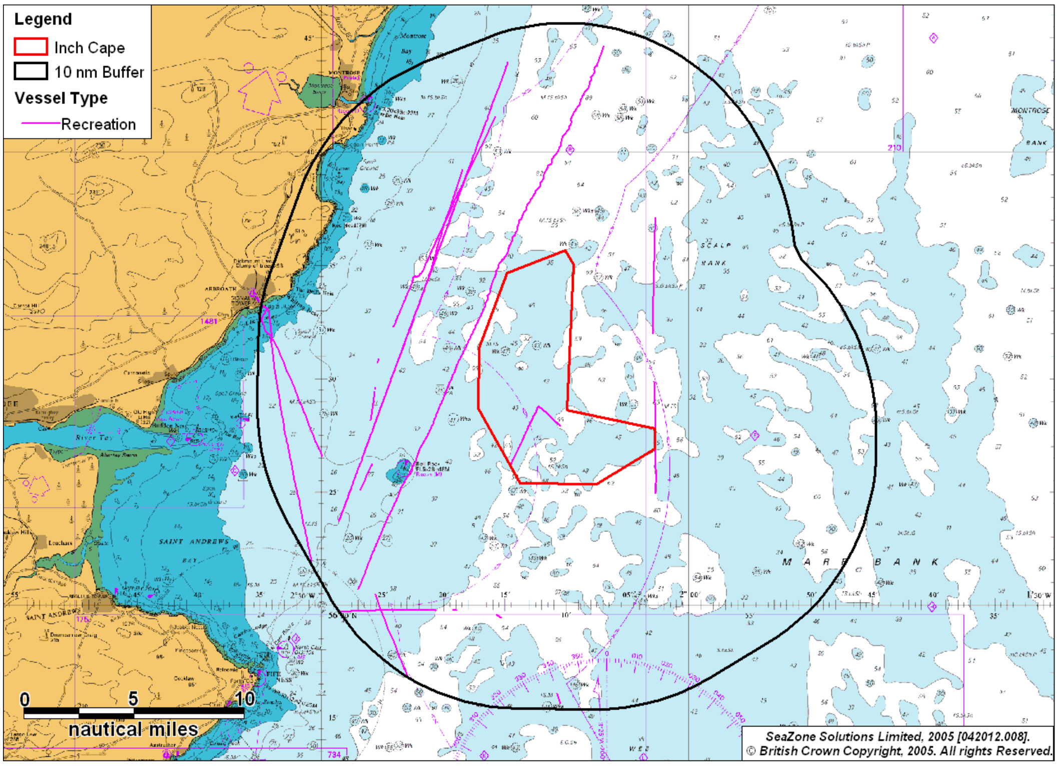
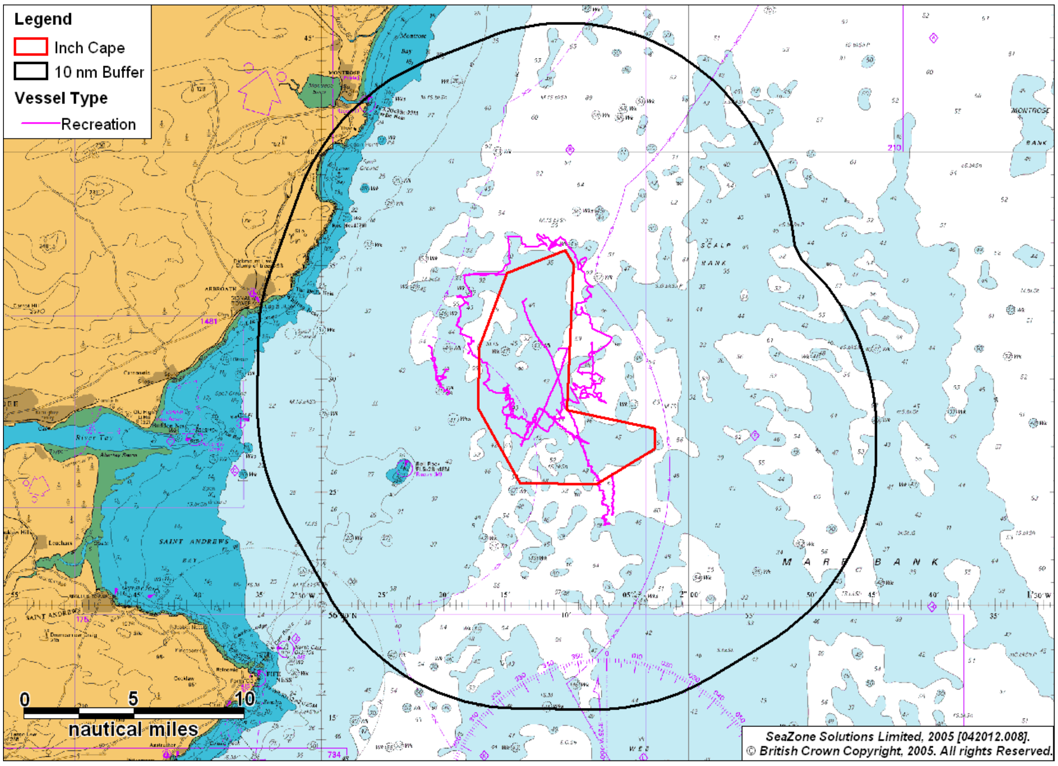


Figure 19A.43 Recreational Vessels Recorded on Radar (28 Days)



It can be seen that recreational vessels were recorded transiting past the site and within the site boundary. Example vessels recorded during the surveys are presented in Figure 19A.44 and Figure 19A.45.

Figure 19A.44 Recreational Vessel *Dana 44*

Figure 19A.45 Recreational Vessel *Kapitan Glowacki*

19A.15.7.2 Recreational Cruising Routes

Historically there has not been a database of recreational use of the UK's marine environment. As a response to the lack of information, the RYA, supported by the CA, started to identify recreational cruising routes, general sailing and racing areas (RYA, 2009). 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 results of this work were published in Sharing The Wind (RYA & CA, 2004) and updated GIS layers published in the Coastal Atlas (RYA, 2009).

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:

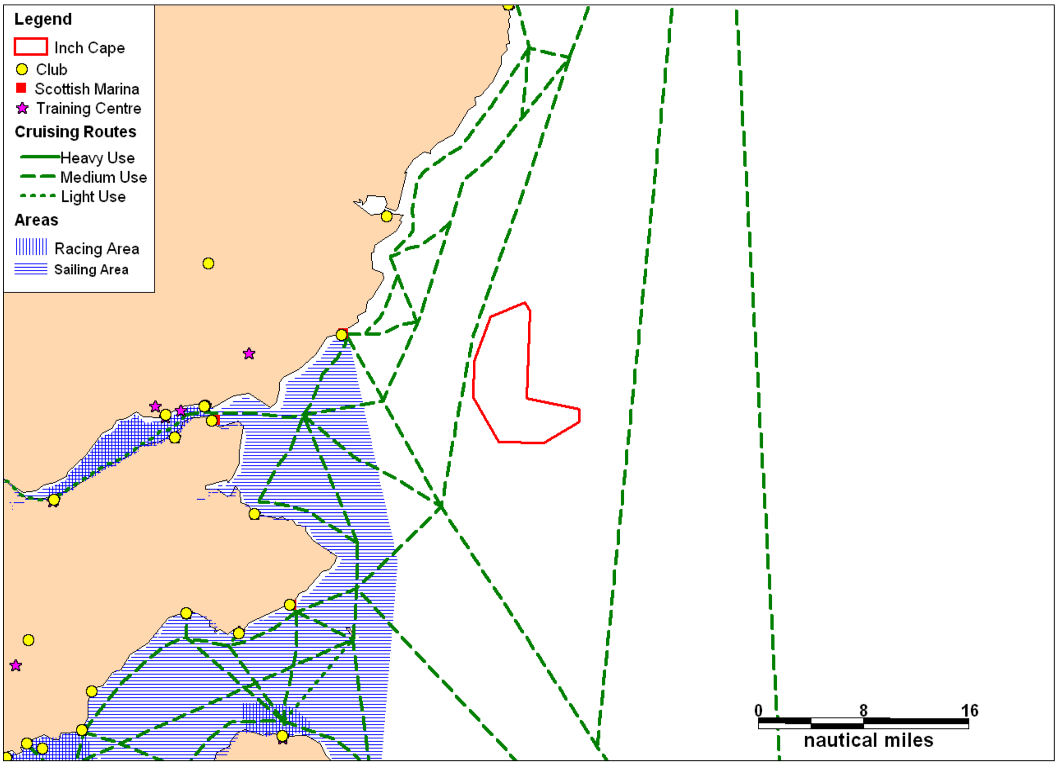
- *Heavy Recreational Routes*: - Very popular routes on which a minimum of six or more recreational vessels will probably be seen at all times during summer daylight hours. These also include the entrances to harbours, anchorages and places of refuge.
- *Medium Recreational Routes*: - Popular routes 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.

These routes were defined by a study undertaken by the RYA and CA. They are not designated courses but are general indications of known recreational routes between specific destinations popular with recreational craft.

19A.15.7.3 Recreational Data

A plot of the recreational activity and facilities in the east of Scotland and in the vicinity of the Development Area is presented in Figure 19A.46.

Figure 19A.46 RYA Overview



There are no cruising routes, sailing or racing areas within the Development Area. A ‘medium-use’ cruising route passes 0.4 nm to the west of the Development Area. Based on the above figure, the Wind Farm is approximately 8 nm east of the general sailing area off the Fife coast.

In terms of facilities the nearest club is the Arbroath Sailing & Boating club, 10 nm to the west of the Development Area, with Montrose Sailing Club a similar distance to the northwest (10.7 nm). The nearest marina to the site is also at Arbroath.

Consultation with the Scottish RYA indicated that the most popular route would be the Blyth to Peterhead transit.

19A.15.8 Fishing Vessel Activity

This section reviews the fishing vessel activity in the vicinity of the Development Area based on the maritime traffic survey data and sightings/satellite data.

19A.15.8.1 Survey Tracks

Fishing vessel activity was recorded during the AIS and Radar surveys, as presented in Figure 19A.47 and Figure 19A.48.

Figure 19A.47 Fishing Vessels Recorded on AIS (28 Days)

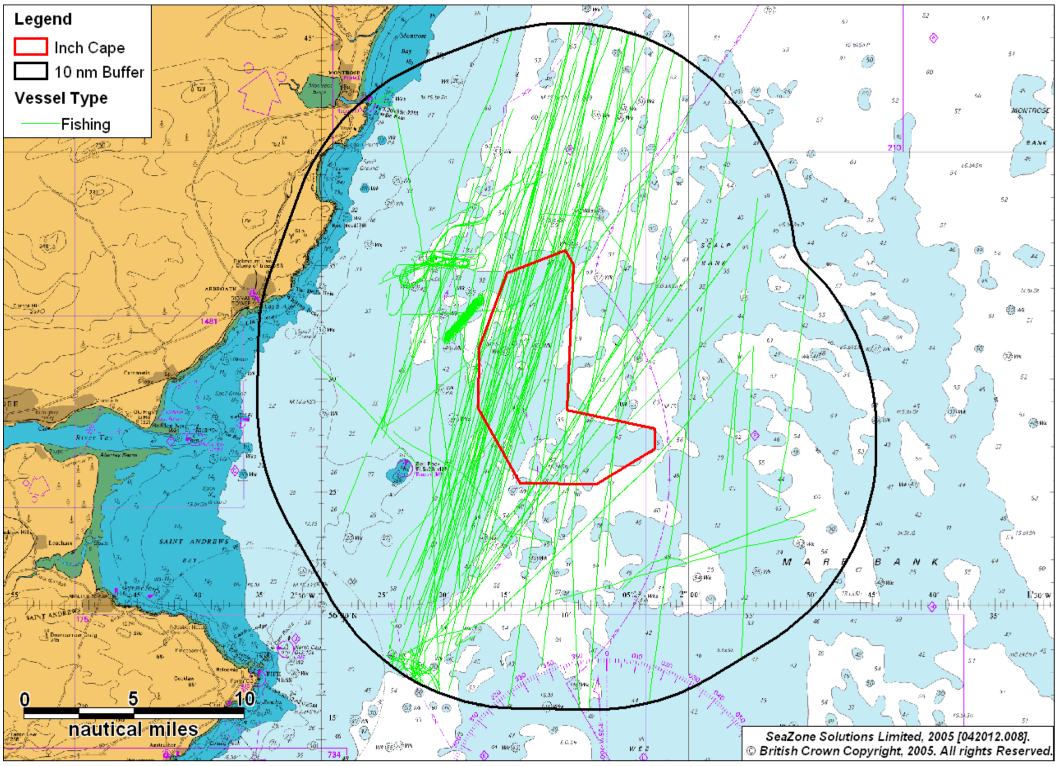
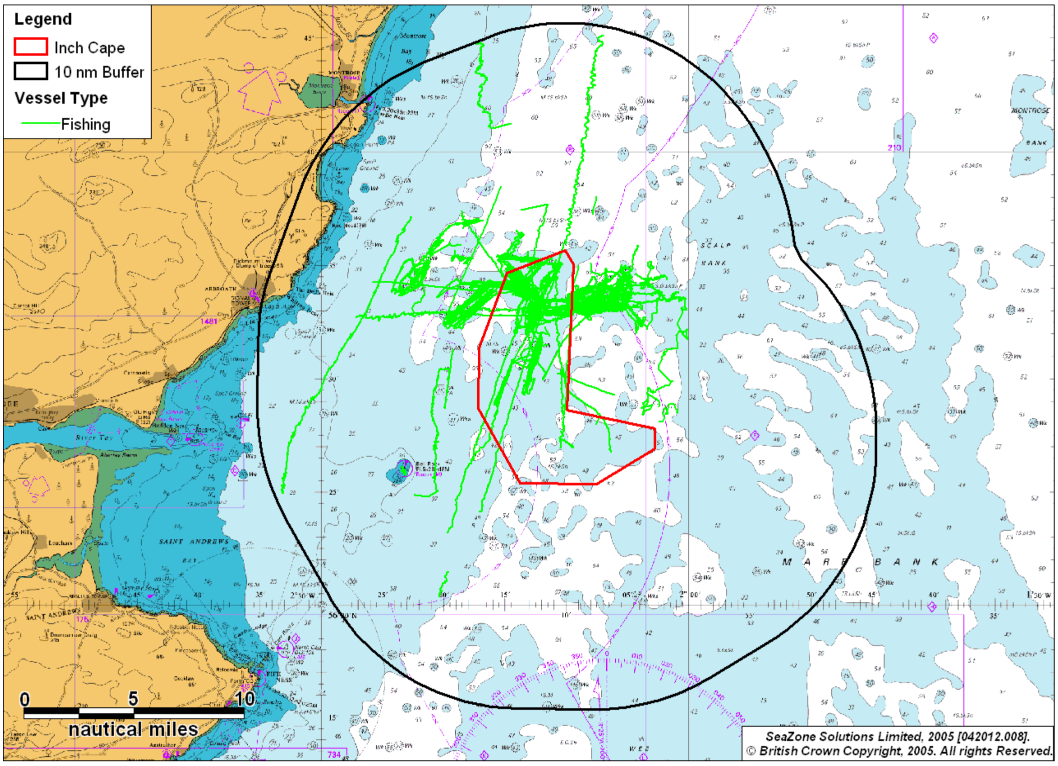


Figure 19A.48 Fishing Vessels Recorded on Radar (28 Days)



It can be seen that a number of fishing vessels transited through the Development Area in a north-south direction with the majority of fishing activity occurring to the north of the Development Area. Examples of fishing vessels recorded in the area are presented in Figure 19A.49 and Figure 19A.50.

