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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.
Collision	The act or process of colliding (crashing) between two moving objects.
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.
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

AIS	Automatic Identification System
ALB	All-weather Lifeboat
AtoN	Aid to Navigation
EU	European Union
FTOWDG	Forth and Tay Offshore Wind Developers Group
GIS	Geographical Information System
GT	Gross Tonnage
IEC	International Electrotechnical Commission
km	Kilometre
m	Metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MEHRA	Marine Environmental High Risk Area
nm	Nautical Mile
NLB	Northern Lighthouse Board
NRA	Navigational Risk Assessment
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SFI	Sea Fisheries Inspectorate
STW	Scottish Territorial Waters
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office

19 Shipping and Navigation

19.1 Introduction

1 This chapter assesses the navigational risk predicted to result from the Inch Cape Offshore Wind Farm and associated Offshore Transmission Works (OfTW) and summarises the findings of the Navigational Risk Assessment (NRA) which details baseline vessel activity and navigational features in proximity to the Development Area and Offshore Export Cable Corridor.

2 This chapter is supported by the baseline assessment which can be found in:

- *Appendix 19A: NRA Development Area;* and
- *Appendix 19B: NRA Offshore Export Cable Corridor.*

3 The NRA is a requirement of shipping and navigation regulators (see *Section 19A.1 in Appendix 19A*) and forms the technical baseline which is used to make an assessment as part of this chapter. Both *Appendices 19A and 19B* follow required guidance including Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 371 and the Department of Trade and Industry (DTI), Department for Transport (DfT) and MCA publication, '*Guidance on the Assessment of the Impact of Offshore Wind Farms: Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms*' (2005). *Appendix 19A* is accompanied by four Annexes (*19A.1-19A.4*) which are:

- '*Regular Operator Consultation;*'
- '*Consequences Assessment Report;*'
- '*Hazard Log*' (outputs of the hazard workshop); and
- '*MGN and Methodology Checklist*'.

The effects of the Wind Farm and OfTW on recreational activities other than their navigational aspects are dealt with separately in *Chapter 21: Other Human Considerations*. This chapter also shares direct linkages with the following chapters and makes reference to their content where relevant:

- *Chapter 18: Commercial Fisheries;*
- *Chapter 22: Socioeconomics and tourism;* and
- *Chapter 23: Summary.*

4 Reference to Inch Cape Structures within this chapter refers to Wind Turbine Generators (WTGs), Offshore Substation Platforms (OSPs) and Meteorological Mast Structures (met masts).

19.2 Consultation

- 5 Key marine and navigational stakeholders were consulted during the scoping phase of the Inch Cape Offshore Wind Farm and subsequently as part of the NRA and Environmental Impact Assessment (EIA) processes in relation to the Wind Farm and the OfTW. Table 19.1 provides a summary of the consultation relevant to shipping and navigation. Consultation was also undertaken during a ‘hazard workshop’ held in September 2012, which is discussed further in *Section 19.4.1*.
- 6 A regional assessment was undertaken in 2011 as part of the Forth and Tay Offshore Developers Group (FTOWDG) to look at cumulative impacts within the area associated with the full development of the Firth of Forth Zone 2, Neart Na Gaoithe and Inch Cape Offshore Wind Farms. This regional assessment was used as background information for the cumulative assessment. It is acknowledged that there is the potential for further wind farms within the Forth Round 3 zone which could increase the cumulative effects. The regions which they could be built in (Phases 2 and 3) are highlighted in *Appendix 19A, 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.
- 7 Full detail of consultation responses can be found within *Section 19.A.4 of Appendix 19A* and *Section 19B.4 of Appendix 19B*.

Table 19.1: Scoping and Consultation Responses

Consultee	Scoping/Consultation Response	Project Response
MCA (Scoping Opinion)	<p>The Environmental Statement (ES) should supply detail on the possible impact on navigational issues for both Commercial and Recreational craft.</p> <p>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.</p> <p>The NRA should be submitted in accordance with Marine Guidance Note (MGN) 371 (and 372) and the DTI/DfT/MCA Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms.</p> <p>Cumulative and in-combination effects require serious consideration (particularly those arising from adjacent wind farm proposals).</p>	<p>Commercial and Recreational craft has been assessed in <i>Section 19A.15.7 of Appendix 19A</i> and <i>Sections 19.6 to 19.9</i>.</p> <p>Two AIS and Radar maritime 28 days data were collected see <i>Section 19A.15 of Appendix 19A</i>.</p> <p>The NRA has been undertaken in accordance with MGN 371 and with DTI/DfT/MCA Methodology.</p> <p>Cumulative impacts have been assessed in <i>Section 19A.22 in Appendix 19A</i> and <i>Section 19.9</i>.</p>
Northern Lighthouse Board (NLB) (Scoping Opinion)	<p>Notices to Mariners, Radio Navigation Warning and publication in appropriate bulletins will be required, stating the nature and timescale of work being carried out.</p>	<p>Inch Cape Offshore Limited (ICOL) will undertake a comprehensive system of information promulgation. See <i>Section 19A.19.1 of Appendix 19A</i> and <i>Section 19.10</i>.</p>

Consultee	Scoping/Consultation Response	Project Response
	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.	Lighting and marking will be agreed in consultation with NLB and in line with O-139. See <i>Section 19A.19.1</i> of <i>Appendix 19A</i> and <i>Section 19.10</i> .
Royal Yachting Association (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.	The RYAs position statement has been considered within the NRA.
Ports and Harbours (Scoping Opinion)	The Development Area 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.	The NRA assesses rerouting and deviations both in isolation and cumulatively.
Chamber of Shipping (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 Chamber of Shipping. The traffic survey should incorporate AIS and radar covering at least 28 days in the 12/24 months before submission. The potential for cumulative effects will have to be carefully assessed. Mitigations need to be considered so that the Wind Farm has minimal impact on shipping operations and safety of mariner.	Impacts have been assessed within the NRA including reroutes and deviations. A marine traffic survey has been undertaken and deviations estimated in <i>Section 19A.16</i> of <i>Appendix 19A</i> . Required marine guidance has been used – see <i>Section 19A.2</i> of <i>Appendix 19A</i> . Traffic surveys are detailed in <i>Sections 19A.7</i> and <i>19B.7</i> of <i>Appendices 19A</i> and <i>19B</i> respectively. Mitigations are detailed in <i>Section 19.10</i>
Scottish Canoe Association (Scoping Opinion)	Given the distance out to sea, this is not an area where sea kayakers would venture into. The Wind Farm 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.	Noted. See Metocean Data in <i>Section 19A.11</i> of <i>Appendix 19A</i> and <i>Chapter 10: Metocean & Coastal Processes</i>

Consultee	Scoping/Consultation Response	Project Response
Forth Ports Ltd (June 2012)	<p>Forth Ports expressed no concerns with the cable passing to the north or the south of the designated anchorage berths within the Firth of Forth.</p> <p>Emergency anchoring should be considered but this is not a concern if the cable is protected or buried.</p> <p>No concerns were raised over the inshore (towards the shore line in shallow waters) Offshore Export Cable Corridor option.</p> <p>Any disruption to port operations during installation should be discussed with Forth Ports prior to operations being carried out.</p>	<p>Offshore Export Cable Corridor amended to avoid passing north of anchorage circles following consultations.</p> <p>Anchoring has been considered within <i>Appendix 19A</i>.</p> <p>Noted.</p> <p>ICOL will discuss with Forth Ports prior to operations being carried out.</p>
Montrose Port (September 2012)	<p>Following consultation with NLB, consultation was sought to identify any hazardous traffic movements within the area.</p> <p>Montrose confirmed that no gas carriers visit the port and the only vessel carrying large hazardous liquids was the <i>Big Orange</i>, a well stimulation vessel.</p> <p>Montrose port expressed no concerns over the project.</p>	<p>Noted.</p>
NLB (October 2012)	<p>No concerns were raised on (Wind Turbine Generator (WTG) selection for the Development Area. A decommissioning plan will have to consider the removal of large gravity base foundations if used.</p> <p>Extreme peripheral structures should be avoided. The eastern most tip of the Development Area should aid navigational safety.</p> <p>NLB is content with the cumulative assessment for the area. The 5 nm gap between Firth of Forth Phase 1 (Alpha and Bravo) and the Development Area is a suitable distance for safe navigation.</p> <p>Lighting and marking will be defined once a final WTG layout has been decided.</p> <p>Buoyage will be considered for construction but is unlikely for operation.</p>	<p>The NRA has been undertaken based on an indicative worst case layout using the information that was available at the time.</p> <p>Further consultation will be undertaken following consent and design of layout.</p> <p>Noted.</p> <p>Noted.</p> <p>Noted.</p>
Chamber of Shipping (October 2012)	<p>Concerns were raised over the way that cumulative assessments would be undertaken. It was confirmed that Firth of Forth Phase 1 (Alpha and Bravo), Neart na Gaoithe and Inch Cape will be considered within the NRA.</p>	<p>Noted, NRA has been undertaken using known project information only; cumulative assessment considers Inch Cape, Neart na Gaoithe and Firth of Forth Phase 1 (Alpha and Bravo) Wind Farms.</p>

Consultee	Scoping/Consultation Response	Project Response
	<p>The CoS would like to see the eastern boundary flattened or sloped to reduce the area sterilised by the Development Area (to the north of the foot). If this is not possible, then other mitigations should be considered.</p> <p>It is preferential to leave a navigable gap between Firth of Forth Phase 1 and Development Area for deviations.</p>	<p>It is not possible to flatten the eastern boundary without adversely affecting the whole Development Area. Additional navigation aids may be considered if required.</p> <p>Noted.</p>
MCA (October 2012)	<p>MCA confirmed that blade clearance would remain at 22 metres above Mean High Water Springs (MHWS) but encourages developers to achieve Highest Astronomical Tide (HAT) where possible.</p> <p>MCA stated that mixed arrays could cause visual confusion for the mariner.</p> <p>MCA raised the issue which recently occurred where the method of cable protection used on an export cable significantly reduced water depths.</p>	<p>NRA has been undertaken as per MGN 371.</p> <p>Noted, NRA has been undertaken using known project information only; cumulative assessment considers Inch Cape, Neart na Gaoithe and Firth of Forth Phase 1 – Alpha and Bravo.</p> <p>See <i>Section 19.10</i> for mitigations. Inch Cape confirmed that navigational safety would be considered when considering burial and/or protection methods to avoid this situation.</p>
MCA (October 2012)	<p>MCA noted that traffic levels in the area were low, when compared to other areas around the UK.</p> <p>MCA considered a realistic cumulative scenario to assess Neart na Gaoithe, Inch Cape and Firth of Forth Phase 1 (Alpha and Bravo) within the NRA. MCA confirmed that they were comfortable with this scenario being assessed and agreed it was unrealistic to consider developments that hadn't yet been defined within Forth Round 3 Zone 2.</p> <p>Overall the MCA had no issues with the cumulative scenario assessed (Forth Phase 1 Alpha and Bravo, Neart na Gaoithe and Inch Cape).</p> <p>MCA noted that management of local issues was important.</p>	<p>Noted</p> <p>See <i>Section 19.7</i> for cumulative impact assessment.</p> <p>Cumulative scenarios are discussed in <i>Section 19.7</i>.</p> <p>Noted.</p>
RYA Scotland (SYRA) (October 2012)	<p>RYA (SYRA) considered it a realistic cumulative scenario to assess Neart na Gaoithe, Inch Cape and Firth of Forth Phase 1 (Alpha and Bravo) only within NRA. They also considered that it did not present any significant issues for recreational craft. SRYA noted that the main recreational route likely to pass through the area was vessels transiting to and from the Caledonian Canal via Peterhead and Blyth.</p>	<p>Noted, NRA has been undertaken using available information from neighbouring project developers; cumulative assessment considers Inch Cape, Neart na Gaoithe and Firth of Forth Phase One – Alpha and Bravo.</p>

Consultee	Scoping/Consultation Response	Project Response
	SRYA 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.	

- 8 Consultation on navigational issues was also undertaken as part of the FTOWDG regional work.
- 9 Consultations undertaken as part of the FTOWDG are detailed within *Section 19A.14.2 of Appendix 19A*.
- 10 The information received through this consultation, together with the formal Scoping Opinion and recognised best practice, has informed the methodology and scope for the assessment of the impacts on shipping, navigation and safety presented in the NRAs and summarised in this chapter.

19.3 Design Envelope and Embedded Mitigation

19.3.1 Design Envelope

- 11 The potential development parameters and scenarios are defined as a Design Envelope and presented in *Chapter 7: Description of Development*. The assessment of potential impacts on shipping, navigation and safety is based upon the ‘worst case scenario’ as identified from the Design Envelope, and is specific to the potential impacts assessed in this chapter.
- 12 Key parameters for the worst case scenario, within the Development Area, for each potential impact are detailed in Table 19.2 below. For this assessment these include consideration of the installation of the maximum number of WTGs with the largest jacket foundation (i.e. maximum loss of navigable sea area). This is based on the assumption that there will be increased potential for collisions when there are more and larger structures in place. The effects of the met masts and the OSPs (in indicative locations on the periphery of the Development Area where they are most exposed) have also been modelled. The worst case position of WTGs and the other structures considered in the assessment is presented in Figure 19.1.
- 13 In addition to the single met mast modelled it is noted that up to two additional met masts could be installed within the Development Area. The location of these potential additional met masts will be confirmed when a final Wind Farm layout has been defined. For the purposes of this assessment they have been considered since they would interchange with a WTG in any assessed location shown in Figure 19.1.
- 14 For the Offshore Export Cable Corridor, the worst case scenario (Table 19.3) assumes that up to six cables will run over a distance of approximately 83 km between the Development Area

and the cable landfall options. The Export Cables will either be buried to a depth of up to three metres (target depth one metre) or protected where they cannot be buried. For the purposes of assessment it has been assumed that some portions of cable may become exposed over time and represent a snagging risk for vessels' anchors and fishing gear.

Table 19.2: Worst Case Scenario - Development Area

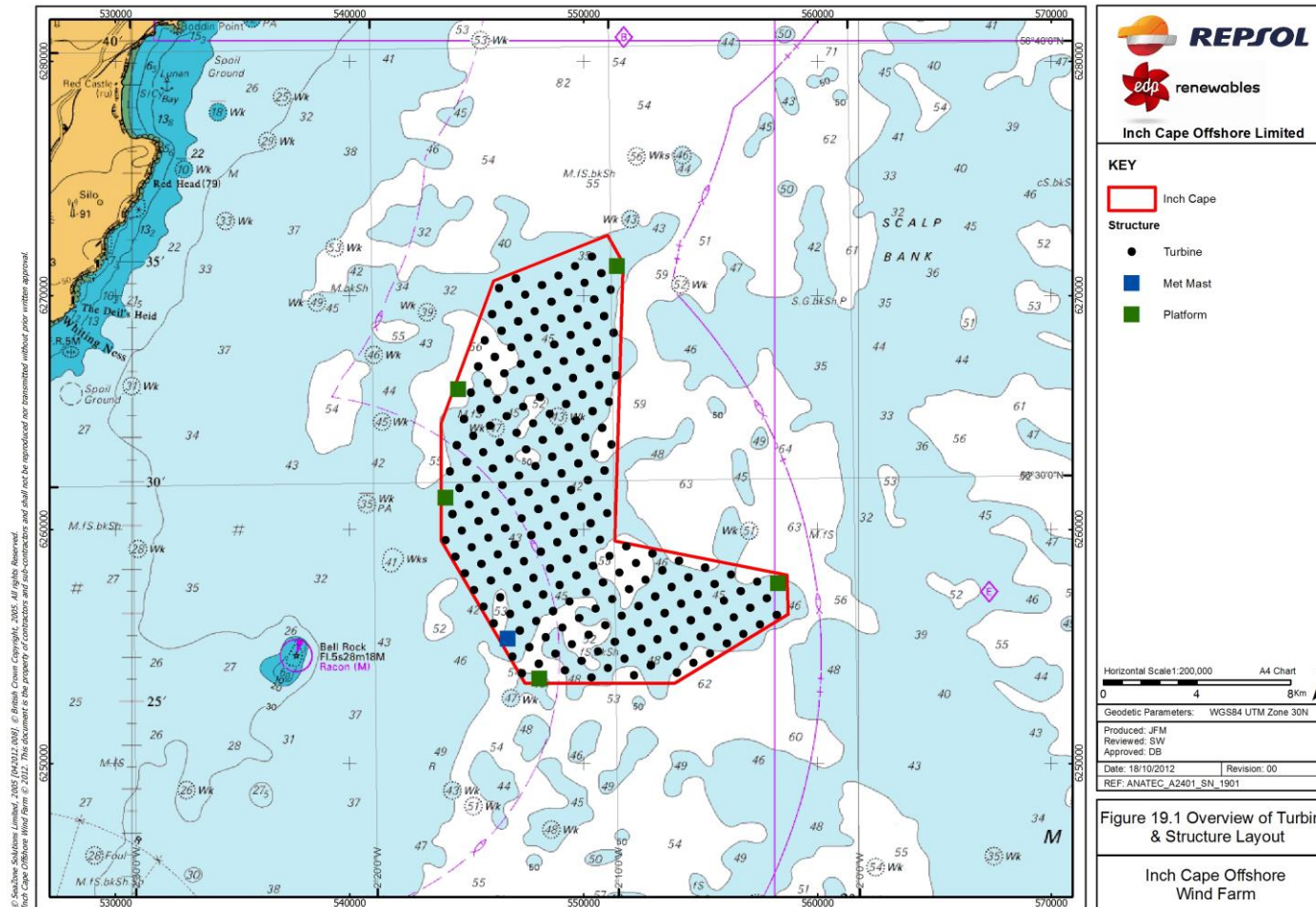
Potential Impact	Design Envelope Scenario Assessed
Construction (and Decommissioning)	
Construction activities in the Development Area may affect existing marine transit routes, resulting in deviation and increasing journey times.	There will be increased transit times and distances when vessels are required to deviate from their main routes to avoid construction works.
Presence of construction vessels and the displacement of existing vessel transit routes may adversely increase encounters and therefore lead to increased vessel to vessel collision risk.	For vessels on these routes there will be an increased vessel to vessel collision risk during construction works due to the increased number of vessels (jack-ups, barges, motherships and transfer vessels) working within the Development Area and associated with the installation of Inch Cape Structures. Vessels could be required to deviate from their main routes to avoid construction works which could lead to an increased number of vessels on these routes.
Presence of partially constructed Inch Cape Structures in previously open sea areas may adversely create vessel to structure collision risk.	Partially constructed WTGs not marked or mitigated against collision for extended periods i.e. not marked with navigational aids.
Commercial fishing vessel gear snagging and/or collision due to the presence of partially constructed structures in the Development Area.	Partially constructed WTGs not marked or mitigated against collision for extended periods i.e. not marked with navigational aids which may cause additional gear interaction with the Inch Cape Structures, including increased snagging risk for commercial fishing.
Increased vessel to vessel collision risk on recreational vessels.	Increased number of vessels working within the Development Area and associated with the installation of Inch Cape Structures. This includes both collision with the construction vessel and collision with another recreational vessel. The displacement of commercial vessels and commercial fishing vessels into areas transited by recreational vessels could further increase this risk.
Creation of vessel to Inch Cape Structure collision risk on Recreational Vessels	Partially constructed WTGs not marked or mitigated against collision for extended periods i.e. not marked with navigational aids. These effects are increased during periods of bad weather, particularly when visibility is reduced by fog.
Operation	
Physical presence of Inch Cape Structures may displace commercial shipping, fishing vessels and recreational vessels leading to increased deviations and effects on vessel transit time.	There will be increased transit times and distances when vessels are required to deviate from their main routes due to the physical presence of Inch Cape Structures.

