Strategic assessment of impacts on navigation of shipping and related effects on other marine activities arising from the development of Offshore Wind Farms in the UK REZ

Prepared by:	Anatec Limited
Presented to:	The Crown Estate (TCE)
Date:	25th June 2012
Revision No.:	00
Ref.:	A2776

Anatec
Address:
Tel:
Fax:
Email:

Aberdeen Office
36 Upperkirkgate, Aberdeen, AB10 1BA, Scotland, UK
01224 633711
0709 2367306
aberdeen@anatec.com

Cambridge Office
16 Ward Way, Witchford, Ely, Cambs, CB6 2JR, UK
01353 661200
0709 2367306
cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of The Crown Estate. The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

Anatec are grateful to all Stakeholders and Developers for their help in the successful completion of this Project. In particular they would like to thank the Steering Group who provided essential guidance and support throughout.

TABLE OF CONTENTS

Executive Summary

Owing to the rapid expansion of offshore wind farm sites in the United Kingdom, combined with an expansion in other offshore uses and the development of European offshore wind farm sites, there was recognition of an increasing potential for cumulative and in-combination effects on shipping and navigation. This recognition and understanding of the need for a strategic assessment was developed through dialogue with wind farm developers and key statutory stakeholders, e.g. the Maritime and Coastguard Agency and Trinity House Lighthouse Services and other stakeholders within the Department of Transport's Nautical and Offshore Renewable Energy Liaison (NOREL) Group.

The purpose of this strategic assessment is to initially identify the key issues, on a strategic level, which may arise from the development of offshore wind farms in the UK REZ and impact on the safe co-existence of commercial shipping and other marine navigation activities. The project has identified issues that are recommended for priority attention. The assessment deals with issues at a strategic level and is not intended to be a project specific Navigational Risk Assessment (NRA) or a Zone navigational appraisal.

Following extensive consultation with key stakeholders, the activities to be considered within the assessment and the potential issues associated these activities were identified. The activities included in the assessment are presented in the following list:

- Dredging Areas and Transit Routes;
- Recreational (Yachting, Power Boating, Scuba, Fishing etc.);
- Subsea Cables and Pipelines;
- Disposal Sites;
- Port Operations;
- Commercial Shipping;
- Commercial Fishing;
- Aids to Navigation;
- Oil and Gas;
- CCS and NGS;
- Wave and Tidal;
- Emergency Response;
- Aquaculture;
- Marine Surveys (including Hydrographic);
- Coastal Protection;
- Conservation Sites;
- MOD Defence, Firing, Practice and Exercise Areas (MOD PEXAs); and
- Heritage including Wrecks.

Through stakeholder consultation, the datasets to be sought for use within the assessment were also identified. Data were obtained and subsequently ranked (high, medium or low) to reflect confidence in the data.

As part of the assessment, seven study areas were defined by expert review giving account to the potential for cumulative and in-combination impacts. The assessment was then carried out by marine risk consultants who used the activities and issues list to identify and refine the cumulative and in-combination impacts within each of the study areas.

Two workshops were held to review the initial findings of the in-combination and cumulative assessment and actively engage others in the assessment process. The first workshop involved Developers and gave them the opportunity to provide input to the process. The second employed the same process with the navigation and shipping Stakeholders.

Following the assessment and consultation process, the results were assessed by the Project Team. The following were identified as strategic issues to be carried forward as recommendations for priority attention:

- Wind Farm Project Site Boundary and Alignment of Structures;
- Radar Implications (Vessel Detection);
- Congestion and Displacement;
- Emergency Response Demand, Provision and the Potential for Restricted Access;
- Adverse Weather Routes;
- Access; and
- Transboundary.

Against each of the issues recommended for priority attention, the assessment has offered a number of suggested actions - all of which are proposed to address the strategic issues identified.

Glossary

Automatic Identification System (AIS)	Very High Frequency (VHF) radio based automatic tracking system used by vessels and shore based station for identifying and locating.
Alignment	Refers to the alignment of turbines within the site boundary.
Allision	Striking of a moving vessel against a stationary vessel or fixed object.
Collision	Striking of two vessels that are in motion.
COLREGS	The International Regulations for Preventing Collisions at Sea 72/77: Rules that apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.
Navigational Element	The part of a marine activity which involves the control of a vessel over water.
Navigational Risk Assessment (NRA)	Study which must be undertaken as part of an offshore developer's Environmental Statement which addresses marine navigational safety risks.
Radar	An on-board navigation system which uses radio waves to detect the range, bearing and speed of other vessels and objects.
Renewable Energy Zone (REZ)	The Renewable Energy Zone (which extends up to a maximum of 200 nautical miles from the UK's baseline) was declared under section 84 of the Energy Act 2004. The Energy Act 2004 vested rights to The Crown Estate to license the generation of renewable energy on the continental shelf within the Renewable Energy Zone. Within the zone, the UK has claimed exclusive rights with respect to the production of energy from water or winds.
Site Boundary	Refers to the overall shape of the wind farm site, the boundary limits and includes any designated shipping corridors and any specifically designed navigational features.
Snagging	The action of a vessel's anchor, fishing gear or other deployed equipment becoming attached to an underwater obstruction such as a submarine cable or pipeline, potentially resulting in damage to the vessel, it's equipment and/or the cable/pipeline.
Territorial Seas	The UK territorial sea is defined by the Territorial Sea Act 1987 as the sea extending 12nm from the baseline.
Vessel	Watercraft capable of being used as a means of transportation on water.
Vessel Traffic Services (VTS)	A service implemented by a Competent Authority designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area.

Abbreviations

ATBA	-	Area to be Avoided
AIS	-	Automatic Identification System
AtoN	-	Aids to Navigation
BMAPA	-	British Marine Aggregates Producers Association
BPA	-	British Ports Association
CA	-	Cruising Association
CCS	-	Carbon Capture and Storage
CoS	-	Chamber of Shipping
CHP	-	Civil Hydrography Programme
CPA	-	Closest Point of Approach
Defra	-	Department for Environment, Food and Rural Affairs
DfT	-	Department for Transport
EU	-	European Union
GIS	-	Geographic Information System
GW	-	Gigawatt
HSE	-	Health and Safety Executive
IALA	-	International Association of Lighthouse Authorities
MCA	-	Maritime and Coastguard Agency
MEHRA	-	Marine Environmental High Risk Area
MGN	-	Marine Guidance Note
MMO	-	Marine Management Organisation
MOD	-	Ministry of Defence
NFFO	-	National Federation of Fisherman (NFFO) England
NGS	-	Natural Gas Storage
NLB	-	Northern Lighthouse Board
nm	-	Nautical Miles
NOREL	-	Nautical and Offshore Renewable Energy Liaison Group
NRA	-	Navigational Risk Assessment
OREEF	-	Offshore Renewable Energy Emergency Forum
PEXA	-	Practice and Exercise Area
RAM	-	Restricted in Ability to Manoeuvre
REZ	-	Renewable Energy Zone
RNLI	-	Royal National Lifeboat Institute
RYA	-	Royal Yachting Association
SAC	-	Special Area of Conservation
SEA	-	Strategic Environmental Assessment
SFF	-	Scottish Fishermen’s Federation
SPA	-	Special Protection Area
STW	-	Scottish Territorial Waters Sites
TCE	-	The Crown Estate
THLS	-	Trinity House Lighthouse Services
UK	-	United Kingdom

UKFIM	-	United Kingdom Fisheries Information Project
UKHO	-	United Kingdom Hydrographic Office
UKMPA	-	United Kingdom Marine Pilots Association
UKMPG	-	United Kingdom Major Ports Group
VHF	-	Very High Frequency
VLCC	-	Very Large Crude Carrier
VTS	-	Vessel Traffic Services

TABLES

FIGURES

1. Introduction

In 2008, The Crown Estate (TCE), announced proposals for the third round (Round 3) of offshore wind farm leasing. The proposals comprised 9 zones with a potential combined capacity of 32 Gigawatts (GW). Following the development of over 1 GW of offshore wind projects to date from Rounds 1 and 2, Round 3 represents a large increase in spatial scale and activity. Some Round 1 and Round 2 sites have also been granted extensions, and following the Scottish Government's offshore wind Strategic Environmental Assessment (SEA) there is also a programme of wind farm development in Scottish Territorial Waters (STW).

The Crown Estate as landowner of the seabed within Territorial Waters, and rights holder for renewable energy projects in the UK Renewable Energy Zone (REZ), upholds its core values of commercialism, integrity and stewardship by promoting sustainable development within its marine estate. Through strategic leasing rounds, The Crown Estate seeks to ensure that the areas leased for the development of Offshore Wind Farms are fit for purpose and allow users of the Country's marine resources to safely co-exist.

Owing to the rapid expansion of offshore wind farm sites in the United Kingdom, combined with an expansion in other offshore uses and the development of European offshore wind farm sites, there was recognition of an increasing potential for cumulative and in-combination effects on shipping and navigation. This recognition and understanding of the need for a strategic assessment was developed through dialogue with wind farm developers and key statutory stakeholders, e.g. the Maritime and Coastguard Agency and Trinity House Lighthouse Services and other stakeholders within the Department of Transport's Nautical and Offshore Renewable Energy Liaison (NOREL) Group. Ultimately this strategic assessment aims to identify the key issues that require addressing in support of the safe and harmonious use of the UK Renewable Energy Zone (REZ) and thereby helps enable users of the UK's marine resources to safely co-exist.

1.1. Purpose of the Project

The purpose of the project is to initially identify the key issues, on a strategic level, which may arise from the development of offshore wind farms in the UK REZ and impact on the safe co-existence of commercial shipping and other marine navigation activities. Subsequently, the project will recommend whether any of the identified issues should be subject to further assessment.

It is recognised that the development of the offshore wind industry brings with it both commercial benefits such as job creation and environmental benefits due to the associated reduction in fossil fuel usage and greenhouse gas emissions, as well as potential negative impacts. However, this study has been designed to focus on the safe co-existence of commercial shipping and other marine navigation activities with offshore wind farms rather than the wider socio-economic issues that are considered on a project level.

1.2. Aims and Objectives

The primary objectives of the project are to;

- Identify issues that arise from the cumulative and in-combination impacts of offshore wind farms on shipping and navigation that should be considered as part of this strategic assessment.
- Make recommendations to assist with ensuring that the areas eventually leased for the development of offshore wind farms are fit for purpose and allow users of the UK's marine resources to safely co-exist.

This report summarises the methodology applied in conducting the assessment and sets out its findings and recommendations.

This project is not intended to be a project specific Navigational Risk Assessment (NRA) or a Zone navigational appraisal. It is also noted that this report does not replace the developer's obligation to conduct NRAs but will provide useful input to inform them, regional assessments, Zone appraisals and can be used by regulators and developers to assist with planning on a strategic level.

1.3. Scope

The project has been designed to identify cumulative and in-combination issues that impact on safe navigation and hence the safe co-existence of commercial shipping, marine navigation activities and the development of offshore wind farms. Accordingly, the scope of the study comprises:

- All planned, consented and or developed UK Offshore Wind Farms (including those allocated under Rounds 1, 2 and 3 of the Offshore Wind Farm leasing programme together with their extensions, demonstration sites and those in Scottish Territorial Waters); and
- European Union (EU) Offshore Wind Farm projects (planned, consented or developed) that may also influence the outcome of this strategic assessment.

1.4. Overview of Program

Table 1.1 identifies the key elements and timescales of the project.

Table 1.1 Overview of Program

Identification of Key Marine Activities and relevant Statutory and Non Statutory Stakeholders	October 2011
Engagement of all Stakeholders to identify Issues (Non Geographic)	November 2011
Data Gathering (from Stakeholders and Developers)	December 2011 to mid-January 2012
Report and Recommendations to Steering Group	January 2012
Engagement of Developers for feedback on results	February 2012
Engagement of Stakeholders for feedback on results	February 2012
Presentation of Findings to Steering Group and Submission of Report	May 2012
Submission of Report and Presentation to NOREL	June 2012

1.5. Key definitions

Definitions of cumulative and in-combination are essential for the correct interpretation of the activities and issues discussed within the project and have been determined as follows;

Cumulative effects - refers to impacts on shipping and navigation arising from all the planned and consented UK offshore wind farms (and their associated activities) including those in EU Member State waters.

In-combination effects - refers to impacts on shipping and navigation arising from offshore wind farms (and their associated activities) combined together with impacts from other marine activities or uses of the sea.

1.6. The Steering Group

The following list identifies those organisations and individuals who, along with Anatec Ltd, formed the Steering Group for this project:

- The Crown Estate
- Maritime and Coastguard Agency
- Trinity House Lighthouse Services
- RenewableUK
- Strategic Marine Services Ltd (Captain Bob Hawley) as specialist Maritime Adviser to The Crown Estate
- Captain Colin Brown as specialist Maritime Adviser to Anatec
- Department for Transport (Reserve)
- Chamber of Shipping (Reserve)

The Steering Group consisted of maritime and renewables professionals who between them added to the in house experience provided by the Anatec team. The group were an essential part of the assessment process providing an important balance in guiding the project and dealing with any issues that arose throughout the process.

2. Assessment Methodology

2.1. Step 1 – Stakeholder Mapping and Activity Identification

A stakeholder mapping exercise was undertaken to identify the key stakeholders that should be involved with the assessment, to help access data, and to enable the project team to understand all the key issues. Stakeholders were identified where an activity has the potential to result in a cumulative and/or in-combination effect on the navigation of shipping and other marine activities.

Step 1 is addressed in Section 3 of this report.

2.2. Step 2 – Activity Screening Workshop

On 11 November 2011, a workshop with representatives of the key stakeholder groups identified in Step 1 (Section 3) was undertaken to:

- Actively engage stakeholders in the project;
- Identify the activities that, when combined with offshore wind, have a cumulative or in-combination impact on the navigation of shipping and other marine activities;
- Define issues relating to each activity that could be impacted cumulatively or in-combination from the development of offshore wind farms;
- Agree the activities to be considered within the assessment; and
- Identify datasets to be sought for use within the assessment.

Appendix A gives details of the process undertaken at the 'Activity Screening Workshop' and the workshop outcomes.

Step 2 is addressed in Section 4 of this report.

2.3. Step 3 – Data Gathering and Review

Following the workshop, using stakeholder and developer contacts, the following tasks were undertaken:

- Gather the data sets identified in the activity screening workshop;
- Gather data from offshore wind farm projects and related shipping information;
- Identify areas where further data may be required. This was based on data coverage and confidence of quality; and
- Rank the level of data representation across the area. A ranking of low, medium or high has been assigned to reflect confidence level.

Step 3 is addressed in Sections 4.4 and 8 of this report.

2.4. Step 4 – In-combination and Cumulative Assessment

An assessment was undertaken by the project team to identify the cumulative and in-combination impacts on shipping and the navigational element of other identified marine activities arising from the development of Offshore Wind Farms. The assessment considered those activities and issues identified by the Project Team, Steering Group and Stakeholders (Appendix A).

As part of the assessment, seven study areas were defined by expert review giving account to the potential for cumulative and in-combination impacts (these Study Areas are illustrated in Section 7 and described fully in Appendix B). The assessment was then carried out by marine risk consultants who used the activities and issues list to identify and refine the cumulative and in-combination impacts within each of the study areas.

A ranking from major positive to major negative was assigned to the identified impacts to create a range.