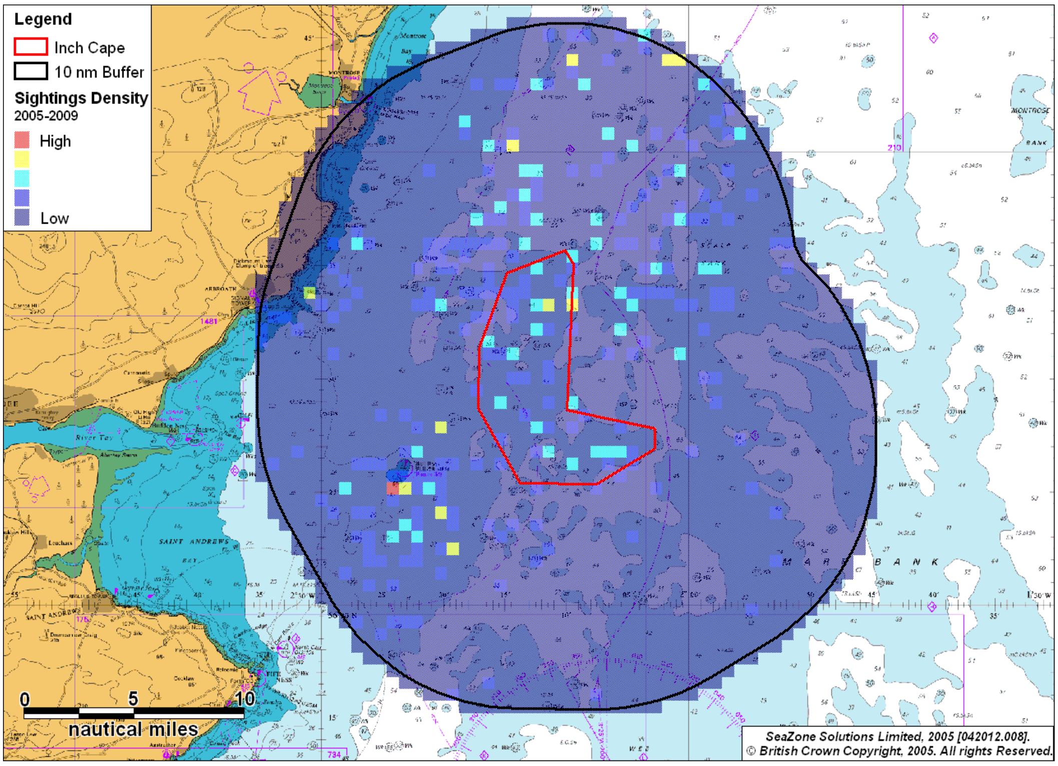
Figure 19A.49 Fishing Vessel *Calisha PD 235*

Figure 19A.50 Fishing Vessel *Crystal Tide*

19A.15.8.2 Vessel Sightings Data

Figure 19A.51 presents a density grid based on the MMO 2005-2009 sightings data to highlight the hot spots of fishing vessel activity within 10 nm of the Development Area.

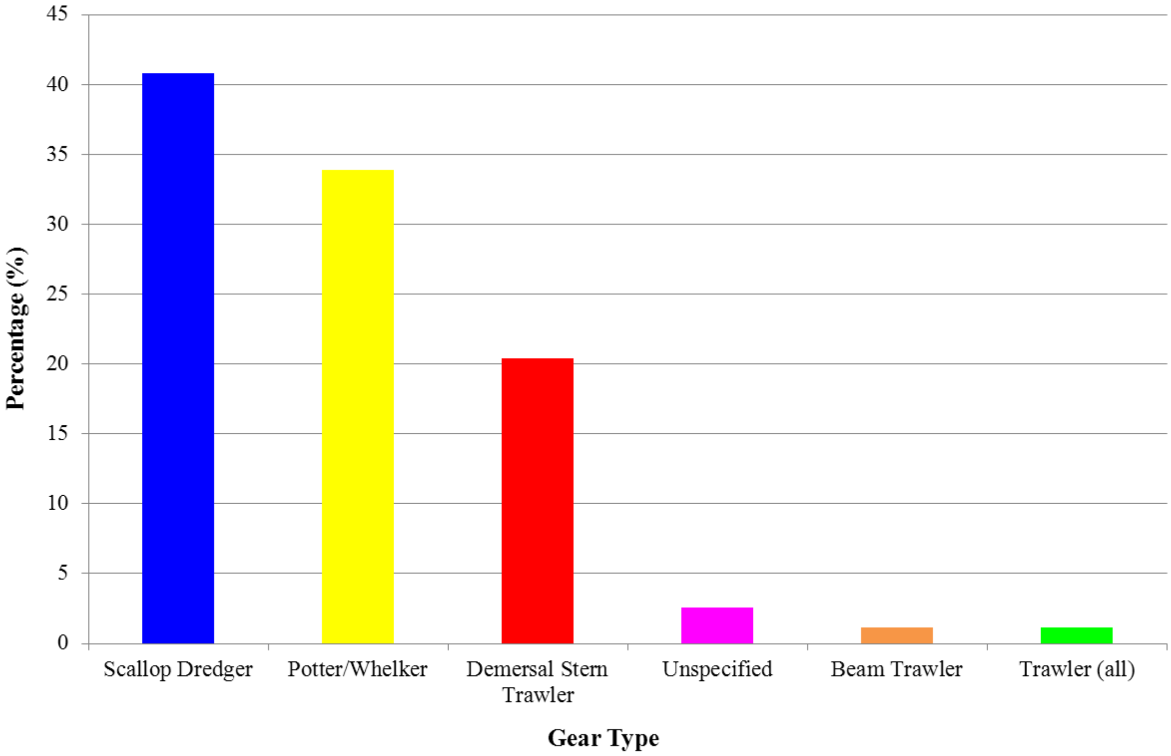
Figure 19A.51 Fishing Vessel Sightings Data (2005-2009)



From analysis of the fishing vessel sightings data, it has been noted that all of the fishing vessels recorded in the vicinity of the Development Area were UK-registered.

The gear type used by fishing vessels is presented in Figure 19A.52.

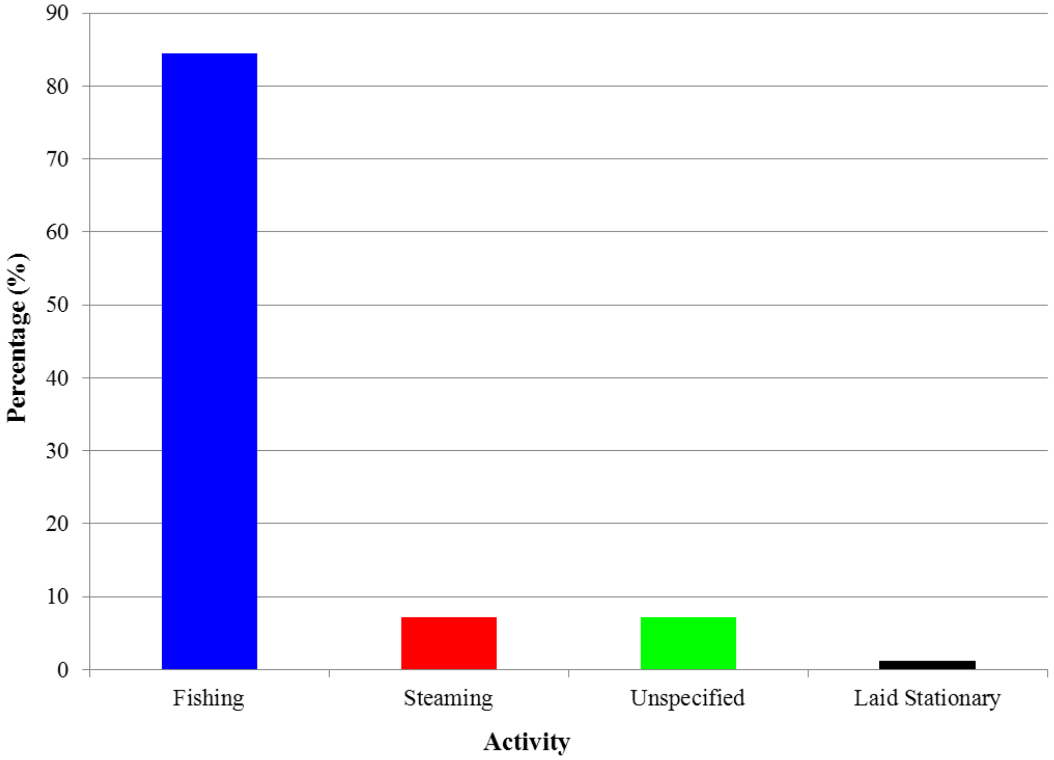
Figure 19A.52 Gear Type from Sightings Fishing Data (2005-2009)



The main gear types recorded in the vicinity of the Development Area were scallop dredgers (41 per cent), potters/whelkers (34 per cent) and demersal stern trawlers (20 per cent).

The fishing vessel activity is presented in Figure 19A.53.

Figure 19A.53 Activity from Sightings Fishing Data (2009)

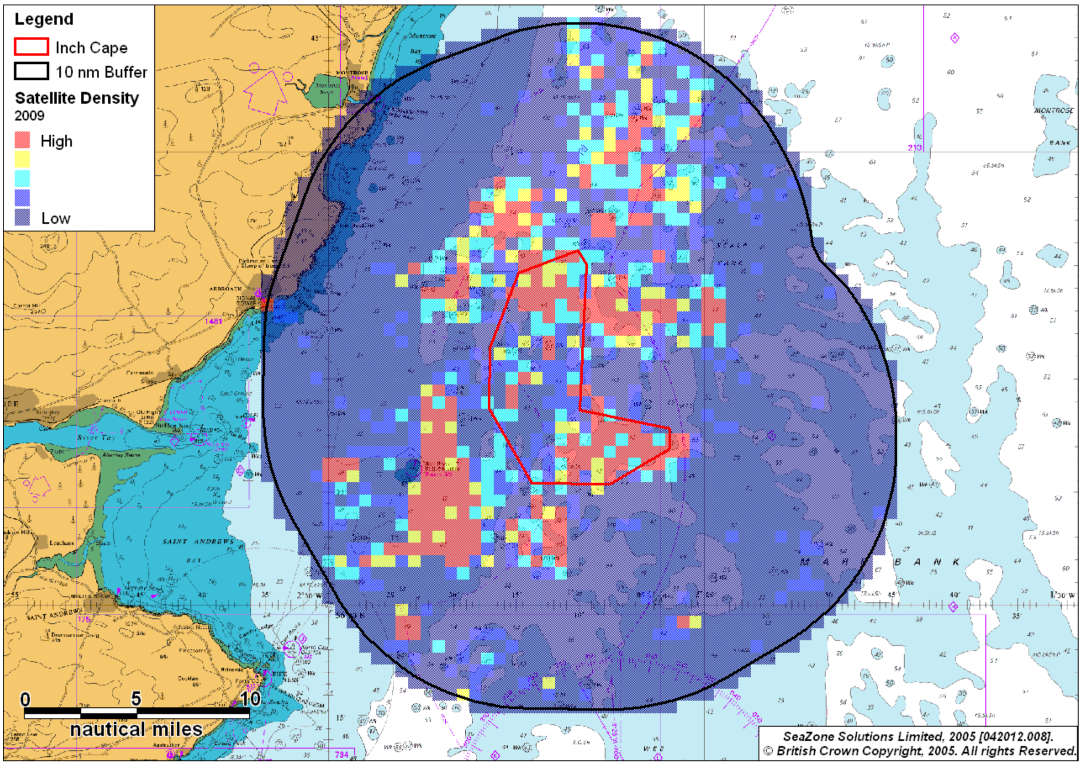


The large majority of fishing vessels within 10 nm of the Development Area were engaged in fishing (84 per cent), 7 per cent were steaming (transiting to/from fishing grounds) and 1 per cent were laid stationary (vessels at anchor or pair trawlers whose partner vessel is taking the catch whilst the other stands by). It was noted that during the marine traffic survey, AIS and Radar data, showed fishing vessels mainly transiting through the Development Area. It is noted however that this perhaps is reflective of seasonal patterns in fishing activity and the relatively short-term nature of the traffic survey.

19A.15.8.3 Satellite Data

Satellite data cover fishing vessels of 15 m length and over. The latest satellite data set analysed is from 2009 and the data include both UK and foreign vessels of 15 m length and over. Plots of vessel positions (received at least every 2 hours) have been converted to a 1 x 1 km density grid and are presented in Figure 19A.54. It should be noted that due to different data collection and analysis techniques, the sightings and satellite density plots cannot be compared.

