Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Environmental Statement Volume 2

Chapter 10: Shipping and Navigation

June 2018, Revision A

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Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Volume 2

Chapter 10: Shipping and Navigation

June 2018

Drafted By:	Marico Marine Ltd
Approved By:	Helen Jameson
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Vattenfall Wind Power Ltd

First Floor

1 Tudor Street

London

EC4Y 0AH

T +44 207 451 1150

www.vattenfall.co.uk

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10 SHIPPING AND NAVIGATION

10.1 Introduction

10.1.1 This chapter of the Environmental Statement (ES) has been drafted in order to assess the impacts posed by the proposed Thanet Extension Offshore Wind Farm (Thanet Extension) to shipping and navigation in the Thames Estuary. It considers the navigational risk and disruption posed by the construction, Operations & Maintenance (O&M) and decommissioning of the wind farm to commercial, fishing and recreational vessels as well as possible strategies to mitigate them.

10.1.1 The chapter considers shipping and navigation aspects drawing on work undertaken to date as part of the comprehensive Navigation Risk Assessment (NRA) (Volume 4, Annex 10-1, Document Ref: 6.4.10.1), the Preliminary Environmental Impact Report (PEIR) as submitted for formal consultation in November 2017, and a pilotage study/simulation (Volume 4, Annex 10-2, Document Ref: 6.4.10.2).

10.1.2 Whilst undertaking this assessment and following the completion of the simulation, collision risk modelling and consultation with stakeholders, a revision was made to the Red Line Boundary at the western corner to reduce the level of impact on navigation safety. This change is reflected in this assessment; however, it should be noted that the consultation and simulation/modelling results refer to the larger footprint.

10.1.3 For further detailed information on the proposed construction methodology, layout and structure of Thanet Extension, please refer to Volume 2, Chapter 1: Project Description (Offshore) (Document Ref: 6.2.1).

10.1.4 For further consideration of the potential effects on commercial fisheries receptors reference should be made to Volume 2, Chapter 9, Document Ref: 6.2.9.

10.1.5 For further consideration of the potential effects on tourism and recreation receptors reference should be made to Volume 3, Chapter 4, Document Ref: 6.3.4.

10.2 Statutory and policy context

10.2.1 The Energy Act 2004 establishes a regulatory regime for offshore wind farms, including Sections 99 and 100 which specifically deal with navigation. Section 36B considers duties in relation to navigation and states that consent cannot be granted for an Offshore Renewable Energy Installation (OREI) which is likely to interfere with the use of recognised sea lanes essential to international navigation.

10.2.2 Furthermore, Section 36B subsection 2 states that the decision to grant consent and any conditions placed on a consent must "have regard to the extent and nature of any obstruction of or danger to navigation which (without amounting to interference with the use of such sea lanes) is likely to be caused by the carrying on of the activities or is likely to result from there having been carried on."

10.2.3 The Marine and Coastal Access Act Part 4, Section 69 provides for the marine licence decision to "have regard to the need to prevent interference with legitimate uses of the sea."

10.2.4 The key guidance document for the assessment of impacts to shipping and navigation from renewable energy installations is the Marine and Coastguard Agency's (MCA) Marine Guidance Note (MGN) 543, superseding (MGN) 371. Table 10.1 gives an overview of this and other policy and guidance documents utilised in this assessment.

10.2.5 Guidance on the issues to be assessed for offshore renewable energy developments are set out in the Overarching National Policy Statement (ONPS) for Energy (EN-1; DECC, 2011a) and the National Policy Statement (NPS) for Renewable Energy Infrastructure (EN-3, DECC, 2011b).

Table 10.1: Legislation, policy context and guidance documents

Policy/ legislation	Key provisions	Section where provision addressed
MGN 543 Guidance on UK Navigational Practice, Safety and Emergency Response Issues	This MGN highlights issues to be considered when assessing the impact on navigational safety and emergency response, caused by OREI developments. Including traffic surveys, consultation, structure layout, collision avoidance, impacts on communications/ radar/ positioning systems and hydrography.	Section 10.3 provides an overview of consultation undertaken. Section 10.6 provides an overview of traffic surveys and analysis. Section 10.11 discusses impacts on shipping and navigation.
Department of Energy and Climate Change (DECC) Methodology for Assessing Marine Navigational Safety Risks of Offshore Wind Farms	The DECC document provides a template for preparing NRA's for offshore wind farms.	This guidance document has been used for drafting the full NRA, which is provided as an appendix to the ES (Document Ref: 6.4.10.1).