The bands for the rankings are as follows:

Table 2.1 Rankings of Strategic Effects used to Create a Range

Major Positive
Moderate Positive
Minor
Moderate Negative
Major Negative

The reason for presenting a range rather than an individual ranking can be attributed to the fact that the assessment was strategic and not tasked with assessing discrete project level impacts or site specific issues.

Throughout the assessment, it was assumed that industry standard mitigations for offshore wind farms will be in place (see Section 9).

Step 4 is addressed in Section 10 of this report, by demonstrating a worked example.

2.5. Step 5 – Workshop

Two workshops were held to review the results of the in-combination and cumulative assessment. The first workshop involved Developers and gave them the opportunity to provide input to the process. The second employed the same process but with the navigation and shipping Stakeholders.

The aim of the workshops was to review Anatec's findings through actively engaging the Developers and Stakeholders in the assessment. There was also a three week consultation

process post workshop to provide further opportunity for Developers and Stakeholders to input into the assessment findings. This consultation feedback then provided a basis for Anatec to finalise the ranges for each issue in each study area.

Appendices C and D contain the minutes from both of these workshops.

2.6. Step 6 – Close Out

Following the workshops, the key issues to be recommended for priority attention were identified using indicators as defined below.

Reasons for recommending issues for priority attention include:

(a) Have a worst case ranking of 'major negative' and/or
(b) Have a high level of uncertainty and/or
(c) There is a lack of consensus between the Stakeholders and/or Developers on the rankings.
(d) Other recommendations by the Project Team based on expert interpretation, reviewed and agreed by the Steering Group.

Overview recommendations to address the issues were identified for further discussion.

The following flow chart (Figure 2.1) demonstrates the above noted selection process used to screen in and out issues as recommendations for priority attention.

Step 6 is addressed in Sections 11 to 14 of this report.

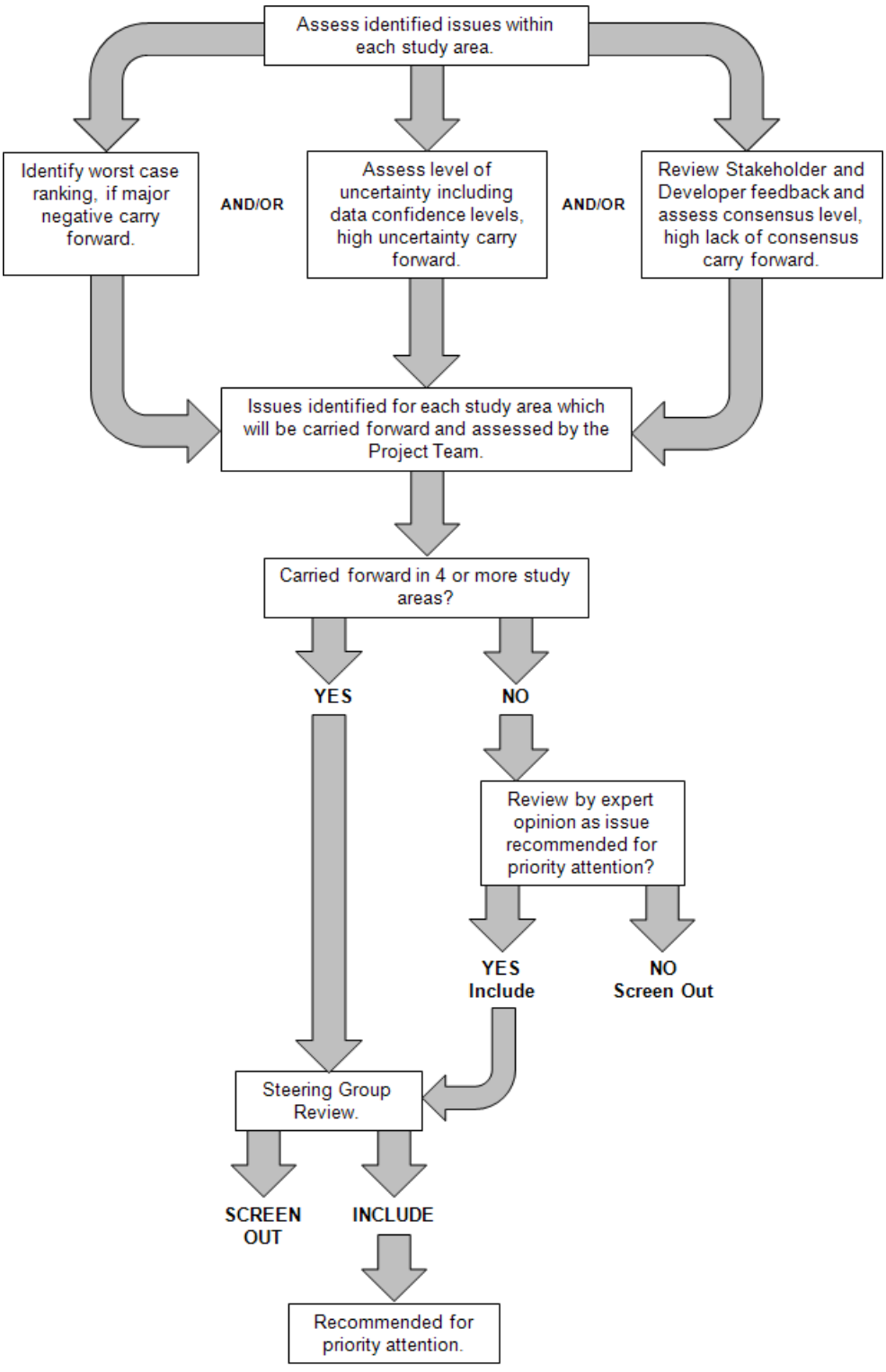


Figure 2.1 Selection Process for Issues to be Carried Forward as Recommendations from Priority Attention

3. Stakeholder Mapping and Activity Identification

As outlined in Step 1 of the methodology, key stakeholders groups and representatives were identified. These are shown by user group in Table 3.1.

Table 3.1 Stakeholder Groups and Recommended Representatives

Aggregate Dredging	• British Marine Aggregate Producers Association (BMAPA)*
Recreational Vessel Activity	• Royal Yachting Association (RYA)* • Cruising Association (CA)
Port Operations	• UK Major Ports Group (UKMPG) • British Ports Association (BPA)* • Harbour Master Association * • UK Marine Pilots Association (UKMPA) • UK Vessel Traffic Services (VTS) Association
Fishing	• National Federation of Fishermen (NFFO) England* • Scottish Fishermen's Federation (SFF) • Welsh Fishermen's Association • Federation of Irish Fisherman
Commercial Shipping	• UK Chamber of Shipping (CoS)* • International Chamber of Shipping (Marisec) • Maritime and Coastguard Agency (MCA)* • Department for Transport (DfT) Shipping Policy* • International Marine Contractors Association • UK Hydrographic Office (UKHO) • Deep Sea Pilots Association* • Intertanko • Stenaline* • P&O Ferries • Isle of Man Steam Packet Company*
Aids to Navigation	• Trinity House Lighthouse Services (THLS)* • Northern Lighthouse Board (NLB)* • Commissioner of Irish Lights*
Oil and Gas Operations	• Oil and Gas UK* • Health and Safety Executive (HSE)
Marine Renewable Operations	• RenewableUK*
Search and Rescue	• Maritime and Coastguard Agency (MCA)* • Royal National Lifeboat Institute (RNLI)*
Environmental	• Marine Management Organisation (MMO)* • Marine Scotland • Department for Environment, Food and Rural Affairs (DEFRA)
Defence	• Ministry of Defence (MOD)

Social	• Nautical Institute • Nautilus*
International Representatives	Representatives of International Regulators were invited from; • Belgium • The Netherlands • Germany • Isle of Man • Denmark • France • Republic Of Ireland

** Indicates attendance at the workshop.*

As part of this exercise, and in conjunction with the Steering Group, a list of marine activities which could have potential in-combination impacts was developed for discussion and screening at the Activity Screening Workshop. These are listed below.

- Aggregate Dredging
- Recreational Yachting and Boating
- Recreational Fishing
- Subsea Cables
- Disposal Sites
- Port Navigation Operations
- Commercial Fishing
- Commercial Shipping
- Aids to Navigation
- Oil and Gas Operations
- Carbon Capture Storage (CCS) and Natural Gas Storage (NGS)
- Offshore Wind (cumulative)
- Wave and Tidal Devices
- Search and Rescue
- Aquaculture
- Hydrographic Surveying
- Coastal Protection
- Marine Protected Areas and Marine Conservation Zones
- Defence
- Tourism e.g. scuba and wildlife watching
- Heritage
- Pollution and Salvage Response

4. Activity Screening Workshop

This section details the outcomes of the Activity Screening Workshop including those activities screened out by the stakeholders, those parked for discussion by the Steering Group and the final list of activities (refer to Appendix A for full details).

4.1. Activities Screened Out During the Workshop

The following activity was screened out of the process during the workshop.

4.1.1. Tourism

Tourism was removed on the basis that marine activities associated with tourism will be incorporated with other activities.

4.2. Discussion on Parked Activities

Following identification at the Activity Screening Workshop, the following parked activities were identified for review by the Steering Group.

4.2.1. Met Office Buoys

The Steering Group decided that this activity did not require its own review but could be included as a separate heading under Aids to Navigation.

4.2.2. Hydrographic Surveying to be widened to Marine Surveying

The Steering Group agreed that the activity should be named 'Marine Surveys' but with a separate sub heading specifically for Hydrographic Surveying.

4.2.3. Aquaculture

Due to unknown development plans at this stage for future aquaculture farms, the Steering Group agreed it should remain as an activity until it is demonstrated that there are no in-combination impacts.

4.2.4. Disposal Sites

The Steering Group agreed that disposal sites should remain as an activity and be assessed to confirm there are no in-combination impacts.

The following changes were also agreed by the Steering Group:

- Defence be renamed as MOD Defence, Firing, Practice and Exercise Areas (MOD PEXAs)
- Heritage to be extended to be Heritage and Wrecks
- Recreational Fishing be incorporated into Recreational
- Search and Rescue amended to Emergency Response.

4.3. Final List of Activities

The following 'in-combination' activities were screened in for inclusion in the assessment:

- Dredging Areas and Transit Routes
- Recreational (Yachting, Power Boating, Scuba, Fishing etc.)
- Subsea Cables and Pipelines
- Disposal Sites
- Port Operations
- Commercial Shipping
- Commercial Fishing
- Aids to Navigation
- Oil and Gas
- CCS and NGS
- Wave and Tidal
- Emergency Response
- Aquaculture
- Marine Surveys (including Hydrographic)
- Coastal Protection
- Conservation Sites
- MOD Defence, Firing, Practice and Exercise Areas (MOD PEXAs)
- Heritage including Wrecks

Potential cumulative and in-combination issues identified for each activity during the workshop are listed in Appendix A. This list was then used to undertake the assessment; however it was continually updated and reviewed by the project team and the Steering Group.

An overview description of the navigational elements of each of these activities is given in Section 5.

4.4. Data Gathering and Review

Navigational Stakeholders and Developers were asked to consider data availability for each of the activities identified. The main questions asked were:

- What data are available on the activity?
- What data are available on the shipping and navigation element of the related activity?

Table 4.1 summarises the discussions on each activity.

Table 4.1 Data Requirements Identified by Stakeholders

Activity	Identified Available Data Sets
Dredging Areas and Transit Routes	• Licensed dredge areas. • Transit routes. • Levels of activity in each dredged areas and estimates of flow between licensed areas and ports.
Recreational (Yachting, Scuba, Fishing etc.)	• Recreational cruising route, racing and general sailing areas and marinas. • Recreational fishing data sets (not successfully acquired).
Subsea Cables	• Cable/Pipeline GIS layer. • Charted information. • Vessel activity (not successfully acquired).
Disposal Sites	• Coordinates of disposal sites. • Charted information. • Transits to disposal sites (not successfully acquired).
Port Operations	• Planned/known future ports developments. • Charted information.
Commercial Shipping	• AIS/Radar data from developers. • 2 x 2 weeks of full coastal coverage AIS data. • Adverse weather routeing from key ships' operators.
Commercial Fishing	• VMS data. • AIS/Radar information.
Aids to Navigation	• Charted information.
Oil and Gas	• GIS layer. • Charted information.
CCS and Gas Storage	• GIS layer. • Charted information.
Wave and Tidal	• GIS layer. • Charted information.
Search and Rescue	• GIS layer.
Aquaculture	• GIS layer.
Hydrographic Surveying	• Civil Hydrography Programme.
Coastal Protection	• GIS layer.
MPAs and MCZs	• GIS layer.
Defence	• Charted information. • MOD data (not successfully acquired).
Heritage	• Charted information.

4.5. Workshop Minutes

Minutes of the Activity Screening Workshop and issue identification by the stakeholders are shown in Appendix A.

5. Overview of Navigational Elements of Activities

The following section gives an overview of the navigational elements of the activities which have been included in this assessment.

5.1. Navigational Element of Commercial Shipping

Commercial shipping includes all vessels that transport goods or provide a commercial service. Types of vessel can vary significantly from a small commercial fishing vessel to a very large crude carrier (VLCC). This assessment has considered the following navigational elements associated with commercial shipping:

- Main transit routes for local, national and international vessels;
- Adverse weather routes taken by vessels to mitigate the health and safety risk to the vessel and crew;
- Designated (charted) and preferred anchorages where vessels are noted as anchoring (including for refuge during adverse weather);
- Routeing according to vessel type for example deep draughted vessels using preferred or approved routeing measures;
- Predictable increases in traffic densities;
- Use of existing navigational equipment;
- Vessel to vessel transfers (as per the Ship-to-Ship Transfers Regulations (2010)); and
- Compliance with the COLREGs and IMO adopted routeing measures.

5.2. Navigational Element of Marine Aggregate Dredging

Marine aggregate dredging is the process of extracting sediment from the sea bed using purpose built vessels and transporting it to shore based processing plants or beach replenishment/nourishment works. The navigational elements considered include transits to/from dredge areas and beach replenishment/nourishment sites and vessels engaged in dredging activities or replenishment/nourishment including those 'Restricted in their Ability to Manoeuvre (RAM)' as shown in Figure 5.1.

Figure 5.1 Vessel Engaged in Dredging and Displaying RAM Day Marks

(Photo courtesy of British Marine Aggregate Producers Association)

5.3. Navigational Element of Recreational Activity

Recreational activity includes all water craft transiting to a recreational site or engaged in navigation practices as part of a recreational activity such as yachting, power boating, leisure fishing or diving.

5.4. Navigational Element of Subsea Cables and Pipelines

Cable and pipeline installations and maintenance is generally undertaken by purpose built vessels. Navigational activities include vessels transiting to cable/pipeline locations for installation, maintenance and inspections. See Figure 5.2 for an example of a vessel engaged in cable operations.

Figure 5.2 Vessel Engaged in Cable Operations

(Photo copyright International Cable Protection Committee)

5.5. Navigational Element of Disposal Sites

This activity includes vessels transiting to closed explosive dumping grounds or operational disposal sites to dispose of material or carry out a survey of the area. Other vessels may be displaced into a disposal area which may impact on navigational safety.

5.6. Navigational Element of Port Operations

This includes current and future access for all vessels to and from ports; as well as port activities such as anchorage areas, surveys, channel maintenance, dredging, pilotage and towage.

5.7. Navigational Element of Commercial Fishing

Commercial fishing activity includes all vessels transiting to a fishing site or engaged in navigation practices as part of the commercial fishing process.

5.8. Navigational Element of Aids to Navigation (AtoN)

The increased or decreased use of Aids to Navigation by vessels including, but not limited to, the use of buoyage, lighting, marking and charted features.