Potential Impact	Design Envelope Scenario Assessed
<p>Physical presence of Inch Cape Structures may displace commercial shipping, fishing vessels and recreational vessels leading to an increase in encounters and therefore vessel to vessel collision risk.</p>	<p>The following presents the largest area and maximum geometric factor for collision risk and creating the maximum number of routes to encounter another vessel or structure including vessels not under command:</p> <ul style="list-style-type: none"> • 213 WTGs with irregular layout • Micro sitting +/- 50 m • Closest Average Downwind Spacing of 820 m • Closest Average Crosswind Spacing of 820 m • Jacket Foundation for WTGs and met mast: <ul style="list-style-type: none"> ○ 30 m x 30 m dimension at sea level for WTGs and met mast. ○ 100 m x 100 m dimension at sea level for OSPs • Minimum air draft of WTGs – 22 m above HAT • Minimum Under Keel Clearance of Inch Cape Structures - four metres below HAT
<p>Physical presence of Inch Cape Structures may cause an additional vessel to structure collision risk for commercial shipping, fishing vessels and recreational vessels and wind farm operators.</p>	
<p>Physical presence of Inch Cape Structures may cause adverse interference with Marine Radar Systems.</p>	
<p>Implications on the response capability of emergency responders.</p>	<p>The presence of the Inch Cape Structures has the potential to increase the need for emergency response activities and restrict access to casualties within the Development Area. However, Inch Cape Structures may also aid emergency response by providing a place of refuge and a point of reference.</p>
<p>Physical presence of inter array cables may cause additional anchor snagging risk for commercial vessels and commercial fishing vessels.</p>	<p>The main effect will be for those vessels anchoring in close proximity to the cable, or those required to do so in an emergency situation, such as machinery failure. The following presents the worst case scenarios involving the Development Area:</p> <ul style="list-style-type: none"> • Burial of 0 m with cable protection • Inter-array cabling length – 353 km • Longest installation period, simultaneous operation and over maximum area.

Table 19.3: Worst Case Scenario - Offshore Export Cable Corridor

Potential Impact	Design Envelope Scenario Assessed
Installation	
Presence of installation vessels and the displacement of existing vessel transit routes may adversely increase encounters and therefore lead to increased vessel to vessel collision risk.	For vessels on these routes there will be an increased vessel to vessel collision risk due to the increased number of installation vessels.
Commercial fishing vessel gear snagging on structures or Offshore Export Cables.	Fishing vessels could potentially snag their gear on partially installed or not yet buried Offshore Export Cables, leading to damage to the vessel and the cable.
Operation	
Physical presence of Offshore Export Cables may cause additional anchor snagging risk for commercial vessels and commercial fishing vessels.	<p>The main effect will be for those vessels anchoring in close proximity to the Offshore Export Cables, or those required to do so in an emergency situation, such as machinery failure. The following presents the worst case scenarios involving the Offshore Export Cables:</p> <ul style="list-style-type: none"> • Burial of 0 m with cable protection • Offshore Export Cabling length – Up to 6 x 83 km • Longest installation period, simultaneous operation and over maximum area.
Physical presence of Offshore Export Cables may cause electromagnetic interference for vessels using magnetic compasses.	Compass deviations are greatest in water depths less than five metres and where the cable is not buried. DC cables have been assessed.

Figure 19.1: Worst Case Inch Cape Structures Layout



19.3.2 Embedded Mitigation Measures

15 The assessment of effects on shipping, navigation and safety has taken account of the following Embedded Mitigation measures:

- WTGs will be designed in accordance with Marine Guidance Note (MGN) 371 (MCA, 2008a) and procedures put in place for generator shut down and other operational requirements in emergency situations to reduce impacts on Search and Rescue (SAR) provision.
- Safety and Exclusion Zones are described in *Section 7.13*. For the purposes of this assessment it has been assumed that a 500 m 'rolling' safety / exclusion zone around working areas during construction, decommissioning and major maintenance activities to exclude vessels not associated with the works, will be enforced. Consultation will be undertaken with relevant stakeholders to ensure effective implementation and management of safety / exclusion zones.
- The Inch Cape Structures will be marked on relevant United Kingdom Hydrographic Office (UKHO) admiralty charts. The Offshore Export Cable will also be charted, although whether the inter-array cables are shown will depend on the scale of the chart.
- Inch Cape Structures will be marked and lit in accordance with International Association of Lighthouse Authorities (IALA) Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA, 2008). The final lighting and marking scheme will be agreed with the relevant stakeholders prior to construction.
- WTGs will be designed and constructed to ensure that the minimum rotor blade clearance is at least 22 m above HAT.
- An Emergency Response Co-operation Plan (ERCoP) will be established for the Project and put in place for the construction, operation and decommissioning stages. The ERCoP will be based on the MCA template and prepared in consultation with the MCA Search and Rescue and Navigation Safety Branches.
- Cables will be suitably buried or will be protected by other means when burial is not practicable. This will reduce the risk of snagging, and will reduce the potential for impacts relating to Electro Magnetic Fields (EMF). Consultation will be undertaken with appropriate stakeholders to ensure minimum draft requirements are considered. These measures would be delivered as part of the Project (*see Appendix 7A: Draft Environmental Management Plan*).

19.4 Assessment Methodology

19.4.1 Methodology

16 The marine traffic surveys, desk-based research and consultation undertaken as part of the baseline assessment allowed for the identification of higher risk areas. As part of the Navigational Risk Assessment process a Formal Safety Assessment (FSA) was carried out in line with the International Maritime Organisation (IMO) FSA Process (IMO, 2002) and

DTI/DfT/MCA guidance (DTI/DfT/MCA, 2005). The FSA process is described in more detail and illustrated in *Appendix 19A*.

- 17 The impact assessment in this chapter assesses the following sections of the formal safety assessment process undertaken as part of the NRA:
- Hazard log and risk ranking (see ‘Hazard Workshop’ section below);
 - Quantified navigational risk assessment for selected hazards;
 - Base case and future case risk levels assessed for selected hazards;
 - Emergency response review; and
 - Assessment of mitigation measures.
- 18 The main part of the impact assessment covers the potential effects to commercial vessels, fishing vessels and recreational vessels from the construction/installation and presence of Inch Cape Structures within the Development Area and the Offshore Export Cable. The effects on emergency response, marine radar systems and navigational equipment are assessed for the operational phase only.

Hazard Workshop

- 19 As part of the NRA, a hazard workshop was held in September 2012 with maritime stakeholders to gain local knowledge and expert opinion and create a project-specific hazard log (*Annex 19A.3*).
- 20 Of the hazards discussed at the workshop; nineteen, for the most likely outcome, were broadly acceptable and nine were in the tolerable region. When the worst case consequences were assessed, all twenty eight of the risks were in the tolerable region. No risks were assessed as being unacceptable. The definitions of broadly acceptable, tolerable and unacceptable are as follows:
- Broadly Acceptable: Risk acceptable with no additional mitigation measures or monitoring required above industry standard risk reduction measures.
 - Tolerable: Risk acceptable with suitable and sufficient mitigation measures and monitoring in place.
 - Unacceptable: Risk mitigation or design modification required.
- 21 The outcomes of the hazard workshop were fed into the FSA process to identify the effects associated with the Project.

Environmental Impact Assessment

- 22 The NRA and FSA process have been used to inform the EIA. This assessment considered effects on shipping and navigation, considering the nature, duration, magnitude and significance of effects arising from the Wind Farm and OfTW during both construction and operational phases. The definitions of sensitivity and magnitude are described below. The methodology has been made specific for shipping and navigation receptors where required.

Sensitivity

- 23 A shipping and navigation receptor can only be sensitive if there is a pathway through which an effect can be transmitted between the source activity and the receptor. When a receptor is exposed to an effect, the overall sensitivity of the receptor is determined and the process incorporates a degree of subjectivity. Sensitivity assessments for shipping and navigation receptors used the following baseline data, in line with expert opinion, to assess:
- Outputs of the hazard workshop;
 - Level of stakeholder concern;
 - Time and/or distance of deviation;
 - Number of transits of specific vessel and/or vessel type; and
 - Lessons learnt from existing offshore wind developments.
- 24 Table 19.4 gives the definitions of sensitivity used in this chapter.

Table 19.4: Sensitivity Definitions

Sensitivity	Definition
Low	Limited impacts through the operational life or minor temporary effects on tolerance, but not resulting in damage to vessels or injury to personnel; Limited commercial effects; and Ability to adapt to majority or all of new effects.
Moderate	Present through the operational life or temporary effects on tolerance, resulting in minor damage to vessel or structure; Medium level of commercial effects potentially resulting in permanent effects on business operations; and Ability to partially adapt to new effects.
High	Present through the operational life or temporary effects on tolerance, resulting in injury or loss of life to personnel and/or damage to vessel or structure; High level of commercial effects potentially resulting in permanent effects on business operations; and Limited or very limited ability to adapt to new effects.

Magnitude

- 25 Determining the overall magnitude of shipping and navigation effects were based on expert opinion and professional judgement in combination with baseline data and assessments already undertaken in the NRA including:
- Consultation feedback from stakeholders and regular operators;
 - Outputs of the Hazard Workshop;
 - Lessons learnt or research from previous developments especially effects associated with navigation and communication, where physical modelling is not available;
 - Results of collision risk modelling in comparison with UK averages; and

- Analysis of baseline data where low confidence in data availability or clear evidence of effect (i.e. deviations) have been identified.
- 26 When assessing the magnitude of an effect, the geographical extent, the duration and the frequency of occurrence were all considered.
- 27 Table 19.5 gives the definitions of magnitude used in this chapter.

Table 19.5: Magnitude Definitions

Magnitude	Definition
Negligible	Small temporary deviation of shipping routes; Temporary effect on area of construction or limited area; Extremely unlikely probability of occurrence; and Very low degree of change from baseline conditions.
Low	Small deviation for the operational phase of the Project or large temporary deviation of shipping routes; Temporary effect on receptors in Development Area and Offshore Export Cable Corridor; Unlikely or very unlikely probability of occurrence; and Low degree of change from baseline conditions.
Moderate	Permanent deviation for the operation phase of the Project or large temporary deviation of shipping routes; Permanent effect, during the operational phase of the Project, on receptors in Development Area and Offshore Export Cable Corridor; Medium probability of occurrence; and Medium degree of change from baseline conditions.
High	Permanent deviation throughout operation phase on or large temporary deviation of shipping routes (including international); Present for the operational phase of the Project on receptors in the vicinity of Development Area and Offshore Export Cable Corridor (including wider Firth of Forth and Firth of Tay area); Likely or extremely likely probability of occurrence; and High or very high degree of change from baseline conditions.

Significance

- 28 The assessment of significance of each potential effect has been based on the sensitivity of receptors and the magnitude of effects, using the following risk matrix in Table 19.6. For the purposes of this assessment those residual positive and negative effects indicated as major and moderate/major are considered significant.

Table 19.6 Assessment Matrix

Magnitude of Impact	Sensitivity of resource/receptor		
	Low	Moderate	High
Negligible	Negligible/Minor	Minor	Minor/Moderate
Low	Minor	Minor/Moderate	Moderate
Moderate	Minor/Moderate	Moderate	Moderate/Major
High	Moderate	Moderate/Major	Major

19.4.2 Guidance and Methods

- 29 The primary guidance documents used during the assessment are listed below:
- *Maritime and Coastguard Agency (MCA) Marine Guidance Notice 371 (MGN 371 Merchant + Fishing) Offshore Renewable Energy Installations (OREIs) Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MCA, 2008a);*
 - *DTI in association with MCA and DfT Guidance on the Assessment of Offshore Wind Farms : Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms (DTI/MCA/DfT, 2005); and*
 - *Guidelines for Formal Safety Assessment (FSA) – MSC/Circ. 1023 (IMO, 2002).*
- 30 MGN 371 (MCA, 2008a) highlights issues that shall be taken into consideration when assessing the effect on navigational safety from offshore renewable energy developments within UK internal waters, territorial sea or Renewable Energy Zones (REZ).
- 31 The MCA require that the DTI/MCA/DfT methodology is used as a template for preparing navigation risk assessments. 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.
- 32 As per MCA requirements the IMO Formal Safety Assessment process (IMO, 2002) approved by the IMO in 2002 under SC/Circ.1023/MEPC/Circ392 has been applied within this assessment. This is a structured and systematic methodology based on risk analysis and cost benefit analysis (if applicable).

33 Other guidance documents used during the assessment are listed below:

- *MCA Marine Guidance Notice 372 (MGN 372 M+F) Offshore Renewable Energy Installations (OREIs) Guidance to Mariners Operating in the Vicinity of UK OREIs (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 Renewable Energy Developments (RYA, 2012)*.

19.4.3 Information Gaps and Limitations

34 The shipping and navigation baseline and impact assessment has been carried out based on the information available and responses received at the time of preparation. Limitations of modelling are covered in *Section 19A.3 of Appendix 19A*.

19.5 Baseline Environment

35 The following section gives an overview of the baseline assessment which can be found in *Appendix 19A* and *Appendix 19B*.

19.5.1 Baseline Development Area

Data Sources

36 Two Automatic Identification System (AIS) and Radar marine traffic surveys (vessel based) were undertaken in waters in and around the Development Area to identify vessel activity. The data collection included both summer and winter to take account of seasonal patterns in marine traffic. Ten days data were collected from the *Gargano* survey vessel between 26 February and 6 March 2012 and 18 days data were collected from the *Shamariah* survey vessel between 23 July and 11 August 2012, giving a combined data set of 28 days. The tracks of the survey vessels during these periods are presented in Figure 19.2. These tracks, and all others in proceeding figures, are presented with a 10 nm buffer around the Development Area which provides a sufficient distance within which to capture shipping movements and navigational features in the area.

37 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. 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 under European Union (EU) Directive 2009/17/EC.

38 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 type and size information. A proportion of smaller vessels also carry AIS voluntarily.

39 In addition to the marine traffic data collected during the vessel surveys within the Development Area, the following data sources were also used to inform the description of the baseline environment:

- Fishing Vessel Sightings Data (2005-2009) and Satellite Data (2009) shown as density grids;
- Maritime Incident Data (Marine Accident Investigation Branch (MAIB) 2001-2010 and Royal National Lifeboat Institution (RNLI) 2001-2010);
- UK Coastal Atlas of Recreational Boating, 2009 and 2010 GIS Shape Files (RYA, 2010);
- UK Admiralty Charts 1407-0 and 734-0; and
- Admiralty Sailing Directions – North Sea (West) Pilot, NP 54 (UKHO, 2009).

40 Further information on data sources can be found in *Section 19A.5 in Appendix 19A* and *Section 19B.1.4 in Appendix 19B*.

Navigational Features

41 An overview of the main navigational features in proximity to the Development Area is presented in Figure 19.3.

Figure 19.2: Survey Vessel Tracks (28 Days)

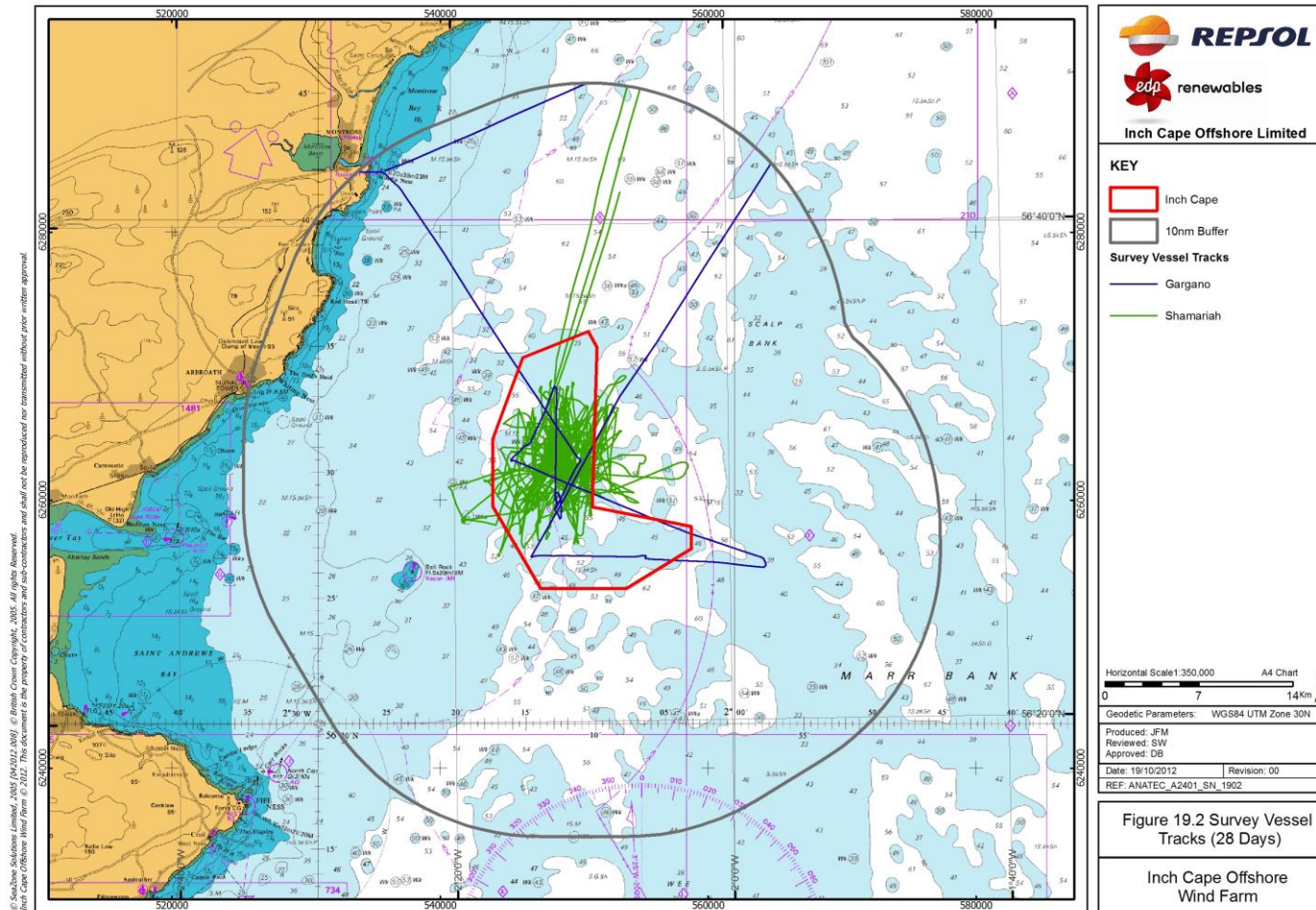
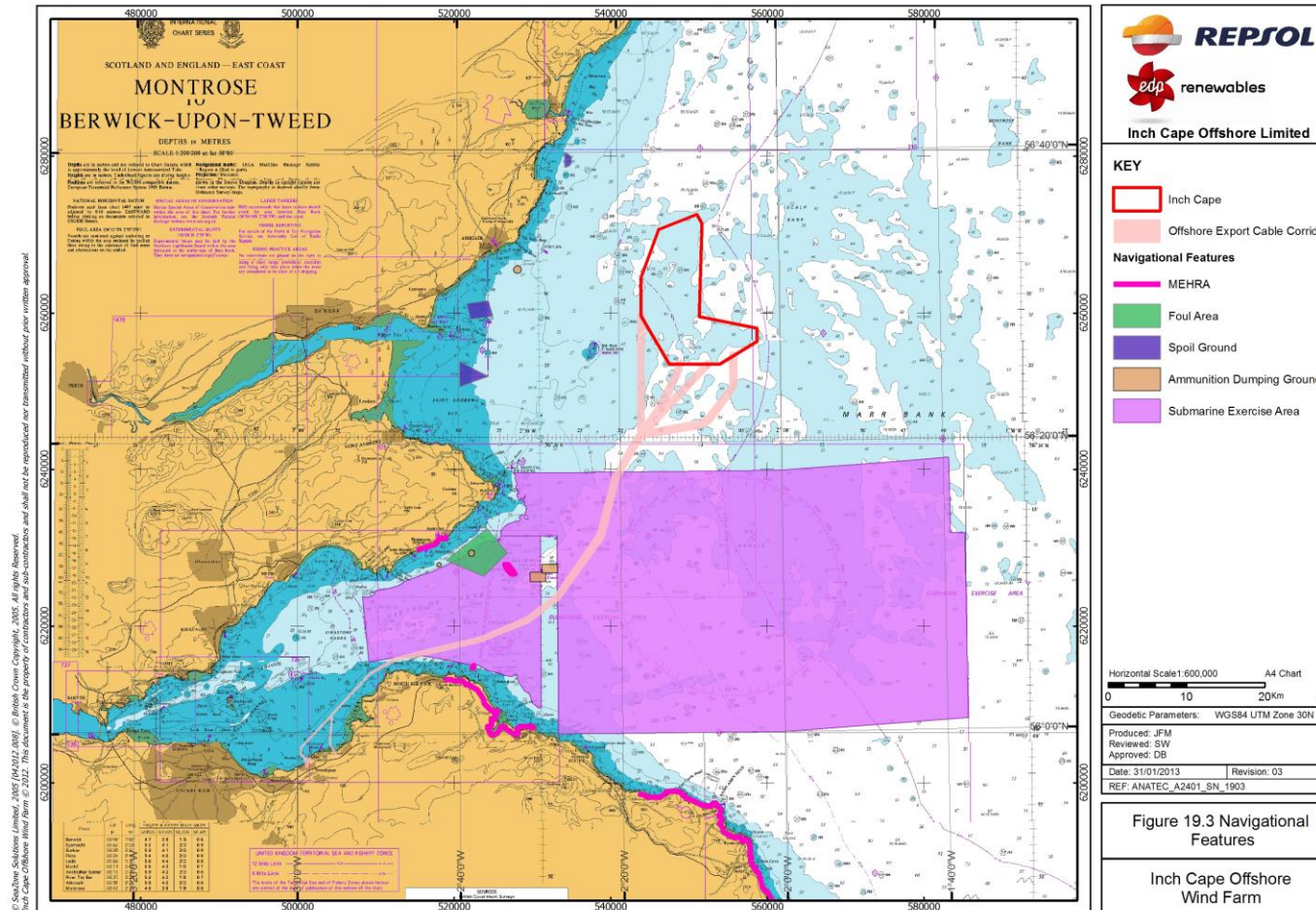


