East Anglia TWO Offshore Windfarm

Chapter 14

Shipping and Navigation

Environmental Statement
Volume 1

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Glossary of Acronyms

AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
BEIS	Department of Business, Energy and Industrial Strategy
BMAPA	British Marine Aggregate Producers Association
CA	Cruising Association
COLREGs	International Regulations for Preventing Collisions at Sea
CoS	Chamber of Shipping
DCO	Development Consent Order
DML	Deemed Marine Licence
DWR	Deep Water Route
ERCoP	Emergency Response Cooperation Plan
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU	European Union
FSA	Formal Safety Assessment
GLA	General Lighthouse Authority
HM	Her Majesty's
IALA	International Association of Lighthouse Authorities
IMO	International Maritime Organization
KIS-ORCA	Kingfisher Information Service-Offshore Renewable Cable Awareness
km	kilometre
m	metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
Met Mast	Meteorological Mast
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MoD	Ministry of Defence
nm	Nautical mile
NPS	National Policy Statement
NRA	Navigational Risk Assessment
NSIP	Nationally Significant Infrastructure Projects
NUC	Not Under Command
OREI	Offshore Renewable Energy Installation
PEI	Preliminary Environmental Information
PEIR	Preliminary Environmental Information Report
PEXA	Practice and Exercise Areas
RAM	Restricted in Ability to Manoeuvre
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
RYA	Royal Yachting Association
SAR	Search and Rescue
SNSOWF	Southern North Sea Offshore Wind Forum

SOLAS	International Convention for the Safety of Life at Sea
SPR	ScottishPower Renewables
SPS	Significant Peripheral Structure
STS	Ship-to-Ship
TH	Trinity House
TSS	Traffic Separation Scheme
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VHF	Very High Frequency

Glossary of Terminology

Applicant	East Anglia TWO Limited.
As Low As Reasonably Practicable (ALARP)	The principle that the residual risk shall be reduced as far as reasonably practicable.
Allision	Contact between a moving and stationary object.
Automatic Identification System (AIS)	Automatic Identification System. A system by which vessels automatically broadcast their identity, key statistics e.g. length, brief navigation details e.g. location, destination, speed and current status e.g. survey. Most commercial vessels and European Union (EU) fishing vessels over 15 m are required to have AIS.
Baseline	The assessment of risk based on current shipping densities and traffic types as well as the marine environment.
Collision	The act or process of colliding (crashing) between two moving objects.
Construction, operation and maintenance platform	A fixed offshore structure required for construction, operation, and maintenance personnel and activities.
East Anglia TWO project	The proposed project consisting of up to 75 wind turbines, up to four offshore electrical platforms, up to one construction operation and maintenance platform, inter-array cables, platform link cables, up to one operational meteorological mast, up to two offshore export cables, fibre optic cables, landfall infrastructure, onshore cables and ducts, onshore substation, and National Grid infrastructure.
East Anglia TWO windfarm site	The offshore area within which wind turbines and offshore platforms will be located.
Formal Safety Assessment (FSA)	A structured and systematic process for assessing the risks and costs (if applicable) associated with shipping activity.
Future Case	The assessment of risk based on the predicted growth in future shipping densities and traffic types as well as foreseeable changes in the marine environment.
Inter-array cables	Offshore cables which link the wind turbines to each other and the offshore electrical platforms, these cables will include fibre optic cables.
Landfall	The area (from Mean Low Water Springs) where the offshore export cables would make contact with land, and connect to the onshore cables.
Marine Environmental High Risk Area (MEHRA)	Areas in UK coastal waters where ships' masters are advised of the need to exercise more caution than usual i.e. crossing areas of high environmental sensitivity where there is a risk of pollution from commercial shipping.
Marine Guidance Note (MGN)	A system of guidance notes issued by the Maritime and Coastguard Agency (MCA) which provide significant advice relating to the improvement of the safety of shipping and of life at sea, and to prevent or minimise pollution from shipping.
Monitoring buoys	Buoys to monitor in situ condition within the windfarm, for example wave and metocean conditions.
Navigational Risk Assessment (NRA)	A document which assesses the overall impact to shipping and navigation of a proposed Offshore Renewable Energy Installation (OREI) based upon formal risk assessment.
Not Under Command (NUC)	Under Part A of the International Regulations for Preventing Collisions at Sea (COLREGs), the term “vessel not under command” means a vessel

	which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.
Offshore cable corridor	This is the area which will contain the offshore export cables between offshore electrical platforms and transition bays located at landfall.
Offshore development area	The East Anglia TWO windfarm site and offshore cable corridor (up to Mean High Water Springs).
Offshore electrical infrastructure	The transmission assets required to export generated electricity to shore. This includes inter-array cables from the wind turbines to the offshore electrical platforms, offshore electrical platforms, platform link cables and export cables from the offshore electrical platforms to the landfall.
Offshore electrical platform	A fixed structure located within the windfarm area, containing electrical equipment to aggregate the power from the wind turbines and convert it into a more suitable form for export to shore.
Offshore export cables	The cables which would bring electricity from the offshore electrical platforms to the landfall. These cables will include fibre optic cables.
Offshore infrastructure	All of the offshore infrastructure including wind turbines, platforms, and cables.
Offshore platform	A collective term for the offshore operation and maintenance platform and the offshore electrical platforms.
Platform link cable	Electrical cable which links one or more offshore platforms, these cables will include fibre optic cables.
Radar	Radio Detection And Ranging – an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects.
Regular Operator	A commercial vessel operator whose vessel(s) are observed to transit through a particular region on a regular basis.
Roll on Roll off (Ro Ro)	Vessels designed to carry wheeled cargo such as cars, trucks and trailers that are driven on and off the vessel on their own wheels or using a platform vehicle.
Safety Zone	A marine area declared for the purposes of safety around a renewable energy installation or works / construction area under the Energy Act 2004.
Scour protection	Protective materials to avoid sediment being eroded away from the base of the foundations as a result of the flow of water.

14 Shipping and Navigation

14.1 Introduction

1. This chapter of the Environmental Statement (ES) summarises the work undertaken by Anatec Limited as part of the Navigational Risk Assessment (NRA) (***Appendix 14.2***) to identify the existing vessel activity and navigational features in the vicinity of the proposed East Anglia TWO project for the construction, operation and maintenance, and decommissioning phases. This shipping and navigation chapter considers vessels recorded transiting the sea area in proximity to the East Anglia TWO windfarm site including commercial vessels, recreational craft and commercial fishing vessels.

2. Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs) specifically in relation to shipping and navigation, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1; Department of Business, Energy and Industrial Strategy (BEIS), 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, BEIS, 2011b). Only the NPS EN-3 includes guidance specific to shipping and navigation although the overarching principles set out in NPS EN-1 have been considered.

3. This chapter presents the shipping and navigation baseline, which has been established based on a high level review of data sources listed in ***section 14.4.4***. A detailed baseline assessment is presented as part of the NRA (***Appendix 14.2*****)**, and is described in ***section 14.5.2***. A description of the study areas, in which the baseline has been established, is presented in ***section 14.3.1***.

14.2 Consultation

4. Consultation is a key feature of the Environmental Impact Assessment (EIA) process, and continues throughout the lifecycle of a project, from its initial stages through to consent and post-consent. To date, consultation with regards to shipping and navigation has been undertaken through formal submission of the Scoping Report (ScottishPower Renewables (SPR) 2017) and the Preliminary Environmental Information Report (PEIR) (SPR 2019) and consultation meetings, as detailed in ***Table A14.1.1*** in ***Appendix 14.1***. Feedback received through this process has been incorporated into the ES where appropriate, and this chapter has been updated for the final assessment submitted with the Development Consent Order (DCO) application.

5. The responses received from stakeholders with regards to the Scoping Report, PEIR and consultation meetings are summarised in ***Table A14.1.1*** in ***Appendix 14.1***, including details of how these have been taken account of within this chapter.

6. It should be noted that regular operators that transit the shipping and navigation study area have also been consulted; details of this are presented in ***section 5.3*** and ***5.4*** of the NRA (***Appendix 14.2***).

7. Ongoing public consultation has been conducted through a series of Public Information Days (PIDs) and Public Meetings. PIDs have been held throughout Suffolk in November 2017, March 2018, June / July 2018 and February / March 2019. A series of stakeholder engagement events were also undertaken in October 2018 as part of Phase 3.5 consultation. Details of the consultation phases are discussed further in ***Chapter 5 EIA Methodology***.

8. ***Table 14.1*** shows public consultation feedback pertaining to shipping and navigation. Full details of the proposed East Anglia TWO project consultation process are presented in the Consultation Report (document reference 5.1), which is provided as part of the DCO application.

Table 14.1 Public Consultation Responses relevant to Shipping and Navigation

Topic	Response / where addressed in the PEI
Phase 1	
• Turbines could be colour coded red/green to aid navigation	The windfarm would be designed and constructed to satisfy the requirements of the Civil Aviation Authority (CAA) and the Trinity House Lighthouse Service (THLS). As outlined in ***section 6.5.5*** of ***Chapter 6 Project Description***, the colour scheme for nacelles, blades and towers is typically RAL 7035 (light grey). Foundation steelwork is generally in RAL 1023 (traffic light yellow) up to the Highest Astronomical Tide (HAT) +15m or to Aids to Navigations, whichever is the highest.
Phase 2	
• Effects of the project on ship to ship transfer business. • Interaction between windfarms and shipping and the risk of collision and oil spills. • CA have concern regarding anything that may result in a not smooth bottom anywhere less than 10m in depth	• Potential impacts on commercial vessels are considered in ***section 14.6*** and the potential risks to navigation in the context of collision are considered in ***section 18.2*** of ***Appendix 14.2*** In terms of oil spill risk, this is considered within the Consequences Assessment (***Appendix 14.5).*** Anchored tankers associated with Ship to Ship (STS) off the coast of Southwold are highlighted in ***section 12.2.10*** and ***section 12.3.9*** of ***Appendix 14.2***. • Works will be undertaken in accordance with MGN 543, ensuring there are no significant changes to charted depths, while also ensuring that appropriate cable protection is used where appropriate.
Phase 3; Phase 4	
None	n/a

14.3 Scope

14.3.1 Study Areas

9. The analysis has been undertaken within a ten nautical mile (nm) buffer of the East Anglia TWO windfarm site (hereafter referred to as the shipping and navigation study area). This buffer has been used as it is considered best practice for NRA and it presents a sufficient area to capture the relevant marine traffic for the project in terms of baseline data, while still remaining site specific to the East Anglia TWO windfarm site. The shipping and navigation study area was initially defined to include the most up to date boundary of the East Anglia TWO windfarm site available at the time (10th August 2018). However, since the analysis was first undertaken at the PEIR stage, the northern extent of the East Anglia TWO windfarm site has been reduced in order to reduce seascape impacts. Despite this change, the shipping and navigation study area has remained the same in order to allow the analysis undertaken at the ES stage to remain comparable to that undertaken at the PEIR stage. It is noted that there has been no reduction in the shipping and navigation study area and that analysis has been carried out within a minimum of 10nm around the East Anglia TWO windfarm site

10. In addition, analysis of marine traffic data and relevant navigational features has been undertaken within a 2nm buffer of the proposed offshore cable corridor (hereafter referred to as the offshore cable corridor study area).

11. As shipping and navigational receptors can be cumulatively impacted by a number of offshore projects, the principles of the cumulative assessments have been extended to 100nm from the East Anglia TWO windfarm site. This includes consideration of transboundary offshore windfarm projects and vessel routes. However, for a cumulative or transboundary windfarm to be considered in the cumulative routeing assessment, a vessel route needs to be impacted (route through or in proximity to) by both the screened windfarm and the East Anglia TWO windfarm site.

14.3.2 Worst Case

12. The design of the proposed East Anglia TWO project (including number of wind turbines, layout configuration, requirement for scour protection, electrical design, etc.) is not yet fully determined, and may not be known until sometime after the DCO has been granted. Therefore, in accordance with the requirements of the Project Design Envelope (also known as the Rochdale Envelope) approach to EIA (Planning Inspectorate 2018) (as discussed in ***Chapter 5 EIA Methodology***), realistic worst case scenarios in terms of potential effects upon shipping and navigation are adopted to undertake a precautionary and robust impact assessment.

13. ***Chapter 6 Project Description*** sets out a detailed description of the proposed East Anglia TWO offshore development area, as well as detailed information on construction, operation and decommissioning. The worst case scenarios with regard to shipping and navigation are presented by impact in ***Table 14.2***. These parameters are applied in the assessment of potential impacts and ensure that it reflects the worst case scenario in every aspect.

14. For shipping and navigation impact assessment, an indicative layout has been assessed which considers the maximum deployment of wind turbines across the maximum area within the East Anglia TWO windfarm site, causing the maximum displacement. Any alternative layouts would then lie within impacts assessed for this worst case scenario. The NRA (***Appendix 14.2***) that underpins this assessment is based on an early 75 wind turbine layout.

15. It should be noted when viewing ***Table 14.2*** that the minimum inter-row and in-row spacing have only been qualitatively assessed rather than modelled, given that the worst case from a shipping and navigation perspective is maximum number of structures over the greatest area. Therefore, 1060m inter-row spacing and 2400m in-row spacing within the 75 wind turbine indicative layout has been modelled, rather than the actual minimum spacing being considered. Further details are provided in NRA (***Appendix 14.2***).

Table 14.2 Realistic Worst case scenarios

Impact	Parameter	Rationale
Construction		
Impact 1: Impact on commercial vessel routeing from construction of structures and implementation of safety zones.	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform • • 500 metres (m) safety zones and 50m pre commissioning safety zones • Offshore construction works occurring over an approximate 27-month window	Construction area and safety zones cause maximum displacement for vessels operating on regular / main routes.
Impact 2: Impact on commercial vessel safe navigation from construction of structures and implementation of safety zones.	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform • Maximum number of construction vessels on site (74) • 500m safety zones and 50m pre commissioning safety zones • Offshore construction works occurring over an approximate 27-month window	Maximum displacement of vessels causing areas of route convergence, with continuous and maximum on-site activity over the longest duration; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 3: Impact on marine aggregate dredgers from	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m	Maximum displacement of marine aggregate dredgers, with continuous and maximum on-site activity over the longest duration; and

Impact	Parameter	Rationale
construction of structures and implementation of safety zones	• Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform • Maximum number of construction vessels on site (74) • 500m safety zones and 50m pre commissioning safety zones • Jacket suction caisson foundations presenting maximum allision risk • Offshore construction works occurring over an approximate 27-month window	Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 4: Impact on commercial fishing vessels from construction of structures and implementation of safety zones. *Note: does not consider gear snagging*	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform • 500m safety zones and 50m pre commissioning safety zones • Jacket suction caisson foundations presenting maximum allision risk • Offshore construction works occurring over an approximate 27-month window	Largest concentration of wind turbines with maximum on-site vessel activity over the longest duration.
Impact 5: Impact on recreational craft from construction of structures and implementation of safety zones	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction, operation and maintenance platform	Maximum displacement for recreational craft seeking to avoid transit through the East Anglia TWO windfarm site; Maximum number of on-site vessels creating maximum potential over longest duration; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest

Impact	Parameter	Rationale
	• 500m safety zones and 50m pre commissioning safety zones • 74 construction vessels on site including associated support craft • Jacket suction caisson foundations presenting maximum allision risk	duration.
Impact 6: Impact on emergency response capability from increased number of vessels and personnel on site	• 74 construction vessels on site including associated support craft; • Increased personnel presence on site; • Potential increased pollution sources; and • Offshore construction works occurring over an approximate 27-month window	Maximum number of vessel and personnel on site with no self-help capability for emergency response.
Operation and Maintenance		
Impact 1: Impact on commercial vessel routeing from presence of structures	• Maximum number of wind turbines (75) • Minimum spacing inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform	Operational windfarm causes maximum displacement for vessels operating on regular / main routes.
Impact 2: Impact on commercial vessel safe navigation from presence of structures	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform • Maximum number of vessel round trips (687 per annum) of associated support craft • 8.9nm separation from Deep Water Route (DWR)	Maximum displacement of vessels and convergence of routes; Offshore development area within close proximity to main routes creating maximum exposure time; Offshore development area within close proximity to main routes creating minimum response time for vessels not under command; and

Impact	Parameter	Rationale
	• 7.3nm separation from Traffic Separation Scheme (TSS) • Up to two export cables, length of 80km per cable • Up to 200km of inter-array cables • Up to seven platform link cables, length of up to 15km per cable with a maximum total length of 75km • Burial depth of between 1 and 3m; • Up to 49.1km of unburied cable due to ground conditions or at cable crossings requiring additional protection	
Impact 3: Impact on marine aggregate dredgers from presence of structures	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction, operation and maintenance platform • Maximum number of vessel round trips (687) of associated support craft • 8.9nm separation from DWR • 7.3nm separation from TSS • Up to two export cables, length of 80km per cable • Up to 200km of inter-array cables • Up to seven platform link cables, length of up to 15km per cable with a maximum total length of 75km • Burial depth of between 1 and 3m • Up to 49.1km of unburied cable due to ground conditions or at cable crossings requiring additional protection	Maximum operational area creating maximum displacement for marine aggregate dredgers not wanting to transit through the East Anglia TWO windfarm site; Minimum spacing and maximum number of wind turbines creating maximum risk of allision; Maximum vessel movements within the East Anglia TWO windfarm site, over continuous 24 hour period and over the longest duration without effective control; and Inadequate protection and or burial creating a navigational hazard.