5.9. Navigational Elements of Routeing Measures

The increased or decreased use of IMO Routeing Measures including, but not limited to, Traffic Separation Schemes, Deep Water Routes and Areas to be Avoided (ATBA).

5.10. Navigational Element of Oil and Gas

This includes vessels engaged in the construction, operation and decommissioning of offshore oil and gas installations including their supply and support. Both the transits to the sites and access and manoeuvrability issues for vessels whilst on site have been considered.

5.11. Navigational Element of CCS and NGS

This includes vessels engaged in the supply, support, construction and decommissioning of offshore Carbon Capture and Storage (CCS) and Natural Gas Storage (NGS) facilities. Both the transits to the sites and access and manoeuvrability issues for vessels whilst on site have been considered.

5.12. Navigational Element of Wave and Tidal

This includes vessels engaged in the supply, support, construction and decommissioning of wave and tidal installations. Both the transits to the sites and access issues for the vessels have been considered.

5.13. Navigational Element of Emergency Response

Offshore emergencies can include search and rescue as well as pollution and salvage control and response. The UKs current SAR and Counter Pollution response includes a variety of vessel response facilities. Navigational elements include both the transit routes to the site and the manoeuvrability once on site.

5.14. Navigational Element of Aquaculture

Aquaculture can be broadly split into three categories: growing finfish in cages or pens, growing shellfish on the seabed, trestles, suspended on ropes or nets and growing seaweeds. The navigational elements have been considered as the transits of vessels to and from the sites.

5.15. Navigational Element of Marine Surveys (including Hydrographic)

This includes vessels on transit to or engaged in surveys. The report considers the potential for all surveys however, due to data availability, it mainly considers the MCA Civil Hydrography Programme (CHP) which undertakes the planning and surveying of the UK's seabed to provide information to the UK Hydrographic Office (UKHO). This assessment considers both the transits to/from and access at the survey sites.

5.16. Navigational Element of Coastal Protection

This includes vessels engaged in both the installation and maintenance of coastal protection installations from the seaward limits. Transits to the sites and access issues for the vessels have been considered along with the fact that other vessels that may be displaced into a coastal protection area which may impact on navigational safety or create environmental issues. See Figure 5.3 for an example of a vessel engaged in coastal protection works.

Figure 5.3 Vessel Engaged in Coastal Protection Works

(Photo courtesy of British Marine Aggregate Producers Association)

5.17. Navigational Element of Conservation Sites

There is minimal vessel activity associated with UK conservation sites. Therefore, this assessment considered the environmental and navigational safety issues associated with vessels being displaced into conservation sites such as Marine Environmental High Risk Areas (MEHRAs).

5.18. Navigational Element of MOD Defence, Firing, Practice and Exercise Areas (MOD PEXAs)

This includes official (Government owned) vessels engaged in water based military exercises within defined MOD PEXAs as identified on hydrographic charts. Submarine areas have been considered, however it is noted that these areas are of significant size and the manoeuvrability of the submarines within them is unknown.

5.19. Navigational Element of Heritage and Wrecks

This activity includes vessels navigating to and from heritage/wreck sites as well as vessels that may be displaced into an area where there is a heritage site/wreck which may impact on navigational safety.

6. Final Issues for Inclusion in the Assessment

The following table provides an overview of the issues considered within the assessment. This list was developed by the Project Team, with inputs from the Steering Group, developers and stakeholders. As the assessment was in part iterative, the list was subject to review and updated throughout the process.

Table 6.1 Final Issues List

Issue	Description
Congestion	Congestion is identified as an increase in traffic in a reduced sea area. This issue identifies congestion on routes due to the proximity of wind farms to other developments, coastal areas and/or when in-combination impacts could potentially increase encounters and therefore collision risk. This congestion could be further increased by the presence of existing features such as hazards to navigation.
Displacement	Displacement of vessels from current routes could potentially increase congestion and therefore have safety implications.
Increased Traffic Densities	Vessels within the area associated with the offshore wind developments (i.e. construction vessels) will increase the traffic density which may lead to increased encounters and therefore collision risk.
Vessel to Structure Allision Risk	There will be an additional vessel to structure allision risk due to the combined presence of wind farms and other offshore structures such as oil and gas platforms. It is noted that wave and tidal structures can present a higher allision risk, especially for deeper draught vessels, due to their sub surface or floating design.
Site Boundary	Refers to overall site boundary and cumulative interactions with other developments. Some wind farm site boundaries could potentially alter a vessel's ability to navigate safely in restricted sea areas for example by impacting on a current shipping route or on a route used by recreational craft and fishing vessels. This could include sites where there are designated shipping corridors for access between or through proposed offshore wind farm developments. It is noted that some developments are limited in their ability to alter the overall design of their site.
Alignment of Structures within the Site Boundary	Turbine alignment (including non-linear boundaries, irregular turbine layouts and peripheral turbines) could potentially hinder a vessel's ability to navigate safely for example when through wind farm developments. Non-linear boundaries and peripheral turbines can have impacts on marine radar and visual navigation by obscuring or impacting on a vessels navigation passage.

Issue	Description
Adverse Weather Routes	Adverse weather routes are considered to be significant course adjustments to mitigate vessel movement in adverse conditions. Additionally, in such conditions, vessels may opt to increase CPAs (closest point of approach) to navigational hazards such as shallow waters. There is the potential for adverse weather routes to be impacted due to the presence of wind farms, their proximity to the coast and/or in-combination effects from other activities. If vessels are unable to follow safe adverse weather routes, this could have health and safety implications.
Anchorages (Designated or Preferred)	There is the potential for access to designated and preferred anchorages to be impacted by the presence of wind farms.
Adverse Weather Anchorages	There is the potential for preferred adverse weather anchorages to be impacted which could increase risk for vessels if they are unable to take safe refuge.
Vessel to Vessel Transfers (as per the Ship-to-Ship Transfers Regulations (2010))	The combination of offshore wind farms and displaced shipping could increase the risk for vessels undertaking offshore transfers by increasing traffic density around them and therefore increasing collision risk.
Navigable Route Depths	Seabed mobility linked to wind farm development may decrease navigable channel depths due to siltation, creating grounding hazards and requiring more frequent hydrographic surveys.
Ease of Compliance with COLREGS	The combination of wind farms and other marine activities may impact on the ability of vessels to comply with regulations defined in the International Convention for the Prevention of Collisions at Sea (COLREGS). For example, a vessel obliged under the regulations to give way to a stand-on vessel may be limited in the manner in which it does so due to the presence of a wind farm and/or in-combination activities. This issue has been noted in study areas where there will be a notable reduction in the ability to comply with COLREGS due to site boundary and/or location of a wind farm.
Transboundary Issues	Transboundary issues could arise when commercial shipping routes transit to and from non UK ports. Displaced international routes could impact on non UK ports and shipping routes and/or be further impacted by other international wind farm developments.

Issue	Description
Snagging	Due to the presence of existing cables, as well as the export and inter array cables associated with the wind farm, the potential for cable snagging during anchoring operations will be increased if cables are not buried to recommended depths and/or sufficiently protected. Scour protection may also create a snagging risk, especially for fishing vessels engaged in trawling.
Routeing Measures and Traffic Flow	The presence of existing routeing measures may aid traffic flow, reduce encounters and increase navigational safety.
Radar Implications (Vessel Detection)	The detection of vessels by radar when within or in close proximity to wind farms may be impaired, therefore increasing the risk of vessel encounters.
Proximity to Disposal Sites	The siting of the wind farm may displace traffic towards disposal sites (including those which are no longer in use). This increases the risk to vessels should they be required to anchor in an emergency.
Proximity to Coastal Protection Sites	Vessels could be displaced in closer proximity to sites where coastal protection projects are taking place.
Proximity to Conservation Sites	Vessels could be displaced in closer proximity to conservation sites, including MEHRAs, SPAs and SACs. Should a pollution incident occur, the response requirements to restore that area may impact on navigation.
Access	There is the potential for reduced access to existing activity areas including installations. Examples of vessels which could potentially see a reduction in access to a specific work area include supply, emergency support, maintenance and exploration vessels attending existing licensed oil and gas locations, maintenance vessels attending existing cables and pipelines, vessels attending dredging sites, construction and maintenance vessels attending CCS and NGS sites and vessels visiting heritage sites.
Safety of Vessels During Operational Manoeuvres	There is a potential safety risk to vessels which are manoeuvring during operations and in close proximity to wind turbines. Examples of vessels which could be manoeuvring on site include those which are engaged in dredging operations, fishing or cable and pipeline maintenance and those which are attending oil and gas installations.
Traffic Levels within Ports	Offshore wind farms have the potential to alter the traffic levels to and from ports which may have safety implications for vessels navigating within ports and/or their approaches.
Future Port Developments	The presence of offshore wind farms and in-combination activities could affect the potential for future port developments by decreasing confidence in a vessel's ability to navigate safety within port approaches.

Issue	Description
Changes to Port Navigational Practices	Changes to navigational practices within port jurisdictional limits due to the deviations around the wind farm developments and other marine activities. For example, a requirement to move a pilot boarding station from what is currently an optimal location.
Use of Existing Aids to Navigation	The use of existing aids to navigation may be constrained due to the development of offshore wind farms.
Increase in Demand and Provision of Emergency Response Resources	There is the potential for an increased demand for emergency response due to activities associated with offshore wind farms and the increased risk of vessel to vessel collisions or allisions already noted. Existing resources may be unable to cope with this increased demand. It is noted that this may increase reliance on helicopters and on-site development vessels to provide effective capabilities. The presence of offshore wind farms could aid emergency response efforts by providing a place of refuge for casualties and a point of reference. Some developments may also have on site emergency resources.
Restricted Access for Emergency Response	Restricted access for emergency response vessels to casualties within the wind farm leading to impacts on response times, quality and capability for all sea users. Restricted access for emergency response vessels dealing with pollution incidents. Note that access for helicopters may be restricted by the development but this has not been assessed in this study.
Demand for Surveys	There will be an increased need for surveys due to changing traffic patterns and seabed mobility around wind farm areas which may increase the need for hydrographic surveys (as required by MGN 371, Annex 2, Section 6).
Reduction in Available Sea Room for Defence Activities	Offshore wind farms in-combination with other marine users may restrict and impact the navigational elements of Ministry of Defence training exercises in defined areas.

7. Defined Study Areas

As per the process defined in Appendix B, seven study areas were defined and used within the assessment to help identify strategic issues across the REZ. These are presented in Figure 7.1 and their delimitation is described in Table 7.1.

Figure 7.1 Study Areas

Table 7.1 Delimitation of Study Areas

Study Area	Description	Delimiting Points
1	Northern North Sea	• UK Coastline from Wick to Berwick-upon-Tweed. • From Wick and Berwick-Upon-Tweed out to the UK REZ boundary.
2	Central and Southern North Sea	• UK Coastline from Berwick-upon-Tweed to Dover. • From Berwick-Upon-Tweed and Dover out to the UK REZ boundary.
3	English Channel and Approaches	• UK Coastline from Dover to Lizard Point. • From Dover to Lizard Point out to the UK REZ boundary.
4	Bristol Channel and Approaches	• UK Coastline from Lizard Point to Saint David's Head. • From Lizard Point to Saint David's Head out to the UK REZ boundary.
5	Irish Sea	• UK Coastline from Saint David's Head to Mull of Galloway. • From Saint David's Head to Mull of Galloway out to the UK REZ boundary. • Boundaries of the Irish Sea, which is the boundary of the UK REZ.
6	North Western Scottish Waters	• UK Coastline from Mull of Galloway to Cape Wrath. • From Mull of Galloway and Cape Wrath out to the UK REZ boundary.
7	Northern Isles	• UK Coastline from Cape Wrath to Wick. • From Cape Wrath and Wick out to the UK REZ boundary. *Note: As Study Area Seven includes no planned or operational offshore wind farms, this area is for information only and is not considered further within the document.*

8. Data Confidence Rankings

8.1. Activity Data Set Rankings

The following table lists the data used in the strategic assessment and the level of confidence in these data (measured on a three point scale from high to low). This was developed by the Project Team and subsequently reviewed by the Steering Group.

Table 8.1 Activity Data Confidence Rankings

Activity	Anatec's Confidence in Data Sets for Each Study Area (Low, Medium or High)							Comments
	1	2	3	4	5	6	7	
Dredging	M	M	M	M	M	M	M	Information on transit routes not readily available for all sites including future licensed areas.
Recreation	L	L	L	L	L	L	L	Lack of data on all recreational user types. Recreational vessels are also not always included in AIS data.
Subsea Cables and Pipelines	M	M	M	M	M	M	M	Information on future developments and transit routes not readily available.
Disposal Sites	M	H	H	H	H	M	M	Data received for Scottish waters was of a lower quality, therefore has been ranked as medium confidence.
Port Operations	M	M	M	M	M	M	M	No specific port information available due to commercial sensitivities. Therefore only publically available information has been used.
Commercial Shipping	H	H	M	M	H	H	H	Lack of available Radar data for some parts of Study Areas 3 and 4. Data sets used for AIS analysis were extensive. For example, for areas within the North Sea approximately 400 days of data were available for use, recorded from offshore locations.
Commercial Fishing	M	M	M	L	M	L	M	Limited scope of VMS data including actual vessel movements rather than positions. Some study areas were of particularly low quality.
Aids to Navigation	H	H	H	H	H	H	H	Charted information.

Activity	Anatec's Confidence in Data Sets for Each Study Area (Low, Medium or High)							Comments
	1	2	3	4	5	6	7	
Oil and Gas	H	H	H	H	H	H	H	Using UK Deal data and being supplemented by oil and gas installations which appear on UKHO charts
CCS and NGS	M	M	M	M	M	M	M	Limited information on transit routes, however both current and potential licensed areas have been considered.
Wave and Tidal	M	M	M	M	M	M	M	Limited information on transit routes.
Emergency Response	M	M	M	M	M	M	M	Limited information available for incidents occurring outside of territorial waters.
Aquaculture	H	M	M	M	M	H	H	Reduced data sets for England, Wales and Northern Ireland locations. It is noted that sites are within near shore waters and of a limited geographic extent.
Marine Surveys	L	L	L	L	L	L	L	UK Civil Hydrography Programme only, no information available on other marine surveys that may have in-combination impacts
Coastal Protection	L	H	H	H	H	L	L	No data from Environment Agency for coastal protection sites within Scottish Waters.
Conservation Sites	H	H	H	H	H	H	H	Extensive data sets.
MOD Exercise Areas	H	H	H	H	H	H	H	Charted information.
Heritage	M	M	M	M	M	M	M	Limited information on non-protected sites popular with divers.

8.2. Project Information Data Set Rankings

The following table details the level of confidence in available project information when taking into account known site boundaries and layouts.

Table 8.2 Project Data Confidence Rankings

Project Information - Confidence in information	Confidence Ranking for Each Study Area (Low, Medium or High)							Comments
	1	2	3	4	5	6	7	

available	L	M	M	H	L	H	n/a[1]	Low level indicates site boundary and/or the alignment of structures are not fully known. The confidence is also weighted by the number of developments within the area.

[1] Study Area Seven includes no planned or operational offshore wind farms and therefore is not included in the assessment.

9. Assumed Standard Mitigations

Throughout this assessment the following industry standard mitigations and project work to date has been considered:

- **Existing mitigations for consented wind farms**
  Standard and additional mitigations already in place as part of an existing wind farm's consent.