Figure 19.3: Navigational Features in Proximity to Development Area



- 42 The main navigational feature in the area is the Racon (Radar beacon which transmits a visible icon on a radar screen to notify the user of a navigational hazard) transmitting Morse letter 'M' (- -) located on Bell Rock (see *Figure 19A.6, Appendix 19A*), approximately four nautical miles from the Development Area. The light on Bell Rock is a flashing light every five seconds, at a height of 28 m above height datum with a luminous range of 18 nm.
- 43 There are four charted spoil grounds located approximately nine nautical miles west of the Development Area, towards the coast. There is a foul area 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 sea bed. There are two disused dumping grounds for ammunition and boom defence gear to the east of the Isle of May, approximately 16 nm south-west of the Development Area.
- 44 There is a submarine exercise area approximately seven nautical miles south of the Development Area.
- 45 There are no oil and gas surface platforms or licensed aggregate dredging sites in proximity to the Development Area.
- 46 Marine Environmental High Risk Areas (MEHRAs) are located within 18 nm of the Development Area along the cliffs of the Isle of May and at Anstruther. Both MEHRAs have been designated on wildlife, landscape and geological grounds. Further information can be found in *Section 19A.10.8 of Appendix 19A*. An additional MEHRA has been identified which is relevant for the Offshore Export Cable Corridor (*Section 19.5.2*)
- 47 Other navigational features scoped out of the EIA assessment process can be found in *Sections 19A.11 of Appendix 19A and Section 19B.5.1 of Appendix 19B*.

Commercial Shipping

- 48 Figure 19.4 presents vessel tracks recorded on AIS during the combined 28 day survey period, colour-coded by vessel type. Temporary traffic has been excluded from Figure 19.4 and the subsequent analysis. This includes tracks of the *Gargano* and the *Shamariah* and other research/survey vessels operating in the area at the time.
- 49 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 was an average of approximately six vessels per day.
- 50 The majority of tracks recorded 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. The 'other' ships category mainly comprised offshore support and supply vessels which passed through the Development Area and 10 nm buffer during the surveys. The remainder of traffic was made up of tugs, passenger vessels, recreational craft and dredgers.

- 51 The AIS data presented above have been assessed and vessels transiting at similar headings and locations have been identified as a route. Nine main routes have been identified as transiting the Development Area and within a 10 nm buffer and are presented in Figure 19.5. Details of the routes are provided in Table 19.7.

- 52 Full details of the marine traffic surveys can be found in *Section 19A.15 of Appendix 19A* and *Section 19B.7 of Appendix 19B*.

Figure 19.4: AIS Data Excluding Temporary Traffic (28 Day Survey Period)

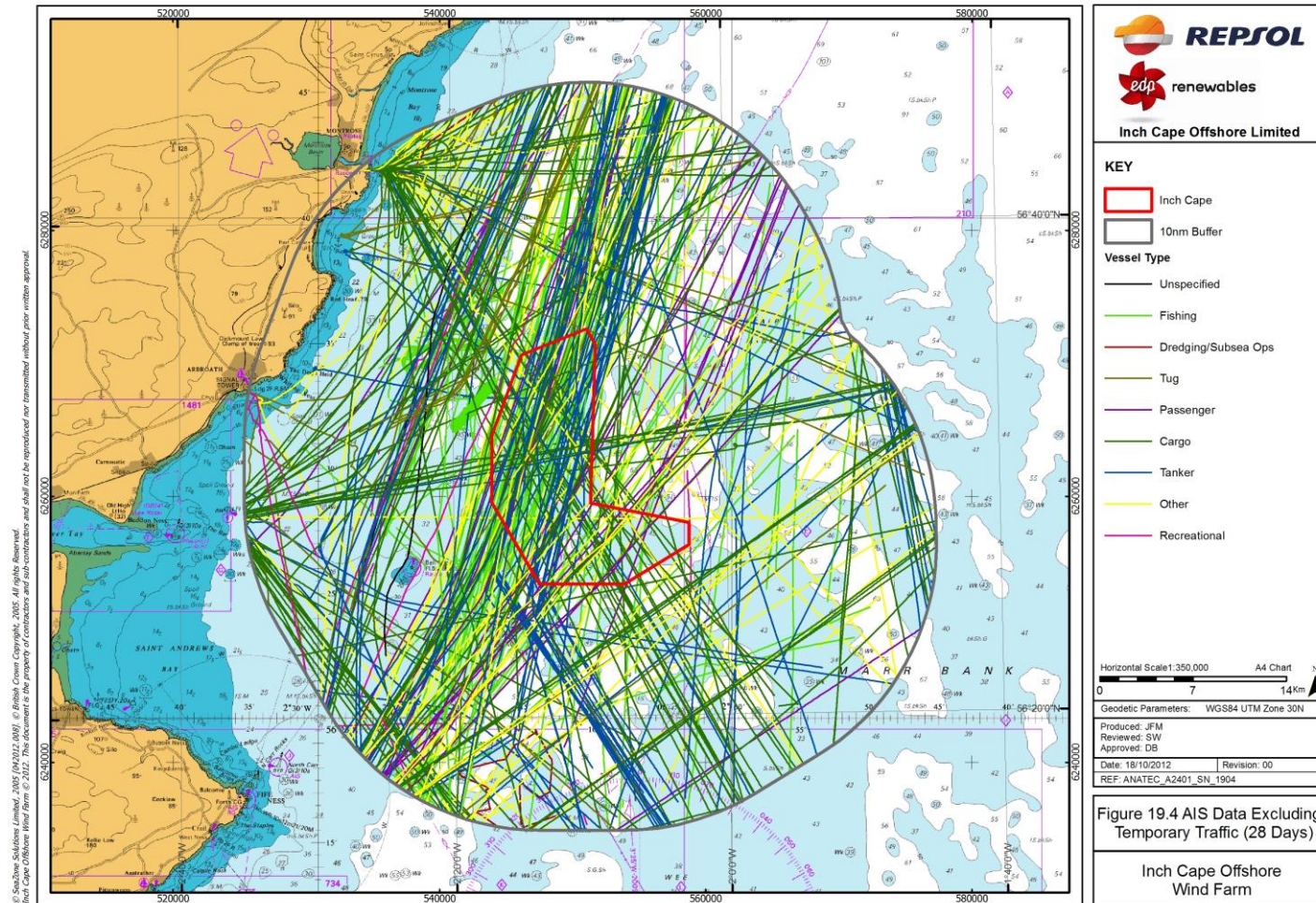
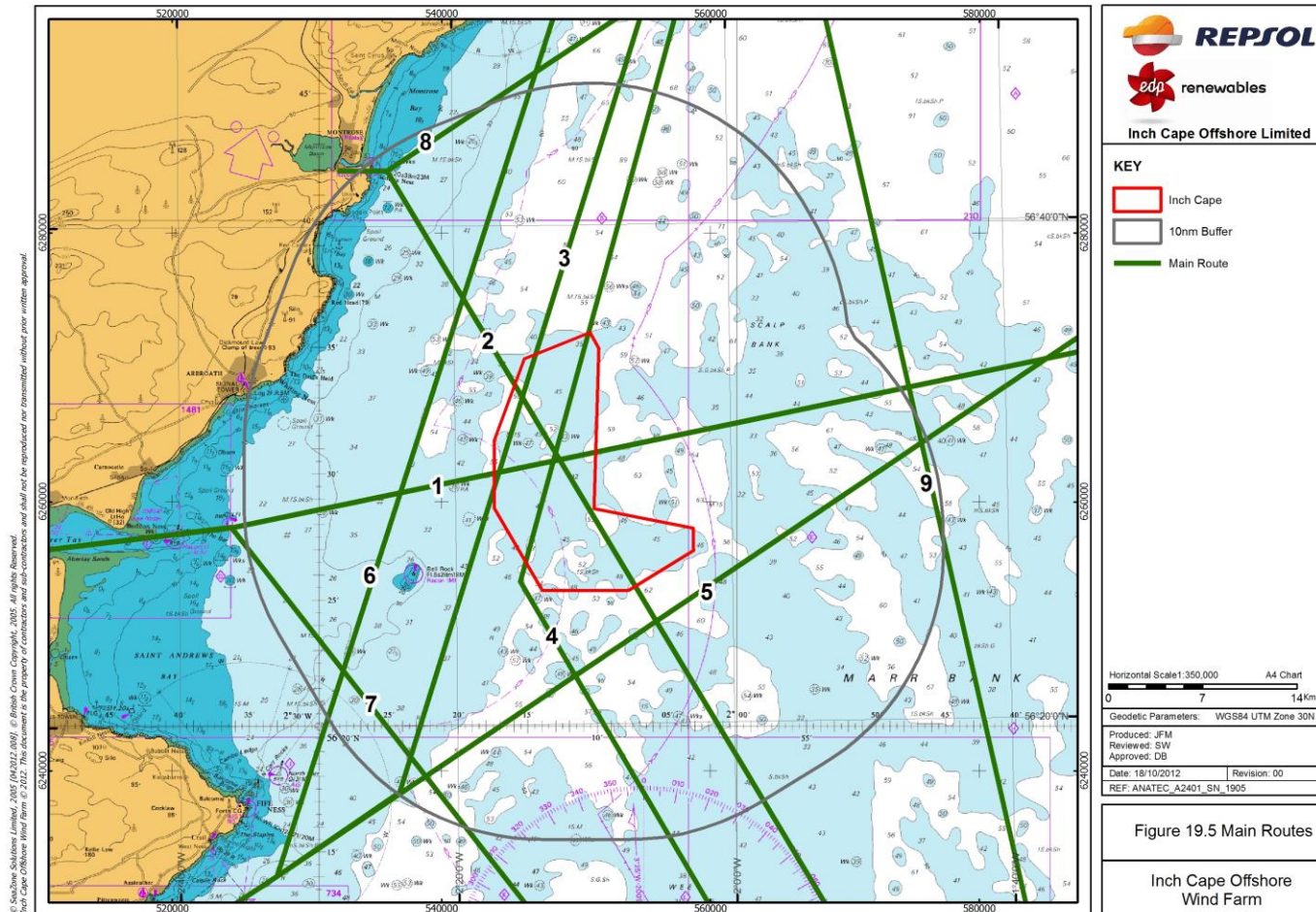


Figure 19.5: Main Commercial Shipping Routes



53 Table 19.7 details the baseline main routes identified for the Development Area, further information is provided in *Section 19A.15.6 of Appendix 19A* with future case routes shown in *Section 19A.16 of Appendix 19A*.

Table 19.7: Description of Main Commercial Shipping 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 Tankers
4	Immingham to Northern Scotland	1 vessel every 2 days	Tankers
5	Forth to Ports in Northern Europe	1 vessel every 4 days	Various
6	Forth to Northern UK Coastal Routes	1 vessel every 2 days	Various
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	Various
9	Aberdeen to Immingham	1 vessel every 3 days	Tankers

54 The vessel tracks recorded on Radar during the marine traffic surveys are presented in Figure 19.6.

55 It can be observed that the majority of vessels recorded on Radar which could be specified were fishing vessels or recreational vessels. More detail can be found in *Section 19A.15.3 of Appendix 19A*.

Fishing Vessels

56 This section reviews the fishing vessel activity in the vicinity of the Development Area.

57 Figure 19.7 presents fishing vessels recorded on AIS and Radar within the 10 nm buffer for the combined 28 day survey period.

Figure 19.6: Radar Data (28 Day Survey Period)

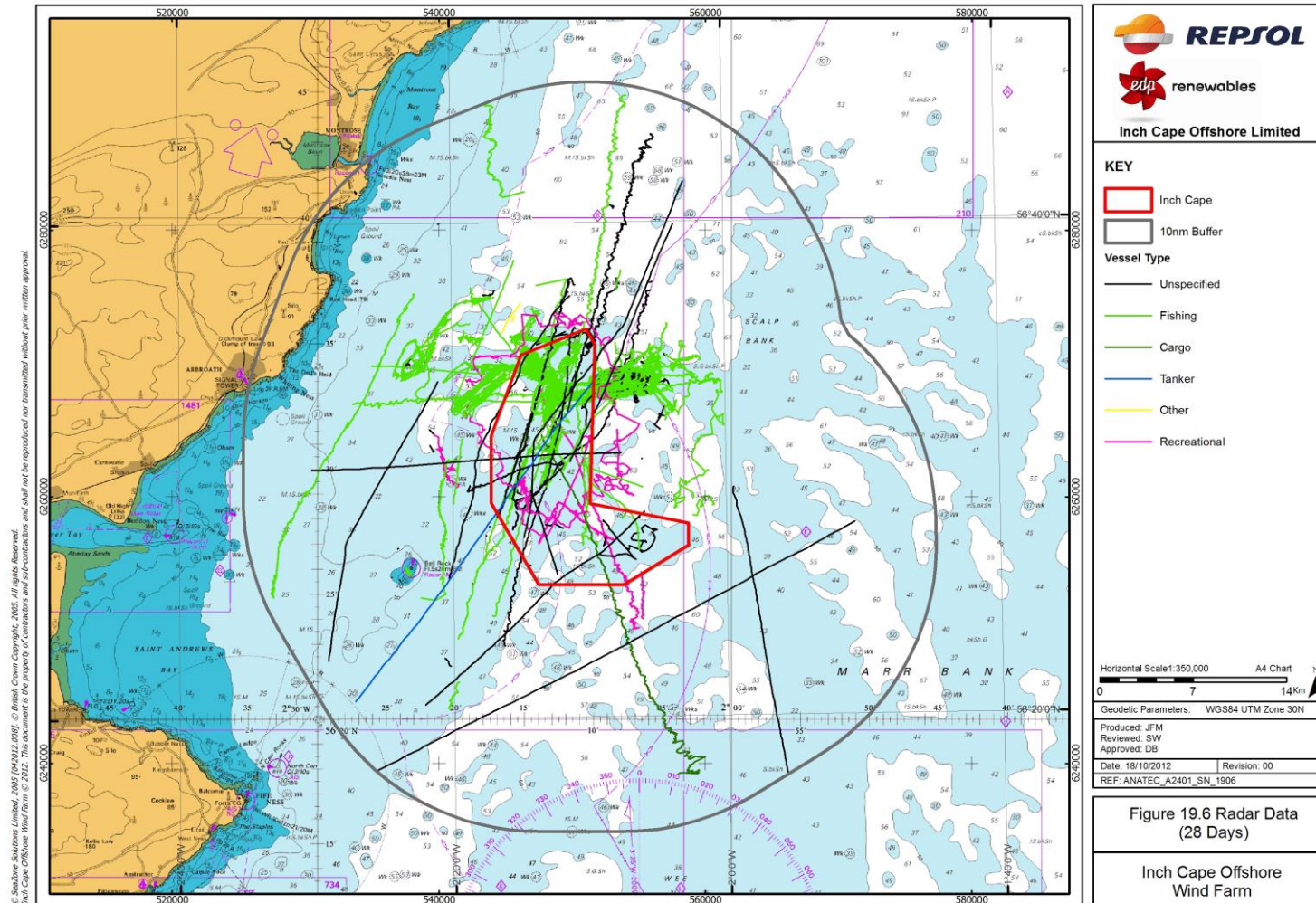
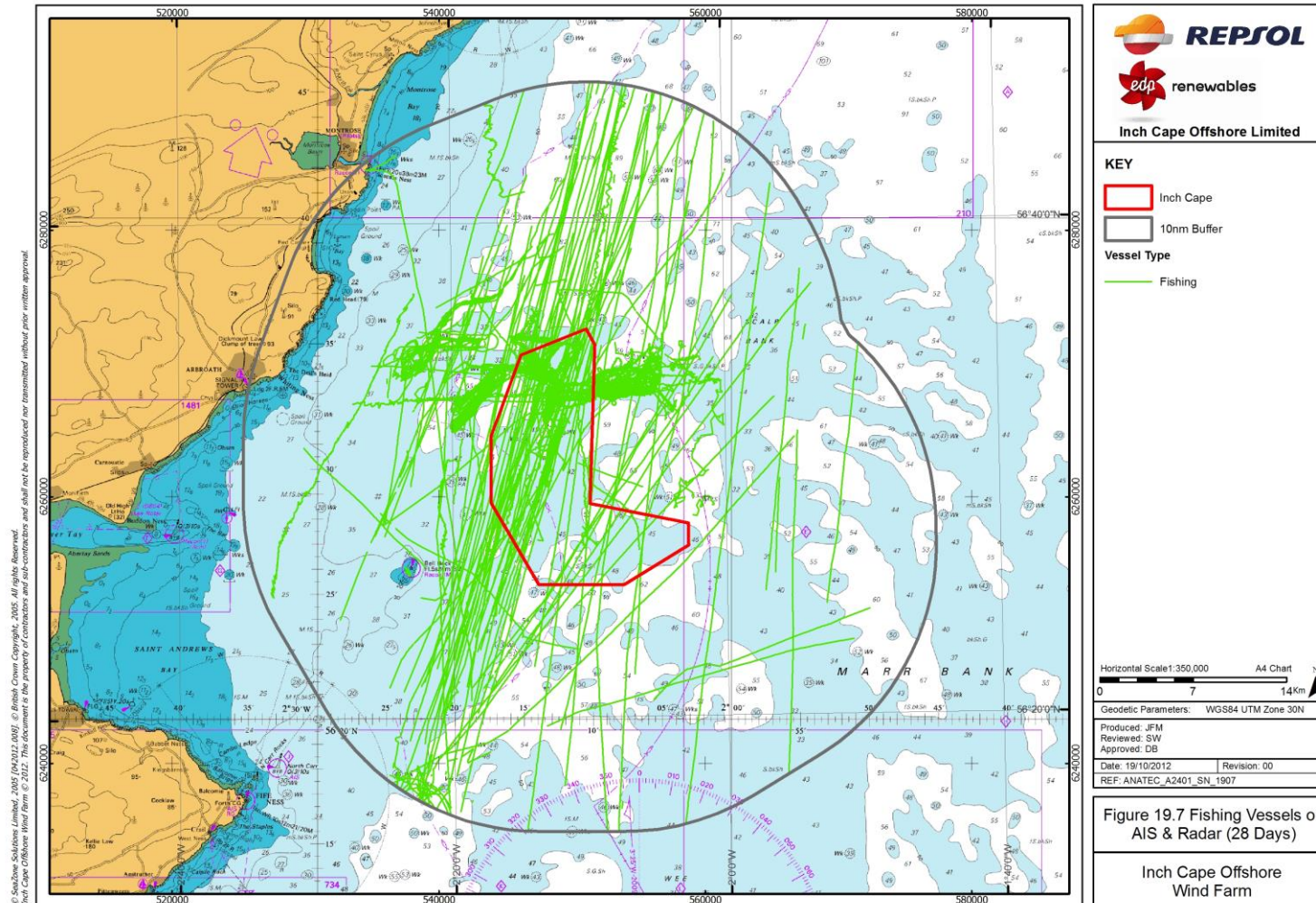