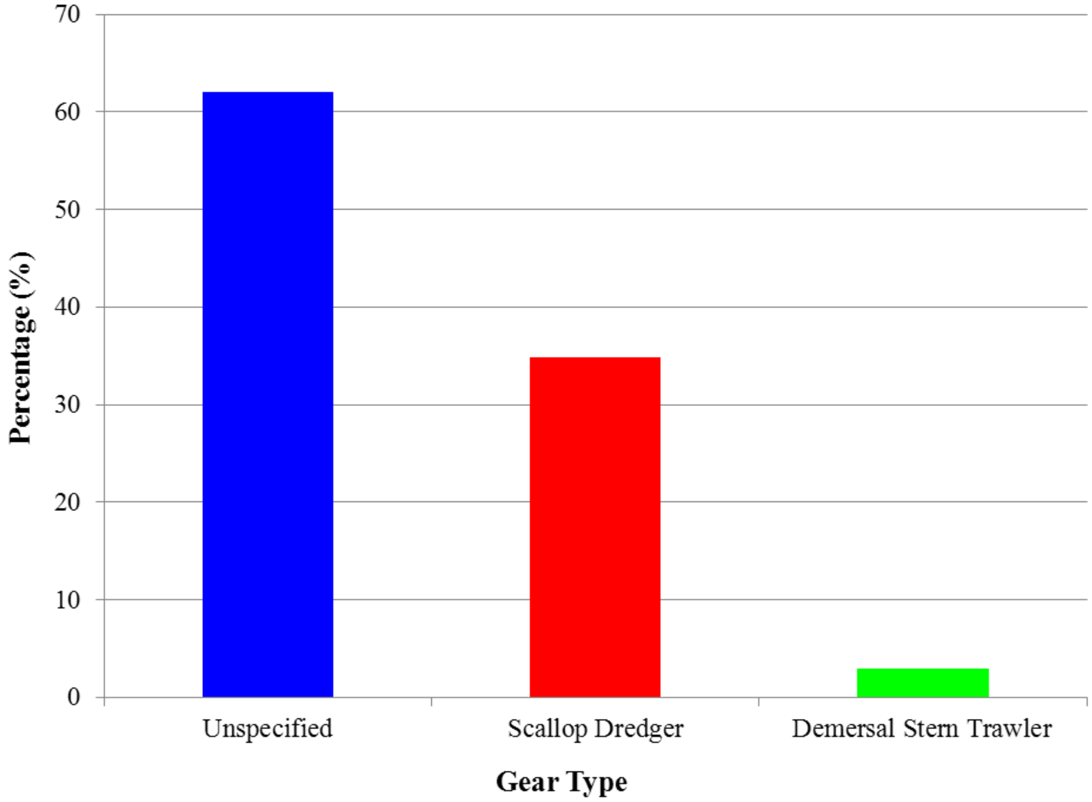
Figure 19A.54 Fishing Vessel Satellite Data (2009)



From analysis of the satellite data it has been identified that the majority of fishing vessels (over 99 per cent) were UK-registered, with vessels from France and The Netherlands also being recorded.

Figure 19A.55 presents the gear type for fishing vessels within 10 nm of the Development Area.

Figure 19A.55 Gear Type from Satellite Fishing Data (2009)



It can be seen that the majority of vessels did not specify a type (62 per cent) with scallop dredgers (35 per cent) and demersal stern trawlers (3 per cent) being recorded amongst those which did. Stern trawlers, freezer trawlers and side trawlers were also recorded, at less than 0.1 per cent each.

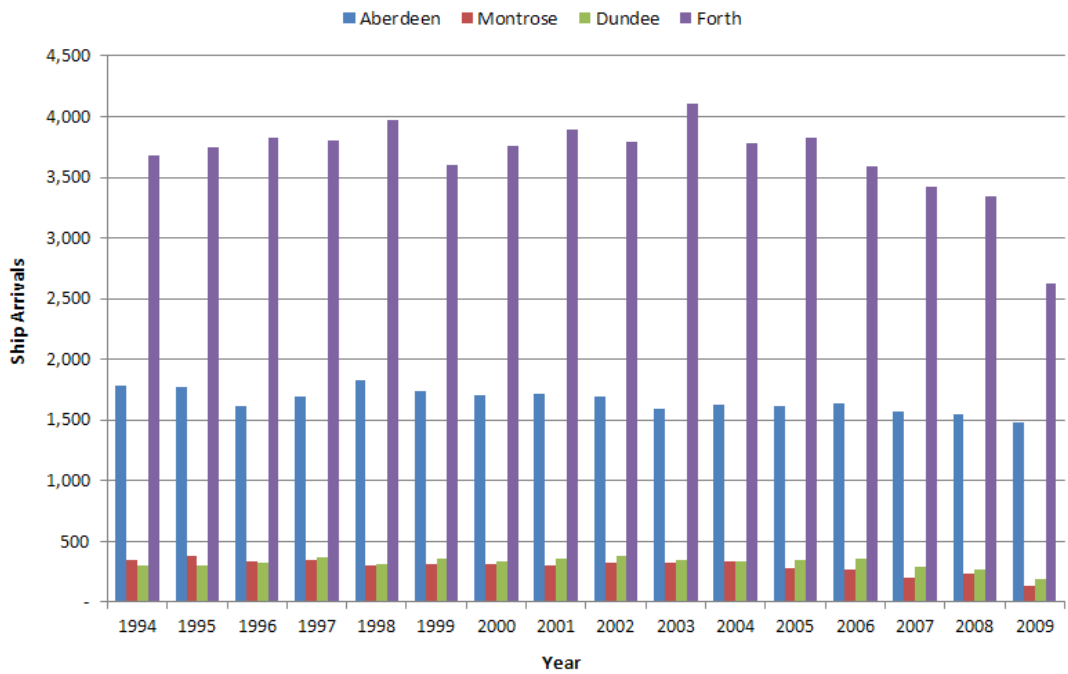
19A.16 Future Case Marine Traffic

This section presents the future case level of activity in the vicinity of the Development Area, which has been input into the collision risk modelling.

19A.16.1 Increases in Traffic Associated with Ports

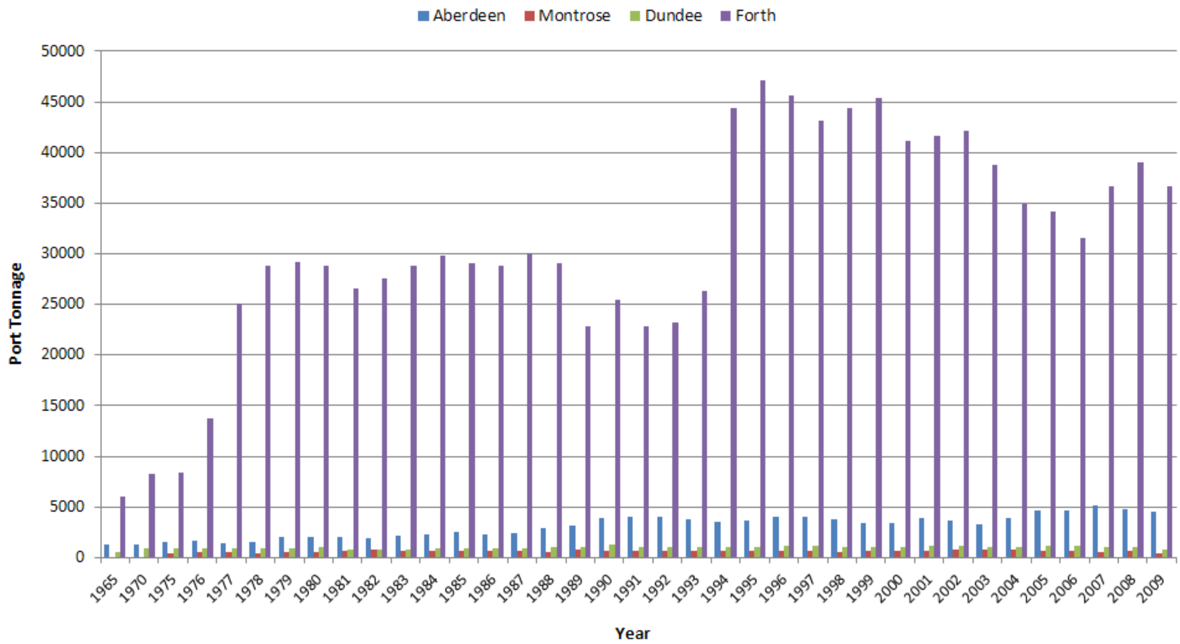
Data published by DfT (DfT, 2009) indicates that, over recent years, the ship arrivals at the ports closest to the Inch Cape Wind Farm (Aberdeen, Montrose, Dundee and Forth) have gradually decreased (see Figure 19A.56).

Figure 19A.56 Vessel Arrivals in Main Ports on East Coast of Scotland (1994-2009)



The tonnage at these ports has varied considerably over the recent years with a slight decrease observed in the last recorded period (2008-2009) (see Figure 19A.57).

Figure 19A.57 Total Tonnage through Main Ports on East Coast of Scotland (1965-2009)



A potential growth in shipping movements of 10 per cent was estimated over the life of the Wind Farm in order for an assessment of future case shipping, as per the DECC methodology requires.

19A.16.2 Increases in Fishing Vessel Activity

For commercial fishing vessel transits, a 10 per cent increase was used to demonstrate potential impacts. Realistic predicted increases in fishing activities have been covered in a separate section of the ES (Chapter 18: Commercial Fisheries).

19A.16.3 Increases in Recreational Vessel Activity

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

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

19A.16.4 Increase in Traffic Associated with Inch Cape Operations

It has been estimated that there will be approximately 3500 vessel movements during the construction phase of the Wind Farm (including foundation, WTG, substructure and inter-array cable installation and WTG commissioning). During the operational phase of the Wind Farm there are estimated to be a maximum of one mothership (80 m in length) and two crew transfer vessels (24 m in length) making two trips to the Development Area per day. Although not considered in the collision risk modelling, as routes will not be defined, these vessels have been considered in the hazard log (Annex 19A.3).

19A.16.5 Collision Probabilities

The potential increase in vessel activity levels would increase the probability of vessel-to-structure allisions (both powered and drifting). Whilst in reality the risk would vary by vessel type, size and route, it is estimated this would lead to a linear 10 per cent increase on the base case with Wind Farm collision risk.

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 Wind Farm, the increased congestion caused by the Wind Farm and potential displacement of traffic in the area may have an influence. Again, a 10 per cent overall increase was assumed on base case with Wind Farm risk.

19A.16.6 Commercial traffic routeing

19A.16.6.1 Deviations per Route

The following section analyses the potential alternative routeing options for routes where displacement may occur. It is not possible to consider all options so the shortest and therefore most likely alternatives have been considered. Assumptions for re-routes include:

- All alternative routes maintain a minimum of 1 nm from offshore installations and potential WTG boundaries in line with the MCA shipping template;
- Time increases are calculated using the average speed for vessels on each individual route; and
- All mean routes take into account areas of shallow water and known routeing preferences.

It should be noted that alternatives do not consider adverse weather routeing.

Following the development of the Inch Cape Structures, deviations would be required for routes 1, 2, 3 and 4. Illustrations of the anticipated shift in main route positions are presented in Figure 19A.58. Information on the route deviations and associated time increases are presented in Table 19A.12. Time increases have been calculated using the average speed for vessels on each route.

Figure 19A.58 Current and Alternative Main Routes

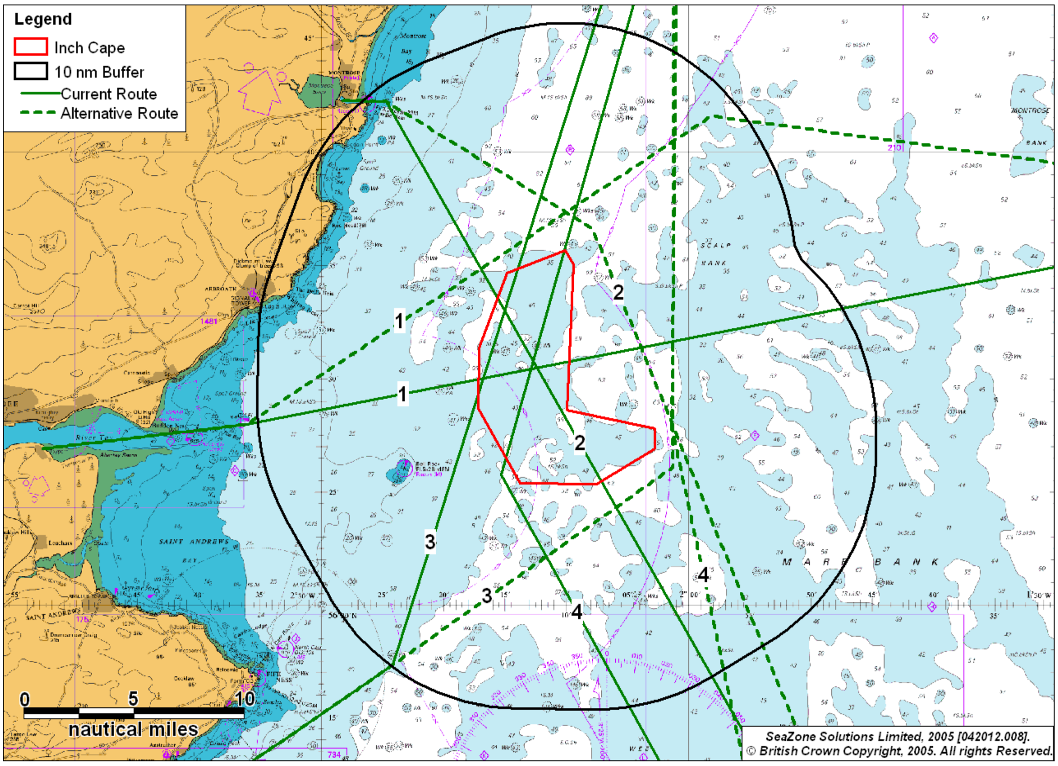


Table 19A.12 Details of Route Deviations for Inch Cape Development Area

Route	Increase in Distance (nm)	Difference	Change in Time for Average Speed Vessel (mins)
Route 1	3.32	5.46% increase	18
Route 2	1.65	3.18% increase	12
Route 3	4.68	7.22% increase	29
Route 4*	-3.99	7.12% decrease	-26

*For route 4 it has not be possible to ascertain the reason for the historical route (despite requesting as consultation). However it is assumed that the vessel may be keeping with the coast for shelter. An alternative option for this route would be to route inshore of the Development Area, which is not expected to increase deviation distance or time significantly.

19A.17 Collision Risk Modelling and Assessment

This section assesses the major hazards associated with the development of the Wind Farm. This is divided into without wind farm (pre-installation) and with Wind Farm (post-installation) risks and includes major hazards associated with:

- Increased vessel to vessel collision risk;
- Additional vessel to structure allision risk;
- Additional fishing vessel to structure allision risk;
- Additional recreational craft (sailing/cruisers) allision risk;
- Additional risk associated with vessels Not Under Command (NUC); and
- Anchor/cable interaction.

The base case assessment uses the present day vessel activity level identified from the maritime traffic surveys, consultation and other data sources. The future case assessment made conservative assumptions on shipping traffic growth over the life of the Wind Farm.

The modelling was undertaken using the worst case layout of 213 WTGs, 3 met masts and 5 OSPs, as illustrated in Figure 19A.8.