- **Site boundary design and alignment work already publicly available for non-consented wind farms**
  Site boundaries and alignments of wind farm projects that are already publicly available have been used to consider risk mitigation. This includes any agreed changes to existing aids to navigation and/or routeing measures.

- **Marine Guidance Note 371 (M+F) Offshore Renewable Energy Installations (OREIs) – guidance on UK Navigational Practice, Safety and Emergency Response Issues**
  MGN 371 highlights issues that shall be taken into consideration when assessing the impact on navigational safety and emergency response (Search & Rescue (SAR) and Counter Pollution). It includes guidance on site position and design, impacts on navigation, mitigation measures and SAR.

- **Marine Guidance Note 372 (M+F) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs**
  Guidance Note 372, through the promulgation of information, mitigates risk by enabling Masters and Skippers to make an informed risk assessment for the intended voyage. It gives an overview of navigation in vicinity to offshore wind, wave and tidal devices.

- **IALA Recommendations O-139 on The Marking of Man Made Structures Edition 1 (2008)**
  IALA sets out internal standards for lighting and marking of man-made offshore structures including wind turbines.

It is noted that other mitigations may be used which have the potential to further reduce overall navigational safety risk for planned offshore wind farms. For example, as technical innovations within the industry move forward including larger turbines leading to reduced numbers and increased separation distances, this could potentially mitigate some of the issues identified within the report. The requirement and effect of these mitigations will be an output of the NRA process and, as a result, they have not been considered within this study.

10. Worked Example of the Assessment

It is important to note that the function of this report is not to present the entire workings and results of the assessment undertaken as per Step 4 of the methodology. This decision was taken in order to preserve the integrity of the NRA process. As a result, this section provides a worked example of an in-combination and cumulative assessment. An assessment has been made of the issues in each study area and this report presents the key strategic issues identified during the assessment and following consultation feedback.

As per the assessment methodology, the in-combination and cumulative assessment was carried out by study area. This worked example will focus on a fictitious example referred to in this section as 'Sample Study Area'.

10.1. Data Confidence

The in-combination and cumulative assessment for each study area began by identifying the level of data confidence for all activities being considered in the assessment. A high, medium or low ranking was assigned to all the data sets obtained for that specific study area.

Activities which had a low level of data confidence were automatically highlighted for further discussion to determine whether there was benefit in identifying them as issues recommended for priority attention. This was done to ensure that an activity was not screened out simply because of poor data quality or lack of available data.

Table 10.1 shows the data confidence rankings for the Sample Study Area.

Table 10.1 Sample Study Area Data Confidence Rankings

Activity	Data Confidence Ranking
Dredging	Medium
Recreation	Low
Subsea Cables and Pipelines	Medium
Disposal Sites	High
Port Operations	Medium
Commercial Shipping	High
Commercial Fishing	Low
Aids to Navigation	High
Oil and Gas	High
CCS and NGS	High
Wave and Tidal	High
Emergency Response	High
Aquaculture	High

Activity	Data Confidence Ranking
Marine Surveys	Low
Coastal Protection	Low
Conservation Sites	High
Defence	High
Heritage	Medium

From the above it can be seen there are four activities where the data confidence is low for the sample study area. These are as follows:

- Recreation
- Commercial Fishing
- Marine Surveys
- Coastal Protection.

10.2. Study Area Review

Using the data obtained for this project (Table 4.1), a review of the study area was undertaken which identified the activities present within the study area and the extent to which they were carried out. Following this initial review of the area, a screening exercise was undertaken to determine those activities which were carried out in the Sample Study Area *and* had the potential to create cumulative and in-combination impacts. On this basis, the following list shows those activities which were included in the example assessment.

- Recreation
- Commercial Shipping (including adverse weather routeing)
- Commercial Fishing
- Wave and Tidal
- Emergency Response
- Marine Surveys
- Coastal Protection
- Conservation Sites
- Defence

Table 10.2 summarises the activities screened out at this stage and records the justification for them being screened out. The table also presents the data confidence for each of the activities.

Table 10.2 Activities Screened out of Sample Study Area

Activity to be Screened Out	Justification for Screening Out	Data Confidence for the Activity
Dredging	There are no dredging sites within the sample study area.	Medium

Activity to be Screened Out	Justification for Screening Out	Data Confidence for the Activity
Subsea Cables and Pipelines	No in-combination impacts have been identified for subsea cables in the sample study area due to the lack of interaction with other activities including wind farms and marine traffic.	Medium
Disposal Sites	There are disposal sites within the sample study area however there were no in-combination impacts identified due to the lack of interaction with other activities including wind farms and marine traffic.	High
Port Operations	No in-combination impacts have been identified with the ports in the sample study area due to the lack of interaction with other activities including wind farms and marine traffic.	Medium
Aids to Navigation	No in-combination impacts have been identified with the aids to navigation in the sample study area due to the lack of interaction with other activities including wind farms and marine traffic.	High
Oil and Gas	There are no oil and gas platforms in the sample study area.	High
CCS and NGS	There are no CCS or NGS platforms in the sample study area.	High
Aquaculture	There are designated aquaculture sites within the sample study area, however no in-combination impacts have been identified due to the fact that they are predominantly located in sheltered sea lochs.	High
Heritage	There are no heritage sites in the sample study area.	Medium

10.3. Study Area Assessment

For each of the activities to be considered in the assessment, the cumulative and/or in-combination issues associated with that activity (as identified in Section 6) were then assessed

using GIS layering and other available data sources and the impact was ranked according to the following scale:

- Major Positive
- Moderate Positive
- Minor
- Moderate Negative
- Major Negative.

10.3.1. Example: Congestion

In the sample study area, congestion was noted as an issue for commercial shipping, recreation and commercial fishing. Figure 10.1 illustrates a small area within the sample study area where the potential for congestion was noted. As illustrated in the figure, there is the potential for commercial traffic and recreational craft currently transiting through or in close proximity to the wind farm site to be displaced towards the coast and for traffic to be displaced by the tidal site, thus increasing the traffic levels in a now reduced sea area. The presence of existing navigational hazards such as shallow water and overfalls further increases the impacts that could arise from congestion.

This area had limited and therefore low confidence fishing data. Because of this it was not possible to accurately assess the impact of fishing on congestion; therefore the range considers the low data confidence and has been adjusted accordingly. The collection and assessment of additional data may further reduce the ranking range.

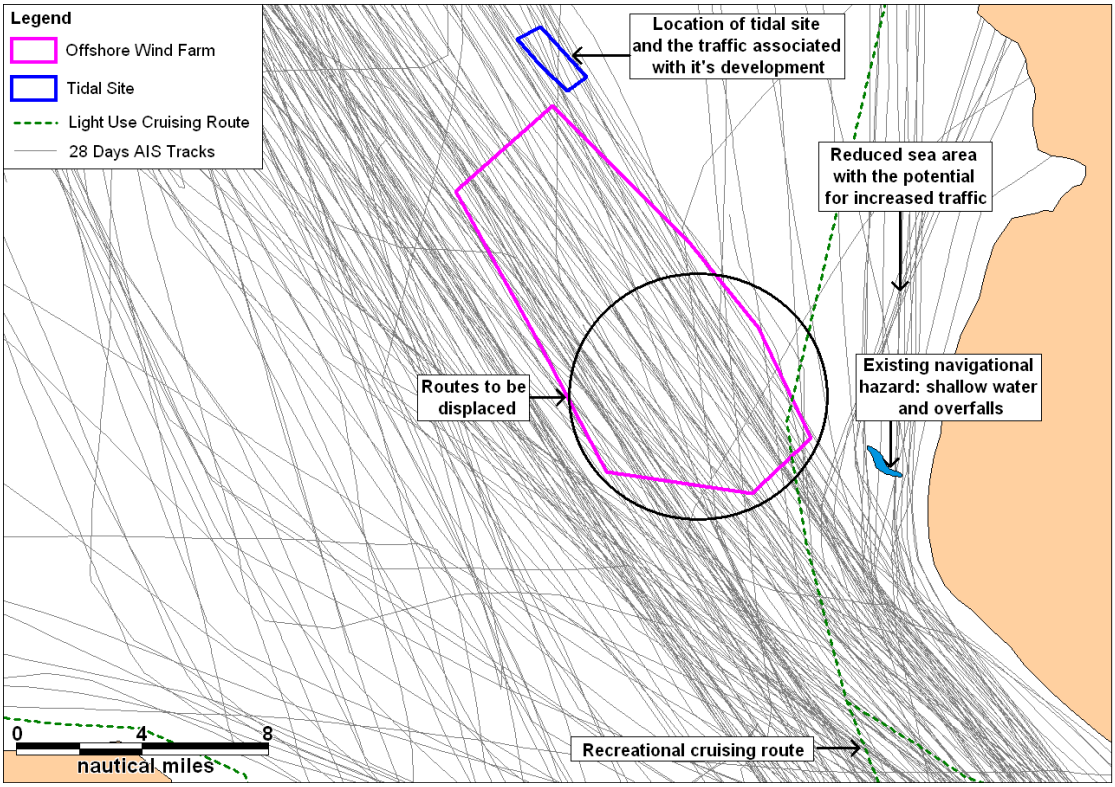


Figure 10.1 Example of Congestion in the Sample Study Area

The issue of congestion was then ranked separately for each of the identified receptors throughout the study area and the rankings were combined together to demonstrate the most likely range of the strategic effect.

In this example, the range of the strategic effect of **congestion** was assessed as **minor** to **moderate negative**.

The same process as that described above was then carried out for Study Areas One to Six for each of the issues identified by the stakeholders (the in-combination assessment was not undertaken for Study Area Seven because there are no operational or planned offshore wind farms within this study area).

As described in the methodology, developers and stakeholders were then consulted on the initial rankings and their feedback was used to identify the final rankings and the key impacts which are identified in the following section.

The example in Figure 10.2 shows the output of this process for the issue of 'congestion'.

SAMPLE ONLY

Study Area Number	Study Area Name	RANGE OF STRATEGIC EFFECT					In combination marine activities identified
		Major Positive	Moderate Positive	Minor	Moderate Negative	Major Negative	
1	Northern North Sea						*Commercial Shipping, Recreation, Commercial Fishing*
2	Central and Southern North Sea						*Commercial Shipping, Dredging, Recreation, Commercial Fishing*
3	English Channel and Approaches						*Commercial Shipping, Dredging, Recreation, Commercial Fishing*
4	Bristol Channel and Approaches						*Commercial Shipping, Dredging, Recreation, Commercial Fishing*
5	Irish Sea						*Commercial Shipping, Dredging, Recreation, Commercial Fishing*
6	North Western Scottish Waters						*Commercial Shipping, Recreation, Commercial Fishing*

Figure 10.2 Sample Table Showing Range of Strategic Effects in Each Study Area

11. Results

Following the assessment and consultation process, the results including data confidence were assessed by the Project Team to identify which issues should be carried forward as recommendations for priority attention (as illustrated in the flowchart in Section 2.6). This section identifies how that process was undertaken using the following indicators:

- Ranked up to major negative within areas of the REZ;
- High level of uncertainty including data confidence; or
- Lack of consensus following the consultation feedback.

11.1. Data Confidence

The following table (Table 11.1) identifies the data sets that were used within the assessment, assesses the confidence within each study area and then defines those areas where data confidence is low enough to support a recommendation for further data collection in the future to support navigational assessments. The levels of data confidence shown in the table below also fed into the decisions made in the final selection process for those impacts which need further consideration.

Table 11.1 Data Confidence Issues

	Confidence Ranking (Approximate confidence throughout the REZ)	Recommendation for future data collection?
Dredging	6 out of 6 areas had medium confidence ranking throughout the REZ.	No
Recreation	6 out of 6 areas had low confidence ranking throughout the REZ.	Yes – Noted that although recreational sailing vessel data was high confidence, other forms of recreational movements, including recreational fishing, were not well documented.
Subsea Cables and Pipelines	6 out of 6 areas had medium confidence ranking throughout the REZ.	No
Disposal Sites	High (4/6) and medium (2/6) confidence rankings throughout the REZ.	No
Port Operations	6 out of 6 areas had medium confidence ranking throughout the REZ.	No

	Confidence Ranking (Approximate confidence throughout the REZ)	Recommendation for future data collection?
Commercial Shipping	High (3/6) and medium (3/6) confidence rankings throughout the REZ.	No
Commercial fishing	Medium (4/6) and low (2/6) confidence rankings throughout the REZ.	Yes
Aids to Navigation	6 out of 6 areas had high confidence ranking throughout the REZ.	No
Oil and Gas	6 out of 6 areas had high confidence ranking throughout the REZ.	No
CCS and NGS	6 out of 6 areas had medium confidence ranking throughout the REZ.	No
Wave and Tidal	6 out of 6 areas had medium confidence ranking throughout the REZ.	No
Emergency Response	6 out of 6 areas had medium confidence ranking throughout the REZ.	No
Aquaculture	High (2/6) and medium (4/6) confidence rankings throughout the REZ.	No
Marine Surveys	6 out of 6 areas had low confidence ranking throughout the REZ.	No – Although low confidence, it is not considered to significantly impact the overall assessment due to minimal cumulative or in-combination impacts.
Coastal Protection	High (4/6) and low (2/6) confidence rankings throughout the REZ. Scottish waters data not available.	No
Conservation Sites	6 out of 6 areas had high confidence ranking throughout the REZ.	No
MOD Exercise Areas	6 out of 6 areas had high confidence ranking throughout the REZ.	No
Heritage	6 out of 6 areas had medium confidence ranking throughout the REZ	No

11.2. Issues Recommended for Priority Attention

The following table (Table 11.2) lists the reasoning for issues being recommended for priority attention at a strategic level. It identifies the number of study areas where the issue was identified and the reasons why the issue has been carried forward. All issues identified in more than four out of the six study areas containing offshore wind developments, as well having high uncertainty, major negative ranking or a lack of consensus have been carried forward (as per methodology in Figure 2.1).

The remaining issues were then also considered by an internal Anatec team, of which displacement, transboundary and restricted access for emergency responders have been carried through due to their significance on a strategic level, inter-relationships with other issues or high level of feedback following the consultation process.

Study Area Seven has not been included in this analysis because, as previously noted, it contains no planned or operational offshore wind developments.

As previously stated this report does not replace the developers obligation to undertake a full Navigational Risk Assessment, it can be however be used to inform cumulative assessment at a Zonal and regional level. Similarly, it should be noted that an issue that has not been recommended for priority attention at a strategic level may have a significant impact at a project level.