Figure 19.7: Fishing Vessels Recorded on AIS and Radar (28 Day Survey Period)

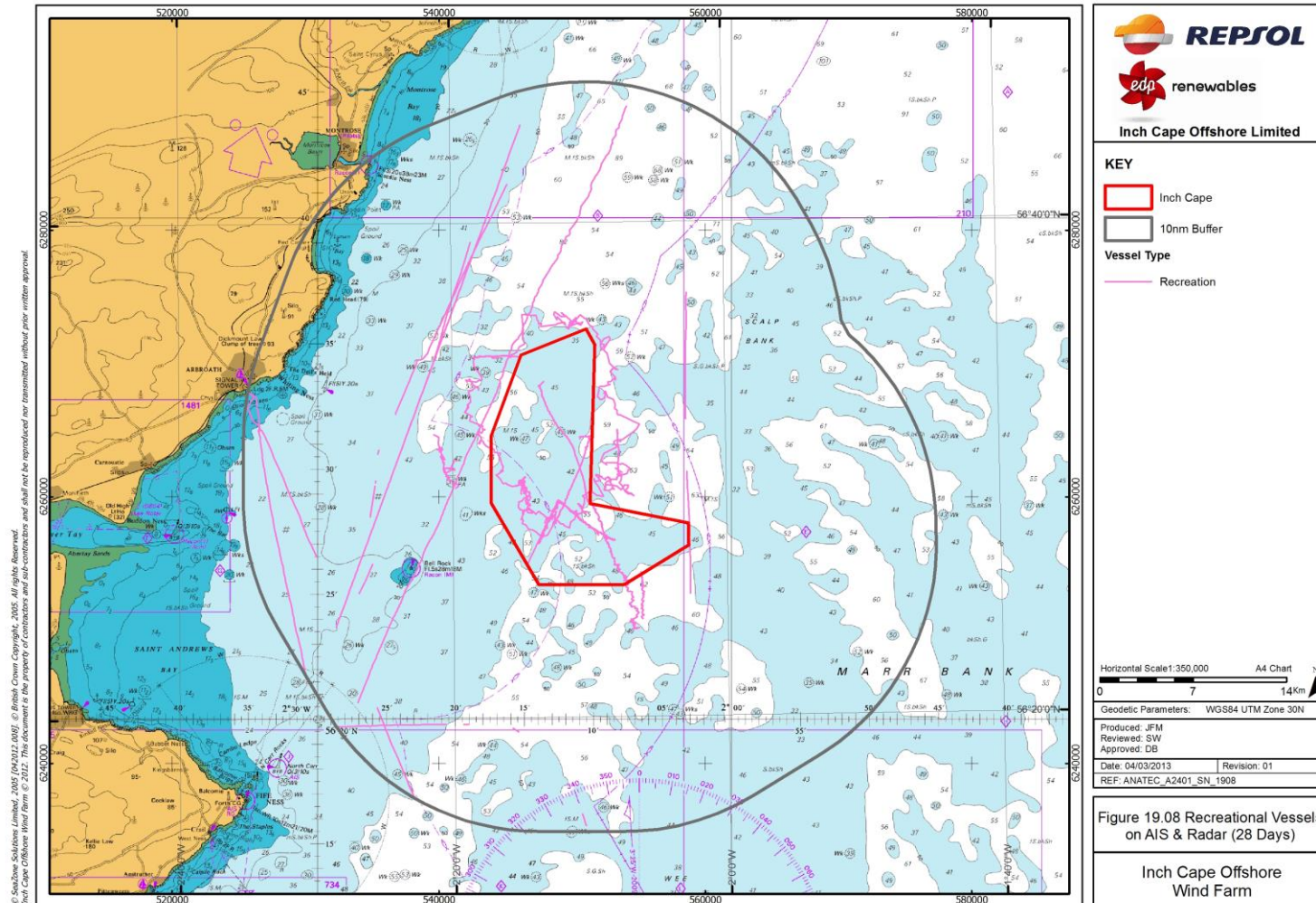


- 58 There was an average of four fishing vessels recorded per day within the 10 nm buffer. The number of fishing vessels was higher in the July/August 2012 survey data compared to the February/March 2012 survey data. It can be seen that the majority of fishing activity was to the north of the Development Area with vessels also recorded as transiting in a north-south direction through the Development Area. Fishing vessel sightings data (2005-2009) and fishing vessel satellite data (2009) have been converted to density plots.
- 59 Further information on commercial fishing can be found in *Section 19A.15.8 of Appendix 19A* as well as *Chapter 18*.

Recreational Vessels

- 60 This section reviews recreational vessel activity at the Development Area.
- 61 Figure 19.8 presents recreational vessels recorded on AIS and Radar within the 10 nm buffer for the combined 28 day survey period.
- 62 On average, one recreational vessel was recorded every two days during the marine traffic surveys with a greater number being recorded in July/August 2012 compared to February/March 2012. It can be seen that recreational vessels were recorded transiting past and/or within the Development Area.
- 63 An overview of the recreational activity and facilities in the east of Scotland and in the vicinity of the Development Area can be found in *Section 19A.15.17 of Appendix 19A*.

Figure 19.8: Recreational Vessels Recorded on AIS and Radar (28 Day Survey Period)



Emergency Response – Search and Rescue (SAR) Helicopters

- 64 This section gives an overview of the emergency rescue and incident reporting within the Development area, more information including figures can be found in *Sections 19A.12 and 19A.13 of Appendix 19A*.
- 65 A review of the SAR helicopter bases in the vicinity of the Development Area revealed that the closest SAR helicopter bases are located at Boulmer and Lossiemouth, both of which are operated by the Royal Air Force (RAF) (see *Appendix 19A*). Due to the fact that RAF Boulmer is scheduled to be phased out from 2016 onwards, the following section will describe the facilities available at RAF Lossiemouth. RAF Lossiemouth is situated approximately 76 nm north by north-west of the Development Area. This base has Sea King helicopters with a maximum endurance of six 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 08:00 and 22:00 hours. Between 22:00 and 08:00 hours, one helicopter is held at 45 minutes readiness.
- 66 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.

Emergency Response – RNLI Lifeboats

- 67 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 around the coast of the UK and Ireland.
- 68 The RNLI stations in the vicinity to the Development Area are presented in *Appendix 19A, Figure 19A.25*.
- 69 Based on the offshore position of the Development Area it is likely that it would be All Weather Lifeboats (ALBs) from Montrose or Arbroath that would respond to an incident. This is confirmed when reviewing the historical incident data (see *Maritime Incidents* section below).

Maritime Incidents

- 70 Data from the MAIB and RNLI were analysed for the period 2001-2010 within 10 nm of the Development Area. A total of 31 unique incidents involving 34 vessels were reported to the MAIB in the period 2001-2010 within 10 nm of the Development Area, corresponding to three to four incidents per year (excluding incidents in port/harbour areas). Two incidents (both hazardous incidents) were recorded within the Development Area.
- 71 A total of 178 unique incidents were recorded by the RNLI (excluding hoaxes and false alarms), within the 10 nm buffer, corresponding to an average of between 17 and 18 incidents per year. 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.

- 72 Plots of the incident locations and detailed analysis of the incidents can be found in *Section 19A.13, Appendix 19A*.

19.5.2 Baseline Offshore Export Cable Corridor

- 73 The following section gives an overview of the baseline assessment which can be found in *Section 19B.5 of Appendix 19B*.

Data Sources

- 74 Fifty six days AIS data have been used in the assessment of the Offshore Export Cable Corridor from the following sources:

- FTOWDG AIS data from coastal survey sites (28 days in January/February 2011); and
- AIS data collected from shore based stations located in proximity to the Offshore Export Cable Corridor (28 days in May 2012).

- 75 Data have been analysed for the Offshore Export Cable Corridor, including consideration of the areas in direct adjacency to provide context.

- 76 Additional data sources described in *Section 19B.1.4, Appendix 19B* were also used for the assessment of the Offshore Export Cable Corridor.

Navigational Features

- 77 In addition to the navigational features illustrated in Figure 19.3, anchorage areas have been identified in proximity to the Offshore Export Cable Corridor and are presented in Figure 19.9.

- 78 It can be seen that there are a number of designated anchorage areas and anchor berths in the Firth of Forth, none of which intersect the Offshore Export Cable Corridor.

- 79 MEHRA are presented in Figure 19.3. An additional MEHRA has been identified which is relevant for the Offshore Export Cable Corridor. The MEHRA is located approximately 1.4 nm south of the Offshore Export Cable Corridor and covers the area around Bass Rock and the adjacent coastline. The MEHRA has been designated on wildlife, landscape and geological grounds (shown in Figure 19.3).

Commercial Shipping

- 80 Figure 19.10 and Figure 19.11 present vessels tracks recorded on AIS during 28 days in January/February 2011 and 28 days in May 2012 respectively, colour-coded by vessel type. Survey vessel tracks and other temporary traffic have been excluded from these figures and the subsequent analysis.

Figure 19.9: Anchorage Areas Relative to the Offshore Export Cable Corridor

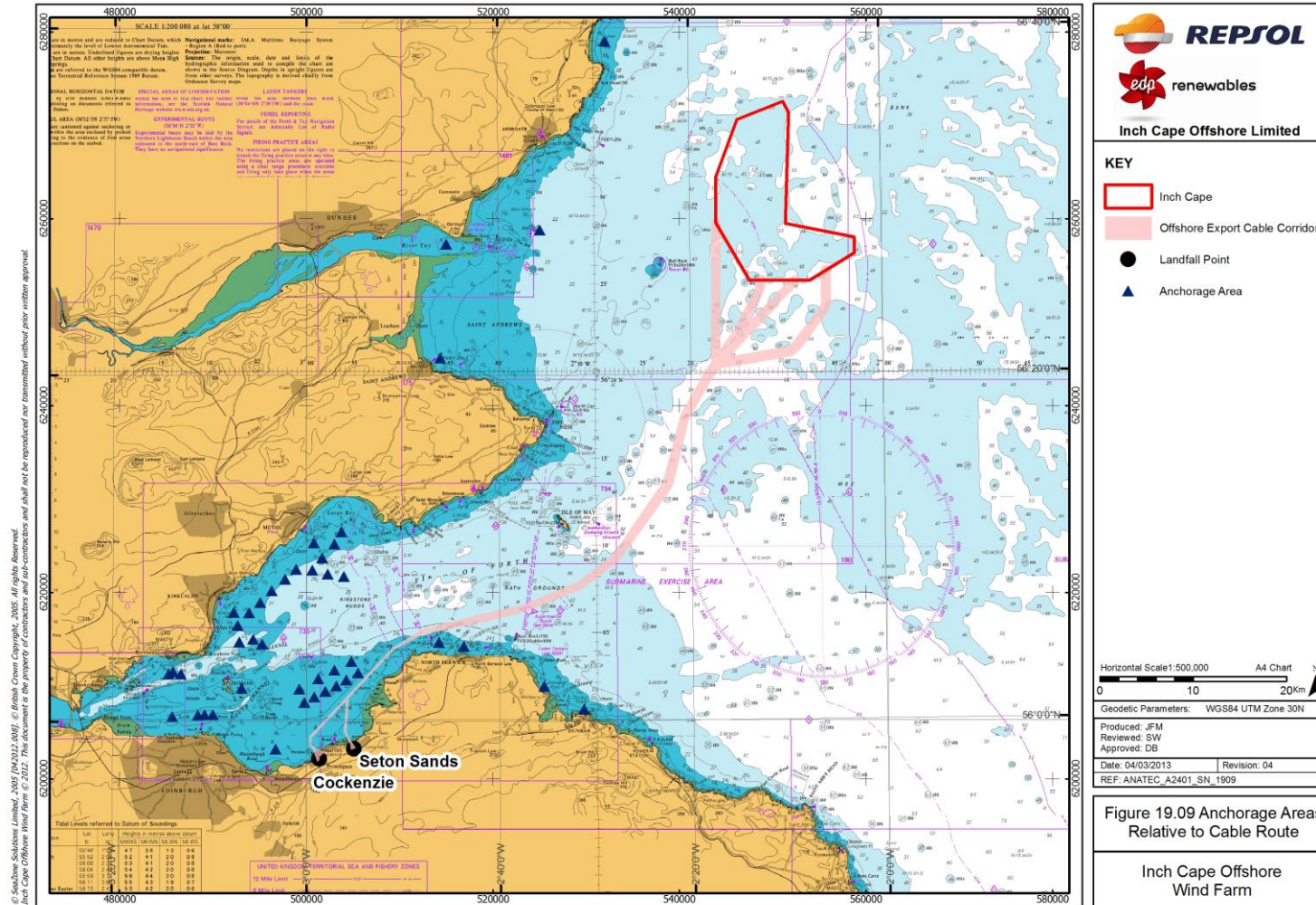


Figure 19.10: AIS Data Excluding Temporary Traffic (28 Day Survey Period January/February 2011)

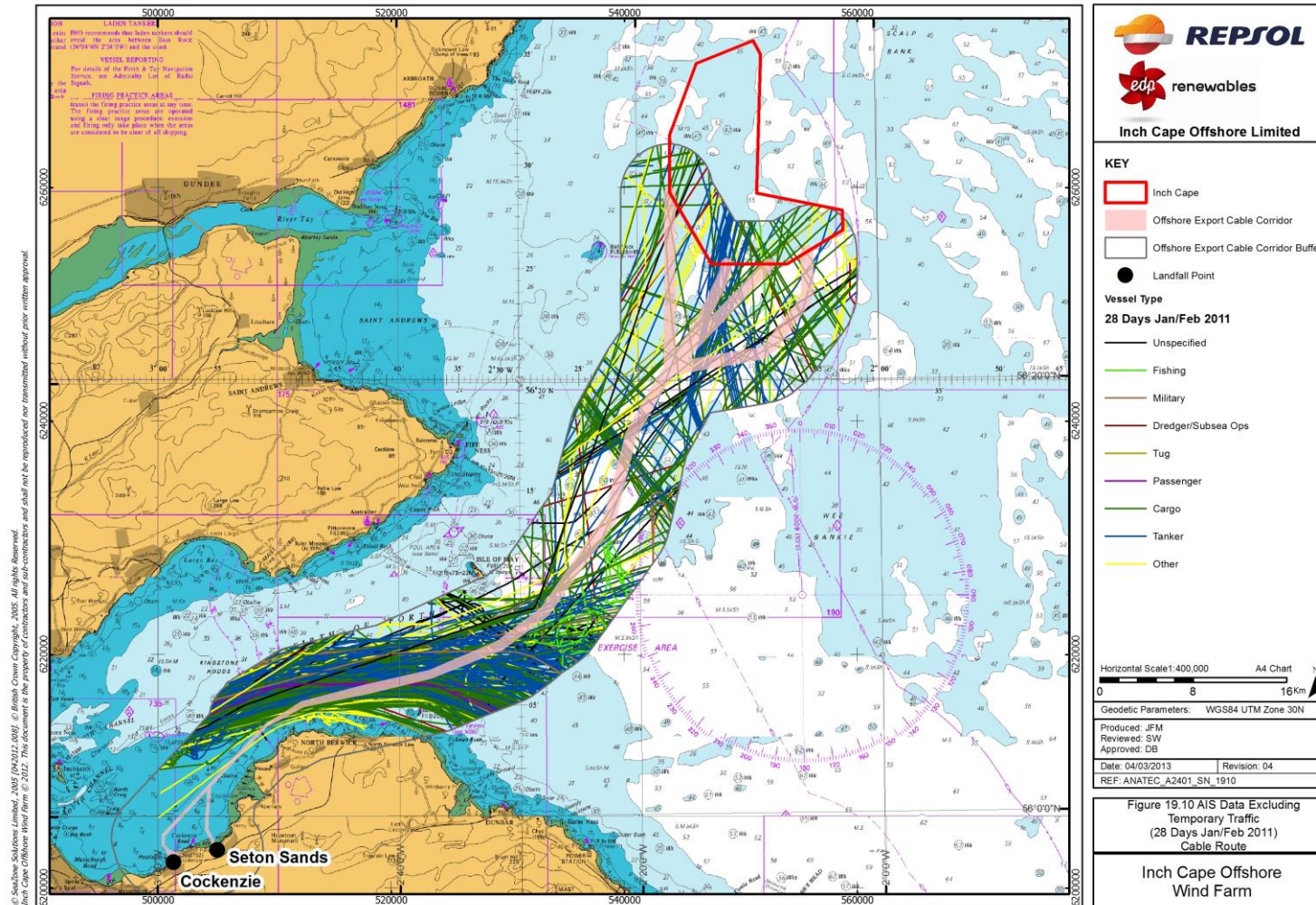
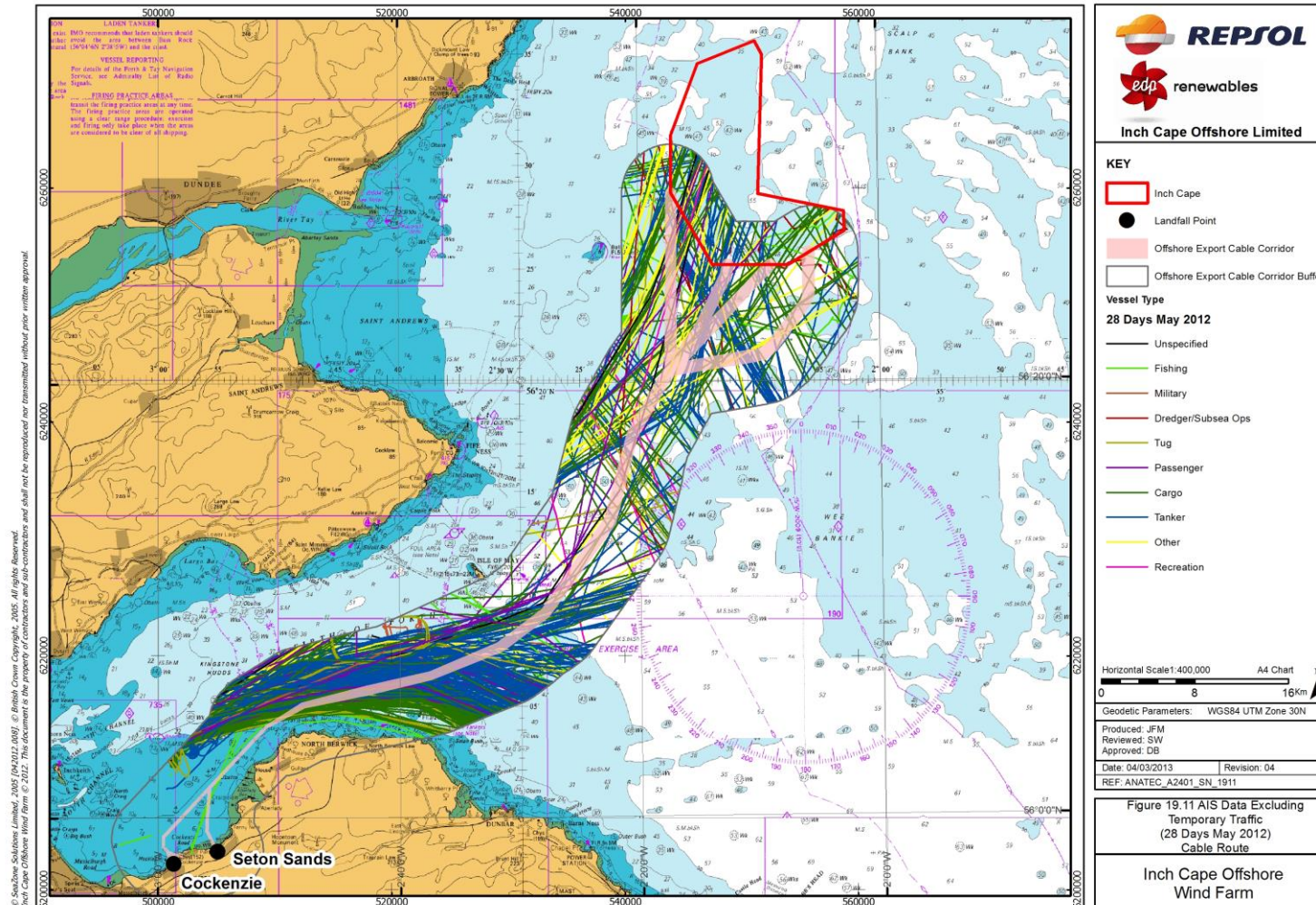