Policy/ legislation	Key provisions	Section where provision addressed
MGN 372 Guidance to Mariners Operating in the Vicinity of UK OREIs	Issues to be taken into account when planning and undertaking voyages near OREI off the UK coast.	Section 10.11 is informed by the impacts discussed in MGN 372.
International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA AISM) 0-139 the Marking of Man-Made Offshore Structures	Guidance to national authorities on the marking of offshore structures including wind farms.	Considered as part of section 10.15 on mitigation options.
International Maritime Organisation (IMO) Formal Safety Assessment	Process for undertaking marine navigation risk assessments.	This guidance document has been used for drafting the full NRA, which is provided as an appendix to the ES (Document Ref: 6.4.10.1).
Royal Yachting Association (RYA) Position on Offshore Energy Developments	Outlines recreational boating concerns for offshore renewable energy developments.	Section 10.11 discusses impacts on shipping and navigation and is informed by this guidance.
Paragraph 2.6.153 of NPS EN-3	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.	Section 10.3 summarises key issues raised during consultation specific to shipping and navigation.
Paragraph 2.6.154 of NPS EN-3	Consultation should be undertaken with the Marine Management Organisation (MMO), MCA, relevant General Lighthouse Authority (GLA), relevant industry bodies and representatives of recreational users.	The consultation summarised in section 10.3 includes issues raised by the organisations stated. The MMO did not respond directly on shipping and navigation impacts within the Scoping Opinion.
Paragraph 2.6.155 of NPS EN-3	Information on internationally recognised sea lanes should be considered prior to undertaking assessments.	Section 10.11 and 10.12 provide information on IMO Routeing measures within the vicinity of Thanet Extension.
Paragraph 2.6.158 of NPS EN-3	Where there is a possibility that safety zones will be sought around offshore infrastructure, potential effects should be included in the assessment on navigation and shipping.	The effectiveness of safety zones is discussed within sections 10.7 to 10.15.
Paragraph 2.6.160 of NPS EN-3	The potential effect on recreational craft, such as yachts, should be considered in any assessment.	The effect of Thanet Extension on recreational vessels has been analysed in Figure 10.9 and discussed within sections 10.7 to 10.15.

10.3 Consultation and scoping

10.3.1 Table 10.2 provides a summary of consultation undertaken with shipping and navigation bodies to date.

10.3.2 The scoping document was issued to the Secretary of State on 4 January 2017; scoping responses were received in February 2017. The PEIR and S42 statutory consultation ran from the 27th November 2017 to the 12th January 2018. In addition, a significant amount of consultation with key shipping and navigation stakeholders has been conducted, the details of which are shown in Table 10.2.

10.3.3 Consultation was undertaken prior to the reduction of the Red Line Boundary to the west of the Extension and therefore the feedback below relates to the larger wind farm footprint.