19A.17.1 Base Case without Inch Cape

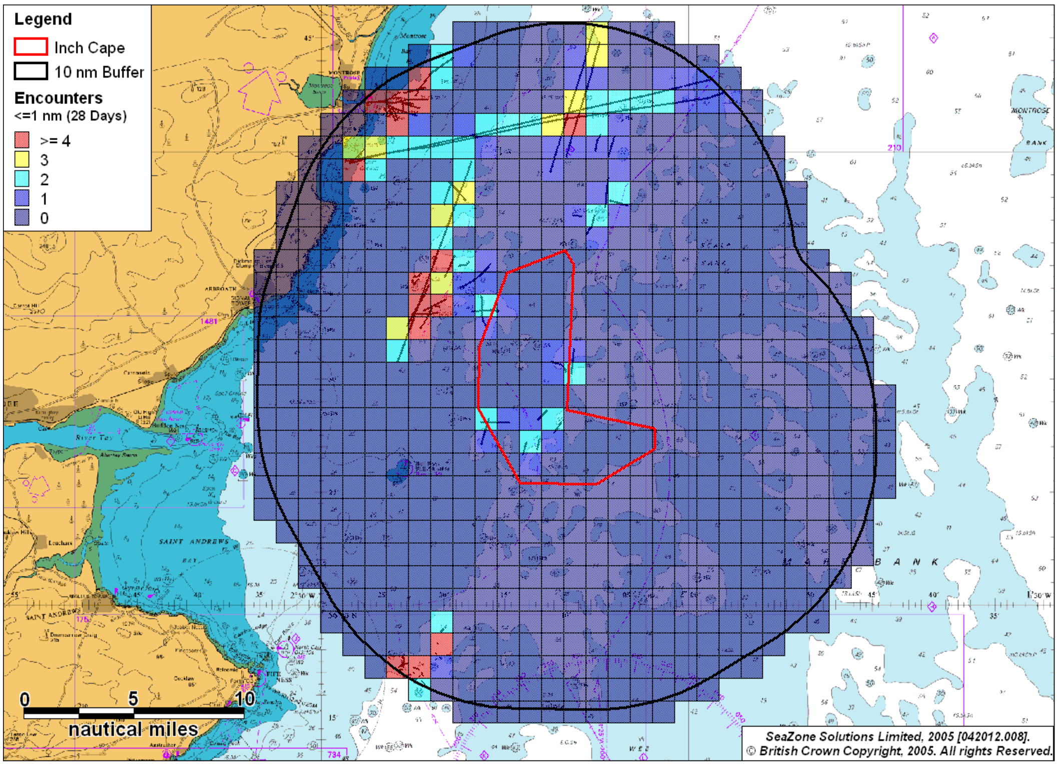
19A.17.1.1 Base Case Vessel to Vessel Encounters

An assessment of current vessel to vessel encounters was carried out by replaying at high-speed 28 days of AIS data from the surveys undertaken in February/March 2012 (10 days) and July/August 2012 (18 days).

An encounter distance of 1 nm has been considered, i.e. two vessels passing within 1 nm of each other has been classed as an encounter. This helps to illustrate where existing shipping congestion is highest and therefore where offshore developments, such as wind farms, could potentially increase congestion and therefore also increase the risk of encounters/collisions.

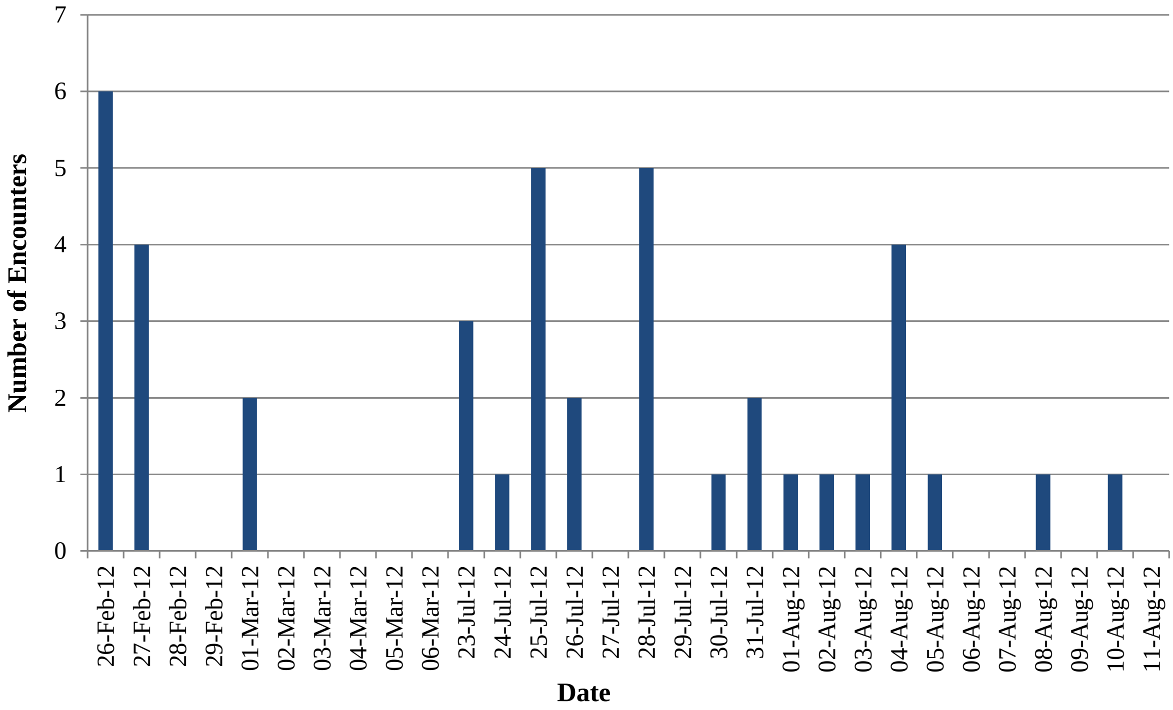
The tracks recorded for vessels during encounters recorded during the 28 days of analyses, and heat maps based on the geographical distribution of encounter tracks within a 1 nm grid of cells, are presented in Figure 19A.59. This figure shows that the density of encounters in the vicinity of the Development Area is generally low.

Figure 19A.59 Vessel Encounters within 1 nm



There were 41 encounter tracks during the 28 day period. Figure 19A.60 presents the number of encounters per day.

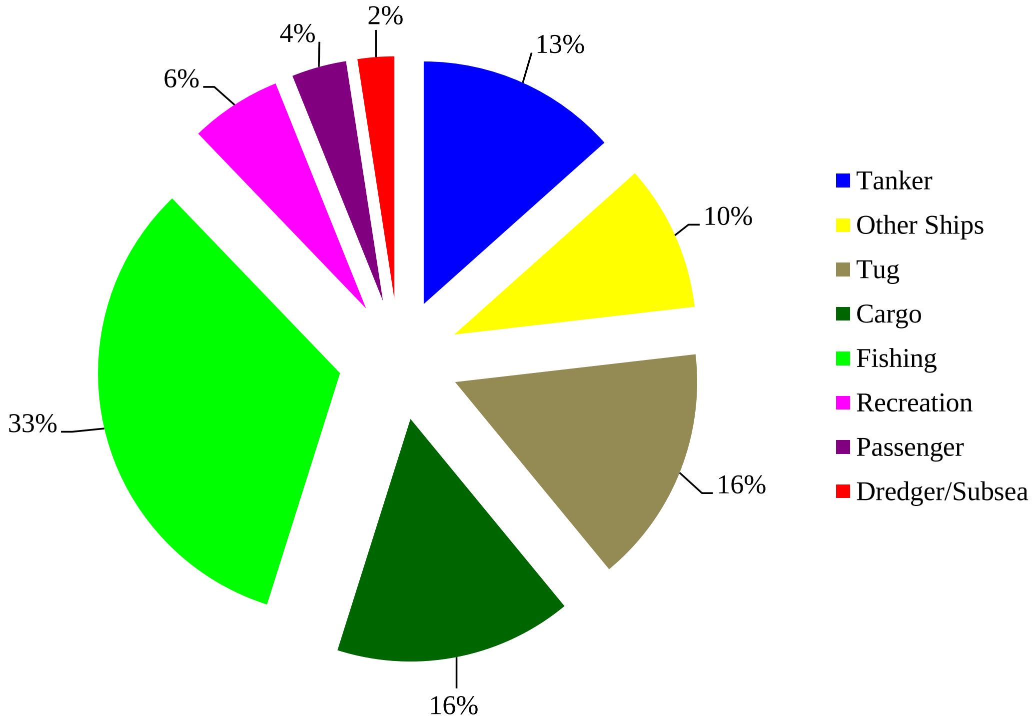
Figure 19A.60 Encounters Per Day within 10 nm of the Development Area



The average number of encounters within the 10 nm buffer around the Development Area was between two and three per day, with the highest number of six encounters being observed on one day during the survey periods.

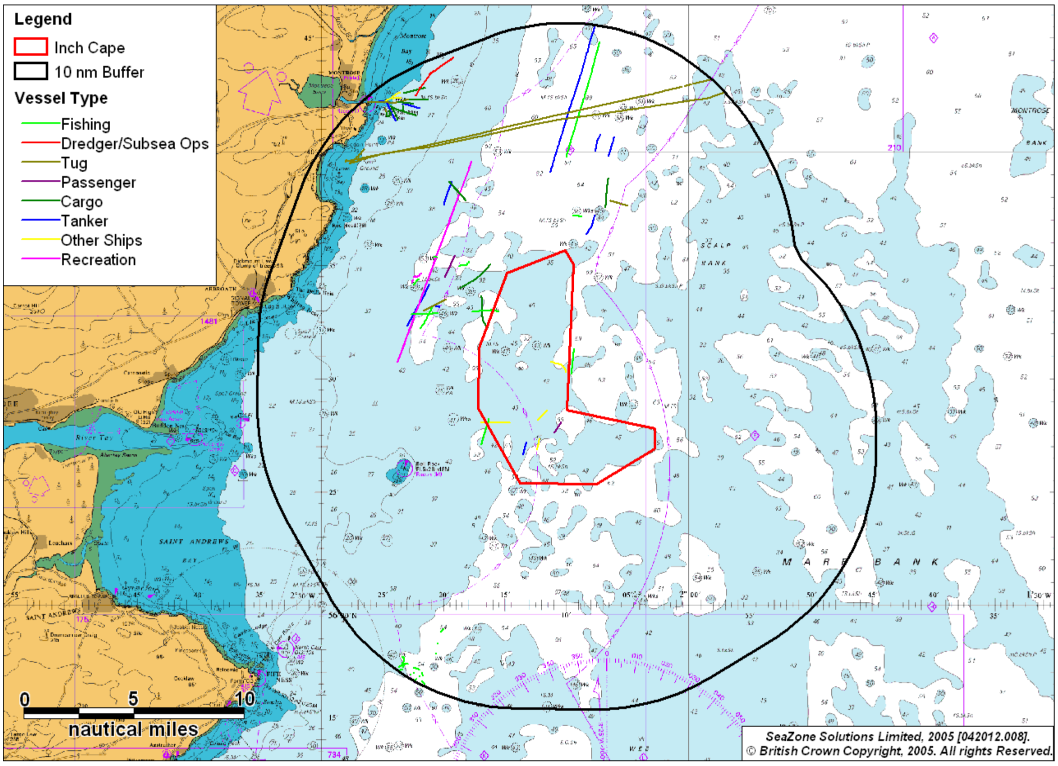
Figure 19A.61 presents the distribution of vessel types involved in encounters within 10 nm of the Development Area.

Figure 19A.61 Vessel Types Involved in Encounters



The locations of encounters colour-coded by vessel type during the 28 day period are presented in Figure 19A.62.

Figure 19A.62 Location of Encounters, Colour Coded by Vessel Type



It can be seen that the majority of encounters were to the north of the Development Area, with relatively few within the Development Area. Encounters were not relative to any particular vessel type.

19A.17.1.2 Vessel-to-Vessel Collisions

Based on the existing routeing 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 Development Area. 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.

The baseline vessel-to-vessel collision risk level without the Wind Farm is in the order of 1 major collision in 797 years.

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. Other incident data from RNLI and MAIB is presented in Section 19A.13, which includes other minor incidents.

19A.17.2 Base Case with Inch Cape

19A.17.2.1 Potential for Increased Vessel to Vessel Collisions

The revised routeing pattern following the construction of the Wind Farm has been estimated based on the review of impact on navigation (see Section 19A.16.6.1).

Based on vessel-to-vessel collision risk modelling of the revised traffic pattern, the collision risk was estimated to increase to 1 major collision every 695 years. The increase in collision frequency due to the Wind Farm was estimated to be approximately 15 per cent.

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.

The following potential affects have not been quantified but may indirectly influence the vessel-to-vessel collision risk. They have been discussed in Sections 19A.22.4 and 19A.23.6.

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

19A.17.2.2 Potential for Additional Commercial Vessel to Structure Allision Risk

There are two main scenarios for passing vessels alliding with offshore structures within the Development Area (WTGs, OSPs and met mast).

Powered Allision	Where the vessel is under power but errant
Drifting Allision	Where a vessel on a passing route experiences propulsion failure and drifts under the influence of the prevailing conditions

Each scenario is assessed in the following sections.

Commercial Vessel Powered Allision

Based on the vessel routeing identified for the area, the anticipated change in routeing due to the Inch Cape Structures, and assumptions that effective mitigation are in place, the frequency of an errant vessel under power deviating from its route to the extent that it comes into proximity with the Inch Cape Structures is not considered to be a probable occurrence.

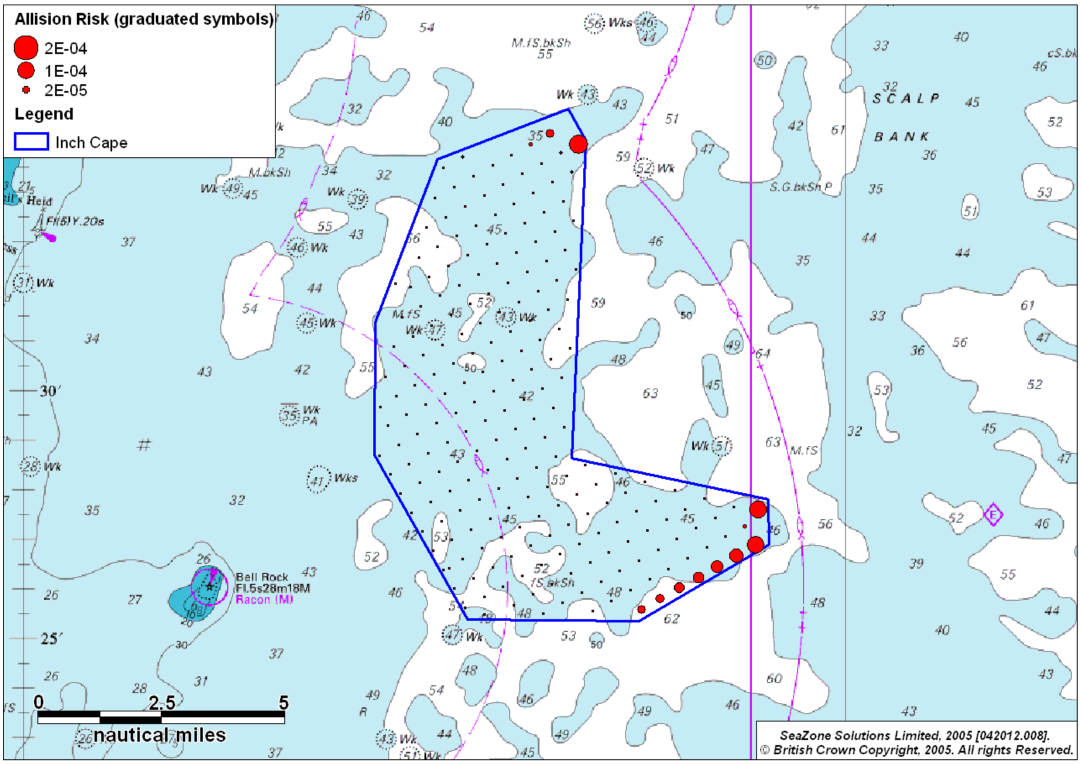
From consultation with the shipping industry it is also assumed that merchant vessels will not navigate between turbine rows due to the restricted sea room and will be directed by the navigational aids in the Development Area.