Figure 19.11: AIS Data Excluding Temporary Traffic (28 Day Survey Period May 2012)



- 81 In January and February 2011, there were averages of 22 unique vessels per day passing within, or directly adjacent to, the Offshore Export Cable Corridor. The most common types of vessel recorded within the buffer were cargo vessels (43 per cent) and tankers (41 per cent) with 'other' vessels making up seven per cent of traffic with the remaining nine per cent made up by military, tugs, passenger, recreational, dredgers and fishing vessels.
- 82 In May 2012, there were averages of 23 unique vessels per day passing within the Offshore Export Cable Corridor and the buffer. The most common types of vessel recorded within the buffer were tankers and cargo vessels making up 41 per cent and 38 per cent of traffic respectively and 'other' vessels comprising 7 per cent. The remaining 14 per cent made up by military, tugs, passenger, recreational, dredgers and fishing vessels.
- 83 A number of commercial shipping routes have been identified as intersecting the Offshore Export Cable Corridor with defined traffic routes being identified as heading to and from ports in the Firth of Forth and the Firth of Tay.
- 84 Traffic headed in and out of the Firth of Forth crosses the Offshore Export Cable Corridor approximately two nautical miles north of the North Berwick coastline and intersects the Offshore Export Cable Corridor for approximately 15 nm of its length. The majority of vessels on this route are cargo and tankers with tugs, 'other' vessels and passenger vessels also being recorded. Traffic is mainly headed between ports in the Firth of Forth (Grangemouth, Leith and Rosyth) to European Ports (Rotterdam, Amsterdam and Antwerp).
- 85 Other lower use main routes also intersect the Offshore Export Cable Corridor. There is a tanker route between Immingham and northern Scotland to the north of the Offshore Export Cable Corridor, towards the Development Area. This route is used by approximately one vessel every two days. The Offshore Export Cable Corridor is also intersected by cargo vessels transiting in and out of the Firth of Tay to ports in northern Europe and vessels headed north-south between the Firth of Forth and ports in northern Europe.

Fishing Vessels

- 86 This section reviews the fishing vessel activity in the vicinity of the Offshore Export Cable Corridor based on AIS data and sightings/satellite data.
- 87 Figure 19.12 and Figure 19.13 present the fishing vessels recorded within the buffer around the Offshore Export Cable Corridor for 28 days in January/February 2011 and 28 days in May 2012 respectively.
- 88 It can be observed that a low number of fishing vessels were recorded within the buffer around the Offshore Export Cable Corridor. In terms of fishing vessel numbers, six unique vessels were recorded in the buffer during 28 days in January/February 2011 and four unique vessels during 28 days in May 2012.
- 89 Fishing vessel sightings data (2005-2009) and fishing vessel satellite data (2009) have been converted to density plots for the Offshore Export Cable Corridor and are presented in Figure 19.14 and Figure 19.15 respectively. It should be noted that due to different data

collection and analysis techniques, the sightings and satellite density plots are not directly comparable.

Figure 19.12: Fishing Vessels (28 Day Survey Period January/February 2011)

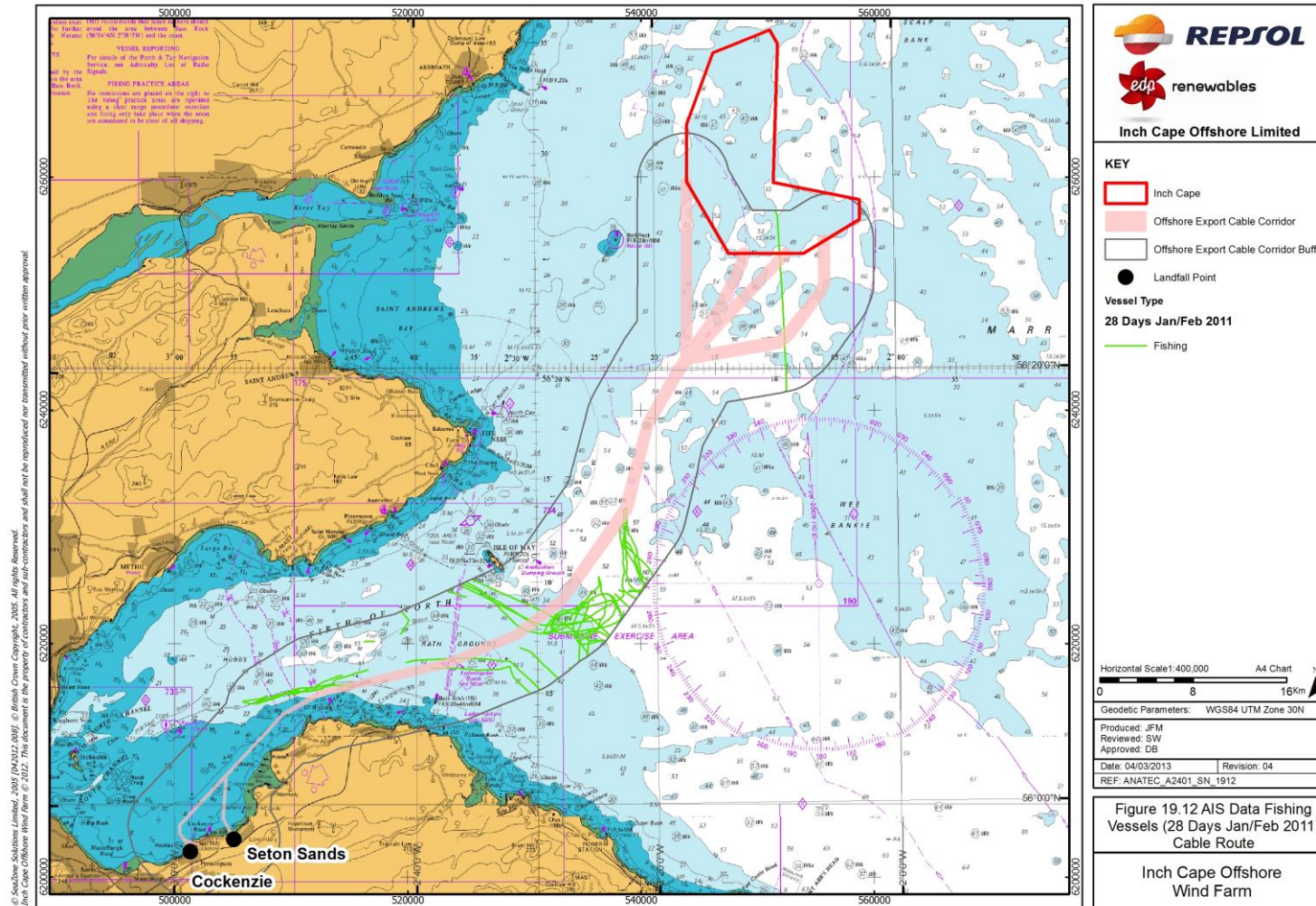


Figure 19.13: Fishing Vessels (28 Day Survey Period May 2012)

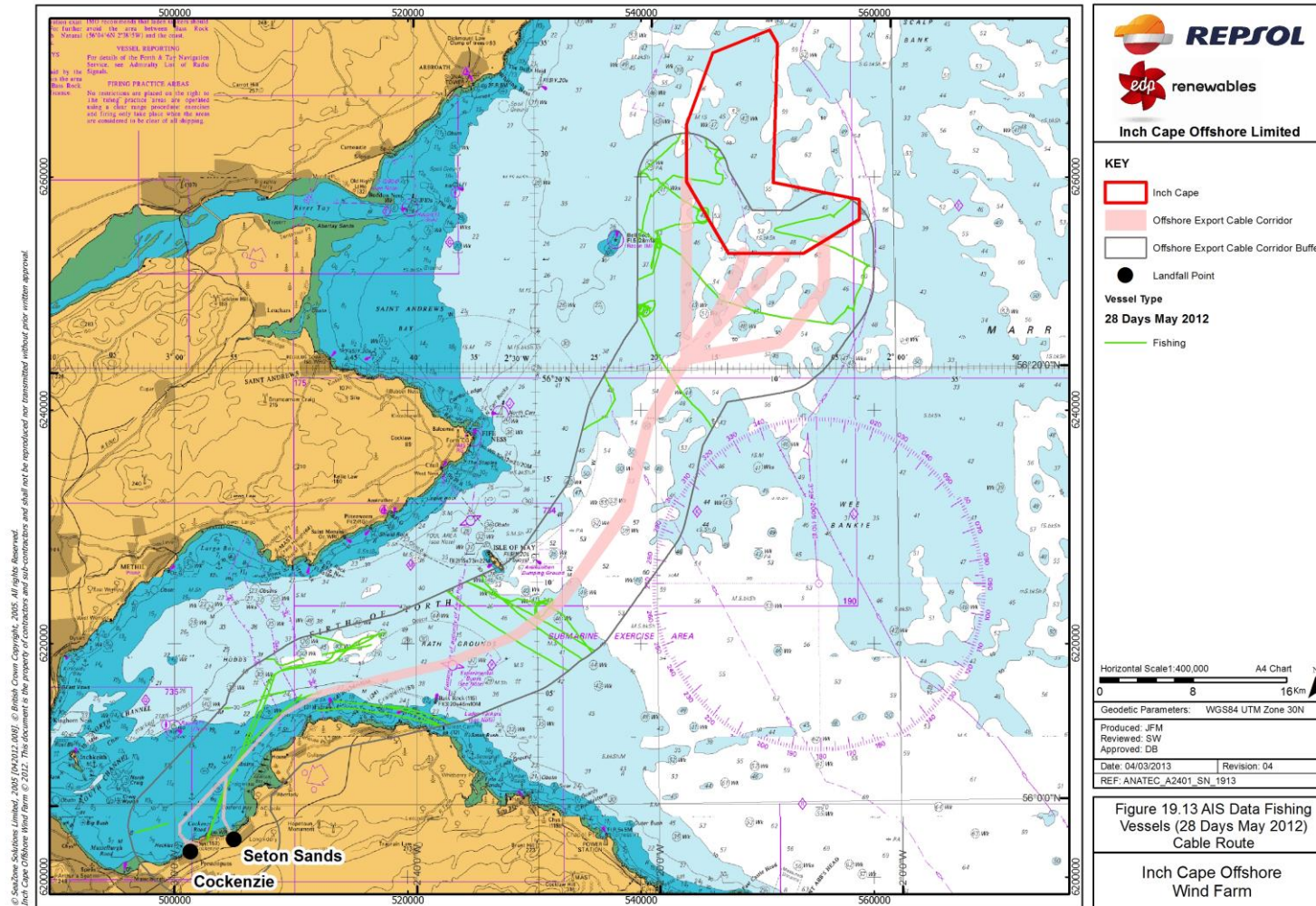


Figure 19.14: Fishing Vessel Sightings Data for Offshore Export Cable Corridor (2005-2009)

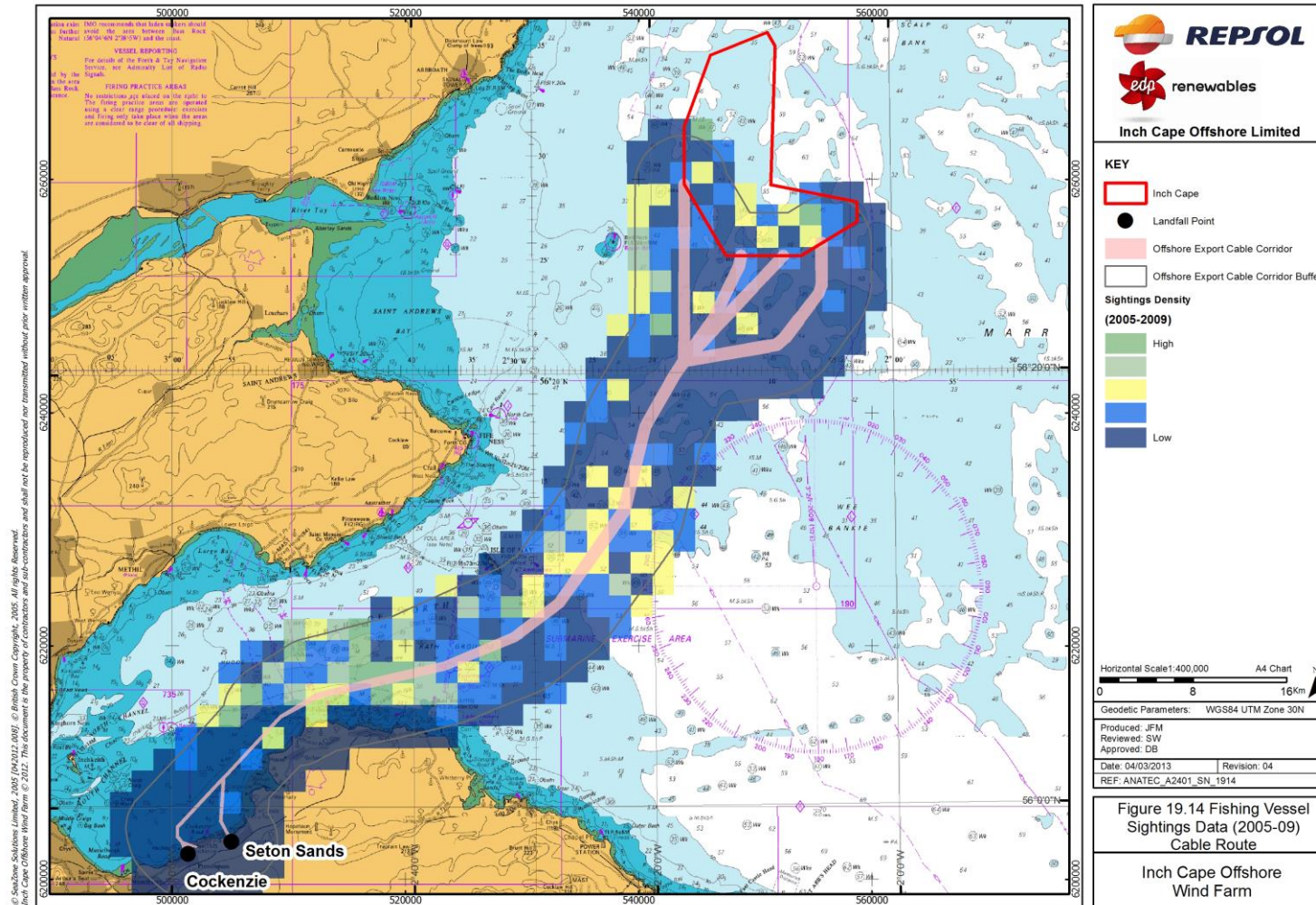
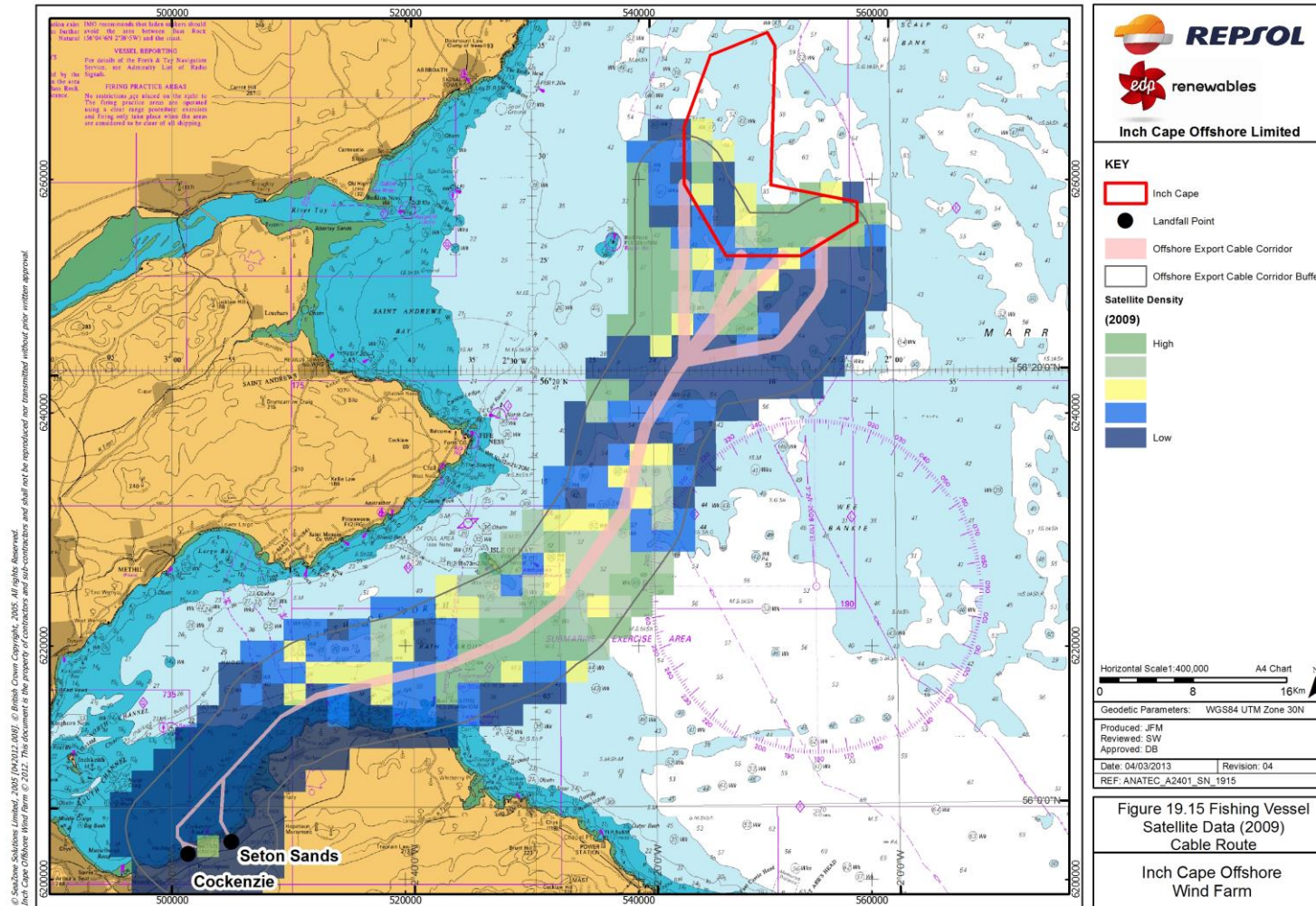


Figure 19.15: Fishing Vessel Satellite Data for Offshore Export Cable Corridor (2009)



90 Analysis of these data has identified that most fishing vessels in the vicinity of the Offshore Export Cable Corridor are UK-registered and have specified their type as demersal stern trawlers or scallop dredgers.