Table 10.2: Summary of consultation relating to shipping and navigation

Consultee	Engagement	Key issues raised	Action Taken	Section
MCA	January 2016 (Meeting) – Pre-Scoping January to December 2016 (Emails) – Pre-Scoping January 2017 - Scoping Response December 2017 (Meeting) – NRA January 2018 (Meeting) – NRA January 2018 – S42 Response February 2018 (Meeting) – Post-S42 March to April 2018 – Review of NRA	Requirement for NRA	MGN 543 Compliant NRA Produced	10.4
		Requirement for Early Engagement with PLA	Early meetings with PLA and ESL held to discuss pilotage	10.3
		Impact on Pilotage at North East Spit	Pilotage study and Pilotage Simulation Study conducted with PLA and ESL showing that pilotage is feasible. Reduction made to RLB to improve sea room.	10.11 / 10.12
		Alignment of WTG with Existing Thanet Wind Farm	Commitment to maintain line of orientation and symmetry.	10.10 / 10.15
		Impact on Anchorage at Margate	Analysis of anchorage footprint at Margate shows extent.	10.11 / 10.12
		Impact on Navigation Safety	MGN 543 Compliant NRA produced showing risks with ALARP.	10.11 / 10.12
		Impact on Vessel Routeing	Vessel routeing reviewed showing minimal impact.	10.11 / 10.12
		Cable Burial Depths	Cable burial depths would not exceed 5% UKC	10.10 / 10.15
		Impacts on AIS/Radar/VHF Coverage	Review of previous studies suggests no significant impact	10.11 / 10.12
		Reduction in Sea Room	Collision modelling and pilotage simulation showed an increase in risk but within ALARP. Reduction in RLB.	10.11 / 10.12
		Provision of Hydrography to MCA	Embedded risk control.	10.10 / 10.15
		Suitability of Risk Controls	Risk controls reviewed since PEIR	10.10 / 10.15
		Impact on SAR	Layout guidance reviewed and recommendations made on line of symmetry and orientation	10.11 / 10.12
		Requirement for ERCOP, Layout Plan and Lighting/Marking	Recommendation made	10.10 / 10.15
Trinity House	January 2016 (Meeting) – Pre-Scoping January to December 2016 (Emails) – Pre-Scoping January 2017 - Scoping Response January 2018 (Meeting) – NRA January 2018 – S42 Response February 2018 (Meeting) – Post-S42 March to April 2018 – Review of NRA	Requirement for NRA	MGN 543 Compliant NRA Produced	10.4
		Requirement for Early Engagement with PLA	Early meetings with PLA and ESL held to discuss pilotage	10.3
		Impact on Pilotage at North East Spit	Pilotage study and Pilotage Simulation Study conducted with PLA and ESL showing that pilotage is feasible. Reduction made to RLB to improve sea room.	10.11 / 10.12
		Impact on Anchorage at Margate	Analysis of anchorage footprint at Margate shows extent.	10.11 / 10.12
		Impact on Navigation Safety	MGN 543 Compliant NRA produced showing risks with ALARP.	10.11 / 10.12
		Impact on Vessel Routeing	Vessel routeing reviewed showing minimal impact.	10.11 / 10.12
		Impacts on AIS/Radar/VHF Coverage	Review of previous studies suggests no significant impact	10.11 / 10.12

Consultee	Engagement	Key issues raised	Action Taken	Section
		Reduction in Sea Room	Collision modelling and pilotage simulation showed an increase in risk but within ALARP. Reduction in RLB.	10.11 / 10.12
		Suitability of Risk Controls	Risk controls reviewed since PEIR	10.10 / 10.15
		Requirement for ERCOP, Layout Plan and Lighting/Marking	Recommendation made	10.10 / 10.15
Port of London Authority	January to January 2017 (Emails) – Pre-Scoping November 2016 (Meeting) – Pre-Scoping February 2017 - Scoping Response May 2017 (Meeting) – Pilotage Study July 2017 (Meeting) – Pilotage Study September 2017 (Meeting) – Pilotage Workshop December 2017 (Meeting) – NRA January 2018 – S42 Response	Requirement for NRA	MGN 543 Compliant NRA Produced	10.4
		Impact on Pilotage at North East Spit	Pilotage study and Pilotage Simulation Study conducted with PLA and ESL showing that pilotage is feasible. Reduction made to RLB to improve sea room.	10.11 / 10.12
		Relocation of Pilot Boarding Station	Relative merits of relocation of pilot boarding station reviewed but not recommended.	10.10 / 10.15
		Operational impact on pilotage	Wear and tear and manning requirements reviewed.	10.11 / 10.12
		Impact on Anchorage at Margate	Analysis of anchorage footprint at Margate shows extent.	10.11 / 10.12
		Impact on Navigation Safety	MGN 543 Compliant NRA produced showing risks with ALARP. Reduction in RLB.	10.11 / 10.12
		Impact on Vessel Routeing and increased transit time	Vessel routeing reviewed showing minimal impact.	10.11 / 10.12
		Impacts on AIS/Radar/VHF Coverage	Review of previous studies suggests no significant impact	10.11 / 10.12
		Reduction in Sea Room	Collision modelling and pilotage simulation showed an increase in risk but within ALARP. Reduction in RLB.	10.11 / 10.12
		Suitability of Risk Controls	Risk controls reviewed since PEIR	10.10 / 10.15
		Lighting and Buoyage Requirements	Recommendation made	10.10 / 10.15
ESL	August to October 2016 (Emails) – Pre-Scoping March 2017 (Meeting) - Scoping July 2017 (Meeting) – Pilotage Study September 2017 (Meeting) – Pilotage Workshop December 2017 (Meeting) – NRA January 2018 – S42 Response	Impact on Pilotage at North East Spit	Pilotage study and Pilotage Simulation Study conducted with PLA and ESL showing that pilotage is feasible. Reduction made to RLB to improve sea room.	10.11 / 10.12
		Relocation of Pilot Boarding Station	Relative merits of relocation of pilot boarding station reviewed but not recommended.	10.10 / 10.15
		Operational impact on pilotage	Wear and tear and manning requirements reviewed.	10.11 / 10.12
		Impact on Anchorage at Margate	Analysis of anchorage footprint at Margate shows extent.	10.11 / 10.12
		Impact on Navigation Safety	MGN 543 Compliant NRA produced showing risks with ALARP.	10.11 / 10.12
		Impact on Vessel Routeing and increased transit time	Vessel routeing reviewed showing minimal impact.	10.11 / 10.12
		Requirement for Simulation	Pilotage simulation study conducted to test feasibility of pilotage, results suggest pilotage would remain feasible.	10.11 / 10.12