Impact	Parameter	Rationale
Impact 4: Impact on commercial fishing vessels from presence of structures. *Note: does not consider gear snagging*	• Maximum number of wind turbines (75) • Minimum spacing inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform • Up to 687 vessel round trips per annum • 8.9nm separation from DWR • 7.3nm separation from TSS • Up to two export cables, length of 80km per cable • Up to 200km of inter-array cables • Up to seven platform link cables, length of up to 15km per cable with a maximum total length of 75km • Burial depth of between 1 and 3m; • Up to 49.1km of unburied cable due to ground conditions or at cable crossings requiring additional protection	Offshore development area near or on fishing grounds creating maximum exposure time for fishing vessels; and Inadequate protection and or burial creating a navigational hazard.
Impact 5: Impact on recreational crafts from presence of structures	• Maximum number of wind turbines (75) • Minimum spacing inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operation and maintenance platform • Up to 687 vessel round trips per annum • 8.9nm separation from DWR	Maximum operational area creating maximum displacement for recreational craft not wanting to transit through the East Anglia TWO windfarm site; Maximum vessel movements within the array, over continuous 24 hour period and over the longest duration without effective control; Minimum spacing and maximum number of wind turbines creating maximum risk of allision; and Inadequate protection and or burial creating a navigational hazard.

Impact	Parameter	Rationale
	• 7.3nm separation from TSS • Minimum blade clearance of 22m above MHWS • Up to two export cables, length of 80km per cable • Up to 200km of inter-array cables • Up to seven platform link cables, length of up to 15km per cable with a maximum total length of 75km • Burial depth of between 1 and 3m • Up to 49.1km of unburied cable due to ground conditions and cable crossings requiring additional protection	
Impact 6: Impact on emergency response capability from increased number of vessels and personnel	• Up to 687 vessel round trips per annum • Increased personnel presence on site • Potential increased pollution sources	Maximum number of vessel and personnel on site with no self-help capability for emergency response.
Decommissioning		
Impact 1: Impact on commercial vessel routeing from safety zones	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of substations (four) • One construction operation and maintenance platform • Decommissioning safety zones	Decommissioning area and safety zones cause maximum displacement for vessels operating on regular / main routes.
Impact 2: Impact on commercial	• Maximum number of wind turbines (75)	Maximum displacement of vessels causing areas of route convergence, with continuous and maximum on-

Impact	Parameter	Rationale
vessel safe navigation from partially decommissioned structures and safety zones	• Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of substations (four) • One construction accommodation and maintenance platform • Maximum number of decommissioning vessels onsite • Decommissioning safety zones • Jacket suction caisson foundations presenting maximum allision risk	site activity over the longest duration; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 3: Impact on marine aggregate dredgers from partially decommissioned structures and safety zones	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of substations (four) • One construction operation and maintenance platform • Maximum number of decommissioning vessels onsite • Decommissioning safety zones • Jacket suction caisson foundations presenting maximum allision risk	Maximum displacement of marine aggregate dredgers, with continuous and maximum on-site activity over the longest duration; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.

Impact	Parameter	Rationale
Impact 4: Impact on commercial fishing vessels from partially decommissioned structures and safety zones. *Note: does not consider gear snagging*	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operations and maintenance platform • Decommissioning safety zones • Jacket suction caisson foundations presenting maximum allision risk	Largest concentration of wind turbines with maximum on-site vessel activity over the longest duration.
Impact 5: Impact on recreational craft displacement from partially decommissioned structures and safety zones	• Maximum number of wind turbines (75) • Minimum inter-row spacing of 1200m • Minimum in-row spacing of 800m • Maximum number of offshore electrical platforms (four) • One construction operations and maintenance platform • Decommissioning safety zones • Maximum number of decommissioning vessels on site including associated support craft • Jacket suction caisson foundations presenting maximum allision risk	Maximum displacement for recreational craft seeking to avoid transit through the East Anglia TWO windfarm site; and Largest concentration of wind turbines with continuous and maximum on-site vessel activity over the longest duration.
Impact 6: Impact on emergency response from increased no. of vessels and personnel	• Maximum number of decommissioning vessels on site including associated support craft • Increased personnel presence on site • Potential pollution sources	Maximum number of vessel and personnel on site with no self-help capability for emergency response.

14.3.3 Mitigation and Best Practice

14.3.3.1 Embedded Mitigation

16. The following embedded mitigation measures relevant to shipping and navigation are secured within the DCO.

- The East Anglia TWO windfarm site will meet the applicable requirements of MGN 543 and its annexes, including requirements to facilitate SAR access;
- Lighting and marking of the East Anglia TWO windfarm site in line with IALA guidance O-139 (2013), which will be agreed with TH and MCA post consent;
- Wind turbines will have at least 22m air clearance above MHWS as per MGN 543 (MCA 2016) and RYA (RYA 2015) requirements.
- Cable protection via burial (or alternative methods where burial is not feasible), including maintenance and monitoring of the protection during the operational phase. A Cable Burial Risk Assessment will be developed post-consent;
- Marking of structures and cables on appropriately scaled navigational charts;
- Compliance from all vessels associated with the proposed East Anglia TWO project with international regulations as adopted by the flag state (most notably International Convention for the Prevention of Collision at Sea (COLREGS) (IMO 1972) and International Convention for the Safety of Life at Sea (SOLAS) (IMO 1974));
- Dedicated Marine Coordination Centre to manage on site vessels;
- Development of an Emergency Response Cooperation Plan (ERCoP); and

14.3.3.2 Additional Mitigation

17. Additional mitigation measures as follow have been identified as necessary to ensure the residual significance of each impact is reduced to As Low As Reasonably Practicable (ALARP):

- Use of guard vessels as appropriate (e.g. during the construction period or during periods of major maintenance);
- Under keel clearance will be risk assessed against MCA and RYA guidance;
- Application through submission of the Safety Zone Statement post consent for safety zones around structures where construction or major maintenance is being undertaken;

- Relevant information promulgated via Notice to Mariners and other appropriate media.

14.3.4 Monitoring

18. Post-consent, the final detailed design of the proposed East Anglia TWO project will refine the worst-case parameters assessed in this ES. It is recognised that monitoring is an important element in the management and verification of the actual proposed East Anglia TWO project impacts.

19. As stated in the In-Principle Monitoring Plan (document reference 8.13), vessel traffic monitoring by AIS during construction and operation with periodic reporting to the MMO and MCA will be undertaken in accordance with the Navigation Monitoring Strategy which will be agreed post consent.

20. The outline Offshore Operations and Maintenance Plan (oOOMP) (document reference 8.12) and outline Navigation Monitoring Strategy (document reference 8.18) have been submitted with the DCO application and are relevant to shipping and navigation. These plans set out the Applicant's intentions for shipping and navigation monitoring and management. The requirement for and final design and scope of monitoring will be agreed with the regulator and relevant stakeholders and included within the relevant Management Plan, submitted for approval, prior to construction works commencing.

14.4 Assessment Methodology

21. Potential shipping and navigation impacts will be assessed for significance using the Formal Safety Assessment (FSA) process detailed by the International Maritime Organization (IMO) (2002) and as required by the MCA Methodology for Assessing the Marine Navigational Safety of Offshore Wind Farms (MCA 2015). The FSA assigns each impact a "frequency" and "severity" ranking which are then used to assess the overall significance as either broadly acceptable, tolerable, or unacceptable, assuming embedded mitigation is in place. Where appropriate, additional mitigation is then introduced to reduce any impacts to ALARP levels as necessary. Rankings will be informed by quantitative modelling results, stakeholder consultation feedback, and expert opinion. Further details of the FSA process are provided in ***section 14.4.5***.

22. The key input to the FSA is the NRA (undertaken as per MGN 543, and available in ***Appendix 14.2***), which establishes the shipping and navigation baseline in detail. The NRA uses the data sources listed in ***section 14.4.4***, and subsequently scopes out impacts not required to be carried through to the FSA.

23. Potential cumulative impacts will also be assessed when the proposed East Anglia TWO project is considered with other southern North Sea offshore windfarm projects. In particular, the impact on vessel routeing will be

considered on a cumulative basis, as this has historically been raised as a key area of shipping and navigation stakeholder concern in relation to the construction of offshore windfarms within the southern North Sea.

14.4.1 Primary Guidance

24. The primary guidance used during this chapter includes:

- MCA MGN 543 OREIs – Guidance of UK Navigational Practice, Safety and Emergency Response (MCA 2016);
- MCA Methodology for Assessing the Marine Navigational Safety of Offshore Wind Farms (MCA 2015); and
- IMO Guidelines for FSA (IMO 2002).

25. MGN 543 highlights issues that shall be taken into consideration when assessing the effect on navigational safety from offshore renewable energy projects, proposed UK internal waters, territorial sea or Renewable Energy Zones (REZ).

26. The MCA require that their methodology is used as a template for preparing NRAs. The methodology is centred on risk management and requires a submission that shows that sufficient controls are, or will be, in place for the assessed risk (base case and future case) to be judged as broadly acceptable or tolerable with mitigation. A checklist referencing the sections in this report and the NRA which address all MCA requirements is presented in ***Appendix 14.6***.

27. As mentioned in ***section 14.1***, planning policy on offshore renewable energy NSIPs specifically in relation to shipping and navigation, is contained in the Overarching NPS for Energy (EN-1; BEIS 2011a) and the NPS for Renewable Energy Infrastructure (EN-3, BEIS 2011b). A summary of the relevant guidance from NPS EN-3 and where it has been addressed within the ES is presented in ***Table 14.3***.

Table 14.3 Summary of NPS EN-3 Guidance

Summary of NPS EN-3 Guidance	Paragraph in NPS EN-3	Where Addressed in the ES
Stakeholders in the navigation sector should be engaged in the early stages of the development phase and this should continue throughout construction, operation and decommissioning.	2.6.153	***Appendix 14.1*** summarises consultation undertaken with stakeholders relevant to shipping and navigation.
Consultation should be undertaken with the Marine Management Organisation (MMO), MCA,	2.6.154	***Appendix 14.1*** summarises consultation undertaken with the organisations stated. Consultation with the MMO is ongoing at an

Summary of NPS EN-3 Guidance	Paragraph in NPS EN-3	Where Addressed in the ES
relevant General Lighthouse Authority (GLA), relevant industry bodies and representatives of recreational users such as the Royal Yachting Association (RYA).		overarching project level.
Information on internationally recognised sea lanes should be considered prior to undertaking assessments.	2.6.155	***Section 14.5.1*** provides information on IMO Routeing Measures in the vicinity of the East Anglia TWO windfarm site. These sea lanes are considered throughout the assessment.
An NRA should be undertaken in accordance with Government guidance prepared in consultation with the MCA and the other navigation stakeholders listed above.	2.6.156	See ***Appendix 14.2***.
Potential effects of safety zones around offshore infrastructure should be assessed.	2.6.158	Impacts associated with the implementation of safety zones are included within the impact assessment in ***section 14.6***.
The potential effect on recreational craft, such as yachts, should be considered in any assessment.	2.6.160	***Section 14.6*** considers the impacts of the proposed East Anglia TWO project upon recreational craft.

14.4.2 East Marine Plan

28. During consultation, (see ***section 14.2***), the Chamber of Shipping (CoS) requested that the East Inshore and East Offshore Marine Plans (Her Majesty's (HM) Government 2014) be taken into consideration therefore the ports and shipping policies have been presented in ***Table 14.4*** along with where the policies have been addressed or how they have been addressed.

Table 14.4 East Marine Plan Ports and Shipping Policies

Policy Number	Description	Where addressed in the ES
PS1	Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance should not be authorised in IMO designated routes.	The offshore development area is not situated within IMO designated routes as presented in ***Figure 14.1***.
PS2	Proposals that require static sea surface infrastructure that encroaches upon important navigation routes should not be authorised unless there are external circumstances. Proposals should: Be compatible with the need to maintain space for safe navigation, avoiding economic impact; Anticipate and provide for future safe navigational requirements where evidence	The identification of the East Anglia TWO windfarm site has been proposed taking into consideration the presence of existing shipping routes and activity. Future trends of shipping in the southern North Sea have been identified as part of the baseline of this chapter and potential impacts to navigation have been assessed in ***section 14.6***.

Policy Number	Description	Where addressed in the ES
	and / or stakeholder input allows; and Account for impacts upon navigation in-combination with other existing and proposed activities.	
PS3	Proposals should demonstrate, in order of preference: That they will not interfere with current activity and future opportunity for expansion of ports and harbours; How, if the proposal may interfere with current activity and future opportunities for expansion, they will minimise this; How, if the interference cannot be minimised, it will be mitigated; and The case for proceeding if it is not possible to minimise or mitigate the interference.	No impacts on ports and harbours are anticipated due to the proposed East Anglia TWO project as described in ***section 14.7.2.3***.

14.4.3 Other Guidance

29. Other guidance considered in the assessment is as follows:

- The Recreational Craft Directives 2013/53/European Union (EU) – implemented into UK law by the Recreational Craft Regulations 2017 No. 737 (BEIS 2016);
- IALA Recommendations O-139 on the Marking of Man-Made Structures (IALA 2013); and
- MCA MGN 372 (M+F) Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA 2008).

14.4.4 Data Sources

30. The baseline presented within the NRA is primarily based on analysis of 28 days of marine traffic survey data plus a further 14 days validation (or top-up) survey as summarised below. This approach to data collection was agreed with the MCA:

- 14 days of summer AIS and Radar data recorded on site by a survey vessel during May and June 2017; and
- 14 days of winter AIS data recorded via a local offshore Met Mast receiver during November and December 2017.
- 14 days of summer AIS and Radar data recorded on site by a survey vessel during August and September 2018;

31. The MCA had previously confirmed that the summer 2017 marine traffic survey presented in the PEIR did not meet the requirements of MGN 543 given the changes to the final application date, therefore a second summer marine traffic survey (AIS and Radar) was undertaken in 2018. The impact assessment and NRA presented in this ES has therefore been updated using the most recent survey data for the NRA and ES DCO application.