91 Further information on commercial fishing in the vicinity of the Offshore Export Cable Corridor can be found in *Section 19B.9 of Appendix 19B* and *Chapter 18*.

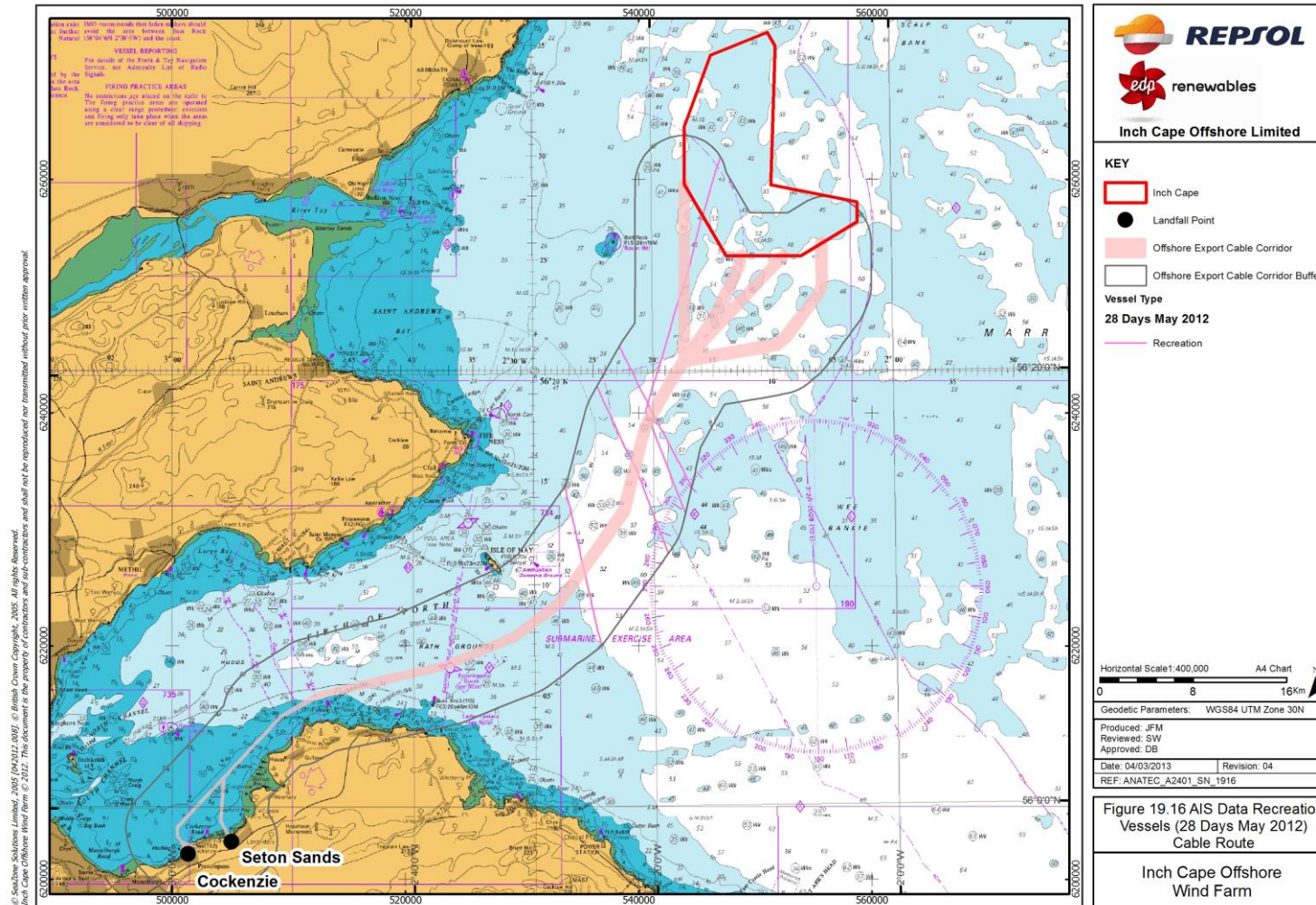
Recreational Vessels

92 This section reviews recreational vessel activity relative to the Offshore Export Cable Corridor, further information can be seen in *Section 19B.8 of Appendix 19B*.

93 No recreational vessels were recorded in the area during the 28 day period in January/February 2011. Three unique vessels were recorded crossing the Offshore Export Cable Corridor during 28 days in May 2012. A plot of these vessels is presented in Figure 19.16.

94 A chart of the recreational sailing activity and facilities relative to the Offshore Export Cable Corridor is presented in *Section 19B.8, Appendix 19B*.

Figure 19.16: Recreational Vessels (28 Day Survey Period May 2012)



Maritime Incidents

- 95 Data from the MAIB and RNLI were analysed for the period 2001-2010 within the buffer around the Offshore Export Cable Corridor.
- 96 A total of 60 incidents were reported to the MAIB in the period 2001-2010 within the Offshore Export Cable Corridor and the buffer, involving 51 vessels, corresponding to an average of six incidents per year. There were two incidents recorded in the Offshore Export Cable Corridor.
- 97 Data on RNLI lifeboat responses within the Offshore Export Cable Corridor and the buffer in the ten year period between January 2001 and December 2010 have been analysed. A total of 201 unique incidents were recorded by the RNLI, corresponding to an average of 20 incidents per year.
- 98 Plots of the incident locations and detailed analysis of the incidents can be found in *Section 19B.6 of Appendix 19B*.

19.5.3 Baseline without the Project

- 99 In the future there is the potential for an increase in commercial shipping movements, fishing vessel activity and recreational vessel activity. This change in baseline conditions has also been considered in the 'future case' (with Wind Farm) collision risk modelling undertaken as part of the NRA (*Section 19A.16 of Appendix 19A*).

19.6 Impact Assessment - Development Area

- 100 This section assesses the effect within the Development Area on shipping and navigation during construction, operation and maintenance, and decommissioning.

19.6.1 Effects of Construction

Effect of Construction on Commercial Vessels

- 101 Following consideration of the baseline the following impacts have been identified for this receptor:
- Increased transit times and distances;
 - Increased vessel to vessel collision risk; and
 - Creation of vessel to structure collision risk.
- 102 Analysis of the marine traffic survey data identified a number of routes transiting through the Development Area, the busiest of which is used by approximately 2.5 vessels per day. For vessels on these routes there will be an increased vessel to vessel collision risk during construction works due to the increased number of vessels (jack-ups, barges, motherships and transfer vessels) working within the Development Area and associated with the installation of Inch Cape Structures. There will be increased transit times and distances when

vessels are required to deviate from their main routes to avoid construction works and their exclusion zones.

- 103 There is also the potential for commercial vessels to allide (impact a stationary object) with partially constructed Inch Cape Structures in the Development Area which may be less visible i.e. if the foundations of WTGs are installed prior to the transition piece and tower. This potential is increased during periods of bad weather, particularly when visibility is reduced by fog.
- 104 Given the number of vessels transiting through the Development Area and the commercial implications of having to deviate, the receptor is considered to be of moderate sensitivity.
- 105 These effects are likely to occur but will only be present for the construction phase and localised to the part of the Development Area where construction work is taking place, resulting in low magnitude. Minor deviations will be required for vessels transiting through the Development Area during the construction phase to ensure a safe passing distance. There is assessed to be sufficient sea room around the Development Area for vessels to make these deviations, although larger tankers may be required to avoid deviating to the west of the Development Area due to the presence of Bell Rock.
- 106 Overall, these effects have been assessed to be minor/moderate.

Effect of Construction on Commercial Fishing Vessels

- 107 Following consideration of the baseline the following impacts have been identified for this receptor:
- Increased vessel to vessel collision risk;
 - Creation of vessel to structure allision risk; and
 - Gear Snagging on structures or cables.
- 108 From analysis of the marine traffic survey data it was identified that there were approximately four fishing vessels per day within 10 nm of the Development Area. These vessels were recorded fishing in the north of the Development Area and transiting through the Development Area in a north-south direction. For these fishing vessels there will be an increased vessel to vessel collision risk during construction works due to the increased number of vessels (jack-ups, barges, motherships and transfer vessels) working within the Development Area and associated with the installation of Inch Cape Structures. The displacement of commercial vessels into areas used by commercial fishing vessels could further increase this risk.
- 109 There is also the potential for commercial fishing vessels to allide with partially constructed Inch Cape Structures in the Development Area which may be less visible i.e. if WTG foundations are installed prior to the transition piece and tower. These effects are increased during periods of bad weather, particularly when visibility is reduced by fog.

- 110 Commercial fishing vessels could be further affected by snagging their gear on partially constructed Inch Cape Structures or unburied inter-array or export cables, leading to damage to the vessel and the Inch Cape Structure/inter-array/export cable.
- 111 Given the number of commercial fishing vessels which will be affected by the construction works and the commercial implications of this, the receptor is considered to be of moderate sensitivity.
- 112 These effects are likely to occur but will only be present for the construction phase and will be localised to the part of the Development Area where construction work is taking place, resulting in a low magnitude. There is sufficient sea room around the Development Area for commercial fishing vessels to deviate and avoid the construction works.
- 113 Overall, these effects have been assessed to be minor/moderate from a navigational safety perspective.

Effect of Construction on Recreational Vessels

- 114 Following consideration of the baseline the following impacts have been identified for this receptor:
- Increased vessel to vessel collision risk; and
 - Creation of vessel to structure collision risk.
- 115 One recreational vessel was recorded every two days during the marine traffic surveys with a greater number being recorded in the summer period compared to winter. There are no RYA cruising routes passing through the Development Area. For these recreational vessels there will be an increased vessel to vessel collision risk during construction works due to the increased number of vessels (jack-ups, barges, motherships and transfer vessels) working within the Development Area and associated with the installation of Inch Cape Structures. This includes both collision with the construction vessel and collision with another recreational vessel. The displacement of commercial vessels and commercial fishing vessels into areas transited by recreational vessels could further increase this risk.
- 116 There is also the potential for recreational vessels to collide with partially constructed Inch Cape Structures in the Development Area which may be less visible i.e. if WTG foundations are installed prior to the transition piece and tower. These effects are increased during periods of bad weather, particularly when visibility is reduced by fog although the number of recreational vessels in the Development Area in these conditions is expected to be very low.
- 117 Given the low number of recreational vessels which will be affected by the construction works and the fact that there are no commercial implications, the receptor is considered to be of low sensitivity.
- 118 This effect is likely to occur but will only be present for a limited duration and will be localised to the part of the Development Area where construction work is taking place,

resulting in a low magnitude. There is sufficient sea room around the Development Area for recreational vessels to alter their routes to avoid the construction works.

119 Overall, these effects have been assessed to be Minor.

19.6.2 Effects of Operation and Maintenance

120 A revised vessel routing pattern following construction of Inch Cape Structures has been estimated based on the review of the baseline shipping data. Four risk assessments were carried out as outlined below and detailed in *Appendix 19A*:

- Base case without Inch Cape Structures level of risk;
- Base case with Inch Cape Structures level of risk;
- Future case without Inch Cape Structures level of risk; and
- Future case with Inch Cape Structures level of risk.

121 The following scenarios were investigated in detail:

- Vessel-to-vessel collisions; and
- Vessel-to- Inch Cape Structure collisions (powered and drifting).

Effect on Commercial Vessel Routing

122 Following consideration of the baseline the following impacts have been identified for this receptor:

- Increased vessel to vessel collision risk; and
- Increased transit times and distances with commercial implications.

123 Analysis of the marine traffic survey data identified a number of routes transiting through the Development Area, the busiest of which is used by approximately 2.5 vessels per day. Due to the presence of Inch Cape Structures in the Development Area, vessels on these routes will be required to make deviations in order to pass the Development Area at a safe distance. There is the potential for an increase in vessel to vessel collision risk when vessels are deviated from their current routes.

124 There is sufficient sea room around the Development Area for vessels to increase their passing distance, although larger tankers may be required to avoid deviating to the west of the Development Area due to the presence of Bell Rock.

125 Vessels will be able to adapt to these effects but there is the potential for commercial implications due to the increased voyage times on deviated routes, giving this receptor a moderate sensitivity. The maximum calculated route deviation is approximately 4.7 nm, corresponding to an increased journey time of approximately 29 minutes for vessels on that route.

126 These effects will be present throughout the operational life of the Wind Farm and will affect receptors within the Development Area. It is a certainty that vessels will be required to deviate from their current routes during the operational phase of the Wind Farm, resulting in a high magnitude.

127 Overall, these effects have been assessed to be moderate/major.

Effect on Commercial Vessel Risk

128 Following consideration of the baseline the following impacts have been identified for this receptor:

- Increased vessel to vessel collision risk; and
- Creation of vessel to Inch Cape Structures collision risk including vessels not under command.

129 The presence of Inch Cape Structures has the potential to increase the vessel-to-vessel collision risk and vessel-to-structure collision risk when compared to baseline levels.

130 Results of modelling undertaken as part of the NRA have shown a 15 per cent increase in vessel-to-vessel collisions from one every 797 years (without Inch Cape Structures) to one every 695 years (with Inch Cape Structures) when vessels are deviated from their current routes in order to avoid the Inch Cape Structures. There is also a risk to commercial vessels of colliding with Inch Cape Structures. For errant vessels under power, the collision frequency is approximately 1 every 1,510 years. For drifting vessels which are “not under command”, the collision frequency is approximately 1 every 12,349 years.

131 Given the ability to adapt to the majority of the effect by deviating from the Development Area and the sufficient sea room available for doing this, the sensitivity is considered to be moderate.

132 These effects will be present throughout the operational life of the Wind Farm and will affect receptors within the Development Area. The results of the collision and collision risk modelling suggest that it is moderately likely to occur meaning that the magnitude is moderate.

133 Overall, these effects have been assessed to be moderate.

Effect on Commercial Fishing Vessels

134 Following consideration of the baseline the following impacts have been identified for this receptor:

- Increased vessel to vessel collision risk;
- Creation of vessel to Inch Cape Structure collision risk; and
- Gear Snagging on Inch Cape Structure or inter-array cables.

- 135 From analysis of the marine traffic survey data it was identified that there were approximately four fishing vessels per day within 10 nm of Development Area. These vessels were recorded fishing in the north of the Development Area and transiting through in a north-south direction.
- 136 During the operation and maintenance stage of the Wind Farm, fishing vessels will be required to either deviate around the Development Area or pass between Inch Cape Structures (this will be a decision made by the skipper and based on the vessel type and size, weather conditions and visibility). There is a risk to fishing vessels transiting through the Development Area of alliding with an Inch Cape Structure or snagging their gear on inter-array cables/structures (in the event they become exposed), leading to damage to the vessel and the cable or Inch Cape Structure. The fishing vessel to structure allision risk has been identified as approximately one every six years for the Inch Cape Structures. It is expected that the majority of fishing vessel to Inch Cape Structure allisions will be low speed and low energy, with the likelihood increasing during adverse weather and poor visibility. Fishing vessels will also be affected by displaced commercial vessels and recreational vessels, therefore increasing the vessel to vessel collision risk.
- 137 Given the number of commercial fishing vessels which will be affected by the Inch Cape Structures, associated works and the commercial implications, the receptor is considered to be of moderate sensitivity.
- 138 These effects will be present throughout the operational life of the Project including associated works and will affect receptors within the Development Area. The results of the allision risk modelling suggest that these effects are likely to occur, resulting in a moderate magnitude. There is sufficient sea room around the Development Area for fishing vessels to alter their routes if required.
- 139 Overall, these effects have been assessed to be moderate from a navigational safety perspective.

Effect on Recreational Vessels

- 140 Following consideration of the baseline the following impacts have been identified for this receptor:
- Increased vessel to vessel collision risk; and
 - Creation of vessel to Inch Cape Structure allision risk.
- 141 One recreational vessel was recorded every two days during the marine traffic surveys with a greater number being recorded in the summer period compared to winter. There are no RYA cruising routes passing through the Development Area.
- 142 During the operation and maintenance stage of the Wind Farm, recreational vessels will be required to either deviate around the Development Area or pass between Inch Cape Structures (when conditions allow). There is a risk to recreational vessels transiting through the Development Area of alliding with an Inch Cape Structure, especially in adverse weather

and poor visibility. Recreational vessels will also be affected by displaced commercial vessels and fishing vessels, therefore increasing the vessel to vessel collision risk.

- 143 Given the low number of recreational vessels in the vicinity of the Development Area which will be affected by the Inch Cape Structures the receptor is considered to be of low sensitivity.
- 144 These effects will be present throughout the operational life of the Wind Farm and will affect receptors within the Development Area, resulting in a moderate magnitude. There is sufficient sea room around the Development Area for recreational vessels to alter their routes if required.
- 145 Overall, these effects have been assessed to be minor/moderate.

Effect on Emergency Response Operations

- 146 Following consideration of the baseline the following impact has been identified:
- Implications on the response capability of emergency responders.
- 147 The Development Area lies within the Scotland and Northern Ireland SAR region with the nearest Marine Rescue Coordination Centre (MRCC) being located in Aberdeen. Under the revised MCA SAR proposals (MCA, 2011), the Aberdeen MRCC centre will become a Marine Rescue Sub Centre (MRSC).
- 148 A review of historical incidents in the vicinity of the Development Area identified that the number of incidents recorded by MAIB and RNLI in the Development Area was low with the majority of incidents occurring towards the coast. The presence of the Inch Cape Structures has the potential to increase the need for emergency response activities and restrict access to casualties within the Development Area. However, Inch Cape Structures may also aid emergency response by providing a place of refuge and a point of reference.
- 149 Given the adaptability of emergency responders to work within wind farm areas, the sensitivity of these receptors is considered to be low.
- 150 This effect will be present throughout the operational lifetime of the Wind Farm and will affect receptors within the Development Area and in the vicinity. It is likely that all emergency response operations in the vicinity of Development Area will be affected by the presence of the Inch Cape Structures, resulting in a high magnitude.
- 151 Overall, this effect has been assessed to be moderate.