Based on modelling of the revised routeing following the construction of the Wind Farm and local metocean data, the frequency of a passing powered vessel allision was estimated to be 6.62E-04 (allision return period of 1 in 1,510 years).

This allision return period is slightly higher than the historical average of 5.3 E-04 per installation-year for offshore installations on the UKCS (1 in 1,900 years).

The individual turbine allision frequencies ranged from 1.18 E-04 for a turbine on the north eastern corner of the Development Area, to negligible for WTGs within the centre of the Development Area. A plot showing the passing powered allision frequency for each structure within the Wind Farm is presented in Figure 19A.63.

Figure 19A.63 Annual Passing Powered Allision Frequency



Commercial Vessel NUC Allision

The risk of a ship losing power and drifting into an Inch Cape 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 but it does not consider human error.

The exposure times for a NUC scenario are based on the ship-hours spent in proximity to the Development Area (up to 10 nm 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 mechanical failure within the area surrounding the Development Area 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; and
- 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 Inch Cape Structure. Vessels that do not recover within this time are assumed to allide.

After running the drifting model for the Inch Cape Structures it was established that weather-dominated drift produced the worst case results

The worst case NUC collision risk has been identified as 1 every 12,349 years for the Inch Cape Structures. NUC collisions are assessed to be less frequent than powered collisions, which is reflective of historical data. There have been no reported 'passing' NUC ship allisions with offshore installations on the UKCS in over 6,000 operational-years. Whilst a large number of NUC 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'.

The majority of the NUC vessel allision frequency is associated with Inch Cape Structures in the south eastern corner of the Development Area since the predominant wind direction is from the south west.

19A.17.2.3 Fishing Vessel Allision

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 allisions between fishing vessels and UKCS offshore installations (published by Health and Safety Executive (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 around the Development Area was based on fishing vessel satellite data (2009).

Using the above Development Area specific data as input to the model, the annual fishing vessel allision frequency (base case) with wind farm structures was estimated to be 0.17, with an allision return period of 1 every 6 years.

This estimated allision frequency is high and reflects the maximum target area assumed for all the structures based on jacket foundations. It also assumes the fishing vessel density following development will remain the same as current levels.

19A.17.2.4 Recreational Vessel Allision

There are two main allision hazards from recreational vessels interacting with wind farms:

- WTG Rotor Blade to Yacht Mast Allision; and

- Vessel Allision with Main Structures

Blade and Mast Allision

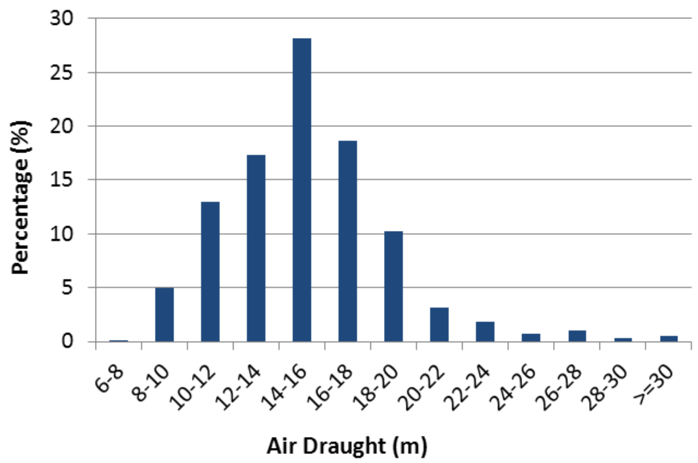
The RYA considers that the largest risk to recreational craft from offshore wind developments is the risk of rotor blade allision and underwater allision associated with scour which reduces the under keel clearance. An allision between a turbine blade and the mast of a yacht or damage to the keel could result in structural failure of a yacht.

In order to mitigate this risk the development of the Inch Cape Structures will adhere to the RYA's guidance on the construction of wind farms including:

- A minimum rotor height clearance above MHWS of 22 m (ICOL will have a minimum rotor height clearance of 22 m above HAT); and
- A minimum underwater clearance of 4 m below chart datum.

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 19A.64 based on a fleet size of over 2,500 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 19A.64 Air Draught Data – IRC Fleet (Data Collected from 2009-2011) (RYA, 2012)



From these data, approximately 4 per cent of boats have air draughts exceeding 22 m. 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.

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

These measures mean that whilst the allision risk cannot be completely eliminated it will be reduced to a level as low as reasonably practicable (ALARP). In terms of consequences, most allisions 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.

Vessel/Structure Allision

In good conditions the Inch Cape Structures 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/moor if necessary to avoid drifting closer to the Inch Cape Structures whilst they fix the problem or call for assistance.

The main risk of allision is considered to be in adverse weather conditions, especially poor visibility, where a small craft could fail to see the Inch Cape Structures 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 small craft being in the area during adverse weather is reduced by the fact that most craft are fitted with radio receivers and very high frequency (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.

Given the ready availability of weather forecasts and growing use of Global Positioning System (GPS), the risk of a vessel being in proximity to the Inch Cape Structures in adverse weather is considered to be low but not negligible. This is supported by the maritime traffic survey which noted a very low level of recreational activity during the survey in February and March 2012. In the scenario of a vessel being out in adverse weather, they may be unable to make their way from the Inch Cape Structures and should alert the Coastguard using mobile phone, VHF or flares to avoid the risk of allision.

To minimise the risk of allision 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 NLB, 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. Information will be promulgated to yacht clubs, marinas and harbour masters.

These measures mean that whilst the allision risk cannot be completely eliminated it will be reduced to a level ALARP. In terms of consequences, most allisions with the WTGs should be relatively low speed and hence low energy. The WTGs will be equipped with access ladders for use in emergency situations, 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.

19A.17.3 Cable Interaction – Anchoring and Trawling

All the subsea cables (inter-array and export) will be buried or trenched where seabed conditions allow, providing protection from all forms of hostile seabed interaction, such as fishing activity, dragging of anchors and dropped objects.. 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.

No anchored vessels were recorded within the Development Area during the surveys. A small number of vessels were at anchor within the 10 nm buffer, mainly towards the coast where water depths are reduced and in the designated anchorage at Lunan Bay.

The predominant fishing activities in the vicinity of the Development Area are demersal stern trawling, scallop dredging and potting/whelking. Both demersal stern trawling and scallop dredging have the potential to interact with cables which could lead to cable and/or vessel damage.

It is therefore assumed that all cables will be suitably protected for the seabed conditions and the fishing activity in the area through burial and trenching, information promulgation and periodic inspection.

More details of the Offshore Export Cable can be found in Appendix 19B Navigational Risk Assessment Offshore Cable Corridor.

19A.17.4 Risk Results Summary

The base case and future case annual levels of risk without and with the Inch Cape Wind Farm are summarised in Table 19A.13. The change in risk is also shown, i.e., the estimated collision risk with the Inch Cape Structures minus the estimated baseline collision risk without the Inch Cape Structures (which is zero except for vessel-to-vessel collisions).

Table 19A.13 Risk Results Summary for Development Area and OfTW

Scenario	Base Case			Future Case		
	Without	With	Change	Without	With	Change
Passing Powered	--	6.62E-04	6.62E-04	--	7.28E-04	7.28E-04
Passing Drifting	--	8.10E-05	8.10E-05	--	8.91E-05	8.91E-05
Vessel-to-Vessel	1.25E-03	1.44E-03	1.90E-04	1.38E-03	1.58E-03	2.09E-04
Fishing	--	1.66E-01	1.66E-01	--	1.82E-01	1.82E-01
Total	1.25E-03	1.68E-01	1.67E-01	1.38E-03	1.85E-01	1.83E-01

The overall annual level of collision risk is estimated to increase due to the Project by approximately 1 in 6 years (base case) and approximately 1 in 5 years (future case). The vast majority of this risk is from fishing vessel collisions.

19A.17.5 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.

An allision involving a larger ship is likely to result in collapse of a structure with limited damage to the vessel. 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 Inch Cape 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 (PLL).

A quantitative assessment of the potential consequences of collision due to the Inch Cape Structures is presented in Annex 19A.2 – Consequences Assessment Report . 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, International Tanker Owners Pollution Federation Limited (ITOPF), etc.).

The annual increase in PLL due to the impact of the Project is estimated to be as follows:

- Base Case PLL: 5.75E-03 fatalities per year
- Future Case PLL: 6.32E-03 fatalities per year

The overall increase in PLL estimated due to the development is 5.75×10^{-3} fatalities per year (base case), which equates to one additional fatality in 174 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^{-9}) 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 Wind Farm is higher than for commercial vessels (in the region of 10^{-5}), it is low compared to the background risk level for the UK sea fishing industry of 1.2×10^{-3} per year.

In terms of environmental impact, the amount of oil estimated to be spilt per year due to the impact of the Wind Farm is 0.47 tonnes (base case). The overall increase in pollution estimated due to the Wind Farm is very low compared to the historical average pollution quantities from marine accidents in UK waters (approximately 0.00295 per cent).

Therefore, the incremental increase in risk to both people and the environment caused by the Project is estimated to be low.

19A.18 Formal Safety Assessment

In order to provide expert opinion and local knowledge, a hazard workshop was undertaken to create a hazard log that was specific to the Project. The hazard log identifies hazards caused or changed by the introduction of structures in the Development Area and the Offshore Export Cable Corridor. It also details the risk associated with the hazard and the controls put in place to reduce the risk. The log includes both industry standard and additional mitigation measures required to show that the hazards associated with the Development Area are *Broadly Acceptable* or *Tolerable* on the basis of ALARP declarations.

19A.18.1 Hazard Workshop

The Wind Farm hazard workshop was held in September 2012 to identify the navigational hazards associated with the Wind Farm. This workshop was attended by maritime stakeholders, as outlined in Table 19A.14. Stakeholders who were invited to the workshop but did not attend are also listed in Table 19.14.

Table 19A.14 Hazard Workshop Invitees

Invitee	Company/Organisation	Attendance
Esther Villoria	ICOL	Yes
Miguel Torres	ICOL	Yes
David Griffiths	ICOL	Yes
Sam Westwood	Anatec	Yes
Jenny Brown	Anatec	Yes
Peter Douglas	NLB	Yes
Archie Johnstone	NLB	Yes
Sandy Ritchie	Anglo Scottish Fishermen's Association	Yes
Allan Russell	RNLI	Yes
Graham Russell	RYA Scotland	Yes
Pete Thomson	MCA	Yes
John Watt	Scottish Fishermen's Federation	Yes
Ashley Nicholson	Forth Ports Ltd	Apologies (issued on the day of the workshop)
Brian Forrest	Montrose Port	Declined

Invitee	Company/Organisation	Attendance
Josephine Henniker-Major	Brown and May Marine Ltd	Declined
Scott Horsburgh	Marine Scotland	Declined
George Mair	Arbroath Harbour	Declined
Richard Nevinson	CoS	Declined
Philip Smith	Department for Transport	Declined
Peter Bradley	RNLI	No Response
Peter Burry	CA	No Response
Des Egan	MOD	No Response
Tony Kirk	James Fisher Tankers	No Response
Roly McKie	MCA	No Response
Ted Osborn	CA	No Response
Graeme Proctor	MCA	No Response
Nick Sice	Faversham Ships Ltd	No Response

19A.18.2 Hazard Workshop Process

As part of the workshop, key maritime hazards associated with Inch Cape Structures in the Development Area and the Offshore Export Cable Corridor were discussed and noted. Where appropriate, vessel types were considered separately to ensure the risk levels were assessed for each and the control options could be identified on a type-specific basis, e.g., risk control measures for fishing vessels differ to those for commercial ships. Other general hazards associated with the construction, decommissioning and operation phases, such as dropped objects, man overboard, pollution incidents and search and rescue operations, were also discussed.

After the workshop, the risks associated with the hazards were ranked based on the discussions held during the workshop and risk reduction measures were identified.

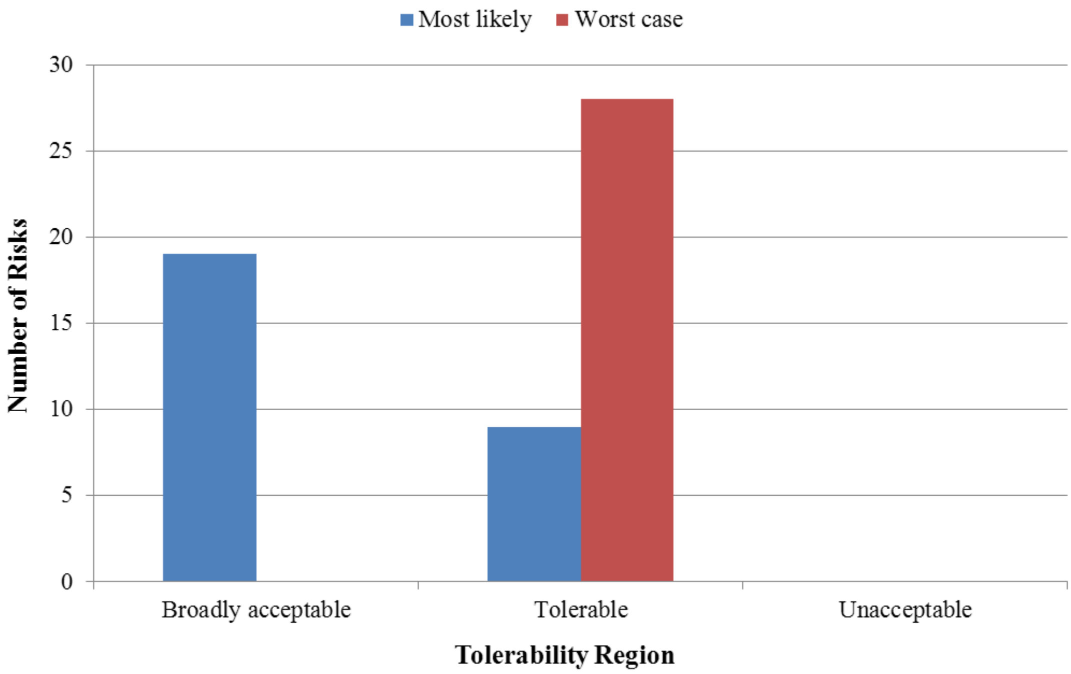
19A.18.3 Hazard Log

The Hazard Log can be found in Annex 19A.3 – Hazard log.