32. Due to the distance of the East Anglia TWO windfarm site from shore, the marine traffic survey data collected within the East Anglia TWO windfarm site did not provide good coverage of the entirety of the offshore cable corridor during the summer and winter 2017 surveys. Therefore, the survey data has been supplemented with AIS data collected from onshore receivers to ensure comprehensive coverage of the entire offshore cable corridor. AIS data collected from the marine coordinator for the East Anglia ONE windfarm site (based in Lowestoft) provided good coverage of the offshore cable corridor study area therefore has been used for the summer 2018 analysis.

33. In addition to the marine traffic survey data, the data sources listed below have also been used to establish the baseline and subsequently inform a FSA where appropriate.

- Marine incident data from Marine Accident Investigation Branch (MAIB) (2005 to 2014) and maritime incident data from the Royal National Lifeboat Institution (RNLI) (2005 to 2014);
- United Kingdom Hydrographic Office (UKHO) Admiralty Charts 1183, 1406, 1408, 1503, 1504, 1610, 1630, 1631, 1632, 2182A and 4140;
- BMAPA Routes (BMAPA 2018);
- Admiralty Sailing Directions – Dover Strait Pilot, NP28 UKHO, 2017
- Admiralty Sailing Directions - North Sea West Pilot, NP54 UKHO (UKHO 2016); and
- UK Coastal Atlas of Recreational Boating (RYA) (2016).

14.4.5 Impact Assessment Methodology

34. Following completion of the FSA and the NRA, this information was fed into the impact assessment undertaken as part of the EIA process.

35. The criteria for determining the significance of effects is a two stage process that involves defining the consequence to receptors and the frequency of the impacts. This section describes the criteria applied in this chapter to assign values to the potential impacts.

36. For the shipping and navigation assessment the following sources were taken into consideration when assigning values:

- Consultation feedback from stakeholders and Regular Operators;
- Outputs of the Hazard Workshop;
- Lessons learned and research from previous developments, especially impacts associated with visual navigation, where physical modelling is not available;
- Results of vessel to vessel collision and vessel to structure allision risk modelling;
- Analysis of baseline data; and
- Clear evidence of impact (i.e. deviations).

14.4.5.1.1Frequency

37. ***Table 14.5*** presents the frequency of occurrence or likelihood definitions that have been assumed within the FSA.

Table 14.5 Definitions of Frequency Levels for Shipping and Navigation

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

14.4.5.1.2Consequence

38. ***Table 14.6*** presents the consequence definitions that have been assumed within the FSA.

Table 14.6 Definitions of Severity Levels for Shipping and Navigation

Rank	Severity	Definition
1	Negligible	• No injury to persons. • No significant damage to infrastructure or vessel. • No significant environmental impacts. • No significant business (safety), operation or reputation impacts.
2	Minor	• Slight injury(s) to person. • Minor damage to infrastructure or vessel. • Tier 1 pollution assistance (marine pollution). • Minor business (safety), operation or reputation impacts.
3	Moderate	• Multiple moderate or single serious injury to

Rank	Severity	Definition
		persons. • Moderate damage to infrastructure or vessel. • Tier 2 pollution assistance (marine pollution). • Considerable business (safety), operation or reputation impacts.
4	Serious	• Serious injury or single fatality. • Major damage to infrastructure or vessel. • Tier 2 pollution assistance (marine pollution). • Major national business (safety), operation or reputation impacts.
5	Major	• More than one fatality. • Extensive damage to infrastructure or vessel (> £10M). • Tier 3 pollution assistance (marine pollution). • Major international business (safety), operation or reputation impacts (> £10M).

14.4.5.1.3 Impact Significance

39. Once 'frequency of occurrence' and 'severity of consequence' (see ***sections 14.4.5.1.1*** and ***14.4.5.1.2*** respectively) are assigned to an impact, the significance of the impact is determined as either 'Broadly Acceptable', 'Tolerable', or 'Unacceptable' via the risk matrix presented in ***Table 14-7***, assuming embedded mitigation is in place as per ***section 14.3.3***.

Table 14-7 Impact Significance Matrix

Frequency	Severity				
	Negligible	**Minor**	**Moderate**	**Serious**	**Major**
Frequent	Tolerable	Tolerable	Unacceptable	Unacceptable	Unacceptable
Reasonably Probable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable	Unacceptable
Remote	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable	Unacceptable
Extremely Unlikely	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable	Tolerable
Negligible	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Broadly Acceptable	Tolerable

14.4.6 Limitations and Assumptions

40. The shipping and navigation baseline and impact assessment has been carried out based on the information available and responses received at the time of preparation. The desk based data sources used are the most up to date publicly available information. The data are therefore limited by what is available and by what has been made available at the time of writing this chapter. Assumptions for modelling and baseline assessments are noted within the NRA (***Appendix 14.2***).

14.4.7 Cumulative Impact Assessment Methodology

41. Cumulative impacts have been considered for shipping and navigation receptors, this includes other offshore projects, as well as activities associated with other marine operations. However, it should be noted that fishing, recreation and marine aggregate dredging transits have been considered as part of the project-only assessment of affected receptors given that they are derivatives of shipping and navigation.

42. Other developments which may increase the effect of impacts to shipping and navigation receptors when considered with the proposed East Anglia TWO project were assessed, and screened in or out depending upon the outcome of the assessment. ***Appendix 14.4*** presents the developments considered and outlines which have been screened in and out of assessment and the reasoning behind this.

43. Cumulative impacts identified through the scoping report (SPR 2017) were then assessed when considered with the developments scoped in during the screening stage undertaken as part of the NRA process (***Appendix 14.2***). As raised during consultation, the key cumulative impact was considered to be vessel routeing when considered with the other southern North Sea windfarm developments, all impacts presented have been considered cumulatively and assessed where a pathway was identified.

14.4.8 Transboundary Impact Assessment

44. ***Chapter 5 EIA Methodology*** presents the methodology associated with transboundary impact assessment. For shipping and navigation, given the international nature of shipping, this is as per the cumulative impacts sections. It should be noted that fishing, recreation and marine aggregate dredging impacts, although they have the potential to be internationally owned or located, have been considered as part of the project-only assessment of affected receptors given that they are derivatives of shipping and navigation.

14.5 Existing Environment

14.5.1 Navigational Features

45. The navigational features baseline has been established following a review of UKHO Admiralty Charts and the Admiralty Sailing Directions (UKHO 2016) covering the area (see ***section 14.4.4*** for more details). An overview of the key navigational features discussed in this section relative to the East Anglia TWO windfarm site is presented in ***Figure 14.1*****.**

46. Within the vicinity of the East Anglia TWO windfarm site, there are IMO routeing measures in place within the southern North Sea. In particular, the DWR to the east of the East Anglia TWO windfarm site (noting that East Anglia ONE lies between the East Anglia TWO windfarm site and the DWR), and the Sunk TSS south of the East Anglia TWO windfarm site.

47. The Southwold Oil Transhipment Area (also known as Southwold STS area) is approximately 0.7nm from the northern arm of the offshore cable corridor. All charted anchorages are outside the shipping and navigation study area and offshore cable corridor study area, however it should be noted that the marine traffic survey data recorded anchoring activity within the area.

48. There are five marine aggregate dredging areas within the shipping and navigation study area (with the closest positioned approximately 1.5nm to the west of the East Anglia TWO windfarm site), in addition to a disused explosives dumping ground (4.8nm west of the windfarm site). As shown in ***Figure 14.1***, there are multiple BMAPA routes recorded transiting through both the shipping and navigation study area and offshore cable corridor study area. It should be highlighted that the BMAPA routes are routes that may be used by marine aggregate dredgers and the frequency of use of these routes is low (relative to baseline traffic levels in the area) which reflects the fact that dredging areas used and delivery ports frequently change.

49. There are four other windfarms within the shipping and navigation study area (noting that upon cumulative assessment of vessel routeing within the EIA, southern North Sea windfarms beyond 10nm will be considered):

- East Anglia ONE (under construction, approximately 5nm to east);
- East Anglia ONE North (DCO application submitted in parallel with the proposed East Anglia TWO project, approximately 5nm to the east);
- Galloper Offshore Wind Farm (operational, approximately 4nm to the south-west); and
- Greater Gabbard Offshore Wind Farm (operational, approximately 7nm to the south-west).

50. It is emphasised that only windfarms either under construction or in operation are considered baseline. Pre-DCO application, in examination / determination, or consented projects deemed relevant are considered on a cumulative basis. Further details are provided in ***section 14.7.2***.

51. In terms of oil and gas infrastructure, the Bacton to Zeebrugge natural gas pipeline intersects the shipping and navigation study area and passes to the east of the East Anglia TWO windfarm site (approximately 5.1nm).

52. There are no designated Ministry of Defence (MoD) Practice and Exercise Areas (PEXAs) within the sea area surrounding the East Anglia TWO windfarm site.

53. A Marine Environmental High Risk Area (MEHRA) is an area within UK coastal waters where there are receptors of high environmental sensitivity therefore vessel masters are advised to take more caution than usual to prevent or minimise pollution from vessels. There are no MEHRAs in the immediate vicinity of the East Anglia TWO windfarm site.

54. The East Anglia ONE and East Anglia THREE offshore cable corridor intersects the East Anglia TWO windfarm site and the offshore cable corridor. The Greater Gabbard and Galloper Wind Farm export cables intersect the offshore cable corridor. There are 11 sub-sea telecommunication cables recorded within the shipping and navigation study area. Of these, three intersect the East Anglia TWO windfarm site and three intersect the offshore cable corridor. Two of the intersecting cables (Aldeburgh to Zandvoort and the Atlantic Crossing) are no longer active.

55. Further information on navigational features is presented in ***section 8*** of ***Appendix 14.2*** and ***Chapter 17 Infrastructure and Other Users***.

14.5.2 Marine Traffic

56. The marine traffic baseline has been established using 14 days of Automatic Identification System (AIS) and Radar data collected by a survey vessel during May and June 2017 and 14 days of AIS data collected from a Met Mast during November and December 2017. The PEIR and initial NRA were informed by the summer and winter 2017 surveys. However, given that the summer 2017 survey falls outside of the required timeframe for data detailed in MGN 543 (data collected within 24 months of submission of the ES), an additional summer 2018 survey was undertaken in August and September 2018. This data has been used to validate the findings of the PEIR and associated draft of the NRA and to refresh the marine traffic assessment. The assessment of both summer surveys combined with the winter survey is included within this ES for reference. The tracks recorded during the summer and winter 2017 marine

traffic surveys are presented in ***Figure 14.2*** and ***Figure 14.3*** respectively, with tracks recorded during summer 2018 presented in ***Figure 14.4***.

57. During the summer 2018 survey, an average of 63 vessels per day passed within the shipping and navigation study area, recorded on AIS and Radar compared to 74 unique vessels during summer 2017. The decrease observed was due to a reduction in recreational vessels within the shipping and navigation study area during summer 2018 (there were no recreational races during the survey period) and also due to the construction at the East Anglia ONE windfarm site causing some traffic to deviate outside of the shipping and navigation study area. During winter, an average of 71 vessels per day passed within the shipping and navigation study area. The majority of this traffic was comprised of cargo vessels (47% during summer 2018, 43% during summer 2017 and 53% in winter) and tankers (27% during summer 2018, 28% during summer 2017 and 28% in winter). It should be noted that commercial cargo ferries are included within this. Both cargo vessels and tankers have been categorised by sub type in ***section 12.2*** and ***section 12.3*** of the NRA (***Appendix 14.2***).

58. The majority of cargo vessels were transiting routes to the east and south of the East Anglia TWO windfarm site as well as the Sunk TSS within the south of the shipping and navigation study area. Ro Ro cargo vessels with container capacity (36% during summer and winter 2017, 35% during summer 2018 and winter 2017) and general cargo vessels (35% during both combined survey periods) were the most frequently recorded cargo vessel type transiting through the shipping and navigation study area, followed by container ships (20% during summer and winter 2017, 21% during summer 2018 and winter 2017). Bulk carriers (7% during summer and winter 2017, 6% during summer 2018 and winter 2017) were also recorded frequently.

59. The majority of tankers were recorded as transiting routes to the east of the East Anglia TWO windfarm site. Combined chemical and oil tankers (39% during summer and winter 2017, 35% during summer 2018 and winter 2017) were the most frequently recorded tanker type transiting through the shipping and navigation study area. Crude oil tankers (19% during summer and winter 2017, 17% during summer 2018 and winter 2017) and Liquid Petroleum Gas (LPG) carriers (18% during summer and winter 2017, 19% during summer 2018 and winter 2017) were also commonly recorded. A number of tankers were recorded engaged in STS transfers within the north of the shipping and navigation study area, with 8% of the tracks recorded intersecting the East Anglia TWO windfarm site. There is a designated Southwold Oil Transhipment Area off the coast of Southwold where STS transfers can take place.

60. Anchoring was observed to occur within the East Anglia TWO windfarm site itself, and to the north and north-west of the windfarm site. Anchored vessels consisted of tankers mainly bound for either Southwold or awaiting orders. This area is not charted as a designated anchorage; however due to the presence of the Southwold Oil Transhipment Area, the anchored tankers may be anchored while undertaking an STS transfer or in preparation for a STS transfer. Other tankers may be anchored while awaiting further orders not associated with an STS transfer.

61. Passenger vessel traffic (including ferries and cruise liners) was also identified within the shipping and navigation study area. Regular passenger vessel transits were recorded to the east and south of the East Anglia TWO windfarm site. During both the combined summer 2017 and winter 2017 and summer 2018 and winter 2017 survey periods, vessels transiting between Hull and Zeebrugge (P&O Ferries) and Rotterdam and Harwich (Stena Line) were the most frequently recorded. The two southern routes were both transiting between Harwich and Rotterdam but were split according to direction. It is noted that due to the construction of the East Anglia ONE windfarm site during the summer 2018 survey, passenger vessels transiting between Hull and Zeebrugge have been displaced further west towards the proposed East Anglia TWO windfarm site.

62. Following vessel routing provided by DFDS Seaways, one year of AIS data (2017) was extracted from a Met Mast within the former East Anglia Zone to validate the routeing within the vicinity of the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and East Anglia TWO windfarm site. A number of DFDS Seaways vessel routes were recorded throughout 2017 with vessels on the Rotterdam to Felixstowe route recorded intersecting the south of the East Anglia TWO windfarm site (22% of vessel tracks). The most frequently used DFDS route during 2017 was the Immingham to Rotterdam route (average of two unique vessels per day) which was recorded to the north-east of the East Anglia TWO windfarm site.

63. Moderate levels of recreational activity were observed within the East Anglia TWO windfarm site during the summer surveys. It is noted that the summer 2017 data period assessed at the PEIR stage was earlier in the year therefore included the Vuurschepen yacht race and the North Sea yacht race. The later summer 2018 survey did not record vessels associated with these races. It is noted in ***Appendix 14.1*** the CA that such recreational races and regattas are common in the area.

64. Active fishing was recorded within the shipping and navigation study area, most notably within the east and south. A proportion of this activity was observed within the windfarm site; however vessels in transit through the windfarm site

(rather than actively fishing) were also recorded. It should be noted that fishing activity is highly seasonal, and can also vary on an annual basis. Further information on fishing can be found in ***Chapter 13 Commercial Fisheries***.

65. Regular windfarm traffic to the Greater Gabbard Offshore Wind Farm and Galloper Offshore Wind Farm was recorded from Lowestoft and Harwich (UK), respectively.

14.5.3 Baseline Routeing

66. The marine traffic survey data was used to identify the main vessel routes within 10nm of the East Anglia TWO windfarm site. The information transmitted via AIS and Radar was used to estimate the types and sizes of vessels using each route, and the origin / destination ports. Anatec's internal UK-wide route database and the charted IMO routeing measures were then used to validate the findings, and to extend the routes beyond the 10nm threshold of the AIS and Radar data.