Table 11.2 Issues Considered as Recommendations for Priority Attention

Issue	Carried Forward in Study Areas (1-6 only)	Reasons for Consideration	Issue Recommended for Priority Attention at Strategic Level? (Expert Opinion)
Alignment of Structures	**Six out of Six**	• Ranked up to major negative within areas of the REZ; • High level of uncertainty due to the availability of projects plans within the site boundary; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	Yes
Radar Implications (Vessel Detection)	**Six out of Six**	• Ranked up to major negative within areas of the REZ; • High level of uncertainty due to technical knowledge within the industry into the implications for Radar use within larger developments and low confidence in smaller vessel movements (non-AIS); and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	Yes
Congestion	**Five out of Six**	• Ranked up to major negative impacts within areas of the REZ; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	Yes

Issue	Carried Forward in Study Areas (1-6 only)	Reasons for Consideration	Issue Recommended for Priority Attention at Strategic Level? (Expert Opinion)
Emergency Response Demand and Provision	**Five out of Six**	• Ranked up to major negative within areas of the REZ; and • High level of uncertainty due to availability of project information regarding their emergency response planning.	Yes
Adverse Weather Routes	**Four out of Six**	• Ranked up to major negative within areas of the REZ; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	Yes
Wind Farm Project Site Boundary	**Four out of Six**	• Ranked up to major negative impacts within areas of the REZ; • High level of uncertainty due to availability of project information including future development plans; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	Yes
Access	**Four out of Six**	• Ranked up to major negative within areas of the REZ; • High level of uncertainty due to availability of project information including future development plans; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	Yes

Issue	Carried Forward in Study Areas (1-6 only)	Reasons for Consideration	Issue Recommended for Priority Attention at Strategic Level? (Expert Opinion)
Port Navigational Practices	**Three out of Six**	• High level of uncertainty due to availability of project information regarding their emergency response planning; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
Displacement	**Three out of Six**	• Ranked up to major negative impacts within areas of the REZ.	Yes – Due to inter-relationship with congestion, level of uncertainty and stakeholder feedback showing lack of consensus (see Section 13.3 for more information).
Adverse Weather Anchorage	**Three out of Six**	• Ranked up to major negative within areas of the REZ; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
Transboundary Issues	**Three out of Six**	• Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact; and • High level of uncertainty due to knowledge of international developments.	Yes – due to high level of uncertainty in the available data for on international developments (see Section 13.7 for more information).

Issue	Carried Forward in Study Areas (1-6 only)	Reasons for Consideration	Issue Recommended for Priority Attention at Strategic Level? (Expert Opinion)
Vessel to Vessel Collision	**Two out of Six**	• Ranked up to major negative impacts within areas of the REZ.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
Vessel to Structure Allision	**Two out of Six**	• Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
Increased Traffic Densities	**Two out of Six**	• Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
Restricted Access For Emergency Responders	**Two out of Six**	• High level of uncertainty due to availability of project information including future development plans.	Yes – due to inter-relationships with emergency response and provision (see Section 13.4 for more information).
Anchorage	**One out of Six**	• Ranked up to major negative within areas of the REZ; and • Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
COLREGS	**One out of Six**	• Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.

Issue	Carried Forward in Study Areas (1-6 only)	Reasons for Consideration	Issue Recommended for Priority Attention at Strategic Level? (Expert Opinion)
Traffic Levels within Ports	**One out of Six**	• Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
Safety of Vessels During Operational Manoeuvres	**One out of Six**	• High level of uncertainty due to availability of project information including future development plans.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.
Future Port Developments	**One out of Six**	• Lack of consensus, high level, from stakeholders increasing the assessment ranking to a major negative impact.	No – For Consideration at NRA, Zonal and Regional Impact Assessment Level.

12. Steering Group Review

Following the assessment and review by the Steering Group (31st May 2012), the issues listed below are recommended for priority attention at a strategic level. In some cases, it was deemed appropriate to merge two issues together – this is indicated in the list below with the merged issue being included in brackets;

- Alignment of Structures;
- Radar Implication;
- Congestion;
- Emergency Response Demand and Provision;
- Adverse Weather Routes;
- Wind Farm Project Site Boundary; and
- Access.
- Displacement (congestion);
- Transboundary; and
- Restricted access for emergency response providers (emergency response demand and provision).

Activities with low data confidence that could have impacted this or future assessments have been identified as;

- Recreational data; and
- Commercial fishing data.

12.1. Issues for Consideration at NRA, Zonal and Regional Level

The following issues, as agreed by the Steering Group, have not been carried forward for consideration at strategic level but should be considered within NRAs and relevant regional assessments:

- Port Navigational Practices;
- Adverse Weather Anchorages;
- Vessel to Vessel Collision;
- Vessel to Structure Allision;
- Increased Traffic Densities;
- Access to Anchorage (Preferred and Designated);
- Ease of compliance with COLREGS;
- Traffic Levels with Ports;
- Safety of Vessels Manoeuvring; and
- Future Port Developments.

13. Key Issues Identified and Suggested Actions

The issues which have been recommended for priority attention at a strategic level are described below, together with suggested actions to address them. The recommendations are explained in more detail in Table 14.1 and data confidence issues are covered in Section 13.8.

13.1. Wind Farm Project Site Design including Boundary and Alignment of Structures

This issue refers to the overall wind farm project design including its boundaries and cumulative impact with other developments. Wind farm site boundaries can impede a vessel's ability to navigate safely by restricting the navigable sea area. This can also include wind farm sites where there are designated shipping corridors for access between or through proposed offshore wind farm developments.

In addition, the alignment of structures within the site (including non-linear boundaries, irregular turbine layouts and peripheral turbines) can influence the overall impact on navigation, as turbine alignment can restrict a vessel's ability to navigate safely, for example small vessel navigation through a wind farm development.

The main receptors that will be impacted cumulatively and/or in-combination are:

- Commercial Vessels;
- Recreation; and
- Commercial Fishing.

The main factor to influence the ranking of this issue was the lack of reliable data available for recreational vessels and commercial fishing. It was recognised that although some data is available through the RYA and Cruising Association Atlas, this was considered not to be sufficient information to make a good assessment of the level of activity in any given area.

It is also noted that at the time of undertaking this study, details on sites boundaries and specifically alignment within them was unavailable, therefore further increasing uncertainty.

Following feedback from the consultations with Stakeholders and Developers and the Steering Group review it was decided to carry both issues forward as recommendations for priority attention.

13.1.1. Conclusions

Key points relevant to the issue of 'Wind Farm Project Site Design including Boundary and Alignment of Structures' are:

- The design of designated shipping corridors within developments and the cumulative impacts associated with other developments;
- Use of the Rochdale Envelope and the potential for developers to alter design post consent to the detriment on navigational safety by creating or adding to cumulative and in-combination impacts;

- Alignment and variation in turbine size and design that may create confusion for both the navigating mariner and emergency responders; and
- Impact of site design on navigational safety for example cable burial depths reducing navigable depths.

13.1.2. Suggested actions

The following actions are proposed to address concerns arising from Wind Farm Project Site Design including Boundary and Alignment of Structures:

- The consenting process, including the principle of the Rochdale Envelope, should be revised with a view to allowing Regulators to have confidence that project details in consent applications reflect the project's selected final design.
- Recommendations and Guidance to developers for the conduct of project NRAs (e.g. the DTI's 'Methodology for Assessing Marine Navigational Risk' supporting guidelines and MGN 371) be reviewed and amended to reflect the revised consenting process. Amended recommendations and guidance should include requirements to obtain meaningful traffic data (as identified during a baseline assessment) which may not be limited to AIS surveys and must include data relating to non AIS carrying vessels. .
- Increased awareness of the effects of design factors on navigational safety for example cable installations.

13.2. Radar Implications (Vessel Detection)

This issue relates to the potential for adversely affecting the performance of a vessels radar when within or in close proximity to a wind farm. The assessment concluded that there was a lack of understanding, from a technical perspective, into the potential implications on vessels radar systems which to date has not been robustly tested within wind farm arrays (with the exception of the MCA and QinetiQ trials at North Hoyle and Kentish Flats).

The main receptors that will be impacted cumulatively and/or in-combination are:

- Commercial Vessels;
- Wind farm maintenance vessels;
- Recreation; and
- Commercial Fishing.

As previously discussed there is a low level of confidence in the recreational and commercial fishing data and therefore a more detailed understanding of small craft movements is required.

Further to this, this issue was carried forward due to the major negative ranking it received within some areas of the REZ and the significant lack of consensus, with some stakeholders proposing a major negative impact for all areas, therefore indicating a high level of concern. Their comments included lack of ability to track small craft and the impact from wind turbines regardless of their location. The stakeholders that responded indicated that rankings

throughout the study areas should be at the highest level due to the lack of understanding and experience related to issues surrounding traffic within corridors and the implications on small craft detection.

13.2.1. Conclusions

Key points derived from the assessment and consultation feedback and relevant to the issue of 'Radar Implications (Vessel Detection)' are;

- Radar detection of small vessels exiting wind farms into main commercial routes and areas used by other activities. This impacts includes the wind farm's own support vessels; and
- Potential for further increased risk within developments containing designated shipping corridors or areas of existing activity such as fishing.

13.2.2. Suggested actions

The following actions are proposed to address concerns arising from Radar Implications:

- Increase the technical understanding of the impacts on marine radar used within offshore wind farms and issues surrounding vessel detection within wind farms and designated corridors.
- Recommendations and Guidance to developers for the conduct of project NRAs (e.g. the DTI's 'Methodology for Assessing Marine Navigational Risk' supporting guidelines and MGN 371) should contain guidance to developers on the impacts of radar arising from offshore wind farms.

13.3. Congestion and Displacement

Congestion was defined as an increase in traffic combined with a reduction in available sea area. This was identified mainly in areas between offshore wind farms, other developments and coastal areas including areas where shallow waters or navigational hazards (including the presence of other sea users) further reduced sea room.

The review also identified that displacement of vessels from their current routes could further increase congestion particularly when vessels were being displaced into areas that were already congested pre-development. Therefore, displacement has been merged with congestion as an issue recommended for priority attention at a strategic level due to the inter-relationship between them.

The main receptors that will be impacted cumulatively and/or in-combination are:

- Commercial Vessels;
- Recreation;
- Commercial Fishing;
- Dredging; and
- Oil and Gas.

The main factors contributing to the outcomes of the issue were the low confidence in data and the level of congestion which was found to be severe in some areas. There was a good level of consensus with this issue between the stakeholders and developers. Following feedback from the consultation period and the steering group review it was decided to carry this issue forward as a recommendation for priority attention.

Data available on small craft activities (recreation and commercial fishing) were assessed with a low confidence. This is reflective of AIS carriage regulations whereby most small craft and fishing vessels do not have to carry equipment. Radar data coverage used within the assessment was limited. It was clear during this assessment and following feedback that increased small craft data, to be used alongside other datasets such as the RYA Sailing Atlas, would enable areas of expected congestion and displacement to be analysed in more detail.

Feedback from stakeholders and developers included the potential effects of future increases in traffic levels including future port expansions which may have the potential to further increase congestion.

13.3.1. Conclusions

Key points derived from the assessment and consultation feedback and relevant to the issue of 'Congestion and Displacement' are;

- Increased risk of encounters and therefore collision risk due to increasing levels of congestion;
- Vessels being displaced into areas already congested by other sea users, increasing risks to both;
- Loss of area or increased risk for vessels engaged in a navigation based activity such as dredging due to displaced and congested vessels;
- Displacement from routes providing safe access to ports and anchorages (designated and preferred); and
- Existing routeing measures being rendered void due to displacement.

13.3.2. Suggested actions

The following actions are proposed to address concerns arising from Congestion and Displacement:

- Develop an improved understanding of the effects of congestion and displacement for use by developers in the project planning stage and to be used as an input into project NRAs.

13.4. Emergency Response Demand, Provision and the Potential for Restricted Access

The assessment identified the potential for an increased demand for emergency response due to activities associated with offshore wind farms and the increased risk of vessel to vessel collisions or allisions already noted. It concluded that existing facilities may be unable to cope with this increased demand. It is noted that this may increase reliance on helicopters

and on-site development vessels to provide effective capabilities and that some developments may also have on site emergency resource.

The presence of the offshore wind farm could also aid emergency response efforts by providing a place of refuge for casualties and/or a point of reference.

Following expert review and consultation it was noted that due to the inter-relationship with demand and provision for emergency response, 'Restricted Access' should be taken forward as well. The issues were therefore merged into one, fully covering the ability of emergency response providers to gain access to casualties and other incidents within the wind farm site.

The main receptors that will be impacted cumulatively and/or in-combination are:

- All sea users;
- Offshore developers and operators; and
- Emergency response providers.

As with previous issues, both recreation and commercial fishing have a low data confidence.

The assessment and consultation feedback identified that emergency response plans have not been finalised at this stage for offshore developments that are still within the planning stages. It was noted that during the consultation there was a general lack of consensus as to what measures would be required, what would be implemented and the positive or negative impact from them.

This issue was carried forward as a recommendation for priority attention due to the low confidence in data (project and activity) and due to major negative rankings within the REZ. In addition there was a lack of consensus from stakeholders and developers on the ranges presented by the project team for this issue.

Stakeholder feedback included general concern over the negative impacts of increased demand on emergency response service in all areas, not just those including numerous developments within a Zone.

13.4.1. Conclusions

Key points derived from the assessment and consultation feedback and relevant to 'Emergency Response Demand, Provision and the Potential for Restricted Access' are;

- Increased emergency response demand due to offshore wind farm activities and the aforementioned increase in collision and allision frequency. Emergency response facilities may be unable to cope with this increased demand;
- The presence of offshore wind farms and other marine activities may restrict emergency response vessels which are locating and accessing casualties within an offshore wind farm;

- The presence of offshore wind farms and other marine activities may restrict emergency response vessels which are dealing with pollution incidents within an offshore wind farm; and
- The potential for offshore wind farms to be used as a place of refuge and/or a point of reference by casualties.

13.4.2. Suggested actions

The following actions are proposed to address concerns arising from Emergency Response Demand, Provision and the Potential for Restricted Access:

- Consideration of this assessment and its conclusions be presented to the Offshore Renewable Energy Emergency Forum (OREEF); and
- Increased guidance into the development of emergency response plans including the requirement for and the importance of developer self-help.

13.5. Adverse Weather Routes

There is the potential for wind farms to restrict the ability of vessels to maintain their current adverse weather routes which are an essential component of safe navigation. Information, including AIS data and stakeholder input, provided details on adverse weather routes that allowed the assessment to be carried out.

The main receptors that will be impacted cumulatively and/or in-combination are:

- Commercial Vessels;
- Recreation; and
- Commercial Fishing.

Two out of the three receptors, recreational and commercial fishing, were assessed with a low confidence in the data available and this included lack of information on adverse weather routeing preferred by smaller vessels. In addition it was difficult to establish adverse weather routes from the AIS data provided.

This issue was carried forward due to the major negative ranking it received within areas of the REZ and the significant lack of consensus from stakeholders who increased the assessment ranking to a major negative impact within some Study Areas indicating a high level of concern.

Feedback from stakeholders and developers included the potential effects of vessels not being able to minimise movement in adverse weather by adjusting course headings and the proximity of the coast severely hampering the mariner's options for deviating due to adverse weather.

13.5.1. Conclusions

Key points derived from the assessment and consultation feedback and relevant to the issue of 'Adverse Weather Routeing' are;

- Loss of preferred adverse weather routes which have safety implication for both persons on board and the vessel;
- Loss of adverse weather shelter/refuge areas, including the access to them; and
- Enclosed sea area including designated corridors within wind farms that do not allow a vessel to achieve a safe heading to mitigate the impacts of the adverse weather.

13.5.2. Suggested actions

The following actions are proposed to address concerns arising from adverse weather routes;

- Recommendations and Guidance to developers for the conduct of project NRAs (e.g. the DTI's 'Methodology for Assessing Marine Navigational Risk' supporting guidelines and MGN 371) should be reviewed and amended to reflect the revised consenting process. Surveys and must include data relating to non AIS carrying vessels.
- Consideration for cumulative impacts of multiple offshore wind farms on adverse weather routes is to being included in the NRA of each project and where adverse weather routes are shown to exist (e.g. from a baseline survey) the project's NRA should demonstrate how that issue has been dealt with.

13.6. Access

The assessment identified that there is the potential for reduced access to areas of existing activity such as licensed oil and gas locations, existing cables/pipelines, dredging sites, CCS/NGS sites, commercial fisheries areas and heritage sites.