19A.18.4 Tolerability of Risks

Figure 19A.65 presents a summary of the overall breakdown by tolerability region for the identified hazards.

Figure 19A.65 Risk Ranking Results



For the most likely outcome, 19 of the risks were broadly acceptable and nine were in the tolerable region. When the worst case consequences were assessed, all of the risks were in the tolerable region.

19A.19 Mitigation Measures

Mitigation and safety measures will be applied to the Project 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.

19A.19.1 Marine Aids to Navigation (AtoN)

Throughout the construction, operation and maintenance of the Wind Farm and Offshore Transmission Works, Aid to Navigation (AtoN) will be provided in accordance with NLB requirements, which will comply with IALA standard O-139 on the Marking of Offshore Wind Farms (IALA, 2008).

19A.19.1.1 Construction and Decommissioning Markings

During the construction/decommissioning of the Project, working areas will be established and marked, where required, in accordance with the IALA Maritime Buoyage System. In addition to this, where advised by NLB, additional temporary marking may also 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 any works, where required.

WTGs, OSPs and the met mast will be marked in accordance with 0-139 on The Marking of Man-Made Offshore Structures (IALA, 2008).

19A.19.1.2 Guidance of the Marking of Groups of Structures (Wind Farms)

A Significant Peripheral Structure (SPS) is the ‘corner’ or other significant point on the periphery of the Wind Farm. Every individual SPS should be fitted with lights visible from all directions in the horizontal plane. These lights should be synchronized to display an IALA ‘special mark’ characteristic, flashing yellow, with a range of not less than five (5) nautical miles. In the case of a large or extended wind farm, the distance between SPSs should not normally exceed three nautical miles.

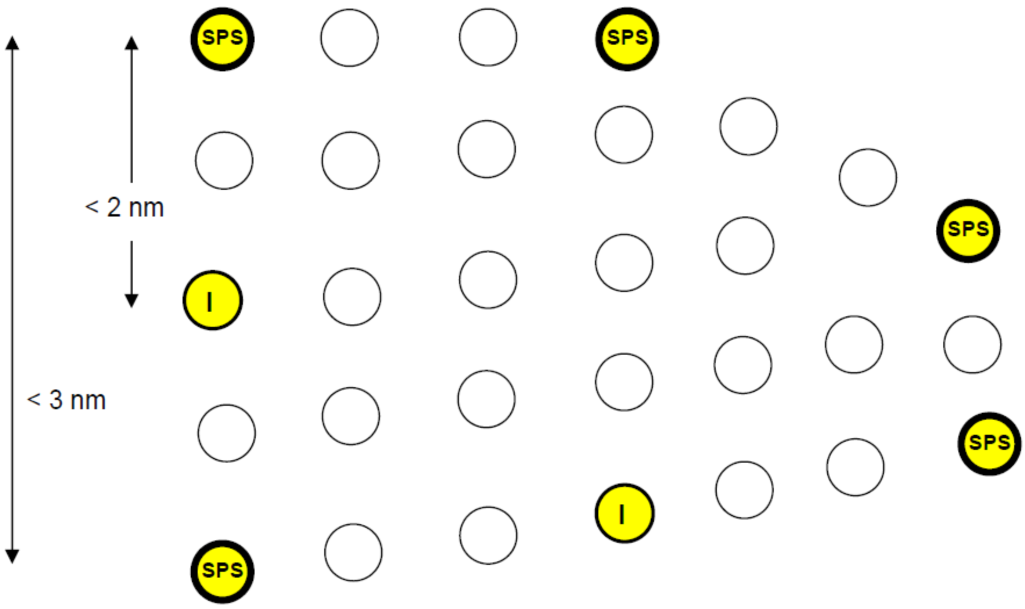
Selected intermediate structures on the periphery of a wind farm other than the SPSs, should be marked with flashing yellow lights which are visible to the mariner from all directions in the horizontal plane. The flash character of these lights should be distinctly different from those displayed on the SPSs, with a range of not less than two nautical miles. The lateral distance between such lit structures or the nearest SPS should not exceed two nautical miles. The sample marking of a wind farm is presented in Figure 19A.66.

Structures should also include omnidirectional fog signals as appropriate and where prescribed by THLS.

Figure 19A.66 Sample Marking of a Wind Farm

SPS - lights visible from all directions in the horizontal plane. These lights should be synchronized to display an IALA 'special mark' characteristic, flashing yellow, with a range of not less than five (5) nautical miles

Intermediate structures on the periphery of a wind farm other than the SPSs - marked with flashing yellow lights which are visible to the mariner from all directions in the horizontal plane with a flash character distinctly different from those displayed on the SPSs and with a range of not less than two (2) nautical miles



The markings for Wind Farm will be agreed in consultation with the NLB once the final turbine layout has been selected.

19A.19.1.3 Numbering of Structures

It is recommended that, where possible, individual structure markings should conform to a spread sheet layout, i.e. lettered on the horizontal axis, and numbered on the vertical axis. The detail of this will depend on the shape, geographical orientation and potential future expansion of each wind farm development. The MCA will advise during the consent process on the specific requirements for the Inch Cape Structures.

19A.19.2 Buoyage

The Wind Farm will be designed to ensure that the overall design or peripheral WTGs do not increase risk by creating high risk areas. This may include the use of buoyage to aid traffic flow around a site particularly during construction and decommissioning. These requirements will be discussed in consultation with NLB.

19A.19.3 Construction and Decommissioning Safety/Exclusion Zones

For the purposes of this assessment there are assumed to be 500 m 'rolling' safety/exclusion zones around each WTG being constructed/decommissioned in order to minimise disruption to mariners and other users of the sea. Safety zones for the construction, major maintenance and eventual decommissioning phases of an offshore wind farm's life will be established on a 'rolling' basis, covering only those areas of the total site in which such activities are actually taking place at a given time. Once that activity has been completed in that specific location, the safety zone will then 'roll on' to cover the next specific location within the site in which such activity is taking place.

19A.19.4 Guard Vessels

The use of guard vessels may be required during construction and significant periods of maintenance during operation to both protect the installation and workers on the WTGs, particularly in areas in proximity to main traffic routes.

Their role would be to both alert vessels to the development activity and provide support in the event of an emergency situation.

19A.19.5 Promulgation of Information

Promulgation of information and warnings through notices to mariners and other appropriate media will enable vessels to effectively and safely navigate around the Wind Farm.

19A.19.6 SAR ERCoP and Active Safety Management System (ASMS)

19A.19.6.1 SAR ERCoP

Operators of the Project will formulate an emergency response plan. The SAR Emergency Response and Cooperation Plan (ERCoP) will be developed and put in place for the construction, operation and the decommissioning phases of any Inch Cape Structure. The ERCoP will be completed following the MCA template and initially in discussion with the MCA Search and Rescue and Navigation Safety Branches. Detailed completion of the plan will then be in cooperation with the Maritime Rescue Coordination Centre (MRCC) responsible for maritime emergency response in the area that the wind farm is to be sited (MCA, 2008a).

19A.19.6.2 ASMS

An Active Safety Management System (ASMS) will be developed to ensure the effective co-ordination of emergency response for the Project. It will be designed to ensure that the risks related to marine operations specific to the Project are managed carefully and over the long term.

The ASMS is particularly focused on ensuring safety of navigation within proximity of the wind farms. This procedure will be developed for the risks identified and will have prepared instructions, including checklists as appropriate, for response. This document also includes lines of communication, procedures for reporting incidents and reviewing processes.

To ensure the safe marine operations and to provide a link between all aspects of the ASMS, a Designated Person will be identified. The responsibility and authority of the Designated Person includes monitoring the ASMS to ensure it is implemented throughout the organisation and reviewed at regular set intervals. Objectives of the ASMS are:

- Ensure that marine based risks are ALARP by applying risk management techniques and setting guidelines for marine operation and emergency response.
- Ensure all personnel and vessels comply with relevant statutory requirements throughout the design, construction, maintenance and operation phases.
- Ensure effective communication with maritime authorities including the MCA, NLB, RNLI, local port authorities and oil/gas installations in the area.
- Ensure all personnel are trained in emergency response procedures including relevant third parties and contractors.
- Instigate a culture of learning in risk management by ensuring that the ASMS is a continuous learning process and documentation is continually reviewed and updated.

19A.19.7 Marine Pollution Contingency Planning

Creation of an Emergency Response Cooperation Plan with the relevant Maritime Rescue Coordination Centre from construction phase onwards is proposed. This should include cooperation with UK National Contingency Plan (MCA, 2006).

19A.19.8 Cable Burial and Protection

Cables will be trenched and buried where seabed conditions allow or protected with suitable methods to ensure the risk of snagging or anchor interaction is mitigated. If it is necessary for the cables to be protected by rock placement, concrete mattresses or other protection which lies clear of the surrounding seabed, the impact on navigation and the requirement for appropriate risk mitigation measures will be assessed. Cables will also be marked on nautical charts in line with United Kingdom Hydrographic Office (UKHO) standards.

The subsea cables will be subject to periodic inspection to ensure they remain buried and do not become a hazard to marine navigation.

19A.19.9 OREI Design Specifications as per MGN 371

The Project will be designed to satisfy the following design requirements for emergency response in the event of a SAR, counter pollution or salvage operation in or around a wind farm (as per MGN 371 guidance - MCA, 2008a);

- All Inch Cape Structures will be marked with clearly visible unique identification characters. The identification characters will be illuminated by a low-intensity light visible from a vessel thus enabling the structure to be detected at a suitable distance to avoid an allision with it. The size of identification characters in combination with lighting should be such that under normal visibility conditions and known tidal conditions they are clearly readable by an observer stationed at 3 m above sea level and at a distance of at least 150 m from the turbine. All lighting should be hooded or baffled so as to avoid unnecessary light pollution or confusion with navigation marks.

- For aviation purposes, OREI structures should be marked with hazard warning lighting in accordance with Civil Aviation Authority (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 500 feet (150 m) above the highest part of the OREI structure.
- The WTG control mechanisms should be able to fix and maintain the position of the WTG blades as determined by the Maritime Rescue Coordination Centre.
- 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.
- Throughout the design process for an OREI, appropriate assessments and methods for safe shutdown should be established and agreed, through consultation with MCA's Navigation Safety Branch, Search and Rescue Branch and other emergency support services.
- Access ladders, although designed for entry by trained personnel using specialised equipment can conceivably be used, in an emergency situation, to provide refuge on the turbine structure for distressed mariners. This scenario will be considered when identifying the optimum position of such ladders and take into account the prevailing wind, wave and tidal conditions.

19A.19.10 Operational Requirements as per MGN 371

- The Central Control Room, or mutually agreed single contact point, should be manned 24 hours a day.
- The Central Control Room operator, or mutually agreed single contact point, should have a chart indicating the GPS position and unique identification numbers of each of the WTGs in the wind farm or individual devices in other types of OREI.
- All MRCCs will be advised of the contact telephone number of the Central Control Room, or single contact point (and vice versa).
- 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.
- All search and rescue helicopter bases will be supplied with an accurate chart of all the OREI and their GPS positions.
- The CAA shall be supplied with accurate GPS positions of all OREI structures for civil aviation navigation charting purposes.

19A.19.11 Operational Procedures as per MGN 371

- Upon receiving a distress call or other emergency alert from a vessel which is concerned about a possible allision with a WTG or is already close to or within a wind farm, or when the MRCC receives a report that persons are in actual or possible danger in or near to 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 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.

- The control room operator, or single contact point, should immediately initiate the shut-down procedure for those WTGs as requested by the MRCC/SC, and maintain the WTG in the appropriate shut-down position, as requested 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.
- The appropriate procedure to be followed in respect of other OREI types, designs and configurations will be determined by the MCA branches on a case-by-case basis, in consultation with appropriate stakeholders.
- Communication procedures should be tested satisfactorily at least twice a year. Shutdown and other procedures should be tested as and when mutually agreed the MCA.

19A.19.12 SAR Helicopter Procedures and Guidance as per MGN 371

Helicopter Search and Rescue units have specific requirements to allow them to operate safely within wind farms and close to, or over, WTGs:

- 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 from/to a WTG, the WTG blades will have to be feathered and the rotor brakes applied (where feasible blades should be pinned - perhaps before major works commence). 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, in bad weather and poor visibility. It is therefore fundamental to the safe operation of SAR helicopters within and around wind farms that the WTGs are detectable to airborne Radars (at a safe range) and that the aircraft crew, using Radar, can discriminate between individual WTGs.

19A.19.13 Vessel Requirements

The following details general good practice that associated vessels will comply with:

- All vessels will be required to carry AIS equipment on board.

- All vessels engaged in activities will comply with relevant regulations for their size and class of operation and assessed on their 'fit for purpose' for any activities that they are required to carry out.
- All marine operations will be governed by operational limits tidal, weather conditions and vessel traffic information. Marine operations will be carried out in daylight as far as is practicable. Final decisions will be taken by the Master of any vessel.
- Coastguard and local rescue and emergency services will be informed in advance as per SAR ERCoP and additional notification will be publicised via maritime safety information (MSI) including notification of any hazardous occurrences.
- The Coastguard should be notified as per SAR ERCoP each time a vessel departs for operations within the Development Area. The report will include person on board, activities being carried out, Inch Cape Structure number (if appropriate) and estimated times of arrival/departure.
- Temporary or fixed Aids to Navigation will be provided as requested by NLB and as per consent conditions.
- When mooring to a structure, vessels will ensure that they can be cast off quickly in the event of an incident. Engines will be disabled when not required but should be maintained in a condition that allows for a rapid start. The Master is responsible for the positioning of the craft during work and deciding whether to remain moored on or off station.

19A.19.14 Personnel

All personnel are to be conversant with the ASMS and emergency response procedures and wear correct Personal Protective Equipment (PPE) at all times as defined by the relevant Quality, Health, Security and Environment (QHSE) documentation.

19A.20 Navigation, Collision Avoidance and Communications

There are a number of additional navigational issues identified within MGN 371 (MCA, 2008a) which require to be addressed by ICOL (as shown in Annex 19A.4 – MGN and Methodology Checklist). The following subsections cover these additional navigation related issues.

19A.20.1 Tides and Tidal Streams

Analysis of the base and future case for the Project has not identified any impacts existing at high water that do not exist at low water (and vice versa), or impacts that are caused by significant tidal streams. This is mainly due to the distance offshore that the Development Area is located where the rise and fall of the tide has less impact on navigational safety.

19A.20.1.1 Scour

Scour is the term used for the localised removal of sediment from the area around the base of support structures located in moving water. When a structure is placed in a current, the flow is accelerated around the structure, ultimately resulting in a downward flow that impacts the bed forming a vortex which sweeps around and downstream of the structure. If the bed is erodible (and the shear stresses are of sufficient magnitude), a scour hole forms around the structure.

As the seabed may be subject to erosional processes, the turbine foundations may require scour protection. Further information can be found in the Metocean and Coastal Processes chapter of the ES (Chapter 10).