67. It is noted that the summer 2018 data was not available at the PEIR stage (i.e., when the routeing assessment was undertaken), therefore the summer 2017 and winter 2017 marine traffic survey data were used to identify the main vessel routes within the shipping and navigation study area, and estimate vessel numbers.

68. Subsequent assessment of the summer 2018 data combined with the winter 2017 data indicated that, other than route 5 (see ***Table 14.8***), vessel numbers on all main routes have either remained static or dropped between 2017 and 2018. Where drops were observed, vessel numbers have not been changed from those estimated at the PEIR stage.

69. It is also noted that due to the construction of the East Anglia ONE windfarm site, three routes were identified as no longer transiting through the shipping and navigation study area (routes 10, 11 and 13, presented in ***section 15.2*** of the NRA (***Appendix 14.2***)). However, these routes were still present within the winter 2017 data therefore the routeing analysis has not been updated to reflect this change in order to present the worst case routeing scenario. Vessels using these routes had either deviated west towards the East Anglia TWO windfarm site and utilised route 5 or deviated east outside of the shipping and navigation study area. It is expected that traffic will shift again post construction of the East Anglia ONE windfarm site once the construction buoyage is removed but not to levels higher than assessed within this report.

70. Galloper Offshore Wind Farm was under construction during the summer and winter 2017 survey period therefore tracks associated with the construction were excluded from the analysis and subsequent routeing assessment. During

the 2018 summer survey period, the Galloper Offshore Wind Farm was commissioned. Operation and maintenance vessels associated with the windfarm were recorded engaged in activity at the windfarm within the south west of the shipping and navigation study area having transited from Harwich. Vessels associated with the neighbouring Greater Gabbard Offshore Wind Farm were recorded using the same routeing from Lowestoft as was recorded during summer 2017 therefore route 14 (see ***Table 14.8***) remains valid.

71. The main routes identified are presented in ***Figure 15.1*** of the NRA (***Appendix 14.2***). A total of 16 main routes were identified, a summary of each is presented in ***Table 14.8***.

Table 14.8 Main Routes

Route Number	Main Destination and Origin Ports	Average Vessels per Day	Main Vessel Types	Description
1	Harwich and Felixstowe – Hook of Holland	5	Commercial Ferry	Traffic transiting east and south-east from Harwich and Felixstowe to the Hook of Holland.
2	Hook of Holland – Harwich and Felixstowe	7	Commercial Ferry	Traffic transiting west from the Hook of Holland to Harwich and Felixstowe.
3	Zeebrugge – Humber	2	Cargo and Commercial Ferry	Traffic transiting both northbound and southbound between Zeebrugge and the Humber.
4	Thames – East Europe Ports	1	Cargo and Tanker	Traffic transiting north-east between ports within the Thames and east Europe ports. Uses the Sunk TSS.
5	Zeebrugge and Flushing – Main UK East Coast	11	Cargo, Commercial Ferry and Tanker	Traffic transiting both northbound and southbound between Zeebrugge and Flushing and ports along the main UK east coast. Marine aggregate dredgers may also transit this route as reflected within the BMAPA routes presented in the NRA (***Appendix 14.2***).
6	Sunk – Germany and Netherlands	2	Cargo	Traffic transiting north-east between the Sunk TSS and Germany and Netherlands.
7	East Europe Ports – Thames	1	Cargo and Tanker	Traffic transiting south-east between east Europe ports and ports within the Thames. Uses the Sunk TSS.

Route Number	Main Destination and Origin Ports	Average Vessels per Day	Main Vessel Types	Description
8	Germany and Netherlands – Sunk	2	Cargo	Traffic transiting south-east between Germany and Netherlands and the Sunk TSS.
9	Humber – Sunk	3	Cargo, Dredger and Tanker	Inshore route with traffic transiting both northbound and southbound between the Humber and the Sunk TSS.
10	Humber – Netherlands and Antwerp	1	Cargo and Tanker	Traffic transiting both north-west and south-east between the Humber and the Netherlands and Antwerp. Split into two separate routes due to deviation around EA1B Met Mast.
11	Humber – Netherlands and Antwerp	1	Cargo and Tanker	
12	Newcastle upon Tyne – Dover Strait	1	Cargo, Commercial Ferry and Tanker	Traffic transiting northbound and southbound between Newcastle upon Tyne and the Dover Strait.
13	Hull – Antwerp	1	Cargo and Dredger	Traffic transiting north-west and south-east between Hull and Antwerp.
14	Lowestoft – Greater Gabbard Offshore Wind Farm	6	Windfarm Support	Northbound and southbound windfarm support traffic associated with the operational Greater Gabbard Offshore Wind Farm.
15	Thames – Norway and Sweden	1	Cargo and Tanker	Traffic transiting north-east and south-west between ports within the Thames and Norway and Sweden.
16	Thames – Scandinavian Ports	1	Cargo and Tanker	Traffic transiting north-east and south-west between ports within the Thames and Scandinavian ports.

14.5.4 Predicted Future Marine Traffic

72. As part of the collision and allision modelling in the NRA (***Appendix 14.2***), an indicative increase of 10% for all vessel types was assessed for the future case traffic modelling over the life of the windfarm; in addition to an assessment of risk should traffic levels remain constant (base case). This increase is in line with the assessments undertaken for other UK offshore windfarms, including East Anglia ONE and Norfolk Vanguard and therefore ensures a consistent approach with existing assessments.

73. In terms of vessel routeing, the future case vessel routes which may deviate due to the presence of the East Anglia TWO windfarm site have been assessed from a worst case modelling perspective. Based on the baseline marine traffic discussed in ***section 14.5.2***, it has been predicted that three main routes could be deviated due to the East Anglia TWO windfarm site. It must be noted that these deviations have been based on a worst case scenario as outlined in the NRA (***Appendix 14.2***). It is likely that vessels will plan ahead and alter their route further from the East Anglia TWO windfarm site.

14.6 Potential Impacts

74. The following sections present the potential impacts associated with the East Anglia TWO windfarm site and offshore cable corridor. It is noted that following consultation with the MCA in May 2017, effects on communications, navigation and Radar, normally considered within the assessment (required as part of MGN 543 (MCA 2016)), have been scoped out of the East Anglia TWO assessment and the NRA (***Appendix 14.2***).

75. The impact assessment has been divided into sections dealing with the impact on shipping and navigation receptors identified and scoped into the assessment as follows:

- Commercial vessels including bulk cargo, passenger vessels, tankers and containerised traffic;
- Marine aggregate dredgers;
- Commercial fishing vessels;
- Recreational craft; and
- Emergency response.

76. Rather than assess each stage of development separately, as done for other chapters in this ES, the impact assessment for this chapter considers the baseline conditions for each receptor. This is then used to identify and assess the impacts individually during all phases of the proposed East Anglia TWO project (construction, operation and maintenance, and decommissioning phases).

77. The structure of each impact is therefore as follows:

- Discussion of pathway/impacts/baseline - windfarm site and offshore cable corridor;
- Assessment of construction impacts;
- Assessment of operation and maintenance impacts; and
- Assessment of decommissioning impacts.

14.6.1 Impact 1: Impact on Commercial Vessel Routeing

14.6.1.1 East Anglia TWO Windfarm Site

78. Marine traffic movements within the shipping and navigation study area have been captured through dedicated vessel based traffic surveys and AIS data collection as noted in ***section 14.5.2***. The marine traffic survey data has also been considered alongside vessel route databases (Anatec ShipRoutes 2018) to define a full and detailed picture of commercial vessel movement with the shipping and navigation study area.

79. The full marine traffic assessment for the East Anglia TWO windfarm site and the offshore cable corridor is presented in ***sections 12*** and ***13*** of ***Appendix 14.2***, respectively.

80. The baseline, future case and adverse weather routeing for commercial vessels is discussed below with regards to the East Anglia TWO windfarm site. This information has then been used to inform the impact assessment for the construction, operation and maintenance and decommissioning phases. The marine traffic assessment undertaken within the NRA (***Appendix 14.2***) has been used to inform the impact assessment with regards to the offshore cable corridor.

14.6.1.1.1 Baseline Routeing

81. A total of 16 main routes were identified from the marine traffic survey data. Full details of the base case routes are presented in ***section 15*** of ***Appendix 14.2***. A summary of each is presented in ***Table 14.8*** of this chapter.

82. Of these 16 routes, there are three routes that would require deviation during the construction, operation and maintenance and decommissioning phases of the East Anglia TWO windfarm site. These are as follows (further details are provided in the NRA (***Appendix 14.2***)):

- Route 2: consists of commercial ferries (passenger and Ro Ro) and used by approximately seven vessels per day, between Harwich / Felixstowe and the Hook of Holland;
- Route 3: consists of cargo vessels and commercial ferries and used by approximately two vessels per day, between Zeebrugge and ports within the Humber; and
- Route 12: consists of cargo vessels, commercial ferries and tankers and used by approximately one vessel per day, between Newcastle upon Tyne (UK) and the Dover Strait.

83. There was concern raised during consultation with CoS (see ***Appendix 14.2*** and ***14.1***) on choke points in traffic particularly entering and leaving Harwich

and Felixstowe. The southern area of the East Anglia TWO windfarm site was highlighted due to potential impacts on eastbound and westbound traffic. The hazard workshop also identified that the East Anglia TWO windfarm site may displace established commercial vessel routes and established commercial vessel adverse weather routeing.

14.6.1.1.2Future Case Routeing

84. ***Appendix 14.2*** presents the anticipated re-routes for the routes potentially impacted by the East Anglia TWO windfarm site during all phases of the proposed East Anglia TWO project. The increase in route distances for vessels displaced by the windfarm site would be minimised by the promulgation of information (including charting) which would enable vessels to passage plan in advance of encountering the East Anglia TWO windfarm site.

85. The East Anglia TWO windfarm site will be charted throughout all phases and during periods of construction and maintenance, ongoing activities would be promulgated through Notice to Mariners, Kingfisher Information Service-Offshore Renewable Cable Awareness (KIS-ORCA) and other standard methods of communication to ensure that vessel Masters are able to effectively passage plan to minimise deviations and avoid current areas of activity.

14.6.1.1.3 Adverse Weather

86. Impacts on adverse weather routeing in the southern North Sea are expected to be low due to the East Anglia TWO windfarm site. The hazard workshop (see ***section 21*** of ***Appendix 14.2***) identified that there may be displacement of commercial vessels on established adverse weather routes but that the frequency of occurrence would be low given the small percentage of adverse weather experienced throughout a year.

87. Following consultation, information on commercial vessel routeing was provided by DFDS Seaways. Following a validation of the routeing provided using one year of AIS data (2017) (see ***section 12.2.8*** of ***Appendix 14.2***) low levels of adverse weather routeing was identified. One vessel with a destination of Felixstowe and Rotterdam was recorded on an adverse weather route intersecting the northern boundary of the East Anglia TWO windfarm site. This vessel track was recorded during the winter period therefore is assumed to be a deviation due to adverse weather conditions (weather data was not assessed). Vessels with a destination of Immingham and Rotterdam were also recorded transiting through the East Anglia TWO windfarm site. These are also assumed to be due to adverse weather conditions. One vessel track on the Rosyth to Zeebrugge route was recorded intersecting the East Anglia TWO windfarm site however it is noted that in April 2018, DFDS announced that they were closing this route.

88. Other commercial ferries, in order to minimise passenger discomfort, often route on coastal courses during adverse weather and are not anticipated to be impacted (given there is ample sea room inshore of the East Anglia TWO windfarm site for navigation).

89. In order to mitigate the effects of adverse weather there is ample safe sea room for vessels to safely route in adverse weather, without significantly increasing time or deviation distance.

14.6.1.2 Offshore Cable Corridor

90. The marine traffic assessment undertaken with the NRA (***Appendix 14.2***) showed regular routed commercial traffic crossing the offshore cable corridor.

14.6.1.3 Construction Phase

14.6.1.3.1 East Anglia TWO Windfarm Site

91. During the construction phase, the presence of structures, to the use of temporary construction safety zones and the buoyed construction area means that there is a potential for routes to be deviated around areas of construction.

92. Maximum deviations during the construction phase would be associated with the buoyed construction area. The location and size of the buoyed construction area would be defined by TH post consent / pre construction depending on the final layout of the windfarm site. However, the final buoyed area would extend approximately 500m beyond the final layout. The buoyed construction area would be agreed with TH prior to deployment and is therefore assumed to be designed to minimise impacts on commercial vessel routeing. The worst case assumes that a buoyed construction area would be in place for the entire offshore construction period (approximately 27 months).

93. However, the buoyed construction area would not preclude vessels from entering the East Anglia TWO windfarm site. Access to vessels through areas currently not being installed (which would be indicated by 500m safety zones around constructing vessels or 50m around pre commissioned structures) would be maintained, allowing greater freedom of movement through the East Anglia TWO windfarm site. Experience at other UK windfarms shows that commercial vessels are generally likely to avoid the buoyed construction area but smaller vessels such as recreational craft and commercial fishing vessels may seek to transit though.

94. Effective promulgation of information (as per ***section 14.6.1.1.2***) would allow vessels to effectively plan their passage to ensure there would not be significant impacts on routeing during the construction phase.

95. Impacts during construction are predicted to be frequent based on the possibility that multiple deviations to multiple routes would occur. However, it is

predicted that there would be no measurable negative consequence to commercial vessels. The impact has therefore been classed as **Tolerable and ALARP** (due to high frequency but low consequence), noting that promulgation of information would enable the vessel Masters to effectively passage plan to minimise disruption.

14.6.1.3.2 Offshore Cable Corridor

96. Cable installation vessels may displace commercial vessels within the offshore cable corridor. However, due to the minimum safe passing distances (around Restricted in Ability to Manoeuvre (RAM) installation vessel(s)) being of a small surface area (likely 1,000m or less) and that installation vessels will be changing location as cables are installed, there would be no perceptible impact on a vessel overall route noting embedded mitigation such as COLREGS (IMO 1972) which details navigational scenarios involving RAM vessels.

14.6.1.4 Operation and Maintenance Phase

14.6.1.4.1 East Anglia TWO Windfarm Site

97. As noted in ***section 14.6.1*** the presence of the East Anglia TWO windfarm site is likely to result in displacement of three routes (generally bound between UK ports, the Netherlands and Belgium). A revised vessel routeing pattern following the construction has been estimated based on the vessel baseline assessment. For the purposes of this assessment a worst case 1nm passing distance (mean of the route) for routes displaced by the East Anglia TWO windfarm site has been used. Re-routeing has been undertaken giving consideration to known projects and routeing measures as well as the vessels' final destination port in ***section 16*** of ***Appendix 14.2*****.**

98. Alongside the vessels main route any adverse weather route deviations are considered to be minor and remote (limited variation over the operation life) and therefore with consideration for embedded mitigations there are not expected to be any residual impacts for commercial vessel routeing during operation and maintenance.

99. The severity of consequence is considered to be negligible and the frequency of effect is considered to be remote given the limited potential for restrictions on navigation. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.1.4.2 Offshore Cable Corridor

100. Given that offshore cables will be buried and / or protected during the operational phase there are no perceptible impacts on commercial vessel routeing.

14.6.1.5 Decommissioning Phase

14.6.1.5.1 East Anglia TWO Windfarm Site

101. As per the construction phase the use of temporary safety zones during decommissioning means there is potential for routes to be deviated around larger areas of decommissioning activity. Again, this impact could be mitigated with effective promulgation of information to allow vessels to passage plan and avoid current areas of activity.