Consultee	Engagement	Key issues raised	Action Taken	Section
		Reduction in Sea Room	Collision modelling and pilotage simulation showed an increase in risk but within ALARP. RLB revision to increase sea room.	10.11 / 10.12
		Suitability of Risk Controls	Risk controls reviewed since PEIR	10.10 / 10.15
Port of Ramsgate / Thanet District Council	December 2017 (Meeting) – NRA January 2018 – S42 Response	Proximity of cable routeing close to Ramsgate	Cable exclusion area implemented in Ramsgate approach channel.	10.11 / 10.12
		Impacts during cable laying and maintenance	Cable exclusion area implemented in Ramsgate approach channel and commitment to cooperate with port during cable laying.	10.11 / 10.12
		Possible risk controls	Discussion of risk controls to minimise impact.	10.10 / 10.15
		Impact on pilotage operations	Pilotage simulation study conducted to test feasibility of pilotage, results suggest pilotage would remain feasible.	10.11 / 10.12
Royal Temple Yacht Club	December 2017 (Meeting) - NRA	Proximity of cable routeing close to Ramsgate	Cable exclusion area implemented in Ramsgate approach channel.	10.11 / 10.12
		Impacts during cable laying and maintenance	Cable exclusion area implemented in Ramsgate approach channel and commitment to cooperate with port during cable laying.	10.11 / 10.12
Thanet Fishermen Association	December 2017 (Meeting) – NRA January 2018 – S42 Response	Disruption during construction.	Cooperation plan with fishing groups to be put in place.	10.11
		Impact of cable laying and disruption	Cooperation plan with fishing groups to be put in place.	10.11 / 10.15
		Offset of shipping into fishing areas	Collision risk modelling and risk assessment undertaken, risks assessed to be within ALARP. Revision of RLB to improve sea room.	10.11 / 10.12
		Navigational Marking Requirements	Recommendation made	10.10 / 10.15
		Practicality of Risk Controls	Risk controls reviewed since PEIR	10.10 / 10.15
RYA	December 2017 (Meeting) - NRA	Offset of shipping into recreational traffic.	Collision risk modelling and risk assessment undertaken, risks assessed to be within ALARP. Revision of RLB to improve sea room.	10.11 / 10.12
		Impact of cable protection and UKC	Cable burial depths would not exceed 5% UKC	10.11 / 10.12
Chamber of Shipping	December 2017 (Meeting) - NRA	Reduction in sea room to west	Collision modelling and pilotage simulation showed an increase in risk but within ALARP. Reduction in RLB.	10.11 / 10.12
		Impact on Pilotage Operations.	Pilotage study and Pilotage Simulation Study conducted with PLA and ESL showing that pilotage is feasible. Reduction made to RLB to improve sea room.	10.11 / 10.12
		Impact to Navigational Aids, Radar and Communications.	Review of previous studies suggests no significant impact	10.11 / 10.12
French Government	January 2018 - S42 Response	Impact to Vessel Routeing	Project site clear of international shipping lanes.	10.11 / 10.12
		Impact to Navigational Aids, Radar and Communications.	Review of previous studies suggests no significant impact	10.11 / 10.12