19A.20.2 Adverse Weather Routeing

Information on meteorological conditions is provided in Section 19A.11.

Following consultation and assessment of marine traffic survey data there are expected to be limited impacts caused by adverse rerouting caused by the Inch Cape Structures. Although the inshore route could prove challenging to navigating in adverse weather conditions due to the proximity to the coastline and Bell Rock, alternative routes that pass to the east of the Development Area do not significantly increase journey times and distances.

There are therefore not expected to be any increased impacts and effects associated with the development of the Project associated with adverse weather.

19A.20.3 Impacts of Structures on Wind Masking/Turbulence or Shear

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 per cent downwind of a turbine (RYA, 2012). 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.

19A.20.4 Visual Navigation and Collision Avoidance

MGN 371 (MCA, 2008a) 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.

19A.20.4.1 Site Design

The Development Area is not expected to increase navigational risk for vessels transiting due to the areas of open sea that are available for vessels to increase their closest point of approach from the Development Area. Routes generally run in a north south direction and will deviate to the east or west of the Development Area, although larger tankers may avoid deviating to the west due to the presence of Bell Rock as indicated by the hazard workshop, recent consultation feedback and the outputs vessel rerouting within this NRA.

It is noted that consultation did highlight issues with the final, including peripheral structures that will need to be discussed further with stakeholders post-consent when finalising the site design.

Commercial vessels are expected to avoid transiting through the Development Area however commercial fishing vessels, recreational may transit through. Marine vessels coordination and promulgation of information into current areas of activity will enable these vessels to avoid encounters or create areas of congestion.

19A.20.4.2 Visual Impact (Vessels)

The detection of vessels by Radar when within or in close proximity to wind farms may be impaired, therefore increasing the risk of vessel encounters. However with minimum turbine spacing of 820 metres there are not expected to be any impacts related to visual or Radar acquisition within the Development Area. It is noted that recreational activity is expected to be low in the Development Area, with most vessels transiting through the site being small or medium commercial fishing vessels. See Section 19A.20.6 for more information.

19A.20.4.3 Visual Impact (Navigational Aids and/or Landmarks)

There is potential for Inch Cape Structures to obscure the use of Bell Rock as an AtoN, however it is noted that the structures will become a good AtoN. No expected impacts are expected with Bell Rock as it is not used as a leading light but to mark the navigational hazard the rocky outcrop poses.

19A.20.5 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 Offshore Wind Farm and experience of personnel/vessels operating in and around other offshore wind farm sites.

19A.20.5.1 VHF Communications (including Digital Selective Calling (DSC))

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 from the Project.

19A.20.5.2 Navtex

The Navtex system is used for the automatic broadcast of localised MSI. The system mainly operates in the Medium Frequency radio band just above and below the old 500 kHz Morse Distress frequency. No significant effect has been noted at other sites and none is expected from the Project.

19A.20.5.3 VHF Direction Finding

During the North Hoyle Offshore Wind Farm trials, the VHF direction equipment carried in the lifeboats did not function correctly when very close to WTGs (within about 50 m). This is deemed to be a relatively small scale impact due to the limited use of VHF direction finding equipment and will not impact operational or SAR activities.

19A.20.5.4 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 Offshore Wind Farm site and no significant impact is anticipated for AIS signals being transmitted and received around the Development Area.

19A.20.5.5 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 must to be given to any potential degradation of GPS signals being used to position construction equipment when close to a tower.

19A.20.5.6 Long Range Navigation (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 nm. 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. It is also noted that the Department for Transport are funding an enhanced LORAN (eLORAN) service in the UK, which commenced on a 15 year contract from May 2007.

The Project is not expected to have a significant impact on LORAN-C.

19A.20.6 Impact on Marine Radar systems

19A.20.6.1 Radar Trials

In 2004, the MCA conducted trials at the North Hoyle offshore wind farm off North Wales to determine any effect of WTGs on marine communications and navigation systems (DfT, 2004).

The trials indicated that there is minimal impact on VHF radio, GPS receivers, cellular telephones and AIS. Ultra High Frequency (UHF) and other microwave systems suffered from the normal masking effect when WTGs 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 WTGs 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 (PLA) 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 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 between 30 April 2006 and 27 June 2006 on behalf of British Wind Energy Association (BWEA, 2007). The project steering group had members from Department for Business Enterprise & Regulatory Reform (BERR), the MCA and the PLA. 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 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; and
- 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.

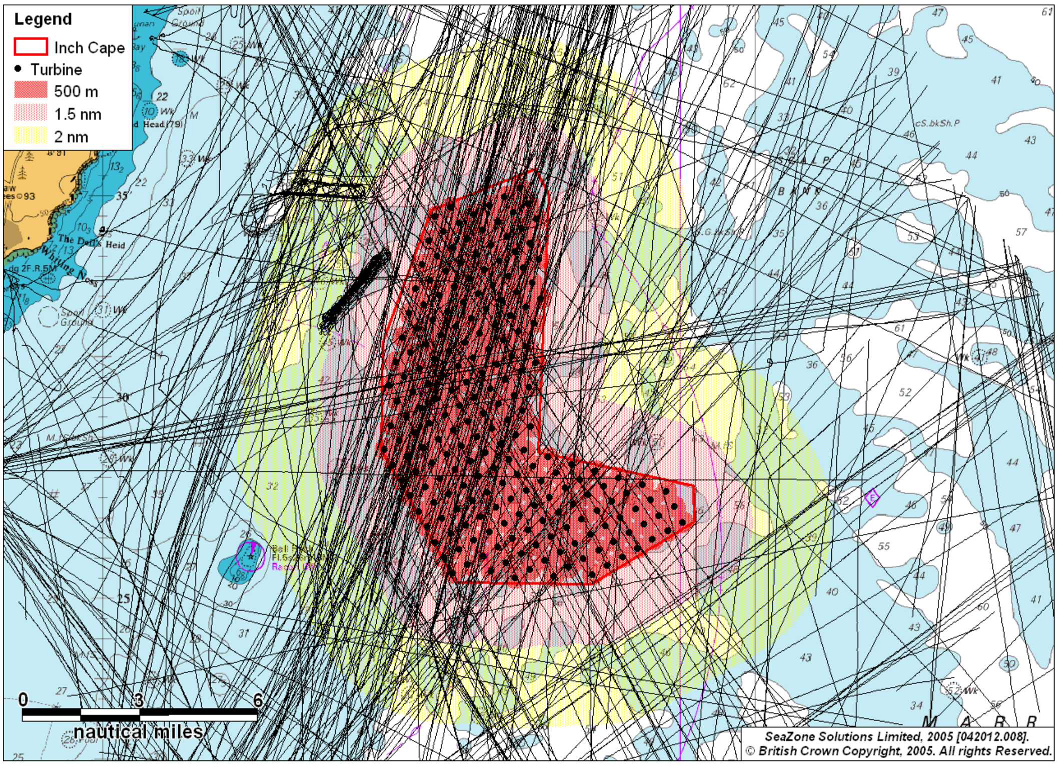
19A.20.6.2 Impact on Collision Risk

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).

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

Figure 19A.67 presents the 28 days of AIS data collected during the vessel based surveys for the Development Area. 500 m, 1.5 nm and 2 nm buffers have been applied around each WTG location to illustrate current passing distances.

Figure 19A.67 AIS Data and Passing Distances



It can be seen that, at present, a number of vessels passing through the Development Area in a north-south and east-west direction are inside the 1.5 nm range from WTGs at which Radar interference could be experienced.

It is noted that upon development of the Project, commercial vessels are likely to pass 1 to 1.5 nm from the Development Area, thereby subject to a small level of Radar interference. There is sufficient sea room around the Development Area for vessels to increase their clearance further if they consider it necessary, although larger tankers may be required to avoid deviating to the west of the Development Area due to the presence of Bell Rock.

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 consequential 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 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 wind farms which highlights Radar issues amongst others to be taken into account when planning and undertaking voyages in the vicinity of offshore wind farms off the UK coast (MCA, 2008b).

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.

19A.20.7 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 from the Project.

19A.20.8 Noise Impact

The concern which must be addressed under MGN 371 (MCA, 2008a) is whether acoustic noise from any wind farm could mask prescribed sound signals.

The sound level from a wind farm at a distance of 350 m has been predicted to be 51 dB (A) to 54 dB (A) a ship's whistle for a vessel of 75 m should generate in the order of 138 dB (A) and be audible at a range of 1.5 nm (IMO, 1977) so this should be heard above the background noise of the Wind Farm. Foghorns will also be audible over the background noise of the Wind Farm.

There are no indications that the sound level of the Wind Farm will have a significant influence on marine safety.

19A.20.8.1 Noise Impacting Sonar

Once in operation it is not believed that there will be any subsea acoustic noise generated by the Wind Farm that will have any significant impact on sonar systems.

19A.20.9 Human Element

MGN 372 has been developed to provide guidance on planning and undertaking voyages in the vicinity of offshore wind farms and states that although structures present new challenges to safe navigation around the UK coast, proper voyage planning, taking into account all relevant information, should ensure a safe passage and the safety of life and the vessel should not be compromised.

19A.21 Cost Benefit Analysis (CBA)

The FSA Guidelines require a process of CBA to rank the proposed risk control options in terms of risk benefit related to life cycle costs. This will be considered in terms of **gross cost of averting a fatality (GCAF).** This is a cost effectiveness measure in terms of ratio of marginal (additional) cost of the risk control option to the reduction in risk to personnel in terms of the fatalities averted. GCAF can be calculated as:

$$\frac{\textbf{\textit{COST}}}{\textbf{\textit{RISK}}}$$

Until mitigation measures are defined a review of CBA cannot be undertaken, however, ICOL is committed to implementing mitigation measures that show a reduction in the value.

19A.22 Cumulative Effects

Cumulative effects have been considered for the Project following the methodology outlined in Section 19A.3.2 including the impacts on shipping and navigation arising from offshore wind farms and the impacts arising from other marine activities or uses of the sea.

Following assessment of the cumulative baseline it has been identified that the development of the Project in combination with other wind farms in the outer Firth of Forth and Firth of Tay region (STW site Neart Na Gaoithe and Alpha and Bravo in the Forth Round 3 Zone) has the potential affect the following:

- Displace and congest vessels from existing routes;
- Cause visual confusion due to alignment of structures;
- Impact adverse weather routes;
- Vessel detection – visual or radar;
- Reduction in available sea room for defence activities;
- Restricted access to existing infrastructure;
- Increasing or diminishing emergency response; and
- Traffic levels within ports.

19A.22.1 Displacement and Congestion of Vessels from Existing Routes

Figure 19A.68 shows the anticipated routes that vessels would be required to take in order to pass the Inch Cape Structures at a safe distance. The associated increases in distance and time are presented in Table 19A.15. Note that route deviations are not required for vessels on routes 6 or 8 so these remain unchanged. The re-routes have been drawn in line with the factors identified in Section 19A.16.6.

It is noted that although a number of the routes now converge there are limited vessels per day on each route therefore there is not expected to be a significant increase in encounters for vessels.

Figure 19A.68 Anticipated Routes in Cumulative Scenario

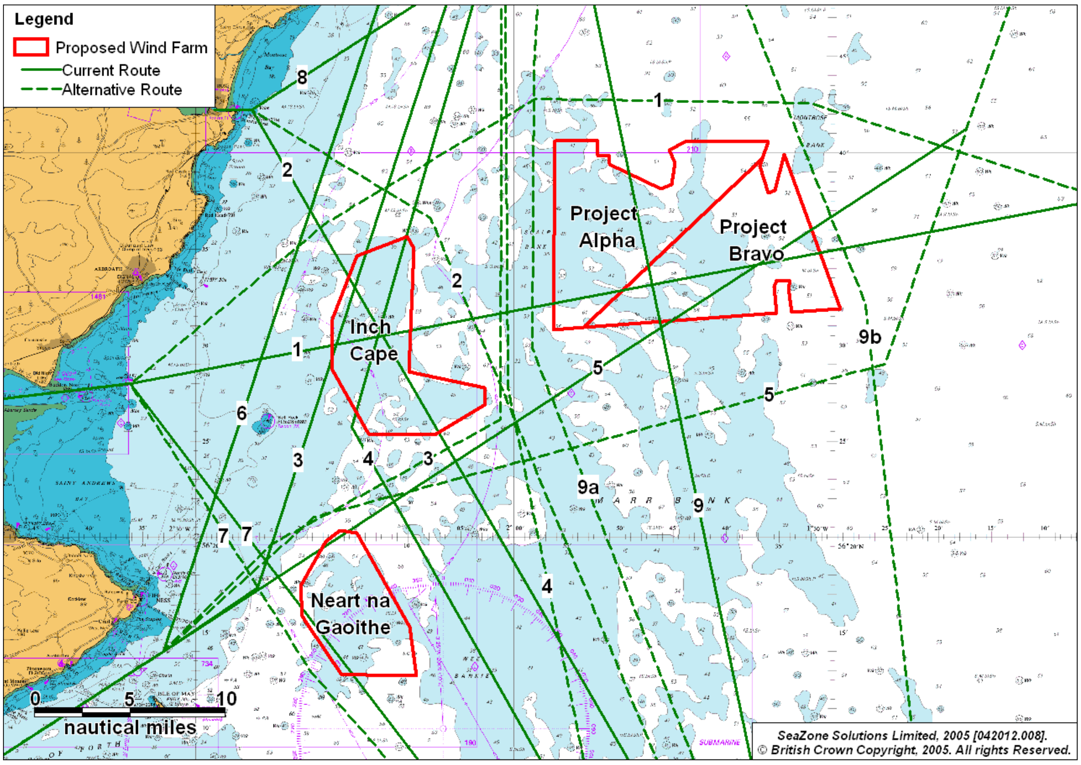


Table 19A.15 Details of Anticipated Routes in Cumulative Scenario

Route	Vessel Numbers	Increase in Distance (nm)	% Difference	Change in Time for Average Speed Vessel (mins)
Route 1	1 vessel every 4 days	4.52	7.44% increase	25
Route 2	1 vessel every 2 days	1.65	3.18% increase	12
Route 3	2.5 vessels every day	4.86	7.49% increase	30
Route 4	1 vessel every 2 days	-4.09	7.30% decrease	-26
Route 5	1 vessel every 4 days	4.41	6.53% increase	25
Route 7	1 vessel every 2 days	0.1	0.19% increase	< 1
Route 9a	1 vessel every 2 days	1.34	2.00% increase	8
Route 9b	1 vessel every 3 days	3.93	5.75% increase	23

19A.22.2 Visual Confusion due to Alignment of Structures

TCE report (TCE, 2012) on cumulative effects identified that turbine alignment (including non-linear boundaries, irregular turbine layouts and peripheral WTGs) could potentially hinder a vessel's ability to navigate safely, for example when passing through wind farm developments. Non-linear boundaries and peripheral WTGs can have impacts on marine Radar and visual navigation by obscuring or impacting on a vessel's navigation passage.