102. Given the familiarity with the development the severity of consequence is considered to be negligible and the frequency of effect is considered to be remote given the limited potential for restrictions on navigation. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.1.5.2 Offshore Cable Corridor

103. Following decommissioning, offshore export cables would be left *in situ* however if they were to be removed, it is anticipated that the offshore cable corridor would create a negligible displacement during decommissioning (an anticipated safe passing distance around RAM installation vessel(s)). Any impacts on commercial vessels are therefore expected to be equal to or less than the construction phase.

14.6.2 Impact 2: Impact on Commercial Vessel Safe Navigation

14.6.2.1 East Anglia TWO Windfarm Site

104. The following assesses the impact of the East Anglia TWO windfarm site on commercial vessel safe navigation, as part of this assessment the following scenarios have been considered as part of the NRA (***Appendix 14.2***) process:

- Base case traffic levels without windfarm;
- Base case traffic levels with windfarm;
- Future case traffic levels without windfarm (assuming 10% increase in traffic); and
- Future case traffic levels with windfarm (assuming 10% increase in traffic).

105. As discussed in ***section 14.6.1*** there are three routes requiring deviation during the construction, operation and decommissioning of the East Anglia TWO windfarm site. Some of these routes are dense traffic routes with the busiest route recording an average of seven vessels per day (the base case routes are presented in ***section 15*** of ***Appendix 14.2***). Following assessment of marine traffic data and feedback from consultation there is potential for hot spots of increased encounters or collision risk to be created however embedded

mitigation in place should manage increased traffic levels and encounters between commercial vessels and third-party vessels.

14.6.2.1.1 Increased Encounters and Collision Risk

106. As part of the modelling undertaken in the NRA (***Appendix 14.2***), an assessment of vessel to vessel encounters has been carried out by replaying at high speed the AIS and Radar data collected for the East Anglia TWO windfarm site. The majority of encounters occurred to the east and north of the East Anglia TWO windfarm site. In comparison, there were relatively few encounters within the west and south-west of the shipping and navigation study area. Within the East Anglia TWO windfarm site, the majority of encounters occurred to the south. The majority of vessels involved in encounters were cargo vessels and tankers, which accounted for 45% and 26% of vessel encounter traffic, respectively. Encounters within the site mostly consisted of cargo vessels (39%), tankers (15%), recreational craft (15%) and fishing vessels (14%).

107. Modelling was also undertaken for increased vessel to vessel collision risk by using the baseline routeing and encounter levels in the area as input to Anatec's CollRisk model suite, the full results of which can be found in the NRA (***Appendix 14.2*** (***section 18*** and ***section 19***)). The change in potential vessel to vessel collision frequency due to the East Anglia TWO windfarm site was estimated to rise from one collision per 90 years pre windfarm, to one every 80 years post wind farm.

108. It was noted that risk of vessel to vessel collisions may increase in the high density areas noted to the south, east and west of the East Anglia TWO windfarm site due to routes altering from their base case routes, which currently intersect the East Anglia TWO windfarm site.

109. Embedded mitigations and good practice such as continuous compliance with COLREGs including conduct of vessel in restricted visibility, following safe speed principles and 'give way' rules, would be complied with.

14.6.2.1.2 Additional Allision Risk

110. Commercial vessels would have the potential to allide with structures associated with the East Anglia TWO windfarm site. Modelling was undertaken for vessel allision risk following revised routeing (assuming operational and maintenance phase), the full results of which can be found in ***Appendix 14.2*** (***section 19***). Two allision scenarios were modelled, powered allision frequency and drifting allision frequency. A powered allision is the scenario whereby a vessel allides with a structure under power. A drifting vessel allision is the scenario whereby a vessel allides with a structure while not under command (NUC) due to propulsion failure.

111. The estimated powered allision frequency due to the East Anglia TWO windfarm site was 4.56 x 10^{-3} which corresponds to one allision per 219 years. The estimated drifting allision frequency due to the East Anglia TWO windfarm site was 1.67 x 10^{-3} which corresponds to one drifting allision per 600 years.

112. The majority of the powered vessel allision frequency is associated with the periphery structures on the eastern boundary. These structures are at highest risk as they are on the periphery of the windfarm boundary and located close to a high traffic density route. The majority of the NUC vessel allision frequency is associated with the structures on the southern boundary; however, this was related to the worst-case scenario of ebb tide currents running in a generally north to north-east direction. In reality, the wind turbines exposed would vary depending upon the prevailing weather and tidal conditions at the time of the drifting incident.

113. A full review of the collision and allision modelling results can be found in ***sections 18*** and ***19*** of the NRA (***Appendix 14.2***).

14.6.2.1.3 Anchoring

114. Anchoring mostly by tankers was recorded during the marine traffic surveys to the north-west of the East Anglia TWO windfarm site, including from one vessel within the site itself. The vessels anchored here were considered likely to be associated with the designated STS transfer area off the coast of Southwold. Further details are provided within the NRA (***Appendix 14.2***).

14.6.2.2 Offshore Cable Corridor

115. For the East Anglia TWO windfarm site, anchoring activity which is recorded within 5nm of the offshore cable corridor, is likely to be associated with the STS transfer area off the coast of Southwold, given that the majority of activity was from tankers anchored north-west of the East Anglia TWO windfarm site.

14.6.2.3 Construction Phase

14.6.2.3.1 East Anglia TWO Windfarm Site

116. The presence of pre commissioned and commissioned structures could create additional allision risk and result in the displacement of commercial vessels and activities within the shipping and navigation study area and offshore cable corridor study area and therefore increased encounters and vessel to vessel collision risk (including to / from vessels associated with the construction and installation of East Anglia TWO).

117. During the construction phase it is estimated that up to 74 vessels could be used to construct the worst case scenario of 75 wind turbines most of which would remain within the construction area for extended periods and therefore

reduce the potential for interaction with third party vessels. In total there are estimated to be 3,672 vessel trips during the construction phase.

118. All construction vessel movements will be managed by a Marine Coordinator who will ensure that construction traffic does not interact with third party vessels. No specific ports have currently been identified for use as a construction base. It is noted that construction and decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port.

14.6.2.3.1.1 Increased Encounters and Collision Risk

119. When considering experience at other constructing windfarms it is identified that commercial vessels do consider Notice to Mariners during passage planning and avoid current areas of construction. There has not been any recorded incident within the buoyed construction area of a UK windfarm whereby a third-party vessel has collided with a construction vessel. It is also likely in reality that vessels would pass clear of the edge of the buoyed construction area, meaning that, given the sea room, the number of hot spots where vessels would be likely to meet would be reduced, thus lowering the risk of encounter.

120. The frequency of potential collisions would be reduced by additional mitigation including the development, implementation and operation of works vessel coordination. This could include the development of construction corridors and / or entry and exit points for support craft to ensure that they are effectively managed and are not displaced into areas used by commercial vessels.

14.6.2.3.1.2 Additional Allision Risk

121. It is assumed that through effective promulgation of information, passing commercial vessels would be aware of the ongoing construction and operational maintenance, and would passage plan in advance. The temporary lighting and marking in place during construction would also provide an indication to passing vessels of the allision hazard, and guard vessels would be deployed where required to protect sensitive areas of construction. It is considered extremely unlikely that a commercial vessel would deliberately enter the buoyed construction area and approach ongoing construction operations, and any allision scenario is likely to be due to human error or machinery failure.

122. The severity of consequence from the East Anglia TWO windfarm site is considered to be moderate given the potential for damage to vessels. The frequency of effect is considered to be extremely unlikely given that mitigations are in place to manage the risk of collision and allision. Experience in windfarm construction for developers, their contractors and the vessel operators is now extensive, with a number of operational windfarms having been constructed within dense shipping and project areas. Consequently, standard mitigation

measures, as outlined in embedded mitigation ***section 14.3.3***, are tried and tested within the industry

123. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.2.3.2 Offshore Cable Corridor

124. The presence of vessels associated with laying the offshore cables may slightly increase the risk of a collision or an encounter due to displacement however this impact would be temporary and limited to a small geographical area surrounding the installation activity. It is assumed that partially buried cables that pose a risk to navigational safety would be marked and guarded until adequate protection is implemented as required to ensure they do not present a risk to anchoring vessels. Therefore, the impact is considered to have no perceptible effect. With embedded mitigation such as COLREGs, promulgation of information and minimum safe passing distances and in place.

14.6.2.4 Operation and Maintenance Phase

14.6.2.4.1 East Anglia TWO Windfarm Site

125. The presence of structures could result in the displacement of commercial vessels and activities could increase encounters, increased vessel to vessel collision and additional allision.

14.6.2.4.1.1 Increased Encounters and Collision Risk

126. During the operational phase, it is estimated that there will be a maximum of 687 windfarm vessel round trips per annum. The presence of these vessels creates a potential collision risk however the risk is reduced from the construction phase when the number of vessel trips is estimated to be 3,672.

127. During the operational phase there is the potential for increased collision risk due to displacement of the three main routes mentioned previously. Displacement of vessels on these routes may create hot spots for potential encounters or collision by being displaced into areas used by other vessels such as recreational craft and commercial fishing vessels, encounters and collision modelling results are shown in ***sections 18*** and ***19*** of the NRA (***Appendix 14.2***) and are considered to be within as low as reasonably practicable parameters.

14.6.2.4.1.2 Additional Allision

128. Allision impact to commercial vessels would also directly arise from the presence of structures within the East Anglia TWO windfarm site. This would continue throughout the operational lifetime of the proposed East Anglia TWO project as whilst the structures are in place, there is potential for an allision to

occur. Allision modelling results are shown in ***section 19*** of the NRA (***Appendix 14.2***) and are considered to be within ALARP parameters.

129. The residual risk for commercial vessels safe navigation could be reduced by additional mitigation including works vessel coordination as defined in ***section 14.3.3***, but also consultation and consideration of the final site design including cable burial and the locations of larger offshore structures.

130. Given the largely sandy nature of the East Anglia TWO windfarm site (see ***Chapter 9 Benthic Ecology***) it is anticipated that the majority of inter-array and platform link cables would be able to be buried in the sea bed. However, to conduct a precautionary assessment, it is estimated that up to 10% of the length of these cables may require cable protection (when burial is not possible due to ground conditions). Cables will also be required to be protected at crossings for which a conservative allowance of up to 25 for inter-array and 30 for platform link cables (see ***Chapter 6 Project Description***) has been assessed. Where protection is required, the assessment has been carried out in line with a number of factors, including marine traffic data, to ensure it does not present a risk to anchoring, emergency anchoring or under keel clearance.

131. It is also assumed that inter-array and platform cables would be effectively monitored through the lifetime of the project mitigating any potential hazards to vessels and navigation.

132. It is also noted that the southern convergence of routes presents an increased drifting allision risk at the south of the windfarm site while a high traffic density route to the east of the East Anglia TWO windfarm site presents increased powered allision risk to the eastern boundary. Additional aids to navigation such as buoyage could be required, following consultation with TH and MCA, to aid the displacement of traffic and prevent the creation of a high risk crossing point.

133. With regards to mitigation of drifting vessels the array is located an acceptable distance from the identified main routes to allow vessels that are NUC to take action to prevent allision with structures (i.e. by undertaking an emergency anchor) however the Applicant would also ensure that their emergency response plan would include additional consideration for a response to vessels NUC. Its own construction, support and service vessels would include responses to this type of emergency situations within their own documented safety systems.

134. The severity of consequence from the East Anglia TWO windfarm site is considered to be moderate given the potential for damage to vessels however the frequency of effect is considered to be lower than that of the construction

phase given that commercial vessel would be familiar with the development, and is therefore considered to be negligible. Standard mitigation measures, as outlined in embedded mitigation ***section 14.3.3*** will also be in place for the operational life of the proposed East Anglia TWO project.

135. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.2.4.2Offshore Cable Corridor

136. Given the largely sandy nature of the offshore cable corridor (see ***Chapter 9 Benthic Ecology***) it is anticipated that the majority of the export cable would be able to be buried in the sea bed. However, to conduct a precautionary assessment, it is estimated that up to 5% of the length of export cable may require cable protection (when burial is not possible due to ground conditions). Cables will also be required to be protected at crossings for which a conservative allowance of up to 30 (see ***Chapter 6 Project Description***) has been assessed. Where protection is required, the assessment has been carried out in line with a number of factors, including marine traffic data, to ensure it does not present a risk to anchoring, emergency anchoring or under keel clearance.

137. It is also assumed that export cables would be effectively monitored through the lifetime of the project mitigating any potential hazards to vessels and navigation.

138. However, given the operational life of the windfarm and the density of shipping passing over the offshore cable corridor there is potential for a vessel to anchor drag in adverse weather or be required to anchor in an emergency situation. The frequency of this is still considered to be extremely unlikely with the mitigations in place with the consequence ranked as minor given the potential for damage to the vessel anchor and / or the cables. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.2.5 Decommissioning Phase

14.6.2.5.1 East Anglia TWO Windfarm Site

139. Similar to the construction phase, during the decommissioning phase there is expected to be an increase in vessels on site and in the vicinity of East Anglia TWO windfarm site. This has potential to lead to an increase in vessel to vessel encounters as well as the potential for increased allision associated with the development's own vessels. No specific ports have been identified for use as a decommissioning base. It is noted that decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port, and commercial vessels would, again, be familiar with the East Anglia TWO windfarm site. As there are no details on the decommissioning plan this impact cannot be fully assessed however

considering a negligible frequency and a moderate consequence the impact is considered to be **broadly acceptable.**

14.6.2.5.2 Offshore Cable Corridor

140. Given that the vessel activity associated with the offshore cable corridor would be temporary and limited to a small spatial area (i.e. RAM vessel and minimum safe passing distance) any impact on commercial vessels is not considered to have a perceptible effect with regards to commercial vessel navigation safety.

14.6.3 Impact 3: Impact on Marine Aggregate Dredgers

14.6.3.1 East Anglia TWO Windfarm Site

141. There are five marine aggregate dredging areas within the shipping and navigation study area, with the closest positioned approximately 1.7nm to the west of the East Anglia TWO windfarm site. Marine aggregate dredging routes provided by BMAPA (BMAPA 2018) highlighted multiple preferred marine aggregate dredger routes, many of which transit through the shipping and navigation study area and offshore cable corridor study area. However, it is noted that the frequency of use of these routes is considered to be low (relative to other traffic) given that the dredging areas used and the delivery port frequently change.

142. The collision and allision risk for marine aggregate dredgers has been considered within the modelling undertaken for commercial vessels in ***section 14.6.2*** and is considered to be within acceptable parameters.

143. It is noted that following consultation, HAML expressed concerns over the displacement of fishing vessels into areas where marine aggregate operations have traditionally taken place. This Chapter considers the impacts of transiting fishing vessels in ***section 14.6.4***. Impacts associated with the displacement of fishing vessels into marine aggregate dredging areas are presented in ***Chapter 13 Commercial Fisheries***. Embedded mitigation such as vessel compliance with COLREGS (IMO 1972) including conduct of vessel in restricted visibility, following safe speed principles and 'give way' rules, would be complied with.

14.6.3.2 Offshore Cable Corridor

144. Based on the BMAPA marine aggregate dredger transit routes (BMAPA 2018) dredging transit through the offshore cable corridor is busiest coastally. As for the East Anglia TWO windfarm site, the frequency of use of these routes is considered low given that areas of the dredging areas used, and the delivery port, frequently change.

14.6.3.3 Construction Phase

14.6.3.3.1 East Anglia TWO Windfarm Site

145. During construction, it is anticipated that the presence of the buoyed construction area (containing the active construction work and safety zones) may displace existing marine aggregate dredger routes from within the East Anglia TWO windfarm site. However, it is likely that that marine aggregate dredgers would transit within the buoyed construction area where no current activity is occurring.

146. The severity of consequence is considered to be moderate given the potential for damage to a vessel, but the frequency is considered to be negligible given the very low use of the BMAPA routes passing through the construction area. The impact has therefore been classed as **broadly acceptable** for the impact on marine aggregate dredgers.