The main receptors that will be impacted cumulatively and/or in-combination are:

- Commercial Vessels;
- Commercial Fishing;
- Subsea Cables and Pipelines;
- CCS and NGS;
- Heritage;
- Dredging; and
- Oil and Gas.

Apart from commercial fishing, all receptors considered for this impact had medium to high levels of data confidence. However, as was the case with site design and alignment it is noted that during the assessment, information on some projects was still in its preliminary stages.

This issue was recommended for priority attention due to the low confidence in project data, ranking major negative within the REZ, feedback from the consultation period and post steering group review.

Stakeholder and developer feedback included concern over the potential for a reduction in access to oil and gas sites increasing the ranking to major negative for navigational safety.

13.6.1. Conclusions

The key point derived from the assessment and consultation feedback and relevant to the issue of 'Access' is;

- Increased allision and collision risk associated with the reduced access to existing installations with proposed wind farm developments.

13.6.2. Suggested actions

The following actions are proposed to address concerns arising from Access:

- The identification of risks arising from Access (to other activities) when considered with proposed offshore wind farm developments, and
- The encouragement of early and extensive consultation by developers with potentially effected users.

13.7. Transboundary

It was identified that transboundary issues could arise when developments impact on commercial shipping routes transiting to and from any non UK ports. This could also include impacts on international ports, shipping routes and/or routes being impacted by other international offshore renewable energy developments.

The main receptors that will be impacted cumulatively and/or in-combination are:

- Commercial Vessels; and
- Commercial Fishing Vessels.

Commercial fishing had a low confidence ranking within the REZ. This was particularly relevant for this issue where data for international fishing vessels can be limited and not show an accurate level of fishing within particular areas.

This transboundary issue could not be applicable in all areas due to the proximity of international boundaries from offshore developments; therefore it has only been identified in three out of the six areas. Because of this and also due to the high level of uncertainty in data, including the lack of available information on international developments and associated mitigations that may be put into place, it has been carried forward as a recommendation for priority attention.

Feedback from stakeholders included the identification of the potential major impacts and also that developers were already working with international authorities to identify and mitigate any transboundary issues.

13.7.1. Conclusions

Key points derived from the assessment and consultation feedback and relevant to transboundary issues are;

- Multiple displacements and/or increased risk associated with the cumulative impact of UK and other transboundary nation developments;

- Potential impacts on UK bound vessels from international waters and non UK bound vessels; and
- Mitigation measures in place within UK wind farms do not align or do not compliment mitigations in place in transboundary developments.

13.7.2. Suggested actions

The following action is proposed to address concerns arising from Transboundary Issues:

- The development of a process by which concerns arising from transboundary issues will be identified and properly considered in each project's NRA. It is anticipated that this process would include provision for the appropriate level of consultation with the relevant parties including other developers and the relevant organisations of EU Member States.

13.8. Data Collection

From the early stages of this assessment, including initial discussion with the Steering Group and Stakeholders, it was clear that the quality of data sets used to support assessments, including this strategic assessment, were reducing the confidence in the outcomes in places. Within this assessment the following data sets requiring additional collection to improve confidence have been identified;

- **Small Craft Data Collection** - Vessels not legally required to carry AIS including recreational craft and commercial fishing vessels less than 24 metres are difficult to identify and monitor out with dedicated Radar surveys. To ensure smaller vessel navigation is well understood and represented in the consent process, it is recommended that a review be carried out to consider the possibilities of improving the quality of data available and access to that data. Specifically this needs to consider the activities of non-RYA recreational craft and whether there is potential to further open up access to fishing VMS data. This suggestion is particularly focused on areas known to be of high activity.
- **Fishing Data Collection** - During the initial data analysis it was noted that commercial fisheries data including international data is being collated for large areas of the REZ. However, due to issues concerning data protection and costs of provision, it is not readily available to developers for use within their assessments. It is therefore recommended that the existing requirements for data provision are reassessed to enable use of data sets that will aid developers in addressing cumulative and in-combination issues. The UK Fisheries Information Project (UKFIM), which is being funded by The Crown Estate and DECC, is also likely to yield good quality commercial fishing data. It is recommended that this information should be made publically available if possible.
- **Collection of Adverse Weather Routeing Information** - During the assessment it was noted that there a significant level of stakeholder concern with adverse weather routeing which included the lack of information on routes taken. Therefore it is recommended that further work is undertaken to evaluate adverse weather routes for

all vessel types (where applicable) with the potential to identify a clear methodology (within supporting guidance) for assessing the level of impact from a navigational safety perspective.

- **Analysis of Automatic Identification System Data -** As well as small craft, fishing vessel and adverse weather routeing data it was noted from consultation that issues surrounding the confidence of all data, including Automatic Identification System data, within assessments should be addressed to ensure identification and potential mitigation of some of the issues identified within this cumulative assessment. Therefore, an outcome of this assessment is to increase the level of data collected, as required within certain areas, and also to communicate the importance of adequate data collection and analysis where specific issues have been identified during a baseline assessment.

14. Summary of Recommended Actions and Next Steps

The following table gives details of the recommended actions which were identified and agreed by the Steering Groups for priority consideration at a strategic level:

Table 14.1 Suggested Actions

Suggested Action	Further Description	Associated With Which Strategic Issue
The consenting process, including the principle of the Rochdale Envelope, should be revised with a view to allowing Regulators to have confidence that project details in consent applications reflect the project's selected final design.	Additional guidance on the use of the Rochdale Envelope and indicative boundaries within the application process including adequate consultation and provision of layouts to all stakeholders. This should also include a guarantee that the final construction plans are sighted and signed by the stakeholders.	• Wind Farm Project Site Design including Boundary and Alignment of Structures.
Recommendations and guidance to developers for the conduct of project NRAs (e.g. the DTI's 'Methodology for Assessing Marine Navigational Risk' supporting guidelines and MGN 371) should be reviewed and amended to reflect the revised consenting process. Surveys must include data relating to non AIS carrying vessels.	Site design and alignment should be addressed in greater detail to include the larger and multiple developments in proximity to one another that are now being considered. Updated to ensure that the appropriate level of analysis and data collection is undertaken on adverse weather routing (This should also include guidance on how this should be effectively assessed). Include consideration for new risks created by the development of offshore wind farms. Amended recommendations and guidance should include requirements to obtain meaningful traffic data (as identified during a baseline assessment) which may not be limited to AIS. Consideration for local and regional sites sharing project data to improve the	• Wind Farm Project Site Design including Boundary and Alignment of Structures; and • Adverse Weather Routes.

Suggested Action	Further Description	Associated With Which Strategic Issue
	cumulative picture should also be considered.	
Increased awareness of the effects of design factors on navigational safety.	Further increased awareness of design features that may affect navigational safety (i.e. cable installation impacting navigational depth) including the importance of early and continuous consultation throughout the process.	• Wind Farm Project Site Design including Boundary and Alignment of Structures.
Increase the technical understanding of the impacts on marine radar used within offshore wind farms and issues surrounding vessel detection with wind farms and designated corridors.	It is recommended that further works be carried out to investigate the potential for tracking and monitoring vessels using radar while they pass within or in proximity to wind turbines. Although these have been carried out to an extent, there is great potential to perform further works and the issues being raised at this time relate more to the larger wind farm developments and their characteristics including corridors between wind farm developments. Recommendations and Guidance to developers for the conduct of project NRAs (e.g. the DECC's 'Methodology for Assessing Marine Navigational Risk' supporting guidelines and MGN 371) should contain guidance to developers on the impacts of radar arising from offshore wind farms.	• Radar Implications (Vessel Detection).
Develop an improved understanding of the effects of congestion and displacement, including consideration of corridor widths, for use by developers in the project planning stage and to be used as an input into project	Following consideration by the Steering Group it was decided that congestion and displacement, and the symptoms including increased encounters, were effectively covered within existing guidance and that issues with understanding were often based around poor data quality. Therefore increased data quality should enable NRAs to better	• Congestion and Displacement.

Suggested Action	Further Description	Associated With Which Strategic Issue
NRAs.	identify and address congestion and displacement issues and ensure adequate mitigations are put in place.	
Consideration of this assessment and its recommendations be presented to the offshore renewable energy emergency forum (OREEF); and	It was recommended that the report be presented to the recently formed OREEF for consideration of the issue surrounding Offshore Emergency Response. This is a newly established forum set up to provide a focal point for discussions on emergency preparedness for offshore renewable energy developments.	• ER Demand, Provision and the Potential for Restricted Access.
Increased guidance into the Development of Emergency Response Plans Including the Requirement and the Importance of Developer Self Help.	Increased guidance on the development, maintenance and operation of emergency response planning during all phases of the offshore wind farm. This information should then be documented and promulgated.	• ER Demand, Provision and the Potential for Restricted Access.
Consideration for cumulative impacts of multiple offshore wind farms on adverse weather routes is to being included in the NRA of each project and where adverse weather routes are shown to exist (e.g. from a baseline survey) the project's NRA should demonstrate how that issue has been dealt with.	Guidance document on increased assessment, including data collection, to enable consideration of cumulative impacts (local, regional and national) on adverse weather routeing.	• Adverse Weather Routes

Suggested Action	Further Description	Associated With Which Strategic Issue
The identification of risks arising from Access (to other activities) when considered with proposed offshore wind farm developments, and the encouragement of early and extensive consultation by developers with potentially effected users.	Early consultation with interested parties to identify and mitigate the potential for increased risk associated with access to existing offshore uses such as wells, platforms, cables and pipelines. It is anticipated this process would include provision for the appropriate level of consultation with the relevant parties including other developers and the relevant organisations of EU Member States.	• Access
The development of a process by which concerns arising from transboundary issues will be identified and properly considered in each project's NRA.	The outcomes of this assessment identified the requirement to enable developers with potential transboundary issues to identify the issue and follow a documented process as required within their Navigational Risk Assessments.	• Transboundary Consultation
Increased Analysis of Data for Small craft Fishing vessels Adverse weather and AIS data.	Issues were noted, in particular with, Small Craft Radar Data, Fishing Vessel Data, Adverse Weather routes but also AIS analysis and collection in general. The project is of the view that proper data is fundamental in the planning of offshore wind farm sites in respect of locality and alignment. Whist appreciating the commercial sensitivities that exist with regard to the capture and sharing of data, the project suggests that there are benefits to be achieved by the sharing of data for the overall and mutual benefit of all parties (Developers, Stakeholders and Regulators).	• All Issues.

14.1. Next Steps

Following completion of the report and the review by the Steering Group it was agreed the next step was for the outcomes of this assessment to be presented to the industry via the Nautical and Offshore Renewable Energy Liaison (NOREL) group, before promulgating to a wider audience. It was noted by the Steering Group that communication was key and therefore presentation at the NOREL forum will enable that group, supported by The Crown Estate if appropriate, to identify ownership of the recommendations identified within Table 14.1.

Appendix A
Activity Screening Workshop

Prepared by:	Anatec Limited
On behalf of:	The Crown Estate (TCE)
Date:	25th June 2012
Revision No.:	00
Ref.:	A2776

Anatec **Aberdeen Office** **Cambs Office**

Address: 36 Upperkirkgate, Aberdeen AB10 1BA, Scotland, UK 16 Ward Way, Witchford, Ely, Cambs, CB6 2JR, UK
Tel: 01224 633711 01353 661200
Fax: 0709 2367306 0709 2367306
Email: aberdeen@anatec.com cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of The Crown Estate. The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

TABLE OF CONTENTS

1. Introduction

An activity screening workshop was held with stakeholders at The Crown Estate offices in London from 10:00 to 14:30 on 11th November 2011. The purpose of the workshop was to actively engage stakeholders in the project and identify the following:

- The activities that, when combined with offshore wind, have an in-combination impact on navigation and shipping;
- The issues relating to the activity that could be impacted by the development of offshore wind farms; and
- The datasets to be sought for use within the assessment.

2. Agenda

- Introduction to project including background, aims & objectives and current status
- Overview of proposed methodology, project plan, definitions, timescales
- Purpose and structure of today's workshop
- Session 1: group work
- Session 2: group feedback & summary
- Data source discussions
- Feedback and Q & A
- Wrap up, actions & next steps

3. Attendees

Andrew Finlay	TCE
Bob Hawley	TCE
Jonny Boston	TCE
Mike Cain	Anatec
Sam Westwood	Anatec
Colin Brown	Anatec
Mark Russell	British Marine Aggregates Producers Association
Alana Murphy	Royal Yachting Association
David Whitehead	British Ports Association
William Barker	UK Harbour Masters Association
James Manson	Deep Sea & Coastal Pilots
Ian Rowe	National Federation of Fisherman's Organisations
Saurabh Sachdeva	Chamber of Shipping (UK & International)
Graeme Proctor	Maritime and Coastguard Agency

Philip Smith	Department for Transport
Roy Cahill	Department for Transport
Garth Halanen	Stenaline
Kane Taha	Isle of Man Steam Packet Company
Roger Barker	Trinity House Light Services
Stephen Vanstone	Trinity House Light Services
Peter Douglas	Northern Lighthouse Board
Tim Ryan	Commissioners of Irish Lights
Nick Medic	Renewables UK
Peter Bradley	Royal National Lifeboat Institute
Ashley Holt	Marine Management Organisation
Shaun Nicholson	Marine Management Organisation
John Burt	UK Oil and Gas
Alan Graveson	Nautilus UK

4. Welcome and Introduction to the Project

- A welcome and introduction to the project was given by Bob Hawley.
- A presentation was given by Andrew Finlay to provide background to the project, highlighting its importance and key objectives.
- A presentation was giving by Mike Cain to provide an overview of the methodology to be applied and to lay out the objectives and format for the day.

5. Key points

The primary objective of the project is ***'to ensure that the areas leased for the development of Offshore Wind Farms are fit for purpose and allow users of the UK's marine resources to safely co-exist'***.

The study is to be **strategic** and is aimed at:

- A more holistic overview of the UK offshore wind programme;
- Improving the understanding of transboundary impacts;
- Better dialogue between sectors; and

- Recommendations for further work.

It is not:

- Project or zone specific work or assessment; or
- Duplication or undermining of developer activity.

The assessment will be carried out by reviewing the data obtained for each of the 'In-combination' activities (agreed by stakeholders at the meeting) along with the cumulative impact of proposed offshore wind farm development plans to map out the main areas of concern in terms of impact on shipping and navigation.

Assessment of the data will also be carried out to provide an overview of data confidence as this may be a primary driver is identifying areas for further assessment.

Deliverables will include identification of regions for which further cumulative and in-combination assessment should be undertaken and, in summary the reasons why and data required.

Definitions were identified as a key part of the project and have been determined by TCE as;

- **Cumulative effects** - refers to impacts on shipping and navigation arising from all the planned and consented UK offshore wind farms (and their associated activities) including those in EU Member State waters.

- **In-combination effects** - refers to impacts on shipping and navigation arising from offshore wind farms (and their associated activities) combined together with impacts from other marine activities or uses of the sea.

The following timescales have been indicated for the Project. Item 2 is the Workshop.