Effect on Marine Radar Systems

- 152 Following consideration of all navigation and communication systems within the baseline (for more detail refer to *Section 19A.20 of Appendix 19A*) the implications on the effectiveness of marine radar has been screened in and identified for shipping and navigation receptors.

- 153 Following assessment within *Appendix 19A* effects on marine radar have been scoped into the impact assessment. Other impacts associated with electronic navigation or communications systems have been considered within *Section 19A.20, Appendix 19A* but scoped out based on this pre environmental impact assessment. Based on marine radar trials carried out to date (DfT, 2004 and BWEA, 2007), 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 (note that trials are on-going by the MCA as UK National Policy develops).
- 154 It was identified from the marine traffic survey data that 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. Once the Wind Farm is developed these vessels are expected to increase their passing distance to 1 to 1.5 nm which will minimise the radar interference. Fishing vessels and recreational vessels transiting within the Development Area also have the potential to be affected by radar interference.
- 155 Given that mariners are expected to adapt to radar interference by increasing their passing distance or by careful adjustment of the receiver amplification (gain), sea clutter and range settings of the radar, the sensitivity of this receptor is low.
- 156 These effects will be present throughout the operational life of the Wind Farm and will affect receptors within the Development Area, resulting in a moderate magnitude.
- 157 Overall, this effect has been assessed to be minor/moderate.

19.6.3 Effects of Decommissioning

- 158 The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the construction phase. The approach to decommissioning is described in *Section 7.12*. A decommissioning plan will be prepared in accordance with the requirements of the *Energy Act 2004* (see *Section 3.2.5*) and will be subject to approval from the Department of Energy and Climate Change (DECC) prior to implementation.

19.7 Impact Assessment - Offshore Export Cable Corridor

- 159 This section assesses the effect of the Offshore Export Cables on shipping and navigation during installation, operation/maintenance and decommissioning.

19.7.1 Effects during Installation

Effect of Export Cable Installation on Commercial Vessels

- 160 Following consideration of the baseline the potential for collision with cable installations vessels have been identified for this receptor as an impact.
- 161 A number of commercial shipping routes have been identified as intersecting the Offshore Export Cable Corridor with defined traffic routes being identified as heading to and from

ports in the Firth of Forth and the Firth of Tay. During cable installation works, the presence of cable laying vessels which are restricted in their manoeuvrability under COLREGs (The International Regulations for Preventing Collisions at Sea 1972) will create an additional collision risk for these vessels.

- 162 The main route crossing the Offshore Export Cable Corridor is used by traffic headed in and out of the Firth of Forth and is used by approximately 14 to 15 unique vessels per day. Given the number of vessels that will be affected and the importance of the route, this receptor is considered to be of moderate sensitivity.
- 163 This effect is likely to occur but will only be present for a limited duration (Offshore Export Cable installation is expected to take up to 15 months and may be phased over separate years) and will be localised to the part of the Offshore Export Cable Corridor where installation is taking place, resulting in a low magnitude. There is sufficient sea room around the Offshore Export Cable Corridor for vessels to alter their routes to avoid the construction works, although the majority of vessels heading from Forth ports to ports in Europe will be required to cross the Offshore Export Cable Corridor at some point.
- 164 Overall, this effect have been assessed to be minor/moderate.

Effect of Export Cable Installation on Commercial Fishing Vessels

- 165 Following consideration of the baseline the following impacts have been identified for this receptor:
- Potential for collision with cable installations vessels; and
 - Gear snagging on structures or Offshore Export Cables.
- 166 From analysis of the marine traffic data, a low number of fishing vessels have been identified in proximity to the Offshore Export Cable Corridor with six unique vessels being recorded during 28 days in January/February 2011 and four unique vessels during 28 days in May 2012. For these vessels, the presence of cable laying vessels which are restricted in their manoeuvrability under COLREGS will create an additional collision risk.
- 167 Fishing vessels could be further affected by snagging their gear on partially installed or not yet buried cables, leading to damage to the vessel and the structure/cable.
- 168 Given the number of fishing vessels that will be affected and the level of commercial implications, this receptor is considered to be of moderate sensitivity.
- 169 This effect is moderately likely to occur but will only be present for a limited duration and will be localised to the part of the Offshore Export Cable Corridor where installation is taking place, resulting in a low magnitude. There is sufficient sea room around the Offshore Export Cable Corridor for fishing vessels to alter their transit routes to avoid the installation works.
- 170 Overall, these effects have been assessed to be minor/moderate from a navigational safety perspective.

Effect of Export Cable Installation on Recreational Vessels

- 171 Following consideration of the baseline the potential for collision with cable installations vessels has been identified for this receptor as an impact.
- 172 From analysis of the marine traffic data, the number of recreational vessels in proximity to the Offshore Export Cable Corridor was very low with three unique vessels being recorded during 28 days in May 2012 and none in January/February 2011. For these vessels, the presence of cable laying vessels which are restricted in their manoeuvrability under COLREGS will create an additional collision risk.
- 173 Given the very low number of recreational vessels which will be affected by the Offshore Export Cable installation works and the fact that there are no commercial implications, the receptor is considered to be of low sensitivity.
- 174 This effect is unlikely to occur, will only be present for a limited duration and will be localised to the part of the Offshore Export Cable Corridor where installation is taking place, resulting in a low magnitude. There is sufficient sea room around the Offshore Export Cable Corridor for recreational vessels to alter their routes to avoid the cable laying vessels.
- 175 Overall, these effects have been assessed to be of Minor significance.

19.7.2 Effects of Operation and Maintenance

Effect of Export Cable on Commercial Vessels

- 176 Following consideration of the baseline snagging risk associated with anchoring including emergency anchoring has been identified for this receptor as an impact.
- 177 A number of commercial shipping routes have been identified as intersecting the Offshore Export Cable Corridor with defined traffic routes being identified as heading to and from ports in the Firth of Forth and the Firth of Tay. There are a number of designated anchorage areas and anchorage circles to the north of the landfall options at Cockenzie and Seton Sands, with vessels being recorded at anchor in these designated areas during the marine traffic surveys.
- 178 The main effect to commercial vessels following the installation of the Offshore Export Cable will be for those vessels anchoring in close proximity to the cable, or required to do so in an emergency situation such as machinery failure.
- 179 Given that there are numerous designated anchorages in the area that can be used rather than anchoring near the Offshore Export Cable; the adaptability to this effect is high therefore resulting in a low sensitivity.
- 180 This effect will be present throughout the operational life of the Offshore Export Cable and will be localised to the area of the Offshore Export Cable, resulting in a moderate magnitude.
- 181 Overall, these effects have been assessed to be minor/moderate.

Effect of Export Cable on Commercial Fishing Vessels

- 182 Following consideration of the baseline gear snagging on export cables has been identified for this receptor as an impact.
- 183 From analysis of the marine traffic data, a low number of fishing vessels have been identified in proximity to the Offshore Export Cable Corridor with six unique vessels being recorded during 28 days in January/February 2011 and four unique vessels during 28 days in May 2012. Analysis of the sightings and satellite data identified the main fishing vessels types in proximity to the Offshore Export Cable Corridor are demersal stern trawlers and scallop dredgers. The main risk to these vessels will be snagging their gear on the Offshore Export Cable which could lead to damage to the cable, the gear and/or the fishing vessel.
- 184 Given the low number of fishing vessels that will be affected, the low level of commercial implications associated with transits and rerouting (not considered not navigational issues), this receptor is considered to be of low sensitivity.
- 185 These effects on navigational safety could be present through the operational life of the Offshore Export Cable and will be localised to the area of the Offshore Export Cable, resulting in a moderate magnitude.
- 186 Overall, this effect has been assessed to be minor/moderate from a navigational safety perspective.
- 187 Effects on fishing vessels have been further discussed in *Chapter 18*.

Effect of Export Cable on Recreational Vessels

- 188 Following consideration of the baseline, potential for anchor snagging in shallower waters has been identified for this receptor as an impact.
- 189 From analysis of the marine traffic data, the number of recreational vessels in proximity to the Offshore Export Cable Corridor was very low with three unique vessels being recorded during 28 days in May 2012 and none in January/February 2011. The main risk to recreational vessels during the operational phase of the Offshore Export Cable will be for those vessels which anchor in close proximity to the Offshore Export Cable.
- 190 Given the very low number of recreational vessels which will be affected by the Offshore Export Cable the receptor is considered to be of low sensitivity.
- 191 This effect will be present throughout the operational life of the Offshore Export Cable and will be localised to the area of the Offshore Export Cable. It is very unlikely given the low number of vessels and the fact that recreational vessels generally do not anchor in water depths greater than 10 m. The magnitude of these effects is low.
- 192 Overall, this effect have been assessed to be minor.

Effect of Export Cable on Vessel Navigation Equipment

- 193 Following consideration of the baseline the following impacts have been identified for this receptor:
- Effects on magnetic compass due to deviations caused by electromagnetic interference from the Offshore Export Cable.
- 194 There are two types of export cable technology which could be installed. Alternating Current (AC) and Direct Current (DC) both produce electromagnetic fields (EMF) which affect a number of receptors.
- 195 Navigational equipment relies upon the earth's magnetic field and interactions with EMF produced by Export Cables have the potential to cause localised compass deviations when vessels are in close proximity to them due to the EMF generated. The amount by which the compass is offset depends on the angle the Export Cable makes with the magnetic meridian and the water depth. Particular receptors for this effect are small vessels such as recreational craft and small fishing vessels.
- 196 Compass deviations are greatest in water depths less than five metres and where the Export Cable is not buried. For the Offshore Export Cable landfall option at Cockenzie, the water depth does not fall below five metres until approximately 0.2 nm away from the shore. For the Offshore Export Cable landfall option at Seton Sands, the water depth becomes less than five metres approximately 0.7 nm from this landfall.
- 197 A low numbers of vessel movements were recorded in the areas of the Offshore Export Cable Corridor where the water depth is below five metres. There is limited ability to adapt to the effect in shallow waters where the impacts will be more noticeable, however the overall sensitivity is considered to be moderate.
- 198 These effects will be present throughout the operational life of the Offshore Export Cable and will be localised to the area of the Offshore Export Cable, resulting in a moderate magnitude.
- 199 Overall, this effect has been assessed to be moderate.

19.7.3 Effects of Decommissioning

- 200 The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the installation phase. The approach to decommissioning is described in *Chapter 7, Section 7.12*. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 (see *Section 3.2.5*) and will be subject to approval from DECC prior to implementation. The decommissioning plan should consider the scenario where the Offshore Export Cable is not completely removed and is considered to be a potential danger to navigation.

19.8 Impact Interactions

- 201 The potential for individual impacts identified through the impact assessment above to interact and create new, or more significant impacts on shipping and navigation receptors has been assessed. No such interactions have been identified.
- 202 This chapter has identified linkages between different areas or disciplines covered in this ES. Potential impacts on commercial fisheries both within the Development Area and the Offshore Export Cable Corridor have been fully assessed in *Chapter 18* and are also referenced where appropriate.
- 203 The cumulative effects of the Project, in conjunction with other schemes are separately addressed within the cumulative section below.

19.9 Cumulative Impacts

- 204 Two other offshore wind farm projects in the Firth of Tay and Firth of Forth region are currently in the planning process and are considered relevant to this cumulative impact assessment. These are the Scottish Territorial Water (STW) site Neart na Gaoithe, and the Alpha and Bravo projects within the Firth of Forth Phase 1, as well as the cumulative impact with this Project's various elements. Potential cumulative effects are described below in *Sections 19.9.1 to 19.9.3*.
- 205 Due to the low level of other marine activities or users of the sea in the vicinity of the Development Area (i.e. limited defence areas and no oil and gas platforms or dredging areas), there are not expected to be significant cumulative effects on the navigational elements of these activities. Also, due to the distance of the Development Area from non-UK ports, there are no major trans-boundary issues to be considered for shipping and navigation.

19.9.1 Effects of Construction

Cumulative Effect of Construction on Commercial Vessels

- 206 Following consideration of the baseline the following impacts have been identified for this receptor:
- Creation of vessel to structure allision with partially constructed WTGs;
 - Increased transit times and distances; and
 - Increased vessel to vessel collision risk.
- 207 In the situation that construction or cable laying activities are being undertaken simultaneously at more than one wind farm within the outer Firth of Forth and Firth of Tay region, there will be an increased number of vessels working in the area which transiting vessels could potentially collide with (note that cable laying vessels are restricted in their manoeuvrability under COLREGS which will create an additional collision risk). Deviations

around the sites to avoid these vessels will be required, leading to increased transit times and distances.

- 208 There will also be an increased potential for commercial vessels to collide with partially constructed structures in the wind farms when there are more and larger structures in place. This effect is increased during periods of bad weather, particularly when visibility is reduced by fog.
- 209 Given the number of vessels transiting through the region as a whole and the commercial implications of having to deviate in order to avoid construction works in multiple wind farms including works associated with all the elements of the Project, the receptor is considered to be of moderate sensitivity.
- 210 This effect is moderately likely to occur given that the construction phases of each wind farm could overlap but will only be present for a limited duration and localised to the part of each wind farm or export cable route where construction/installation work is taking place, resulting in a low magnitude. However it is noted that it is unlikely that the construction phases for the three wind farms will overlap completely.
- 211 Overall, this effect has been assessed to be minor/moderate.

Cumulative Effect of Construction on Commercial Fishing Vessels

- 212 Following consideration of the baseline the following impacts have been identified for this receptor:
- Increased vessel to vessel collision risk;
 - Creation of vessel to partially constructed collision risk; and
 - Gear snagging on partially constructed structures or cables.
- 213 In the situation that construction or cable laying activities are being undertaken simultaneously at more than one wind farm within the outer Firth of Forth and Firth of Tay region, there will be an increased number of vessels working in the area which fishing vessels could potentially collide with (note that cable laying vessels are restricted in their manoeuvrability under COLREGS which will create an additional collision risk). The displacement of commercial vessels into areas used by fishing vessels could further increase this risk.
- 214 There will also be an increased potential for fishing vessels to collide with or snag their gear on partially constructed structures / cables in the wind farms when there are an increased number of structures / cables present. The risk of collision is increased during periods of bad weather, particularly when visibility is reduced by fog.
- 215 Given the number of fishing vessels in the region and the commercial implications of having to deviate in order to avoid construction works in multiple wind farms, the receptor is considered to be of moderate sensitivity.

- 216 This effect is moderately likely to occur given that the construction phases of each project could overlap but will only be present for a limited duration and localised to the part of each wind farm or export cable route where construction/installation work is taking place, resulting in a low magnitude.
- 217 Overall, this effect has been assessed to be minor/moderate from a navigational safety perspective.
- 218 Effects on fishing vessels have been further discussed in *Chapter 18*.

Cumulative Effect of Construction on Recreational Vessels

- 219 Following consideration of the baseline the following impacts have been identified for this receptor:
- Increased vessel to vessel collision risk; and
 - Creation of vessel to partially constructed structure allision risk.
- 220 In the situation that construction or cable laying activities are being undertaken simultaneously at more than one wind farm within the outer Firth of Forth and Firth of Tay region, there will be an increased number of vessels working in the area which recreational vessels could potentially collide with (note that cable laying vessels are restricted in their manoeuvrability under COLREGS which will create an additional collision risk) and they will be required to deviate from their preferred routes to avoid these vessels. The displacement of commercial vessels and commercial fishing vessels into areas used by recreational vessels could further increase this risk.
- 221 There will also be an increased potential for recreational vessels to allide with partially constructed structures in the wind farms when there are when there are more and larger structures in place. The risk of allision is increased during periods of bad weather, particularly when visibility is reduced by fog.
- 222 Given the low number of recreational vessels which will be affected by the construction works including works associated with all the elements of the projects combined with the fact that there are no commercial implications, the receptor is considered to be of low sensitivity.
- 223 This effect is moderately likely to occur given that the construction phases of each project could overlap, but will only be present for a limited duration and localised to the part of each wind farm or export cable route where construction/installation work is taking place, resulting in a low magnitude.
- 224 Overall, this effect has been assessed to be minor.

19.9.2 Effects of Operation and Maintenance

Cumulative Effect on Commercial Vessels

- 225 Following consideration of the baseline the following impacts have been identified for this receptor:
- Cumulative routing impacts associated with Firth of Forth Phase 1 (Alpha and Bravo), Neart na Gaoithe and Inch Cape Wind Farms;
 - Impacts associated with adverse weather routing;
 - Increased vessel to vessel collision;
 - Additional vessel to structure allisions;
 - Increased visual confusion when navigating; and
 - Increased radar interference.
- 226 Due to the combined presence of multiple offshore wind farms in the outer Firth of Forth and Firth of Tay region, vessels will be required to deviate from their current main routes in order to pass the wind farm structures at a safe distance. Of the nine main routes identified in the vicinity of the Development Area, seven will be cumulatively affected by the presence of Inch Cape, Neart na Gaoithe and Firth of Forth Phase 1 (Alpha and Bravo). The largest deviation required is an increase in distance of approximately 4.9 nm for vessels transiting between the Forth and northern Scotland, corresponding to an increased time of approximately 30 minutes (based on the average speed of vessels on that route). There is also the potential for preferred adverse weather routes to no longer be used 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.
- 227 There is also an increased risk of vessel to vessel collisions and vessel to structure allisions due to the fact that route deviations will increase the traffic density on routes passing close to the wind farm areas. Once the offshore export cables are installed, there are not expected to be any cumulative impacts associated with other elements of the projects, apart from limited periods where cable maintenance occurs.
- 228 Multiple wind farms can cause visual confusion for mariners because WTG alignment (including non-linear boundaries, irregular WTG layouts and peripheral WTGs) could potentially hinder a vessel's ability to navigate safely, therefore increasing the collision and allision risk.
- 229 Commercial vessels may also be affected by Radar interference from WTGs, as discussed in '*Cumulative Effect on Marine Radar Systems*'.
- 230 Given the number of commercial vessels in the region which will be cumulatively affected and the commercial implications of route deviations, the receptor is considered to be of moderate sensitivity.

231 These effects are likely to occur given that vessels will be required to deviate when multiple wind farms are present and will be present throughout the operational life of the wind farms and across the entire region, resulting in a high magnitude.

232 Overall, this effect has been assessed to be moderate/major and therefore significant.

Cumulative Effect on Commercial Fishing Vessels

233 Following consideration of the baseline the following impacts have been identified for this receptor:

- Cumulative routing impacts associated with Forth Phase 1 (Alpha and Bravo), Neart na Gaoithe and Inch Cape Wind Farms;
- Increased vessel to vessel collision;
- Increased fishing vessel to structure collision; and
- Increased Radar Interference.

234 Analysis of the survey data identified that a number of fishing vessels transit through the Development Area in a north-south direction and these vessels will be cumulatively affected by the presence of Neart na Gaoithe meaning they will be required to deviate around the sites or pass between the wind farm structures (this will be a decision made by the skipper and based on the vessel type and size, weather conditions and visibility). There is assessed to be adequate sea room for vessels to deviate around the wind farms.