14.6.3.3.2 Offshore Cable Corridor

147. As with commercial vessel safe navigation the construction within the offshore cable corridor is considered to have no perceptible effect, with embedded mitigation; burial, protection and monitoring in place.

14.6.3.4 Operation and Maintenance Phase

14.6.3.4.1 East Anglia TWO Windfarm Site

148. Similar to the construction impacts, it is expected that BMAPA routes (BMAPA 2018) would not be significantly deviated during operation and maintenance. Marine aggregate dredger stakeholders were consulted and stated that traditional dredger routes used to transit from licensed areas to discharge ports could be impacted. The future case routeing in ***section 16*** of the NRA (***Appendix 14.2***) presents the potential route deviations for the identified main routes. It is noted that the decision to navigate through the East Anglia TWO windfarm site could be taken by the Master of a marine aggregate dredger following a risk assessment.

149. As with the construction phase the severity of consequence is considered to be moderate given the potential for damage to a vessel but the frequency is considered to be negligible given the very low use of the BMAPA routes passing through the windfarm site and the potential for marine aggregate dredgers to transit through as per their own passage plans. The impact has therefore been classed as **broadly acceptable** for the impact on marine aggregate dredgers.

14.6.3.4.2 Offshore Cable Corridor

150. As with commercial vessel safe navigation given the operational life of the windfarm and the number of marine aggregate dredgers passing over the offshore cable corridor there is potential for a vessel to anchor drag in adverse

weather or be required to anchor in an emergency situation. The frequency of this is still considered to be negligible with the mitigations in place with the consequence ranked as minor given the potential for damage to the vessel anchor and / or the cables. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.3.5 Decommissioning Phase

14.6.3.5.1 East Anglia TWO Windfarm Site and Offshore Cable Corridor

151. Given that there is limited information associated with the future licensing and operation of any marine aggregate dredging area or routes to and from, it is not possible to assess the impacts at the decommissioning stage of the proposed East Anglia TWO project; however, impacts are expected to be equal to or less than the construction phase.

14.6.4 Impact 4: Impact on Commercial Fishing Vessels (In Transit)

14.6.4.1 East Anglia TWO Windfarm Site

152. As noted in the NRA (***Appendix 14.2***) an average of three unique fishing vessels per day were tracked during both the summer 2017 and summer 2018 marine traffic surveys while an average of five per day were recorded during winter 2017. The majority of the fishing vessels were recorded within the east and south of the shipping and navigation study area rather than the East Anglia TWO windfarm site. In terms of fishing vessels intersecting the site, an average of three unique vessels per day were recorded during summer 2017 compared to two every three days during summer 2018 and two every two days during winter 2017. A

153. No fishing vessels were recorded at anchor within the marine traffic survey data.

154. Given the low levels of fishing vessel traffic recorded within the East Anglia TWO windfarm site during the marine traffic survey and embedded mitigation (including guard vessels and marine traffic coordination) the risk of collision is expected to be less than that for commercial vessels.

14.6.4.1.1 Increased Encounter, Collision Risk and Additional Allision Risk

155. There is the potential for a commercial fishing vessel to allide with a structure within the East Anglia TWO windfarm site during any phase of the project. Fishing vessels may choose to transit through the array during the construction and operation and maintenance phases (outside of active safety zones), and it is likely that this may be preferable to utilising the areas frequented by commercial vessels notably during the operations and maintenance phase. There is also potential that commercial vessels may be displaced into fishing areas, however embedded mitigations should ensure that there is not increased risk with regards to encounters and collision.

156. As noted within ***Appendix 14.2***, it was estimated that a commercial fishing vessel would allide with a wind farm structure once every 15 years (assuming no mitigation). This value is based on the assumption that levels of fishing activity within the East Anglia TWO windfarm site would remain consistent with the baseline activity. It should also be considered that this estimation assumes that all vessels are in transit. In reality, any allision incident would be likely to occur whilst engaged in fishing activity (should a fishing vessel have its gear deployed it may have reduced mobility compared to a transiting vessel, and would therefore have less scope for initiating avoidance manoeuvres when on an allision course). Consequently, any allision incident would likely occur at slow speed and with low energy. It is also noted that during the operation and maintenance phase vessels are likely to be more familiar with the structures within the East Anglia TWO windfarm site (for example locations programmed into fish plotter) and therefore the frequency of allision would be lower than during the construction phase.

157. Consultation has been undertaken with the commercial fishing industry and is reported in ***Chapter 13 Commercial Fisheries***, which considers commercial fishing displacement. There were no significant comments during consultation in relation to commercial fishing vessels in transit as per ***Appendix 14.1*****.**

14.6.4.2 Offshore Cable Corridor

158. During the survey periods there was an average of three fishing vessels per day within the offshore cable corridor study area. There are no surface piercing structures with the offshore cable corridor.

159. No commercial fishing vessels were recorded at anchor within the marine traffic survey data.

160. ***Chapter 13 Commercial Fisheries*** considers commercial fishing gear snagging associated with the offshore cable corridor.

14.6.4.3 Construction Phase

14.6.4.3.1 East Anglia TWO Windfarm Site

161. As noted in ***section 14.6.4.1.1*** during the construction phase and due to the use of temporary construction safety zones, there is potential for commercial fishing vessels to be displaced around or away from areas of construction.

162. From a navigational safety perspective, commercial fishing vessels would be able to transit through the buoyed construction area during construction using the embedded mitigation of promulgation of information to note areas of current construction activity. Given the smaller size of commercial fishing vessels transiting through the area (compared to commercial vessels) and their ability to navigate through the buoyed construction area, the frequency of deviations and

re-routeing (of vessels in transit) is expected to be lower than that of commercial vessels.

163. Construction vessels pose a collision risk to commercial fishing vessels transiting through the buoyed construction area, noting that some such construction vessels would have RAM[1] status. However, given that such vessels are likely to be within the confines of a safety zone when engaged in construction works, and guard vessels will also be utilised, such a collision scenario is considered unlikely.

164. Standard mitigation measures, as outlined in embedded mitigation ***section14.3.3***, are tried and tested within the industry.

165. The severity of consequence is considered to be minor given the limited potential for damage to vessels and the frequency of effect is considered to be remote given the proximity to the coast and the number of potential transits. The impact has therefore been classed as **broadly acceptable** for commercial fishing vessel navigational safety during transit.

166. It should be noted that there is also potential for snagging of commercial fishing vessel gear on partially constructed structures and / or cables however this impact has been discussed within ***Chapter 13 Commercial Fisheries*** along with displacement from commercial fishing grounds.

14.6.4.3.2 Offshore Cable Corridor

167. The presence of vessels associated with laying the offshore export cables may slightly increase the risk of a collision or an encounter due to displacement however this impact would be temporary and limited to a small geographical area surrounding the installation activity. It is assumed that partially buried cables would be marked and guarded until protection was installed as required to ensure they do not present a risk to anchoring fishing vessels; particularly to smaller fishing vessels where snagging may lead to a loss of stability. Therefore, the impact is considered to have no perceptible effect with embedded mitigation such as COLREGs, promulgation of information and minimum safe passing distances in place.

14.6.4.4 Operation and Maintenance Phase

14.6.4.4.1 East Anglia TWO Windfarm Site

168. The presence of structures could result in the displacement of commercial fishing vessels in transit from the East Anglia TWO windfarm site. Therefore,

[1] RAM vessels are those restricted in their ability to manoeuvre (defined by COLREGS), as a result of the nature of the work they are undertaking (i.e. underwater survey or installation operations) they are unable to take avoiding action.

increased encounters and vessel to vessel collision risk may be experienced including with vessels engaged in operation and maintenance activities (anticipated maximum of 687 vessel round trips of associated support craft). However, as noted with the construction phase impact, the commercial fishing vessels are not anticipated to be excluded from the windfarm site therefore reducing the likelihood of encounters and collision risk due to displacement; given impact mitigations including maintenance safety zones and promulgation of information encounters with operational vessels is also expected to be low.

169. The main impact on commercial fishing vessels during the operational phase from a shipping and navigation perspective would be allision with a windfarm structure within the East Anglia TWO windfarm site. There is the potential that fishing vessels may get close to turbines (whilst fishing) and any potential under keel allision risks would need to be effectively mitigated (i.e., through additional marking). Modelling results are detailed in ***section 19*** of the NRA (***Appendix 14.2***).

170. The impact on vessels transiting to/from fishing grounds can be considered similar to other transiting vessels such as commercial vessels. However, it is noted that due to the smaller size of commercial fishing vessels and the spacing between the structures, there is the likelihood that commercial fishing vessels would choose to navigate through the East Anglia TWO windfarm site. The decision to do so lies with the Master of the vessel who would be responsible for assessing the risks associated with navigating in proximity to and through a windfarm. This decision is likely to be based on weather and sea conditions and the type and size of vessel.

171. Commercial fishing vessels exiting the East Anglia TWO windfarm site after transiting through the windfarm array have the potential to encounter commercial vessels and recreational craft navigating outside the array thus increasing the likelihood of encounters and collision risk.

172. There would be some risk associated with collision or encounter with a service or support vessel working within the East Anglia TWO windfarm site as some commercial fishing vessels may choose to transit through the site. It is estimated that there will be a maximum of 687 vessel round trips per annum associated with operation and maintenance. However, when compared to the number of vessel trips during construction (3,672), the risk is reduced.

173. The severity of consequence is considered to be minor given the limited potential for damage and the frequency of effect is considered to be remote (noting minor allisions with no notable consequence may be more frequent). The impact has therefore been classed as **broadly acceptable** with embedded mitigations for commercial fishing vessels during transit.

14.6.4.4.2 Offshore Cable Corridor

174. Anchoring is considered to be a low frequency event within the offshore cable corridor given that no fishing anchoring activity was recorded during the marine traffic surveys.

175. As with commercial vessels, anchoring impacts are expected to be mitigated by effective cable burial and protection. The impact is considered to have no perceptible effect with embedded mitigation in place.

176. The potential for snagging of commercial fishing vessel gear on export cables has been discussed within ***Chapter 13 Commercial Fisheries.***

14.6.4.5 Decommissioning Phase

14.6.4.5.1 East Anglia TWO Windfarm Site

177. Similar to the construction phase, during the decommissioning phase there is expected to be an increase in vessels in and around the East Anglia TWO windfarm site. This has potential to lead to an increase in vessel to vessel encounters for commercial fishing vessels as well as the potential for increased allision risk. No specific ports have been identified for use as a decommissioning base. It is noted that decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port and that commercial fishing vessels would again be familiar with the development. Impacts are predicted to be equal to or no greater than construction and therefore are considered to be **broadly acceptable**.

14.6.4.5.2 Offshore Cable Corridor

178. It is assumed that the offshore export cables will be removed during decommissioning (the worst case) rather than left in-situ. Given that the offshore cable corridor decommissioning would be limited in size of decommissioning activity (i.e. RAM vessel and minimum safe passing distance) any impact on commercial fishing vessels is considered to be equal to or less than the construction phase.

14.6.5 Impact 5: Impact on Recreational Craft

14.6.5.1 East Anglia TWO Windfarm Site and Offshore Cable Corridor

179. For the purpose of this assessment vessels between 2.5 to 24m length (and not operating on a commercial basis) were identified as recreational. Numbers were considered relatively high (compared to other areas of the UK) during the summer marine traffic surveys. It is noted that, the Vuurschepen yacht race between Scheveningen and Harwich and the North Sea Race between Harwich and Scheveningen are held during May annually therefore a higher number of recreational vessels are likely to be recorded in the area during these events (this is illustrated in the summer 2017 recreational activity presented in the NRA

(***Appendix 14.2***). A total of two recreational vessels were recorded during the winter survey.

180. An overview plot of the recreational sailing activity and facilities in the area from the UK Coastal Atlas of Recreational Sailing (RYA 2016), relative to the East Anglia TWO windfarm site, is presented in ***Figure 14.5*****.**

181. Given the moderate levels of recreational traffic recorded during the summer 2018 survey and that the high levels of recreational traffic recorded during the yacht races are generally non-routine in the transit lines they take as well as the embedded mitigation is in place (including guard vessels and marine traffic coordination), the risk of collision is expected to be less than that for commercial vessels.

14.6.5.2 Construction Phase

14.6.5.2.1 East Anglia TWO Windfarm site

182. As with consideration of commercial vessels there would be some risk associated with service or support vessels transiting in the area. During construction, it is anticipated that the presence of the buoyed construction area (containing the active construction work and safety zones) would displace the existing recreational activity from within the East Anglia TWO windfarm site. Due to their small vessel size, there is potential for recreational craft to transit through the buoyed construction area therefore increasing collision risk with construction vessels. However, experience at other UK windfarm projects shows that recreational craft would transit within buoyed construction areas where no current activity is occurring, meaning that recreational craft should stay out with areas used by construction vessels.

183. Construction safety zones may displace traffic temporarily for the construction phase and would be managed through effective promulgation of information and active safety measures. Therefore, the impact on recreational vessel transits throughout the construction period would not differ greatly.

184. The physical presence of pre-commissioned structures would create a vessel to structure allision risk for a recreational craft navigating within the East Anglia TWO windfarm site. It is noted that during the construction phase, the final lighting and marking of the structures may not yet have been implemented.

185. It is expected that the majority of recreational activity would avoid the buoyed construction area altogether and promulgation of information would ensure recreational users are well informed of the East Anglia TWO windfarm site. Embedded mitigation would ensure that recreational users are aware of ongoing construction activities (including current safety zones) although some recreational craft may still enter the buoyed construction area including

accidentally. If a recreational vessel were to enter into the buoyed construction area a guard vessel (or other vessels on site) would inform the vessel of the ongoing works.

186. Experience in windfarm construction for developers, their contractors and the vessel operators is now extensive, with a number of operational windfarms having been constructed within dense shipping and project areas. Consequently, standard mitigation measures, as outlined in embedded mitigation ***section 14.3.3***, are tried and tested within the industry.

187. The severity of consequence is considered to be minor due to most likely scenario being displacement rather than any increased allision or collision risk and the frequency of effect is considered to be remote, given their adaptability to the site. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.5.2.2 Offshore Cable Corridor

188. Given that the offshore cable corridor would create negligible displacement during installation (an anticipated safe passing distance around RAM installation vessel(s)); any impact on recreational vessels is not considered to have a perceptible effect with regards to displacement.

14.6.5.3 Operation and Maintenance Phase

14.6.5.3.1 East Anglia TWO Windfarm Site

189. The physical presence of structures could result in the displacement of recreational craft within the shipping and navigation study area and therefore increased encounters and vessel to vessel collision risk. However, as noted with recreational craft displacement, vessels will not be excluded from the East Anglia TWO windfarm site therefore reducing the likelihood of collision risk or encounter due to displacement.

190. The main impact on recreational craft during the operational phase would be the potential loss of recreational routes due to the presence of the East Anglia TWO windfarm site. The shipping and navigation study area is intersected by two eastbound cruising routes (RYA, 2016). However, recreational craft should be able to transit between the wind turbines in suitable conditions as well as route around the East Anglia TWO windfarm site. It is noted that there are a number of factors that would influence a Vessel Masters decision (including recreational sailors) to navigate through, around or avoid a windfarm including the vessels characteristics, the weather and sea condition.

191. It is assumed that in adverse weather and during winter, limited recreational activity would be present within the shipping and navigation study area (an

assumption supported by the findings of the marine traffic survey data assessment).

192. Similar to commercial fishing vessels, recreational craft exiting the East Anglia TWO windfarm after transiting through the windfarm array have the potential to encounter commercial vessels and commercial fishing vessels thus increasing the likelihood of encounters and collision risk.