- Identification of Key Marine Activities - October 2011
- **Engagement of Stakeholders (Non Geographic) - Nov 2011**
- Data Gathering (Stakeholders and Developers) - Nov 2011
- Strategic Assessment (Geographic Review) – Dec 2011
- Report and Recommendations to Steering Group – Dec/Jan 2012
- Presentation of Findings/Workshops for Stakeholders - Jan 2012

6. Workgroups

The objectives for the workgroups were as follows:

- Generate a list of marine activities that combine with offshore wind farms to have an increased impact on navigation and shipping, e.g. aggregate dredging or wave and tidal developments.
- Identify the effects of those marine activities when combined with offshore wind farms on navigation and shipping
- Identify if there are any impacts on the shipping and navigational operations of the identified marine activity that may result from offshore wind farm development.
- Decide whether the activities should be considered within the Strategic Assessment
- Agree and identify data sources required for the Strategic Assessment.

The following activities were provided for initial consideration by the workgroups. This list of activities had been identified by the Project Team and the Steering Group.

- Aggregate Dredging
- Recreational Yachting and Boating
- Recreational Fishing
- Subsea Cables
- Disposal Sites
- Port Navigation Operations
- Commercial Fishing
- Commercial Shipping
- Aids to Navigation
- Oil and Gas Operations
- Carbon Capture and Storage (CCS) and Natural Gas Storage (NGS)
- Offshore Wind (cumulative)
- Wave and Tidal Devices
- Search and Rescue
- Aquaculture
- Hydrographic Surveying
- Coastal Protection
- Marine Protected Areas and Marine Conservation Zones
- Defence
- Tourism, e.g. scuba and wildlife watching.
- Heritage
- Pollution and Salvage Response

The format of the workshop was as follows;

- Four breakout workgroups were used.
- Workgroup size restricted to a maximum of 7 people and 6 topics.
- Workgroups were arranged so each activity was represented by a relevant organisation in one workgroup.

- Mariners were included in each workgroup to provide the input needed to assess the possible effects of the marine activity when combined with an offshore wind farm on shipping and navigation.
- A facilitator was provided to record the process using a standard format (note: facilitators highlighted in **bold** in the tables below).

The workgroups were as follows:

Group 1	
Members	**Activities**
• **Sam Westwood (Anatec)** • Steve Vanstone (THLS) • Graeme Proctor (MCA) • Kane Taha (IoM Steam Packet Co.) • Mark Russell (BMAPA) • Alana Murphy (RYA) • Shaun Nicholson (MMO)	• Dredging • Recreational Yachting and Boating • Pollution and Salvage Response • Recreational Fishing • Tourism

Group 2	
Members	**Activities**
• **Mike Cain (Anatec)** • John Burt (Oil and Gas UK) • Nick Medic (Renewables UK) • Philip Smith (DfT) • Alan Graveson (Nautilus UK) • Roger Barker (THLS)	• Oil and Gas • Offshore Wind • Wet Renewables • Aids to Navigation • CCS and Gas Storage • Heritage

Group 3	
Members	**Activities**
• **Jonny Boston (TCE)** • Tim Ryan (CIL) • Saurabh Sachdeva (CoS) • Peter Bradley (RNLI) • Dave Whitehead (BPA) • William Barker (UKHMA) • James Manson (DSCP)	• SAR • Port Navigation Operations • Hydrographic Survey • Defence • Coastal Protection

Group 4	
Members	**Activities**

Group 4	
Members	**Activities**
• **Bob Hawley (TCE)** • Roy Cahill (DfT) • Gareth Halanen (Stenaline) • Ian Rowe (NFFO) • Ashley Holt (MMO) • Peter Douglas (NLB)	• Commercial Fishing • Marine Protected Areas • Subsea Cables • Disposal Sites • Aquaculture

7. Workshop outcomes

The following table lists the issues generated by the workgroups for each activity.

Activity	Issues
Dredging	• Increased risk of collision between aggregate extraction vessels and commercial vessels due to commercial routes now passing closer to dredging areas; • Increased risk for commercial vessels due to the squeeze between wind farm developments and dredging areas; • Reduced ability for commercial vessels to comply with COLREGS due to the presence of wind turbines and RAM vessels; • Increased number of vessels on transit routes to/from dredging areas due to the squeeze between wind farm developments and dredging areas; • Displacement of vessels transiting to/from the dredging areas due to the presence of the wind farm - this has time and cost implications; • Buffering and manoeuvring required between turbines and dredge areas; • Risk of there not being enough space to get into dredging areas; • Commercial/recreational/fishing vessels being squeezed onto dredging areas; and • Beach nourishment.
Recreation	• Recreational vessels exiting from wind farm into shipping lanes/commercial routes; • Recreational vessels pushed into shipping lanes/commercial routes when they try to avoid the wind farm; • Recreational vessels crossing between lanes/enclosed channels and not having enough room to manoeuvre out of the way; • Reduced ability to comply with COLREGS when recreational craft are on commercial routes; • Radar impact resulting in a reduction in the visibility of recreational craft due to them being ‘cluttered’ out on other vessels' radars due to the effect of wind turbines;

Activity	Issues
	• Buoyage during construction could further displace or 'lead' recreational craft into commercial areas; • Commercial vessels which have been displaced from their regular routes impact on recreational routes; • Difficulties for recreational vessels navigating within wind farms if there is not sufficient blade clearance; • Impacts on journey planning; and • Loss of cruising routes due to presence of wind farm.
Pollution and Salvage Response	*See SAR*
Tourism	*No issues discussed*
Oil and Gas	• Increased risk of collision with platform due to vessels being displaced; • Increased risk of collision with support/supply vessels due to vessels being displaced; • Time, cost and emissions implications if large deviations are required; • Increased navigational risk due to reduction in sea room; and • Supply/support vessels displaced due to the presence of the wind farm - restricted access to the site.
Wet Renewables	• Increased number of vessels due to surveying, construction and operation/maintenance at wave/tidal sites; • Increased navigational risk due to further reduction of sea room; • Presence of additional OREIs which need to be avoided (some of which may be difficult to see if they are located at the surface or subsurface); • Wave and tidal devices are installed in high risk areas (due to the nature of the technology); • No safety zones; and • Floating blades.
Aids to Navigation	• Requirement to mark new hazards and/or channels; • Reduction in visibility of existing navigational aids; • Rearrangement of existing navigational aids; and • Additional routeing measures may be needed.
CCS and Gas Storage	• Additional vessels associated with storage activities; • Pipelines create additional risk for anchors and fishing gear; • Further restriction in sea room; • High risk consequences; • Protection zone needs to be larger; and • Vulnerability of positioning system.
Heritage	• Vessels being deviated into heritage sites and close to wrecks; • Restrictions in sea room which could potentially result in further deviations in routeing; • Presence of the wind farm may reduce access to the site for diving and

Activity	Issues
	monitoring; and • Presence of the wind farm may increase damage to the site itself.
SAR	• Increased demand for SAR due to activities associated with the wind farm and the increased risk of vessel to vessel collisions - facilities may be unable to cope with this increased demand; • SAR activities may be made more difficult by the presence of the wind farm (ie due to impacts of turbines on Radar, AIS and other navigational/communication aids); • Reduced access for SAR vessels to casualties within the wind farm which has an impact on response times; • Increased congestion if SAR activities move outside the wind farm area (including interaction with other vessels); and • Impacts if shipping routes are closed as a result of a collision.
Port Navigation Operations	• Increased risk of vessel to vessel collision due to displacement and squeeze in port approaches; • Increased risk of vessel to vessel collision due to displacement and squeeze in TSS's; • Increased number of vessels transiting to/from ports (operation and maintenance vessels); • The presence of the wind farm and associated vessel deviations may make it difficult to navigate towards pilot boarding stations; • Restricted access to port; • Increased pilotage; • Reduced anchorage areas; • VTS/Radar impacts; • Changes to navigational practices; • Changing traffic/trade levels; and • Restrictions on future port expansions.
Hydrographic Survey	• Increased traffic density in areas where surveying is being carried out; • Restricted sea room due to presence of surveying vessels; • There will be an increased need for surveys due to the changing traffic patterns within wind farm areas; and • If surveys are restricted, there will be a reduction in the quality of information that is given to the mariner which will compromise safe shipping.
Defence	• Displaced vessels may be deviated towards practice and exercise areas - increased congestion and risk of collision; • Reduction in open sea room available for firing and practice and exercise areas due to the presence of the wind farm; and • Impacts on submarine activity due to the presence of structures.
Coastal Protection	• Increased activity within the area; • Vessel displacement; and

Activity	Issues
	• Increased number of vessels transiting between offshore extraction areas and onshore replenishment areas.
Commercial Fishing	• Displacement of fishing vessels away from the wind farm into commercial shipping routes and recreational craft areas • Limitations to safe navigation for fishing vessels when trawling in close proximity to the wind farm; • Increased transit times to/from fishing sites and implication for increased fuel use; • Limitations of fishing in offshore wind farm sites; and • Increase in fishing activity due to creation of new habitats from turbines/foundations.
Marine Protected Areas	• Vessels being displaced into areas which have been designated for conservation; • Increased risk of oil spill; and • Increased incidents and response requirements.
Subsea Cables	• Presence of subsea cables /pipelines reduces areas in which vessels may anchor; • Interference with navigational position fixing aids due to electromagnetic interference from cables; • Risk for fishing vessels due to gear fouling on cables/pipelines; and • Wind farm activities could be impacted by installation activities and maintenance.
Disposal Sites	• Displacement of commercial vessels into/within close proximity of disposal sites; • Displacement of vessels transiting to/from the disposal sites due to the presence of the wind farm; • The areas between wind farms and disposal sites could cause navigational concern due to squeeze; and • These areas may make it difficult for vessels to anchor in.
Aquaculture	• Aquaculture (particularly fish farm sites) could add to seabed squeeze.

Commercial shipping was discussed by all of the groups and the following issues were raised:

- Displacement of commercial vessels from regular routes;
- Time, cost and emissions implications if alternative routes are longer than existing route;
- Increased vessel to vessel collision risk due to vessels being squeezed onto alternative routes or into shipping channels;
- Additional vessel to structure collision risk due to the presence of structures in the wind farm;
- Loss of preferred adverse weather routes for commercial vessels due to the presence of the wind farm; and

- Reduction in sailings during periods of adverse weather and associated commercial implications.

It was agreed that the following activity be removed:

- Tourism will be removed on the basis that marine activities associated with tourism will be incorporated with other activities.

It was agreed that the following activities be 'parked' for consideration by the steering group[1]:

- Hydrographic Surveying which should be broadened to Marine Surveying
- Met Office Activities i.e. Met Buoys
- Aquaculture in particular fish farm sites could also add to seabed squeeze. Currently there are no sites that cause a cumulative impact, but there is potential for this in the future. At this stage is not consider a pertinent issue at a national assessment level but should be included in regional assessments. This is to be considered by the steering group.
- Disposal Sites

It was agreed that the following changes be made:

- Defence be renamed as MOD Defence, Firing, Practice and Exercise areas
- Heritage to be extended to be Heritage and Wrecks
- Recreational Fishing be incorporated into Recreational

Adverse Weather Routeing was highlighted as a major issue by a number of the workshop teams. It was agreed that this would be included as an activity within the assessment.

8. Data Sources

The group were asked to consider data availability for the each of the activities identified. The main questions asked were:

- What data is available on the activity; and
- What data is available on the shipping and navigation related to the activity.

The following table summarises the discussions on each activity.

Activity	Identified Available Data Sets
Dredging Areas and Transit Routes	• Licensed Dredge Areas • Transit Routes • Levels of activity in each dredged areas and estimates of flow between license areas and ports

[1] The parked activities are discussed in Section 4.2 of the main report.

Activity	Identified Available Data Sets
Recreational (Yachting, Scuba, Fishing etc.)	• Recreational cruising routes, racing and general sailing areas and marinas/clubs • Recreational fishing data sets (not successfully acquired)
Subsea Cables	• Cable/Pipeline GIS layer • Charted information • Vessel activity (not successfully acquired)
Disposal Sites	• Coordinates of Disposal Sites • Charted information • Transits to disposal sites (not successfully acquired)
Port Operations	• Planned/known future ports developments • Charted information
Commercial Shipping	• AIS/Radar data from developers • 2 x 2 weeks of full coastal coverage AIS Data • Adverse weather routeing from key regulator operators
Commercial Fishing	• VMS Data • AIS/Radar information
Aids to Navigation	• Charted information
Oil and Gas	• GIS layer • Chartered information
CCS and Gas Storage	• GIS Layer • Charted Information
Wave and Tidal	• GIS Layer • Chartered Information
Search and Rescue	• GIS Layers
Aquaculture	• GIS Layer
Hydrographic Surveying	• Civil Hydrography Programme
Coastal Protection	• GIS Layers
MPAs and MCZs	• GIS Layers
Defence	• Charted information • MOD data (not successfully acquired)
Heritage	• Chartered information

Appendix B
Definition of Study Areas

Prepared by:	Anatec Ltd
On behalf of:	The Crown Estate (TCE)
Date:	25th June 2012
Revision No.:	00
Ref.:	A2776

Anatec **Aberdeen Office** **Cambs Office**
Address: 36 Upperkirkgate, Aberdeen AB10 1BA, Scotland, UK 16 Ward Way, Witchford, Ely, Cambs, CB6 2JR, UK
Tel: 01224 633711 01353 661200
Fax: 0709 2367306 0709 2367306
Email: aberdeen@anatec.com cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of The Crown Estate. The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

TABLE OF CONTENTS

1. Definition of Study Areas

Study areas in which the strategic assessment could be undertaken have been defined. The definition of these study areas has been undertaken with consideration for the existing data baseline, other initiatives where areas have been outlined for similar assessments (on-going or completed) and existing boundaries within the United Kingdom Continental Shelf (UKCS). These elements have then been overlaid and reviewed by navigational experts to identify areas were cumulative or in combination impacts are identifiable.

The following section identifies the other elements that have been used to define the study areas for this assessment.

1.1 Other Initiatives

Other initiatives including consenting and licensing agreements are identified in this section.

1.1.1 Existing Offshore Energy Licensing and Consenting Process

Under The Crown Estate Act 1961 (structures and cables on the seabed), The Petroleum Act 1998 (identification and extraction of petroleum resources) and The Energy Act 2004 (leases for renewable energy zones), extensive consenting and licensing has already occurred within the UKCS (BERR, 2007) for extraction of energy resources from the seabed.

1.1.2 United Kingdom (UK) Strategic Environmental Assessment (SEA)

Strategic Environmental Assessments (SEAs) are continually being undertaken prior to any licensing for offshore energy developments. They take a strategic and regional view of the environmental baseline and aid the planning process for offshore developments. As part of the assessments, eight SEA areas were defined to assess impacts on regional levels (DECC, 2012a).

1.1.3 Nautical and Offshore Renewable Energy Liaison (NOREL)

The Nautical and Offshore Renewable Energy Liaison (NOREL) group provides a forum for Government, industry and navigational organisations to discuss matters of mutual interest related to navigation safety and ensure successful co-existence with offshore renewable energy installations. Three strategic sea areas (including rounds 1 and 2) were identified as areas with cumulative issues requiring consideration at NOREL. These include the Wash, Thames and the Northwest. These areas have recently been extended to include round three developments (DECC, 2012b).

1.1.4 Joint Nature Conservation Committee Regional Sea Areas

As part of their research into nature conversation, JNCC identified the need for regional sea areas for implementing on-going conservation strategies. The regional sea areas were developed by using biogeographic principles and, although not fully aligned with this study, they were developed with consideration for the distribution of natural resources and socio-economic areas. Therefore, they have been used to inform the development of the study areas for this assessment (JNCC, 2004).