This effect is increased when there are multiple wind farms in place and vessels are therefore transiting between wind farms.

19A.22.3 Adverse Weather

Adverse weather routes are considered to be significant course adjustments to mitigate vessel movement in adverse conditions. Additionally, in such conditions, vessels may opt to increase CPAs (closest point of approach) to navigational hazards such as shallow waters.

There is the potential for adverse weather routes to be impacted due to the presence of wind farms, their proximity to the coast and/or in-combination effects from other activities. If vessels are unable to follow safe adverse weather routes, this could have health and safety implications.

Due to the proposed presence of multiple wind farms in the outer Firth of Forth and Firth of Tay region, preferred adverse weather routes currently taken by vessels may no longer be used. This is because the course and heading usually taken on coastal routes to mitigate the effects of adverse weather may no longer be considered safe due to the presence of the wind farms.

19A.22.4 Vessel Detection – Visual or Radar

The detection of vessels by Radar when within or in close proximity to wind farms may be impaired, therefore increasing the risk of vessel encounters. Section 19A.20.6 noted that there was sufficient room for vessels to deviate around the Development Area to reduce the effects of the WTGs on Radar, however this sea-room is decreased with the presence of other wind farms in the area.

19A.22.5 Reduction in Available Sea Room for Defence Activities

Offshore wind farms in-combination with other marine users may restrict and impact the navigational elements of MOD training exercises in defined areas. However due to the limited defence activities that occur in the area, there is not expected to be an impact when multiple wind farms are present.

19A.22.6 Restricted Access to Existing Infrastructure

There are no oil and gas platforms or dredging sites within the area, therefore meaning that there will be no cumulative effect on reducing access to existing infrastructure.

19A.22.7 Increasing or Diminishing Emergency Response

Offshore emergencies can include search and rescue as well as pollution and salvage control and response. The UK's current SAR and Counter Pollution response includes a variety of vessel response facilities. Navigational elements include both the transit routes to a wind farm and the manoeuvrability once within the WTGs.

With the presence of multiple wind farms in the outer Firth of Forth and Tay region, the availability of self-help facilities will need to be developed, including the implementation of joint response plans and facilities.

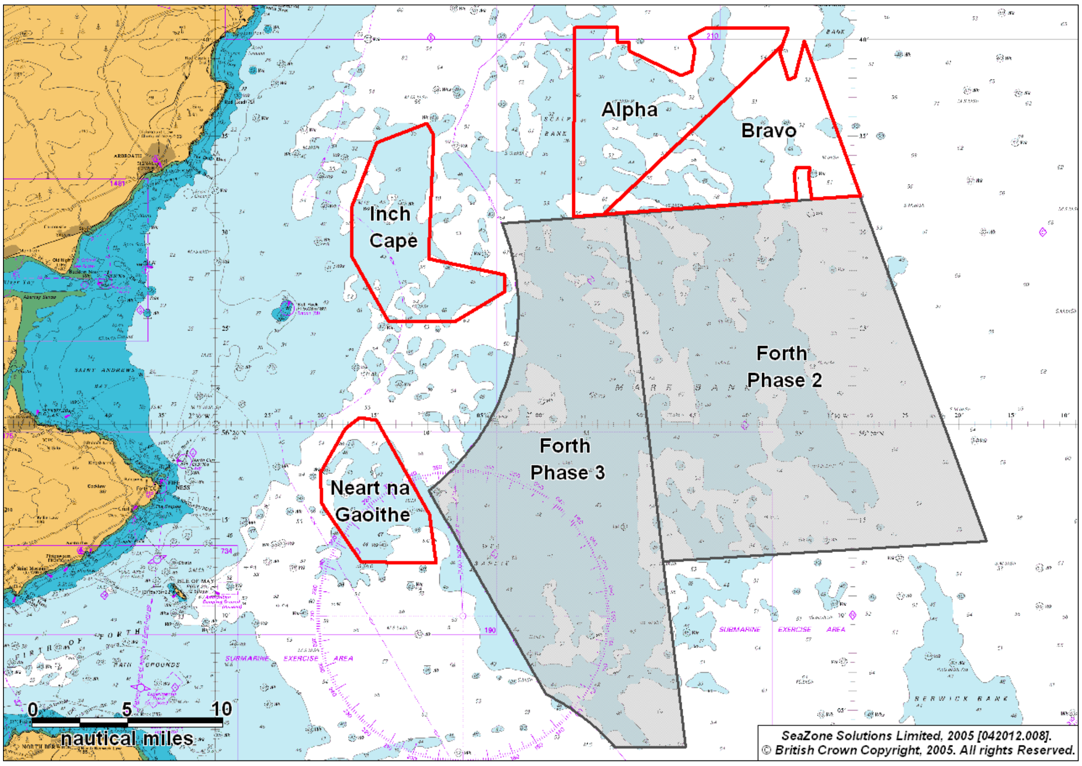
19A.22.8 Traffic Levels within Ports

Due to the proximity of the wind farms to large ports on the east coast of Scotland and those within the Firth of Tay and Firth of Forth, there is the potential for traffic levels within these ports to be altered when multiple wind farms are in place. This could either be an increase in traffic levels if the port is used for wind farm operation and maintenance vessels or a decrease in levels if vessels choose to avoid the area due to the wind farms.

19A.22.9 Future Cumulative Effects.

Although not assessed at this stage, it has been acknowledged that there is the potential for further wind farms within the Forth Round 3 zone, which could increase the cumulative effects described above. The regions which they could be built in (Phases 2 and 3) are highlighted in Figure 19A.69. It was agreed with stakeholders (MCA, DfT, CoS, NLB and Scottish RYA) that there is currently insufficient site boundary and project parameter information on which to base assessment of the effects of the latter phases of development in the Round 3 Zone.

Figure 19A.69 Future Areas to be considered for Cumulative Effects



19A.23 Transboundary

Due to the distance of the Development Area from non-UK ports, there are no major transboundary issues associated with the Development Area.

19A.24 Through Life Safety Management

19A.24.1 Safety Policy and Safety Management Systems (SMS)

QHSE documentations including a policy statement and SMS will be in place for the project and will be continually updated throughout the development process. The following sections provide an overview of documentation and how it will be maintained and reviewed with reference where required to specific marine documentation.

Monitoring, reviewing and auditing will be carried out on all procedures and activities and feedback actively sought. The Designated Person (identified in QHSE documentation), managers and supervisors are to maintain continuous monitoring of all marine operations and determine if all required procedures and processes are being correctly implemented.

19A.24.2 Incident reporting

After any incidents, including near misses, an incident report form will be completed in line with the operator's SMS. This will then be assessed for relevant outcomes and reviewed for possible changes required to operations.

The operator shall maintain records of investigations and analyse incidents in order to:

- Determine underlying deficiencies and other factors that might be causing or contributing to the occurrence of incidents;
- Identify the need for corrective action;
- Identify opportunities for preventive action;
- Identify opportunities for continual improvement; and
- Communicate the results of such investigations.

All investigations shall be performed in a timely manner.

A database (lessons learnt) of all marine incidents will be developed. It will include the outcomes of investigations and any resulting actions. The operator will promote awareness of their potential occurrence and provide information to assist monitoring, inspection and auditing of documentation.

When appropriate, the designated person should inform the MCA of any exercise or incidents including any implications on emergency response. If required the MCA should be invited to take part in incident debriefs.

19A.24.3 Review of Documentation

The operator will be responsible for reviewing and updating all documentation including the risk assessments, SAR ERCoP and ASMS and, if required, the operator will convene a review panel of stakeholders.

Reviews of the risk register should be made after any of the following occurrences:

- Changes to the project, conditions of operation and prior to decommissioning;
- Planned reviews; and
- Following an incident or exercise.

A review of potential risks should be carried out annually. A review of the response charts should be carried out annually to ensure that response procedures are up to date and should include any amendments from audits/incident reports/deficiencies.

19A.24.4 Inspection of Resources

All vessels, facilities, and equipment necessary for marine operations are to be subject to appropriate inspection and testing to determine fitness for purpose and availability in relation to their performance standards. This will include monitoring and inspection of all Aids to Navigation to determine compliance with the performance standards specified by NLB.

19A.24.5 Audit Performance

Auditing and performance review are the final steps in safety management systems. The feedback loop enables an organisation to reinforce, maintain and develop its ability to reduce risks to the fullest extent and to ensure that continued effectiveness of the system. The operator will carry out audits and periodically evaluate the efficiency of the marine safety documentation.

The audits and possible corrective actions should be carried out in accordance with standard procedures and results of the audits and reviews should be brought to the attention of all personnel having responsibility in the area involved.

19A.24.6 Future Monitoring

The operator has a commitment to manage the risks associated with the activities undertaken by the Project. It has established an integrated management system which ensures that the safety and environmental impacts of those activities are tolerable.

19A.24.7 Future Monitoring of Marine Traffic

Whilst no radar monitoring of vessel movements has been proposed for the site, AIS monitoring will be available from a suitable structure to record the movements of vessels around the Development Area, associated Offshore Export Cable Corridor to shore and works vessels. There will be vessels regularly operating in the Development Area, including during maintenance, which can monitor any third party vessel activity both visually and on Radar, although this will not be their primary function.

19A.24.8 Decommissioning Plan

A decommissioning plan will be developed as part of a separate consent process. With regards to impacts on shipping and navigation this will also include consideration of the scenario where on decommissioning and on completion of removal operations, an obstruction is left (attributable to the wind farm) which is considered to be a danger to navigation and which it has not proved possible to remove. Such an obstruction may require to be marked until such time as it is either removed or no longer considered a danger to navigation.

19A.25 Next Steps - Impact Assessment for EIA

Following identification of both future case impacts and the outcomes of the Formal Safety Assessment an impact assessment in line with EIA guidance has been undertaken. This impact assessment screens the identified impacts from the NRA with effective pathways.

The likely and significant effects of the Project during pre-construction, construction, operation and decommissioning stages of the project are assessed and feedback provided to the design and engineering teams to mitigate or modify the development in order to avoid, prevent, reduce and, where possible, offset any significant adverse effects on the environment. Following this is the identification of any residual effects and any further mitigation measures that may be required.

19A.26 Conclusions

Following a review of the base case environment, a NRA for the Development Area has been undertaken. The assessment has included collision risk modelling and a formal safety assessment for all phases of the developments as well as an assessment of cumulative effects.

19A.26.1 Consultation

Consultation has been undertaken with the following regulators and stakeholders:

- DfT
- MCA;
- NLB;
- Forth Ports PLC;
- Montrose Port;
- CoS; and
- Scottish RYA.

Regular operators that would be required to deviate following the development of the Wind Farm were identified and consulted via electronic or hardcopy mail in August 2012.

19A.26.2 Marine Traffic

An analysis of the vessel types recorded passing within 10 nm of the Development Area showed that the majority of tracks were cargo vessels (29 per cent) and fishing vessels (27 per cent). 90th percentiles were identified by principles set out in MCA guidance MGN 371 (MCA, 2008a) and from these nine main routes were identified as operating in the vicinity of the Development Area.

Deviations for the identified main routes were considered with the most significant being an increase of 29 minutes for Route 3 (equating to 7.22 per cent of total journey time).

In terms of recreational vessel activity, there are no RYA cruising routes crossing the Development Area. The majority of vessels were recorded during the summer survey (July/August 2012) rather than in the February/March 2012 survey.

During the marine traffic surveys, a number of fishing vessels were recorded transiting through the Development Area in a north-south direction with the majority of the fishing activity occurring in the north of the Development Area. The main fishing vessel types recorded in the vicinity of the Development Area were scallop dredgers, potters/whelkers and demersal stern trawlers. The vast majority of fishing vessels (>99 per cent) were UK-registered.

19A.26.3 Collision Risk Modelling

An assessment of current vessel to vessel encounters was carried out by replaying (at high-speed) 28 days of AIS which showed that the density of encounters in the vicinity of the Development Area is generally low. There were 41 encounters (vessels passing within 1 nm of each other) during the 28-day period within 10 nm of the Development Area. The majority of encounters involved fishing vessels, cargo vessels, tugs and tankers.

The baseline vessel-to-vessel collision risk current level is in the order of one major collision in approximately 797 years and the level with the Wind Farm present is approximately one major collision in every 695 years, which is an increase of 15 per cent.

The frequency of passing powered allisions has been assessed to be one every 1,510 years for the Wind Farm. This allision return period is slightly higher than the historical average of 5.3E-04 per installation-year for offshore installations on the UKCS (1 in 1,900 years).

The NUC allision risk has been identified as one every 12,349 years for the Wind Farm. NUC collisions are assessed to be less frequent than powered collisions, which reflects the historical data.

In order to mitigate blade, mast and keel collision for recreational craft the development of Wind Farm will adhere to the RYA's guidance on the construction of WTGs including;

- A minimum rotor height clearance above MHWS of 22 m; and
- A minimum underwater clearance of 4 m below chart datum.

These guideline measurements mean that whilst the collision risk cannot be completely eliminated, it will be reduced to a level ALARP.

With regarding to cable interaction for anchoring and trawling, all the subsea cables (export and inter array) will be buried or trenched where seabed conditions allow, providing protection from all forms of hostile seabed interaction, such as fishing activity, dragging of anchors and dropped objects. Cables will be protected by other means when burial is not possible. There will be periodic inspections and surveys to ensure they do not become exposed over time. The cables 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.

19A.26.4 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 Development Area.

- **Site Design**

The Development Area is not expected to increase navigational risk for vessels transiting due to the areas of open sea that are available for vessels to increase their closest point of approach from the Development Area.

- **Visual Impact (vessels)**

The detection of vessels by Radar when within or in close proximity to wind farms may be impaired, therefore increasing the risk of vessel encounters. However with minimum WTG spacing of 820 metres there are not expected to be any impacts related to visual or Radar acquisition within the Development Area.

- **Visual Impact (navigational aids and/or landmarks)**

There is potential for the Wind Farm to obscure the use of Bell Rock as an AtoN, however it is noted that the Wind Farm itself will become a good AtoN. No impacts are expected with Bell Rock as it is not used as a leading light but to mark the navigational hazard the rocky outcrop poses.

19A.26.5 Formal Safety Assessment

In ordered to provide expert opinion and local knowledge, a hazard workshop was undertaken to create a hazard log that was specific to the Project. The hazard log identified the hazards caused or changed by the introduction of the Project, 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 Project are **Broadly Acceptable** or **Tolerable** on the basis of ALARP declarations. For the most likely outcome, 19 of the risks were broadly acceptable, 9 were in the tolerable region and none were ranked as unacceptable. When worst case consequences were assessed all risks were ranked as tolerable.

Hazards identified will be considered further in line with stakeholder consultation and mitigation measures following refinement of the Design Envelope.

19A.26.6 Mitigation Measures

Mitigation and safety measures will be applied to the Project 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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