193. There would be some risk associated with collision or encounter with a service or support vessel working within the East Anglia TWO windfarm site as some recreational craft may choose to transit through the site. It is estimated that there will be a maximum of 687 vessel round trips per annum associated with operation and maintenance. However, when compared to the number of vessel trips during construction (3,672), the risk is reduced.

194. Due to the physical presence of structures, there is the potential risk of recreational craft allision with a windfarm structure within the East Anglia TWO windfarm site should a recreational craft choose to transit through the array. However, any allision is likely to be of low speed and energy due to the smaller sizes of recreational craft compared to commercial vessels therefore a relatively low risk to crew and levels of pollution resulting from the allision.

195. Minimum row spacing of 800m between wind turbines should allow adequate sea room for recreational craft to navigate through the windfarm. It is noted that there are factors that would influence a mariner's decision (including recreational sailors) to navigate through, around or avoid a windfarm such as the vessels characteristics, the weather and sea conditions. The recreational sailor is likely to take due consideration for the weather conditions and passage plan accordingly to ensure safe passage. During the winter survey (November /December 2017), only two recreational craft were recorded within the shipping and navigation study area suggesting that recreational craft are unlikely to transit the area in poor weather conditions.

196. The air clearance between wind turbines rotors and sea level at MHWS will not be less than 22m, as per MGN 543 and RYA guidance therefore minimising the risk of interaction between rotor blades and yacht masts of a recreational craft transiting through the East Anglia TWO windfarm site.

197. The severity of consequence is considered to be minor given the limited potential for damage (lower speed allision) and the frequency of effect is considered to be remote given the level of recreational activity. The impact has therefore been classed as **broadly acceptable** for navigational safety during transit.

14.6.5.4 Decommissioning Phase

14.6.5.4.1 East Anglia TWO Windfarm Site

198. Like the construction phase, during the decommissioning phase an increase in vessels in and around the East Anglia TWO windfarm site is expected. This has potential to lead to an increase in vessel to vessel encounters as well as the potential for increased allision associated with the decommissioning vessels. No specific ports have been identified for use as a decommissioning base. It is noted that decommissioning vessels would be in contact with local vessel traffic services to aid traffic management on the approaches to a port, and that recreational vessels would again be familiar with the East Anglia TWO windfarm site. Impacts are predicted to be equal to or no greater than construction and therefore are considered to be **broadly acceptable**.

14.6.5.4.2 Offshore Cable Corridor

199. It is assumed that the offshore export cables will be removed during decommissioning (the worst case) rather than left in-situ. Given that the spatial extent of decommissioning work associated with the offshore cable corridor would be temporary and limited in size (i.e. RAM vessel and minimum safe passing distance) any impact on recreational vessels is considered to be equal to or less than that of the construction phase.

14.6.6 Impact 6: Impact on Emergency Response Capability

14.6.6.1 East Anglia TWO Windfarm Site and Offshore Cable Corridor

200. Under national and international law, the operators of East Anglia TWO windfarm site would be required to comply with existing emergency response requirements, as detailed in ***Appendix 14.2*****,** as well as giving consideration to other response groups within the area. Owing to the increased level of activity in and around the East Anglia TWO windfarm site there are expected to be some increased demands on SAR facilities within the area. The vessels working within the East Anglia TWO windfarm site would also increase traffic and activity to a level that self-help emergency response would be required and consideration in the ERCoP should be given to what resources would be needed to provide a level of response that would ensure that response time and resources are not impacted.

14.6.6.2 Construction Phase

14.6.6.2.1 East Anglia TWO Windfarm Site and Offshore Cable Corridor

201. Construction within the offshore development area, including the increased presence of vessels and personnel within the area may increase the risk of an incident occurring therefore may diminish the overall ability of emergency responders, including pollution response. The total number of vessel movements for construction is predicted to be 3,672. The offshore construction period is anticipated to last approximately 27 months.

202. Embedded mitigation includes compliance with MGN 543 and the development of an ERCoP. The operator would comply with the requirements of MGN 543 including Annex 4 'Safety and mitigation measures recommended to OREIs during construction, operation and decommissioning' and Annex 5 SAR and emergency response matters'.

203. The ERCoP would include the following but may also consider site specific parameters:

- Facilitation of SAR responders (helicopters);
- Place of safe refuge;
- Remote monitoring and control; and
- Marking and lighting.

204. The severity of consequence is considered moderate given the level and type of activity on site and the frequency of effect is considered to be Extremely Unlikely given the mitigations in place i.e. marine coordination. The impact has therefore been classed as **broadly acceptable** for impacts on emergency response capability.

14.6.6.3 Operation and Maintenance Phase

14.6.6.3.1 East Anglia TWO Windfarm Site and Offshore Cable Corridor

205. As with the construction phase, impacts during the operational and maintenance phase would put increased requirement on emergency response due to an increased presence of vessels and personnel within the area which may increase the risk of an incident. However, as the number of annual vessel round trips is lower at 687, the frequency is reduced from that of the construction phase.

206. Due to the reduction in activity on site compared to the construction phase, the frequency of effect is reduced to negligible and the severity of consequence is considered to be minor (typically lower risk activities) resulting in the impact considered to be **broadly acceptable**.

14.6.6.4 Decommissioning Phase

14.6.6.4.1 East Anglia TWO Windfarm Site and Offshore Cable Corridor

207. Given the limited information of the decommissioning activity and the likely UK resources available at the time of writing it is not possible to effectively assess the impact on emergency response ability; however it is expected to be similar to that of the construction phase.

14.6.7 Decommissioning Plan

208. A Decommissioning Plan in line with standard requirements will be developed.

209. It is expected that decommissioning will require the removal of wind turbines, offshore platforms, foundations and some of the buried cables. Other buried cables would be de-rated and left *in situ*, and would be notified to UKHO to remain on navigation charts.

14.7 Cumulative Impacts

14.7.1 Impact Screening

210. Each impact receptor assessed for the East Anglia TWO windfarm site in isolation (see ***section 14.6***) has been screened for the potential of cumulative impact (with other projects / marine activities) over and above that already assessed within the project-only case. This process is summarised in ***section 14.4.6***. Those impacts which have been screened in on a cumulative basis are then assessed and ranked as per the FSA process detailed in ***section 14.3.3.***

Table 14.9 Receptor Screening – Cumulative Assessment

Receptor	Potential for Cumulative Impact	Rationale
Construction, Operation and Maintenance and Decommissioning		
Commercial vessel routeing	Yes	• The consideration of multiple projects may result in larger deviations than if the project is considered in isolation. This was raised as an issue during consultation; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and because during the operation phase there would not be any surface infrastructure requiring deviation.
Commercial vessel safe navigation	Yes	• Given the potential for increased deviations, there may be an increased collision risk when multiple projects are considered. Furthermore, allision risk would increase when cumulative projects are considered due to the increase in the number of structures; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and because during the operation phase there would not be any surface infrastructure requiring deviation and any potential for anchor dragging would be isolated.
Marine aggregate dredgers	No	• Marine aggregate dredgers (in transit) are considered as part of the commercial vessel cumulative impact assessment.
Commercial fishing vessels	No	• Given that fishing vessels are able to enter into the East Anglia TWO windfarm site, no additional cumulative displacement impact

Receptor	Potential for Cumulative Impact	Rationale
		has been identified. Allision and collision risks are not considered to be perceptibly higher than for the East Anglia TWO windfarm site in isolation given that interaction with more than one project is limited; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and because during the operation phase there would not be any surface infrastructure requiring deviation.
Recreational craft	No	• Given that recreational vessels are able to enter into the East Anglia TWO windfarm site, no additional cumulative displacement impact has been identified. Allision and collision risks are not considered to be perceptibly higher than for the East Anglia TWO windfarm site isolation given that interaction with more than one project is limited; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and because during the operation phase there would not be any surface infrastructure requiring deviation.
Emergency response capabilities	No	• Given baseline incident levels, the consideration of multiple projects is not anticipated to have a perceptible effect on emergency response capabilities with embedded mitigations in place, i.e. marine traffic coordination and onsite vessels able to assist; and • No cumulative impacts were identified for the offshore cable due to the limited area of installation and because during the operation phase there would not be any surface infrastructure requiring deviation.

14.7.2 Project and Third Party Activity Screening

14.7.2.1 Other Wind Farms

211. ***Table 14.10*** presents the projects that are deemed to have a cumulative effect. These have also been presented in ***Figure 14.6***. Due to the national and international nature of shipping, impacts on vessel routeing can occur a significant distance from the project being assessed. Therefore, the cumulative list for shipping and navigation includes all constructed, consented or planned wind farms within the southern North Sea that could cumulatively influence a

vessel's navigational routeing. ***Appendix 14.4*** presents the list of all projects within 100nm considered for the CIA.

212. In order to assess the cumulative issues arising from the proposed projects within the other Round Three zones in the southern North Sea (the former East Anglia Zone, former Hornsea Zone and Dogger Bank Zone) the three windfarm developers undertook a joint report as part of the Southern North Sea Offshore Wind Forum (SNSOWF) in 2013 (Anatec 2013). Cumulative routeing has primarily been assessed based on the outputs of this work.

213. It should be noted that any projects with a currently dormant status, or which are still classed as development zones, have not been included within the cumulative screening.

14.7.2.2 Oil and Gas Installations

214. Given the limited spatial extent of oil and gas platforms, and noting there are no nearby surface installations, there is not considered to be any cumulative routeing impacts and therefore collision risk associated with existing gas installations in the southern North Sea. Further details of Southern North Sea oil and gas infrastructure are provided in the NRA (***Appendix 14.2***).

215. Should any future surface gas developments be applied for within the gas fields within the area they would be subject to their own navigational risk assessments including at a cumulative level.

14.7.2.3 Port Activities

216. Given that the East Anglia TWO windfarm site is outside the operational area or limits of any ports, harbours or marinas there are not considered to be any cumulative impacts associated with the construction, operation and maintenance or decommissioning phases. Routeing to and from ports is considered in ***section 14.6*** (offshore development area in isolation) and ***section 14.7*** (cumulatively).

14.7.2.4 Third Party Marine Activities

217. A number of marine activities were scoped out of the assessment with regards to vessel movement as these were considered to be part of the baseline for vessel traffic. This includes traffic associated with marine aggregate extraction areas, fishing activity and recreational craft transits.

14.7.2.5 Summary of Projects

218. ***Table 14.10*** details the projects that have been included within the cumulative assessment.

Table 14.10 Summary of Projects Included for the CIA in Relation to Shipping and Navigation

Project	Status	Distance from East Anglia TWO windfarm site (nm)	Rationale
UK Wind Farms			
East Anglia ONE	Under construction	5.4	Cumulatively affects a route that has also been displaced by East Anglia TWO windfarm site.
East Anglia ONE North	Application submitted	5.4	
East Anglia THREE	Pre-construction	25.7	
Galloper	Fully commissioned (although still constructing at the time of the 2017 marine traffic surveys)	3.9	
Hornsea Project One	Under construction	94.3	
Hornsea Project Three	In determination	88.9	
Hornsea Project Two	Pre-construction	97.3	
Norfolk Boreas	In examination	42.1	
Norfolk Vanguard	In determination	34.0	
EU Wind Farms			
Mermaid	Consented	23.8	Cumulatively affects a route that has also been displaced by East Anglia TWO windfarm site.
Northwester 2	Consented	25.9	
Poseidon P60 - Mermaid	Concept and early planning	24.3	

14.7.3 Potential Cumulative Impacts

14.7.3.1 Commercial Vessel Routeing

219. Predicted cumulative rerouting has been assessed within the NRA (***Appendix 14.2***). The assessment assumed that commercial vessels would be required to deviate due to the East Anglia TWO windfarm site, and at least one of the other projects considered cumulatively, as listed in ***Table 14.10***.

14.7.3.1.1 East Anglia TWO Windfarm Site

220. East Anglia ONE windfarm site, East Anglia THREE windfarm site and East Anglia ONE North windfarm site are located to the east and north-east of the East Anglia TWO windfarm site. The East Anglia ONE windfarm site is currently under construction (with a buoyed construction area) therefore any

routes identified as passing through the East Anglia ONE buoyed construction area (within the baseline marine traffic survey data which was collected prior to the commencement of construction works) may be deviated into a gap between the East Anglia ONE windfarm site and the East Anglia TWO windfarm site. This has been reflected within the summer 2018 marine traffic survey period with traffic as discussed in ***section 14.5.3*** and discussed further in the NRA (***Appendix 14.2***). However, some traffic was also recorded deviating east of the East Anglia ONE windfarm site. As the summer and winter 2017 marine traffic surveys were undertaken prior to construction commencing on the East Anglia ONE windfarm site, such deviations were not reflected. East Anglia ONE North is in the pre-application stage however if consented this project would also deviate routes into this gap; the spacing between projects is considered in ***section 20.5*** of the NRA (***Appendix 14.2***).

221. There are four routes out of the 16 main routes identified from the baseline routeing undertaken for the East Anglia TWO windfarm site (see ***section 15*** of ***Appendix 14.2***, a summary of the routes is presented in ***Table 14.8*** of this chapter) which would transit this gap. However, only route 5 is impacted cumulatively by the East Anglia TWO windfarm site, East Anglia ONE windfarm site and East Anglia ONE North windfarm site. This route is dense in traffic, with an average of eleven vessels per day recorded. Whilst this route will not be deviated due to the windfarm sites, it will be constrained due to the gap. At the PEIR stage, the other three routes (route 10, 11 and 13) were predicted to be displaced into the gap due to the East Anglia ONE windfarm site and the East Anglia ONE North windfarm site and therefore were not considered to be cumulatively affected. This has been reflected within the summer 2018 marine traffic survey undertaken since during the construction of the East Anglia ONE windfarm site. It is noted that some traffic was also recorded deviating east of the East Anglia ONE windfarm site.

222. It should be noted that route 12 was recorded as intersecting the south west of the East Anglia TWO windfarm site therefore would also be expected to transit the gap between the East Anglia ONE windfarm site, East Anglia THREE windfarm site and East Anglia ONE North windfarm site however, based on cumulative routeing proposed as part of the SNSOWF (SNSOWF 2013), this route is instead predicted to deviate at the TSS far south of the East Anglia TWO windfarm site and route around the boundaries of the East Anglia ONE windfarm site and East Anglia ONE North windfarm site.

223. Norfolk Vanguard and Norfolk Boreas are located approximately 34nm and 39nm north-east of the East Anglia TWO windfarm site, respectively. Both windfarms have been included within the cumulative assessment as routes displaced due to the East Anglia TWO windfarm site are also displaced due to

the presence of Norfolk Vanguard and Norfolk Boreas. Route 12 is displaced by Norfolk Vanguard, Norfolk Boreas and the East Anglia THREE windfarm site. An average of one vessel per day was recorded on this route.

224. Hornsea Project One, Hornsea Project Two and Hornsea Project Three are approximately 90nm north of the East Anglia TWO windfarm site and are therefore located at the edge of the 100nm buffer considered for the CIA. Vessels displaced due to Hornsea Projects would transit the gap between Hornsea Project One and Hornsea Project Two and Hornsea Project Three. As mentioned previously, route 12 is expected to deviate at the TSS far south of the East Anglia TWO windfarm site and route around the boundaries of the East Anglia ONE windfarm site and East Anglia ONE North windfarm site. Traffic northbound on this route will then transit the sea area between Norfolk Vanguard, Norfolk Boreas and the East Anglia THREE windfarm site, continuing north to eventually transit the gap between Hornsea Project One, Hornsea Project Two and Hornsea Project Three. Southbound traffic will take the same route therefore route 12 would be cumulatively affected by the Hornsea Projects and the East Anglia TWO windfarm site.

225. To the south-west of the East Anglia TWO windfarm site is the Galloper Offshore Wind Farm site. This site is, at the time of writing, fully commissioned but at the time of the 2017 marine traffic surveys was still undergoing construction and therefore has been included within this cumulative assessment. The base case routeing assessment presented in ***Appendix 14.2*** reveals that the marine traffic is not affected by the site.