1.1.5 DEFRA Marine Planning Areas

The UK government undertook a review of offshore planning to help achieve clean, healthy, safe, productive and biologically diverse oceans and seas. A key step towards realising this vision is the introduction of new systems of marine planning across the UK through the Marine and Coastal Access Act 2009 and the Marine Scotland Act 2010. As part of this a consultation on marine planning areas was undertaken to define recommended planning areas in English inshore and offshore areas. The results of this consultation have been considered in the development of study areas for this assessment (DEFRA, 2010).

1.1.6 Existing Offshore Wind Forums

The issue of cumulative impacts on shipping and navigation has already been considered by forums set up under the guidance of the Nautical and Offshore Renewable Energy Liaison (NOREL) group, TCE and following zone appraisals where cumulative issues associated with shipping and navigation were identified.

The two groups that have been considered in the development of the strategic assessment study areas are;

- **Southern North Sea Offshore Wind Forum (SNSOWF)** which includes round three developers Forewind (Dogger Bank Zone 3), Smart Wind (Hornsea Zone 4) and Scottish Power Renewables/Vattenfall (East Anglia Zone 5).
- **Forth and Tay Offshore Wind Developers Group (FTOWDG)** which includes round three developer Sea Green (Zone 2 Forth) and Scottish Territorial Waters developers Mainstream (Neart na Gaoithe) and Repsol (Inch Cape).

1.2 Existing UK Continental Shelf Boundaries

The following boundaries have been considered when delimiting the proposed study areas for this assessment:

1.2.1 Territorial Waters

Territorial waters are 12 nautical miles out from the UKs baseline and the seabed rights are owned by TCE. Within this area the coastal state (UK) is free to set laws, regulate use, and use any resource. The territorial waters will be used to help define areas by considering cumulative effects inshore that should be considered within one sea area.

1.2.2 UK Continental Shelf (UKCS) and the Renewable Energy Zone (REZ)

The continental shelf is defined as the natural prolongation of the territory to the continental margin or 200 nautical miles from the countries baseline (whichever is furthest). Under the Energy Act 2004, a Renewable Energy Zone was defined in line with the UKCS, where the coastal nation has exploitation rights over natural resources (in this case exploitation of offshore renewable energy sources). TCE has the rights to license the generation of renewable energy on the continental shelf within the Renewable Energy Zone out to 200nm. The REZ will be considered as the furthest delimitation of all study areas defined in this assessment.

1.3 Data Baseline

The data baseline as identified in the main report has been overlaid alongside the UK coastline, the REZ and the territorial waters boundaries. This data has then been analysed by navigational experts against AIS to identify areas where a number of sea uses and navigation activities have the potential to create cumulative and in combination impacts. This layering of marine activities within a Geographic Information System (GIS) has then allowed a high level spatial assessment of activities which will then form the baseline of the assessment.

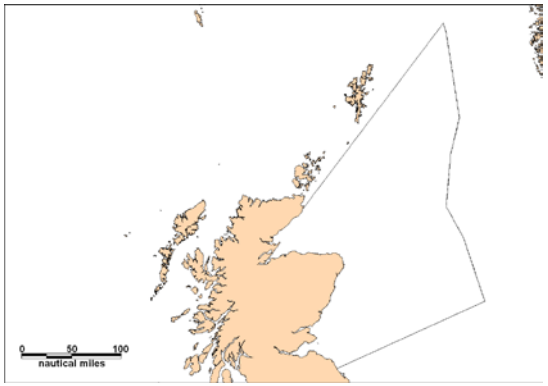
1.4 Consultation

The definition of the study areas was originally carried out by Anatec and updated following review by the Steering Group. Subsequently, both the developers and stakeholders were consulted to ensure their views were given full consideration.

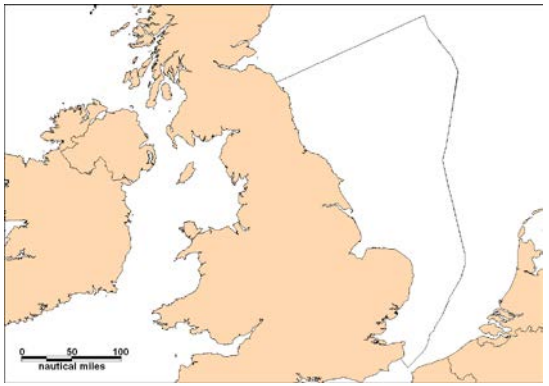
Section 2 of this appendix illustrates the study areas.

2. Study Areas

Study Area 1: Northern North Sea



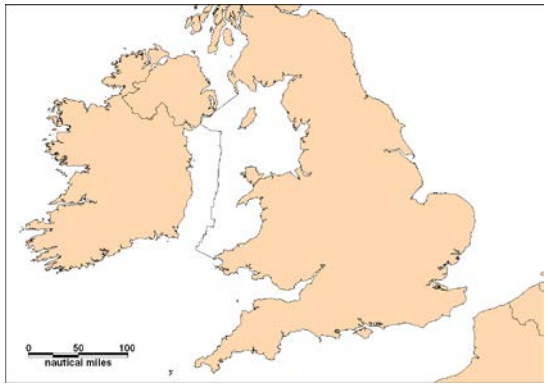
Study Area 2: Central and Southern North Sea



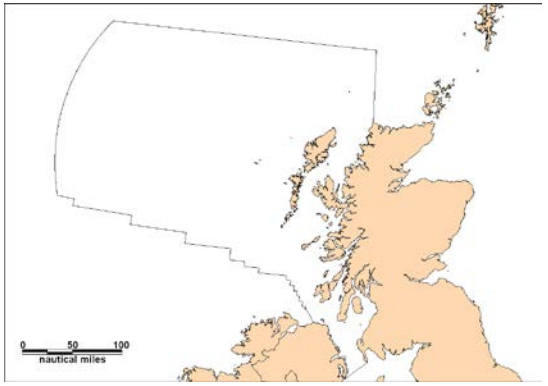
Study Area 3: English Channel and Approaches

Study Area 4: Bristol Channel and Approaches

Study Area 5: Irish Sea



Study Area 6: North Western Scottish Waters



Study Area 7: Northern Isles

Appendix C
Minutes of Developers Workshop

Prepared by:	Anatec Ltd
On behalf of:	The Crown Estate (TCE)
Date:	25th June 2012
Revision No.:	00
Ref.:	A2776

Anatec **Aberdeen Office** **Cambs Office**

Address: 36 Upperkirkgate, Aberdeen AB10 1BA, Scotland, UK 16 Ward Way, Witchford, Ely, Cambs, CB6 2JR, UK

Tel: 01224 633711 01353 661200

Fax: 0709 2367306 0709 2367306

Email: aberdeen@anatec.com cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of The Crown Estate. The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

TABLE OF CONTENTS

1. Introduction

A workshop was held with offshore wind farm developers at The Royal Institution of Great Britain in London from 10:00 to 16:00 on 13th February 2012. The purpose of the workshop was to provide developers with the opportunity to become involved in the assessment process and comment on the findings to date.

2. Attendees

Following a review of all Rounds 1, 2, 2 Extension, 3 and Scottish Territorial Waters sites, representatives of all development companies were identified. These are listed below.

- Airtricity
- Centrica
- Dong
- EDF Energy
- EDP Renewables
- Eneco
- EON
- Forewind
- Mainstream
- NAREC
- Repsol
- RWE
- ScottishPower
- SSE Renewables
- Statoil Hydro
- Vattenfall
- Warwick Energy

The following table shows the representatives of those companies that attended the workshop as well as the project team and steering group members.

Andrew Finlay	TCE
Bob Hawley	TCE
Jonny Boston	TCE
Mike Cain	Anatec
Sam Westwood	Anatec
Colin Brown	Anatec
Jenny Brown	Anatec

Roger Barker	Trinity House Lighthouse Services
Alexander Bakovljev	DONG Energy
Brian Juel Jensen	DONG Energy
Andrew Hamilton	EDP Renewables
Kim Gauld-Clark	Forewind
Martina Gassner	Repsol
Paul Carter	RWE
Richard Britton	ScottishPower Renewables
Naomi Healey-Cathcart	Seagreen (SSE Renewables)
Liam Leahy	SMart Wind (Mainstream)
Rosie Scurr	SSE Renewables
Goran Loman	Vattenfall
Matthew Green	Vattenfall

3. Welcome and Introduction

Andrew Finlay welcomed everyone to the workshop on behalf of The Crown Estate.

Bob Hawley introduced the project to the developers and highlighted the strategic nature of the work being carried out.

Roger Barker emphasised the importance of the study for ensuring that risks from new developments are mitigated and for raising awareness of issues on a strategic level.

4. Project Methodology

A presentation was given by Mike Cain to provide details of the project deliverables and methodology. It was emphasised that the project is a strategic assessment and that efforts have been made to avoid overlap with NRAs.

Sam Westwood presented an overview of the study areas and details of how they were defined. The developers were generally happy with these areas and no issues were raised.

5. Key Points

The developers were presented with a worked example and then with Anatec's findings of the assessment. The key points discussed during these presentations were as follows:

- The outcome of this project is not intended to impact the NRA hazard log process. Guidance is already available on this (such as DECC Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (2005) and MCA Marine Guidance Note 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues (2008)).

- Where data confidence was ranked as low, other sources were looked at. It is intended that activities with a low data confidence will be taken through to the next stage of the project.

- There were concerns over the mid-point on the scale used to rank the issues (potential minor negative impact) because it was felt that the scale should not be weighted more heavily towards negative impacts. Post meeting the scale used to rank the issues was subsequently amended to give an equal weighting to positive and negative impacts.

- It is not within the scope of the project to assess benefits of offshore wind such as job creation, increased numbers of UK-flagged vessels and reduced emissions. Reference should be made to these in the final report with justification for why they have not been included in the assessment.

- The baseline level of mitigations assumed for this assessment should be stated.

- The end point of the project will be a list of the strategic issues and will not be project or geographically specific.

- The method of presenting the range caused concern amongst the developers, particularly due to the use of colours. Suggestions were made for how the presentation of the range could be improved and a final option was agreed with the steering group.

- There were concerns over the term ‘site design’ because it was felt that this was a project level impact. It was discussed that this term actually referred to the overall site boundary and the terminology was subsequently reworded.

- The provision of emergency response facilities by offshore wind farm developers was discussed. There was a strong feeling amongst the developers that this should be a positive impact because of the vessels/helicopters that they will provide for rescue operations. However, it was noted that at present, the commitment of these obligations is unknown and the industry is not in a position to state that all these facilities will be offered by every development.

- It was suggested that commercial and economic issues should not be included within this project because they are not within the scope. It was subsequently agreed by the

steering group, that economics would be addressed at a project level rather than a study area level.

Appendix D
Minutes of Stakeholders Workshop

Prepared by:	Anatec Ltd
On behalf of:	The Crown Estate (TCE)
Date:	25th June 2012
Revision No.:	00
Ref.:	A2776

Anatec **Aberdeen Office** **Cambs Office**
Address: 36 Upperkirkgate, Aberdeen AB10 1BA, Scotland, UK 16 Ward Way, Witchford, Ely, Cambs, CB6 2JR, UK
Tel: 01224 633711 01353 661200
Fax: 0709 2367306 0709 2367306
Email: aberdeen@anatec.com cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of The Crown Estate. The assessment represents Anatec's best judgment based on the information available at the time of preparation. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

TABLE OF CONTENTS

1. Introduction

A workshop was held with stakeholders at The Crown Estate offices in London from 10:00 to 16:00 on 20th February 2012. The purpose of the workshop was to further engage stakeholders and provide them with the opportunity to become involved in the assessment process and comment on the findings to date.

2. Attendees

Andrew Finlay	TCE
Bob Hawley	TCE
Mike Cain	Anatec
Sam Westwood	Anatec
Colin Brown	Anatec
Jenny Brown	Anatec
Roger May	Marine Scotland
Peter Bradley	Royal National Lifeboat Institute
Tim Ryan	Commissioners of Irish Lights
Kane Taha	Isle of Man Steam Packet Company
Julian Hansen	Royal Yachting Association
Stuart Carruthers	Royal Yachting Association
Alana Murphy	Royal Yachting Association
Richard Nevinson	Chamber of Shipping
Ian Rowe	National Federation of Fishermen's Organisations
Michael Sutherland	Scottish Fishermen's Federation
John Watt	Scottish Fishermen's Federation
Philip Smith	Department for Transport
Pete Thomson	Maritime and Coastguard Agency
Graeme Proctor	Maritime and Coastguard Agency
Peter Prins	Royal Association of Netherlands Shipowners
James Langley	International Chamber of Shipping
Peter Douglas	Northern Lighthouse Board

Janneke van Berlo	Dutch Ministry of Transport, Public Works and Water Management
Philip van Wijnen	P&O Ferries
Jae Jones	Hanson Aggregates Marine
Julian Seaman	UK Harbour Masters' Association
Nick Dodson	Trinity House Light Services
Roger Barker	Trinity House Light Services
Harry Gale	Nautical Institute
Tom Woolley	Marine Management Organisation
Michael Brew	Isle of Man Government Representative

3. Welcome and Introduction

Andrew Finlay welcomed everyone to the workshop on behalf of The Crown Estate and highlighted the importance of the project because such issues have not been looked at on a strategic level before.

Bob Hawley introduced the project to the stakeholders and emphasised the strategic nature of the work which is not intended to be a zonal assessment or NRA.

Roger Barker emphasised the importance of the study for ensuring that risks from new developments are mitigated and for raising awareness of issues on a strategic level.

4. Project Methodology

A presentation was given by Mike Cain to provide details of the project deliverables and methodology. It was emphasised that the project is a strategic assessment and that efforts have been made to avoid overlap with NRAs.

Sam Westwood presented an overview of the Study Areas and details of how they were defined. The stakeholders were generally happy with these areas and no issues were raised.

5. Key Points

The stakeholders were presented with worked examples and Anatec's findings of the assessment. The key points discussed during these presentations are as follows:

- The outcome of this project is not intended to impact the NRA hazard log process. Guidance is already available on this (such as DECC Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (2005) and MCA Marine

Guidance Note 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues (2008)).

- Mitigations are an NRA process and may be very site/layout specific. Mitigations are therefore not within the scope of this project.

- Existing route deviations have been considered from navigational safety perspectives but commercial implications have not been considered. This will be covered under the socio-economic section of NRAs including the implications on lifeline routes to islands. The focus of this study is navigational safety.

- Charted information and GIS data sets were primarily used to inform the assessment. In-house local knowledge was also used to expand on the available information.

- The assessment is a qualitative risk assessment rather than a quantitative one (i.e. the severity of the consequences and the likelihood of occurrence have not been measured).

- It was agreed that the impacts for commercial shipping and the impacts for other marine activities be combined together when the same issue is common to both.

- There were concerns over the use of the word 'potential' because it was felt that this made it difficult to define the expected range that an issue covers. This was reworded to reflect the comments.

- The COLREGS issue should be renamed 'Ease of compliance with COLREGS' rather than 'Compliance with COLREGS' because it is not an option whether or not vessels comply with it. This impact was included in the study to demonstrate where compliance would become more difficult due to the siting of a wind farm.

- Emergency response was discussed, particularly with reference to the Round 3 developments which are located far offshore. In these developments the first line of response is more likely to be with the developer and the self-rescue element will become more important as the distance offshore increases. Some developers will have year round all weather craft, manned bases within the wind farm and helicopters that could be used to aid emergency response.

- There was a general consensus amongst the stakeholders that the positive element of 'Traffic levels within ports' was too commercial to be included in this project. As a result, any rankings related to the commercial benefits have been removed.