235 There is a risk to fishing vessels transiting through wind farms of colliding with a structure or snagging their gear on cables and this risk will increase with the number of structures in the area.

236 Commercial fishing vessels may also be affected by Radar interference from WTGs, as discussed in '*Cumulative Effect on Marine Radar Systems*'.

237 Given the number of commercial fishing vessels which will be affected by the presence of multiple wind farms and the commercial implications, the receptor is considered to be of moderate sensitivity.

238 These effects will be present throughout the life time of the wind farms and will affect receptors within the wind farms and wider area. However, it is noted that the traffic levels for fishing vessels are considered low within the wider area, therefore the magnitude has been considered as moderate.

239 Overall, this effect has been assessed to be moderate from a navigational safety perspective.

Cumulative Effect on Recreational Vessels

- 240 Following consideration of the baseline the following impacts have been identified for this receptor:
- Cumulative routing impacts associated with Forth Phase 1 (Alpha and Bravo), Neart na Gaoithe and Inch Cape Wind Farms;
 - Increased vessel to vessel collision;
 - Increased recreational craft to structure collision;
 - Increased Radar Interference.
- 241 Generally the level of recreational vessel activity was low and there are no RYA cruising routes which will be cumulatively affected by the presence of multiple wind farms in the outer Firth of Forth and Firth of Tay region.
- 242 However, for vessels choosing to transit through any of the wind farms there is a risk of colliding with a structure and this risk will increase as the number of structures in the area increases. Once the export cables are installed, there are not expected to be any cumulative impacts associated with other elements of the projects, apart from limited periods where cable maintenance occurs.
- 243 Recreational vessels may also be affected by Radar interference from WTGs, as discussed in '*Cumulative Effect on Marine Radar Systems*'.
- 244 Given the low number of recreational vessels in the vicinity of the projects which will be affected by the wind farms and the fact that there are no commercial implications, the receptor is considered to be of low sensitivity.
- 245 This effect will be present throughout the life of the wind farms and could potentially affect receptors within the wider area. However, it is noted that the traffic levels for recreational vessels are considered low within the wider area, therefore the magnitude has been considered as moderate.
- 246 Overall, this effect has been assessed to be minor/moderate.

Cumulative Effect on Marine Radar Systems

- 247 Following consideration of the baseline the following impacts have been identified for this receptor:
- Implications on the effectiveness of marine radar.
- 248 Based on marine radar trials carried out to date (DfT, 2004 and BWEA, 2007), 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 (note that trials are on-going). The available sea room for vessels to increase their passing distance in order to minimise the effects of WTGs on radar is decreased with the presence of multiple wind farms in the area, therefore increasing the risk of radar interference.

- 249 Given the reduced sea room available for increasing passing distance, the sensitivity of this receptor is moderate.
- 250 This effect will be present throughout the life of the wind farms and will affect receptors within the wider area, resulting in a high magnitude.
- 251 Overall, this effect has been assessed to be moderate/major and therefore significant.

Cumulative Effect on Emergency Response

- 252 Following consideration of the baseline the following impacts have been identified for these receptors:
- Implications on the response capability of emergency responders.
- 253 The presence of multiple wind farms and associated infrastructure has the potential to increase the need for emergency response activities and restrict access to casualties within the wind farms. However, wind farm structures may also aid emergency response by providing a place of refuge and a point of reference.
- 254 Given the adaptability of emergency responders to work within wind farm areas the sensitivity of this receptor is considered to be low.
- 255 This effect will be present throughout the life of the wind farms and will affect receptors within the wind farms areas and wider area. It is likely that all emergency response operations in the outer Firth of Forth and Firth of Tay region will be affected by the presence of the wind farms, resulting in a high magnitude.
- 256 Overall, this effect has been assessed to be moderate.

Cumulative Effect on Ports

- 257 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 region, 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. However, at this stage a full assessment of the effects cannot be undertaken due to the uncertainty over which ports will be used for construction works and operations and maintenance.
- 258 Once the export cables are installed, there are not expected to be any cumulative impacts associated with other elements of the projects, apart from limited periods where cable maintenance occurs.

19.9.3 Effects of Decommissioning

- 259 The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the construction phase.

19.10 Mitigation

19.10.1 Development Area

260 The following section details the Additional Mitigation measures which will be used to reduce residual effects on shipping and navigation receptors in the Development Area (see Table 19.8). This excludes the Embedded Mitigation measures outlined in *Section 19.3.2*.

Table 19.8: Summary of Additional Monitoring and Mitigation Measures

Receptor/Effect	Additional Mitigation and Monitoring Measures	Purpose/Outcome
Effect of Construction on Commercial Vessels/ Commercial Fishing Vessels/ Recreational Vessels	Appropriate marine co-ordination (through a dedicated marine coordination function) will be implemented.	This will ensure that construction and support vessels do not create an unacceptable navigation risk.
	A risk assessment will be carried out to determine any requirements for guard vessels during the construction phase.	This will ensure that construction activities are appropriately protected and third parties are sufficiently alerted of construction activities.
	Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB.	This will guide vessels around temporary navigational hazards prior to implementation of the final marking and lighting scheme.
	All vessels will be fit for purpose for construction and operation activities as per MCA, international and project safety management system requirements.	This will ensure that navigational risks are appropriately managed.
Effect of Operation on Commercial Vessel Collision Risk	An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation.	To inform the mariner of the location of the Inch Cape Structures so they can effectively passage plan.
Effect of Operation on Commercial Fishing Vessels	Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB.	This will guide vessels around temporary navigational hazards prior to implementation of the final marking and lighting scheme.
	An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation.	To inform the mariner of the location of the Inch Cape Structures so they can effectively passage plan.
Effect on Commercial Vessels Snagging Risk	A monitoring plan will be determined for the Offshore Export Cable, which considers higher risk areas such as anchorage locations. Appropriate remedial action will be taken where required.	To ensure maintenance of appropriate cable protection and burial.

Receptor/Effect	Additional Mitigation and Monitoring Measures	Purpose/Outcome
Effect on Recreational Vessels	Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB.	This will guide vessels around temporary navigational hazards prior to implementation of the final marking and lighting scheme.
	An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation.	To inform the recreational sailor of the location of the Inch Cape Structures so they can effectively passage plan.
Effect on Marine Radar Systems	Consideration will also be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout.	Extra aid to help vessels safely navigating around the Development Area.

19.10.2 Offshore Export Cable Corridor

261 The following section details the additional mitigation measures which have been suggested to reduce the effect on shipping and navigation receptors in vicinity of the Offshore Export Cable Corridor (see Table 19.9). This excludes the embedded mitigations as outlined in *Section 19.3.2*.

Table 19.9: Summary of Monitoring and Additional Mitigation Measures

Effect	Additional Mitigation and Monitoring Measures	Purpose/Outcome
Effect of Construction on Commercial Vessels/ Commercial Fishing Vessels/ Recreational Vessels	Appropriate marine co-ordination (through a dedicated marine coordination function) will be implemented.	This will ensure that construction and support vessels do not create an unacceptable navigation risk.
	A risk assessment will be carried out to determine any requirements for guard vessels during the construction phase.	This will ensure that construction activities are appropriately protected and third parties are sufficiently alerted of construction activities.
	Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB.	This will guide vessels around temporary navigational hazards.
Effect of Offshore Export Cable on Commercial Vessels / Fishing Vessels / Recreational Vessels	A monitoring plan will be determined for the Offshore Export Cable, which considers higher risk areas such as anchorage locations. Appropriate remedial action will be taken where risks have been determined to be unacceptable.	To ensure anchoring risk to vessels is managed.
	The Offshore Export Cable will be marked on relevant United Kingdom Hydrographic Office (UKHO) admiralty charts.	

Effect	Additional Mitigation and Monitoring Measures	Purpose/Outcome
Effect of Offshore Export Cable on Vessel Navigation Equipment	Cables will be suitably buried or will be protected by other means when burial is not practicable. They will be specified to reduce EMF emissions as per industry standards and best practice such as the relevant IEC specifications.	This will reduce will reduce the potential for impacts relating to EMF.

19.11 Residual Effects

262 This section presents a summary of the effects and relevant mitigation measures for the Wind Farm, Offshore Export Cable and cumulative effects and presents the post-mitigation (residual) effects. This is the risk level that is remaining following the implementation of additional mitigation measures.

19.11.1 Development Area

263 Table 19.10 summarises the effects, mitigations and residual effects for the construction, operations and maintenance within the Development Area. The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the construction phase. The approach to decommissioning is described in *Chapter 7*. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 (see *Section 3.2.5*) and will be subject to approval from DECC prior to implementation.

Table 19.10: Summary of Effects and Mitigation

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction				
Allision with partially constructed Inch Cape Structures	Commercial Shipping	Minor/Moderate	<ul style="list-style-type: none"> Appropriate marine co-ordination (through a dedicated marine coordination function) will be implemented. This will ensure that construction and support vessels do not create an unacceptable navigation risk. A risk assessment will be carried out to determine any requirements for guard vessels during the construction phase Additional temporary buoyage, relating to partially constructed works, will be determined through 	Negligible/Minor
Increased transit times and distances				
Vessel to vessel collision risk				

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
			risk assessment and agreed in consultation with the NLB. <ul style="list-style-type: none"> An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. All vessels will be fit for purpose for construction and operation activities as per MCA, international and project safety management system requirements. 	
Vessel to vessel collision risk	Commercial Fishing Vessels	Minor/Moderate	<ul style="list-style-type: none"> As above 	Negligible/Minor
Allision with partially constructed structures				
Gear snagging on partially constructed Inch Cape Structures or installed cables				
Vessel to vessel collision risk	Recreational Vessels	Minor	<ul style="list-style-type: none"> As above 	Negligible/Minor
Allision with partially constructed Inch Cape Structures				
Operation and Maintenance				
Increased transit times and distances	Commercial Vessels Routeing	Moderate/Major	<ul style="list-style-type: none"> Consideration will be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout. An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	Minor/Moderate

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
			<ul style="list-style-type: none"> • Consultation with regular operators and local ports. 	
Vessel to vessel collision risk	Commercial Vessels	Moderate	<ul style="list-style-type: none"> • Consideration will also be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout. • An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	Minor
Allision with Inch Cape Structures				
Vessel to vessel collision risk	Commercial Fishing	Moderate	<ul style="list-style-type: none"> • Consideration will also be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout. • An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	Minor
Allision with Inch Cape Structures				
Vessel to vessel collision risk	Recreational Vessels	Minor/Moderate	<ul style="list-style-type: none"> • Consideration will also be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout. • An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	Negligible/Minor
Allision with Inch Cape Structures				
The presence of the Wind Farm and associated infrastructure has the potential to	All Sea Users and Emergency Response Operators	Moderate	<ul style="list-style-type: none"> • An enhanced ERCoP will consider any site specific issues relating to the ICOL Project. It will include the principles of self-help with respect to SAR. Project staff will be given appropriate training to carry out 	Minor

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
increase the need for emergency response activities and restrict access to casualties within the Development Area.			emergency response capability identified through the ERCoP.	
Effect on Marine Radar Systems	All Sea Users	Minor/Moderate	<ul style="list-style-type: none"> • Consideration will also be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout. • An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	Negligible/Minor

19.11.2 Offshore Export Cable Corridor

264 Table 19.11 summarises the effects, mitigations and residual effect for the construction, operation/maintenance of the Offshore Export Cable.

265 The potential effects of decommissioning are considered to be equivalent to and potentially lower than the worst case effects assessed for the construction phase. The approach to decommissioning is described in *Chapter 7*. A decommissioning plan will be prepared in accordance with the requirements of the Energy Act 2004 (see *Section 3.2.5*) and will be subject to approval from DECC prior to implementation.

Table 19.11: Summary of Effects and Mitigation – Offshore Export Cable

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Installation				
Vessel to vessel collision risk	Commercial Vessels	Minor/Moderate	<ul style="list-style-type: none"> • Appropriate marine co-ordination (through a dedicated marine coordination function) will be implemented. This will ensure that construction and support vessels do not create an unacceptable 	Negligible/Minor

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
			<p>navigation risk.</p> <ul style="list-style-type: none"> • A risk assessment will be carried out to determine any requirements for guard vessels during the construction phase. • Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB. • An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	
Vessel to vessel collision	Commercial Fishing Vessel	Minor/Moderate	<ul style="list-style-type: none"> • As above 	Negligible/Minor
Snagging risk				
Vessel to vessel collision	Recreational Vessels	Minor	As above	Negligible/Minor
Operations and Maintenance				
Effects on anchoring operations	Commercial Vessels	Minor/Moderate	<ul style="list-style-type: none"> • A monitoring plan will be determined for the Offshore Export Cable, which considers higher risk areas such as anchorage locations. Appropriate remedial action will be taken if risks are determined to be unacceptable. • The Offshore Export Cable will be marked on relevant United Kingdom Hydrographic Office (UKHO) admiralty charts. 	Negligible/Minor
Snagging risk	Commercial Fishing Vessels	Minor/Moderate	<ul style="list-style-type: none"> • A monitoring plan will be determined for the Offshore Export Cable, which considers higher risk areas such as anchorage locations. Appropriate remedial action will be taken if risks are determined to be unacceptable. 	Negligible/Minor

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Effects on Anchoring Operations	Recreation Vessels	Negligible/Minor	A monitoring plan will be determined for the Offshore Export Cable, which considers higher risk areas such as anchorage locations. Appropriate remedial action will be taken if risks are determined to be unacceptable.	Negligible/Minor
Interference caused by EMF	Vessel Navigation Equipment	Moderate	<ul style="list-style-type: none"> • Cables will be specified to reduce EMF emissions as per industry standards and best practice such as the relevant IEC specifications. • A monitoring plan will be determined for the Offshore Export Cable, which considers higher risk areas such as anchorage locations. Appropriate remedial action will be taken if risks are determined to be unacceptable. 	Negligible/Minor

19.11.3 Cumulative Summary Table

266 Table 19.12 summarises the effects, mitigation (Inch Cape only) and residual effect when considering multiple offshore wind farm developments in the outer Firth of Forth and Firth of Tay area.

Table 19.12: Summary of Effects and Mitigation

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Construction				
Vessel to vessel collision risk	Commercial Vessels	Minor/ Moderate	<ul style="list-style-type: none"> • Appropriate marine co-ordination (through a dedicated marine coordination function) will be implemented. This will ensure that construction and support vessels do not create an unacceptable navigation risk. • A risk assessment will be carried out to determine any requirements for guard vessels during the construction phase • Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB. • An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. • All vessels will be fit for purpose for construction and operation activities as per MCA, international and project safety management system requirements. • Consider co-ordination and co-operation between wind farm developers in outer Firth of Forth and Firth of Tay region where practicable. 	Negligible/ Minor
Allision with partially constructed structures				
Vessel to vessel collision risk	Commercial Fishing Vessels	Minor/ Moderate	<ul style="list-style-type: none"> • As above 	Negligible/ Minor
Allision with partially constructed structures				

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Gear snagging on partially constructed structures or installed cables				
Vessel to vessel collision risk	Recreational Vessels	Minor	<ul style="list-style-type: none"> As above 	Negligible/ Minor
Allision with partially constructed structures				
Operation and Maintenance				
Increased transit times and distances	Commercial Vessels	Moderate/ Major	<ul style="list-style-type: none"> Consideration will be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout. An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	Moderate
Vessel to vessel collision risk				
Vessel to structure allision risk				
Increase of visual confusion when navigating				
Deviations to avoid the wind farm areas.	Commercial Fishing Vessels	Moderate	<ul style="list-style-type: none"> Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB. 	Minor/ Moderate
Vessel to structure allision risk				
Vessel to structure allision risk	Recreational Vessels	Minor/ Moderate	<ul style="list-style-type: none"> Additional temporary buoyage, relating to partially constructed works, will be determined through risk assessment and agreed in consultation with the NLB. 	Negligible/ Minor

Effect	Receptor	Pre-Mitigation Effect	Mitigation	Post-Mitigation Effect
Effects on Marine Radar Systems	All Sea Users	Moderate/Major	<ul style="list-style-type: none"> Consideration will also be given to any additional Aids to Navigation that result as a requirement of the finalised Project layout. An advanced level of promulgation of information will be carried out which is specifically targeted to receptors identified through consultation. 	Minor/Moderate
The presence of multiple wind farms and associated infrastructure has the potential to increase the need for emergency response activities and restrict access to casualties within the wind farms.	All Sea Users and Emergency Response Operators	Moderate	<ul style="list-style-type: none"> An enhanced ERCoP will consider any site specific issues relating to the ICOL Project. It will include the principles of self-help with respect to SAR. Project staff will be given appropriate training to carry out emergency response capability identified through the ERCoP. 	Minor/Moderate

19.12 Summary

267 NRAs have been undertaken for both the Wind Farm (*Appendix 19A*) and the Offshore Export Cable (*Appendix 19B*). These include an assessment of the baseline environment by analysing AIS and Radar marine traffic data, historical incident data and emergency response facilities, as well as presenting results of collision risk modelling and a qualitative risk assessment for the Wind Farm and Offshore Export Cable. These NRAs have informed the impact assessment undertaken in this chapter.

268 Effects on shipping and navigation receptors (commercial vessels, commercial fishing vessels, recreational vessels and emergency responders) have been assessed by evaluating the sensitivity of the receptors and the magnitude of the effect, resulting in an assessment of significance (as detailed in *Sections 19.4 to 19.7*). The assessment has been separated into effects of the Wind Farm and effects of the Offshore Export Cable and also split up by phase to recognise that the effects will be different during construction/installation works compared to during times of operation and maintenance. It is assumed throughout that the effects during decommissioning will be the same as or potentially less than those described for the construction phase. Assessments have also been made of the effect of the Wind

Farm on Marine Radar Systems and the effect of the Export Cable on vessel navigation equipment.

- 269 Following the assessment of the effects (which assumed that Embedded Mitigation measures were in place), additional mitigation measures were outlined which would reduce the significance and the residual effect was stated.
- 270 For the assessment of effects of the Wind Farm during construction, all effects can be reduced to a negligible/minor level following the implementation of additional mitigation measures. When the effects of the Wind Farm during operation and maintenance were assessed, it was found that mitigation measures could generally reduce the residual effect to a minor low or minor/negligible level. However, for the effect on commercial vessel routeing whereby vessels will be subject to increased transit times and distances, the residual effect was assessed to be minor/moderate.
- 271 For the installation and operation/maintenance phases of the Offshore Export Cable, all residual effects were assessed to be negligible/minor.
- 272 Cumulative effects were also assessed to consider the effect of multiple offshore wind farms in the outer Firth of Forth and Firth of Tay area (Firth of Forth Phase 1 (Alpha and Bravo), Neart na Gaoithe and Inch Cape). In the situation that construction or cable laying activities are being undertaken simultaneously at more than one wind farm within the outer Firth of Forth and Firth of Tay region, all residual effects were assessed to be negligible/minor. When considering the cumulative effects during the operation and maintenance phases of multiple wind farms, the following were identified as having the most significant residual effects:
- The cumulative effect on commercial vessels, potentially resulting in increased transit times and distances, adverse weather routing, increase of visual confusion when navigating, vessel to vessel collision risk and vessel to structure allision risk (moderate residual effect);
 - The cumulative effect on commercial fishing vessels, potentially resulting in deviations to avoid the development areas and vessel to structure allision risk (minor/moderate residual effect);
 - The cumulative effect on recreational vessels is negligible/minor;
 - The cumulative effect on marine radar systems, affecting all sea users (minor/moderate residual effect); and
 - The cumulative effect on emergency responders, potentially increasing the need for emergency response activities and restricting access to casualties within the areas (minor/moderate residual effect).

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