226. The three EU windfarms scoped into the assessment include Mermaid, Northwester 2 and Poseidon P60 – Mermaid windfarms. These projects have been included due to their proximity to the cumulative deviation of route 5. Route 5 would transit the gap between the East Anglia TWO windfarm site, East Anglia ONE windfarm site and East Anglia ONE North windfarm site; however, on approach and departure to and from Zeebrugge / Flushing, it is also likely to be displaced due to the Mermaid, Northwester 2 and Poseidon P60 – Mermaid windfarms.

14.7.3.1.1.1 Adverse Weather

227. Impacts on adverse weather routeing in the southern North Sea may occur due to the combined presence of the East Anglia TWO windfarm site, East Anglia ONE windfarm site and East Anglia ONE North windfarm site.

228. Following consultation, information on commercial vessel routeing was provided by DFDS Seaways. Following a validation of the routeing provided using one year of AIS data (2017) (see ***section 12.2.8*** of ***Appendix 14.2***) low levels of adverse weather routeing were identified. Vessels with a destination of

Felixstowe and Rotterdam were recorded on adverse weather routes transiting north of the East Anglia ONE North windfarm site and one track recorded intersecting the northern boundary of the East Anglia TWO windfarm site. These vessel tracks were recorded during the winter period therefore are assumed to be deviations due to adverse weather conditions (weather data was not assessed). Vessels with a destination of Immingham and Rotterdam were recorded transiting through the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and the East Anglia TWO windfarm site. These are also assumed to due to adverse weather conditions.

14.7.3.1.1.2 Construction

229. Due to the required deviations, the cumulative impact of displacement is considered to be greater than that assessed for the East Anglia TWO offshore windfarm site in isolation during the construction phase. Overall, the frequency of displacement is considered to be frequent and the severity of consequence negligible resulting in this cumulative impact considered being **tolerable and ALARP**.

14.7.3.1.1.3 Operation and Maintenance

230. Due to the required deviations, the cumulative impact of displacement is considered to be greater than that assessed for the East Anglia TWO windfarm site in isolation during the operation and maintenance phase. Overall, the frequency of displacement is considered to be reasonably probable and the severity of consequence negligible resulting in this cumulative impact considered to be **broadly acceptable**.

14.7.3.1.1.4 Decommissioning

231. Decommissioning impacts are anticipated to be similar or less than that of construction activities, given the familiarity with the development. However, given that decommissioning schedules are not available for any project it is not possible to rank the impact at this time.

14.7.3.2 Commercial Vessel Safe Navigation

14.7.3.2.1 East Anglia TWO Windfarm Site

14.7.3.2.1.1 Collision Risk

232. From a shipping and navigation perspective, the area of highest vessel collision risk would be the gap created by the cumulative presence of the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and East Anglia TWO windfarm site. This is due to a number of routes intersecting the three sites anticipated as likely to deviate into the same sea area.

233. As previously noted, there are four routes identified through the marine traffic surveys undertaken for the East Anglia TWO windfarm site which would transit

into the gap. Due to the location of the East Anglia TWO windfarm site, these routes are dense in traffic; particularly route 5 on which an average of eleven vessels per day was recorded. It is noted that whilst route 5 will not be deviated into the gap, it will be constrained due to the width of the gap. At the time of the marine traffic survey during the PEIR stage, construction of the East Anglia ONE windfarm site had not yet commenced therefore traffic was still recorded transiting through the site. However, as of spring 2018, the East Anglia ONE windfarm site is now under construction therefore traffic recorded during the summer 2018 confirmed that traffic had been deviated into the gap and was transiting route 5. It is also noted that some traffic was recorded deviating east of the East Anglia ONE windfarm site rather than transiting the gap between the projects.

234. To the south of the East Anglia TWO windfarm site, two high density routes were recorded (routes 1 and 2). Following the construction of the proposed East Anglia TWO offshore development area, route 2 would be deviated further south and therefore closer to route 1. Due to this deviation, the collision risk between vessels on these two routes therefore marginally increases, particularly due to the presence of the Galloper Offshore Wind Farm which route 1 currently already deviates around.

235. Due to the distance of other cumulative projects from the proposed East Anglia TWO offshore development area, there is not anticipated to be increased cumulative collision risk arising from these projects.

14.7.3.2.1.2 Allision Risk

236. Following assessment of the cumulative routeing it has been identified that the development of the East Anglia ONE windfarm site, East Anglia ONE North windfarm site, East Anglia TWO windfarm site and Galloper Offshore Wind Farm has the potential to cumulatively impact upon navigational transits and thus to cumulatively increase vessel to structure allision risk. Cumulative allision is considered to affect vessels transiting within the cumulative study area that are not able to easily adapt to new routeing due to availability of sea room.

237. Cumulative lighting (notably the array boundaries bordering the gap between the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and East Anglia TWO windfarm site) and the sea area between the East Anglia TWO windfarm site and Galloper Offshore Wind Farm shall be considered in order to minimise any potential effects and avoid confusion from a proliferation of aids to navigation in a high-density development of turbines. The mariner would use significant peripheral structures (SPS) lights (similar to entering a port) to navigate with, including fixing their position. Following agreement on

the final layout post consent, the applicant will identify aids to navigation, in consultation with TH, which are most appropriate.

238. Within the gap and the sea area between the East Anglia TWO windfarm site and Galloper Offshore Wind Farm, emergency anchoring (dependent on the vessel's speed) could be used to prevent drifting allision with a structure. As there are currently no existing IMO routeing measures within these areas it cannot be guaranteed that it is hazard free to allow safe anchoring. A vessel will have emergency anchoring procedures for areas where there may be sub-sea hazards (such as port approaches) and these procedures would likely be used. It is noted that COLREGS (IMO, 1972) prevents anchoring within a narrow channel under normal conditions.

239. Due to the distance of other cumulative projects from the proposed East Anglia TWO windfarm site, there is not anticipated to be increased cumulative allision risk arising from these projects.

14.7.3.2.2Construction

240. During construction of the East Anglia TWO windfarm site, collision risk would be highest in areas of maximum displacement due to buoyed construction areas. Commercial vessels would be allowed access through these areas where installation is not currently taking place; however this can increase the likelihood of encounters and therefore collision risk with construction vessels. It is likely that during construction the East Anglia ONE North windfarm site may also be under construction while the East Anglia ONE windfarm site, Galloper Offshore Wind Farm and Greater Gabbard Offshore Wind Farm would be operational. The combined presence of construction vessels associated with the proposed East Anglia ONE North offshore development area and the proposed East Anglia TWO offshore development area presents a higher collision risk than the proposed East Anglia TWO offshore development area in isolation.

241. Allision risk would be highest in areas with partially constructed structures. It is likely that during construction, the East Anglia ONE North windfarm site may also be under construction while the proposed East Anglia ONE windfarm site, Galloper Offshore Wind Farm and Greater Gabbard Offshore Wind Farm would be operational. This combined presence of multiple partially constructed or deconstructed structures with operational structures presents a higher allision risk than the proposed East Anglia TWO windfarm site in isolation. Post consent discussions would include consideration of cumulative lighting effects, consideration of directly adjacent windfarm boundaries and alignment of wind turbines (in conjunction with TH) to ensure that differing design envelopes do not adversely affect shipping and navigation.

242. The impact as a whole is considered to be of moderate consequence given the increased collision risk and the potential for damage to be caused to vessels in the event of an allision and the reasonably probable frequency of occurrence. Therefore, the impact is expected to be **tolerable and ALARP** with mitigations in place (i.e. marine coordination).

14.7.3.2.3 Operation and Maintenance

243. During operation of the proposed East Anglia TWO project, collision risk would be increased due to the displacement of commercial vessel routes. From a shipping and navigation perspective, the gap formed between the East Anglia ONE windfarm site, East Anglia ONE North windfarm site and the East Anglia TWO windfarm site would present the area of highest collision risk, along with the sea area between the Galloper Offshore Wind Farm and East Anglia TWO windfarm site.

244. During operation allision risk would be due to the presence of operational structures within the East Anglia TWO windfarm site. It is likely that both the East Anglia ONE windfarm site and East Anglia ONE North windfarm site would also be operational and therefore the gap formed would present the area of highest allision risk due to a narrow sea area bordered by multiple structures. As of spring 2018, the Galloper Offshore Wind Farm has been operational and therefore the operational structures at both this windfarm and the East Anglia TWO windfarm site would also present an operational allision risk however the risk is anticipated to be lower than that created within the gap between the East Anglia ONE windfarm site, the East Anglia ONE North windfarm site and the East Anglia TWO windfarm site.

245. Post consent discussions would include consideration of cumulative lighting effects, consideration of directly adjacent wind farm boundaries and alignment of wind turbines (in conjunction with TH) to ensure that differing design envelopes do not adversely affect shipping and navigation.

246. The impact as a whole is considered to be of moderate consequence given the potential for increased collision risk and the potential for damage to be caused to vessels in the event of an allision and the extremely unlikely frequency of occurrence given the familiarity with the sites. Therefore, the impact is expected to be **broadly acceptable**.

14.7.3.2.4 Decommissioning

247. Decommissioning impacts are anticipated to be similar or less than that of construction activities, given the familiarity with the development. However, given that decommissioning schedules are not available for any project it is not possible to rank the impact at this time.

14.8 Transboundary Impacts

248. This section considers the potential transboundary impacts associated with international offshore renewable projects. Transboundary impacts for shipping and navigation receptors include vessels routeing from the UK to the Netherlands, Belgium and Denmark that may be impacted by projects within both UK waters and transboundary waters. Given the international nature of shipping this is covered by the cumulative impact in ***section 14.7.3***.

14.9 Inter-relationships

249. The following section identifies potential inter-relationships associated with shipping and navigation and other identified effects associated with the development of the proposed East Anglia TWO project. It should be noted that shipping and navigation as a receptor contains a number of marine activities that are both transient in the form of a navigating vessel as well as localised in terms of their activity, e.g. fishing vessels in transit and fishing vessels engaged in fishing. This chapter has already considered these receptors in their navigational (or transient) state and the following table highlights any additional interrelationships with their localised activities.

Table 14.11 Shipping and Navigation Inter-relationships

Topic and Description	Related Chapter	Where Addressed in this Chapter
Increased collision risk for fishing vessels engaged in fishing	***Chapter 13 Commercial Fisheries***	Impacts on the navigational safety of fishing vessels are considered in ***section 14.6***. All navigational safety impacts are considered ALARP.
Increased snagging risk for fishing vessels engaged in fishing	***Chapter 13 Commercial Fisheries***	Navigational safety impacts for vessels in transit have already been considered within this chapter; impacts on gear snagging (which could affect their navigational status) have been considered within ***Chapter 13 Commercial Fisheries***.
Impacts on aggregate dredging activities	***Chapter 17 Infrastructure and Other Users***	Impacts on the navigational safety of marine aggregate dredgers are considered within ***section 14.6***.

14.10 Summary

250. Following consideration of the outputs of the hazard workshop, desk based assessments and modelling. ***Table 14.12*** presents a summary of the identified residual impacts and mitigations with regards to the East Anglia TWO windfarm site.

Table 14.12 Potential Impacts Identified for Shipping and Navigation and the East Anglia TWO Windfarm Site

Potential Impact	Consequence	Frequency	Examples of Potential Mitigation Measure	Residual Impact
Construction				
Commercial vessel routeing	Negligible	Reasonable Probable	n/a	**Broadly Acceptable**
Commercial vessel safe navigation	Moderate	Remote	n/a	**Tolerable and ALARP**
Marine aggregate dredgers	Moderate	Negligible	n/a	**Broadly Acceptable**
Commercial fishing vessels	Minor	Remote	n/a	**Broadly Acceptable**
Recreational craft	Minor	Remote	n/a	**Broadly Acceptable**
Emergency response capability	Moderate	extremely Unlikely	n/a	**Broadly Acceptable**
Operation				
Commercial vessel routeing	Negligible	Remote	n/a	**Broadly Acceptable**
Commercial vessel safe navigation	Moderate	Negligible	n/a	**Broadly Acceptable**
Marine aggregate dredgers	Moderate	Negligible	n/a	**Broadly Acceptable**
Commercial fishing vessels	Minor	Remote	n/a	**Broadly Acceptable**
Recreational craft	Minor	Remote	n/a	**Broadly Acceptable**
Emergency response capability	Minor	Negligible	n/a	**Broadly Acceptable**
Decommissioning				
Commercial vessel routeing	Negligible	Remote	n/a	**Broadly Acceptable**
Commercial vessel safe navigation	Moderate	Negligible	n/a	**Broadly Acceptable**
Marine aggregate dredgers	n/a	n/a	n/a	**n/a**
Commercial fishing vessels	Minor	Negligible	n/a	**Broadly Acceptable**

Potential Impact	Consequence	Frequency	Examples of Potential Mitigation Measure	Residual Impact
Recreational craft	Minor	Negligible	n/a	**Broadly Acceptable**
Emergency response capability	n/a	n/a	n/a	**n/a**

251. The following table presents a summary of the identified residual impacts and mitigations with regards to the offshore cable corridor.

Table 14.13 Potential Impacts Identified for Shipping and Navigation and the Offshore Cable Corridor

Potential Impact	Consequence	Frequency	Examples of Potential Mitigation Measure	Residual Impact
Construction				
Commercial vessel routeing	n/a	n/a	n/a	**No Perceptible Effect**
Commercial vessel safe navigation	n/a	n/a	n/a	**No Perceptible Effect**
Marine aggregate dredgers	n/a	n/a	n/a	**No Perceptible Effect**
Commercial fishing vessels	n/a	n/a	n/a	**No Perceptible Effect**
Recreational craft	n/a	n/a	n/a	**No Perceptible Effect**
Emergency response capability	See impact on windfarm site			
Operation				
Commercial vessel routeing	n/a	n/a	n/a	**No Perceptible Effect**
Commercial vessel safe navigation	Minor	Extremely Unlikely	n/a	**Broadly Acceptable**
Marine aggregate dredgers	Minor	Negligible	n/a	**Broadly Acceptable**
Commercial fishing vessels	n/a	n/a	n/a	**No Perceptible**

Potential Impact	Consequence	Frequency	Examples of Potential Mitigation Measure	Residual Impact
				Effect
Recreational craft	n/a	n/a	n/a	**No Perceptible Effect**
Emergency response capability	See impact on windfarm site			
Decommissioning				
Commercial vessel routeing	n/a	n/a	n/a	**No Perceptible Effect**
Commercial vessel safe navigation	n/a	n/a	n/a	**No Perceptible Effect**
Marine aggregate dredgers	n/a	n/a	n/a	**n/a**
Commercial fishing vessels	n/a	n/a	n/a	**No Perceptible Effect**
Recreational craft	n/a	n/a	n/a	**No Perceptible Effect**
Emergency response capability	See impact on windfarm site			

252. The potential cumulative impacts are summarised in the ***Table 14.14***.

Table 14.14 Potential Cumulative Impacts Identified for Shipping and Navigation

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
Construction				
Commercial vessel routeing	Negligible	Frequent	n/a	Tolerable and ALARP
Commercial vessel safe navigation	Moderate	Reasonably Probable	n/a	Tolerable and ALARP
Operation and Maintenance				
Commercial vessel routeing	Negligible	Reasonably Probable	n/a	Broadly Acceptable
Commercial vessel safe navigation	Moderate	extremely Unlikely	n/a	Broadly Acceptable

Potential Impact	Consequence	Frequency	Mitigation	Residual Impact
Decommissioning				
Commercial vessel routeing	n/a	n/a	n/a	n/a
Commercial vessel safe navigation	n/a	n/a	n/a	n/a

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