Consultee	Engagement	Key issues raised	Action Taken	Section
Port of Sheerness	January 2018 - S42 Response	Impact on Pilotage at North East Spit	Pilotage study and Pilotage Simulation Study conducted with PLA and ESL showing that pilotage is feasible. Reduction made to RLB to improve sea room.	10.11 / 10.12
		Reduction in Sea Room	Collision modelling and pilotage simulation showed an increase in risk but within ALARP. Reduction in RLB.	10.11 / 10.12
		Impact on Vessel Routeing and increased transit time	Vessel routeing reviewed showing minimal impact.	10.11 / 10.12
		Impact to Navigational Aids, Radar and Communications.	Review of previous studies suggests no significant impact	10.11 / 10.12
UK Marine Pilots Association	January 2018 – S42 Response	Impacts to Pilotage	Pilotage study and Pilotage Simulation Study conducted with PLA and ESL showing that pilotage is feasible. Reduction made to RLB to improve sea room.	10.11 / 10.12
		Validity and Limitations of Pilotage Simulation Workshop	The pilotage simulation workshop was designed in consultation with the PLA and ESL to determine the parameters, runs and conditions of each trial. Whilst any simulation is not a true reflection of reality and there are inevitably limitations, it was agreed by the participants that the results of assessment were valid and that pilotage would remain feasible, albeit with a reduced margin for error.	10.11 / 10.12
		Impact on Navigational Safety	Collision modelling and pilotage simulation showed an increase in risk but within ALARP. An MGN 534 compliant NRA produced. Reduction in RLB undertaken to improve traffic flow.	10.11 / 10.12
Marine Management Organisation	January 2018 - S42 Responses	NRA	MGN 543 Compliant NRA Produced	10.4
		Safety zones	Safety zone distance stipulated as 500m during construction	10.10 / 10.15
		Aids to Navigation Plan	Required as part of marine license.	10.10 / 10.15
		Cable risks	Ongoing monitoring of cable risks to be undertaken	10.10 / 10.15
		Thanet Cable Replacement	Scoped into in-combination assessment	10.13

10.4 Scope and methodology

Study Area

10.4.1 The study area for this assessment is the Thames Estuary in the vicinity of Thanet Extension, with direct impacts up to a distance of 5 nautical miles (nm) from the array boundary and two nautical miles from the Offshore Export Cable Corridor (OECC) boundary. Additional comments will be given on the impacts in the wider area such as cumulative impacts of other OREIs and the routeing of vessels into ports adjacent to the Thames Estuary.

10.4.2 The study area was chosen to include all shipping routes which pass near enough to the development to be affected by its presence and could be tracked during the vessel traffic surveys. Furthermore, other routes are naturally separated due to the presence of the Kent coastline, the Dover Straits Traffic Separation Scheme and the shallows to the north. The study area was discussed with stakeholders during consultation.

Data Sources

10.4.3 The principal sources of data for the ES are data from the Automatic Identification System (AIS) collected by a VWPL receiver in Ramsgate and AIS and radar collected from a survey vessel. AIS is a transponder system, required on large commercial ships of over 300 Gross Tonnes (GT) and carried voluntarily by smaller fishing and recreational craft, that sends information about vessel identity and location every few seconds to nearby vessels. By collecting this data for long durations, the patterns of vessel traffic can be analysed.

10.4.4 A full MGN 543 compliant 2 x 14-day radar, AIS and visual traffic survey was conducted during 2017 from a survey vessel which was stationed to the west of the existing wind farm (7th and 25th February 2017 and 15th and 29th June 2017). In addition to this standard requirement the applicant undertook further analysis of two months of AIS data provided from the Ramsgate receiver (1 December 2016 to 1 February 2017). This latter dataset formed the basis for initial consultation on the pilotage analysis report (Document Ref 6.4.10.2).

10.4.5 Additional data such as Vessel Monitoring System (VMS) data of fishing activity through the MMO, pilotage data from the PLA, recreational routes through the RYA, and pilotage guides and sailing directions from the Admiralty will also be utilised within the ES.

Assessment of Impacts

10.4.6 The shipping and navigation study included a full NRA that assessed the likelihood and consequence of a variety of hazards associated with the Extension. This fed into a wider impact assessment, presented in this ES, which considered wider impacts which might not necessarily be related to navigation risk.

10.4.7 Each impact or risk was identified in the process shown in Figure 10.1. The process starts with the identification of all potential hazards and impacts. It then assesses the likelihood/sensitivity (frequency) of an impact/hazard and considers the possible consequences/magnitude of that impact/hazard. It does so in respect of two scenarios, namely the "most likely" and the "worst credible". The quantified values of frequency and consequence are then combined to produce a risk score for each hazard. The resulting impacts or risk scores are reviewed and the need for possible additional mitigation identified.

10.4.8 The method of assessment represents best practice, is compliant with MGN 543, and has been agreed as appropriate with the statutory consultees during consultation (Volume 4, NRA, Doc Ref 6.4.10.1)

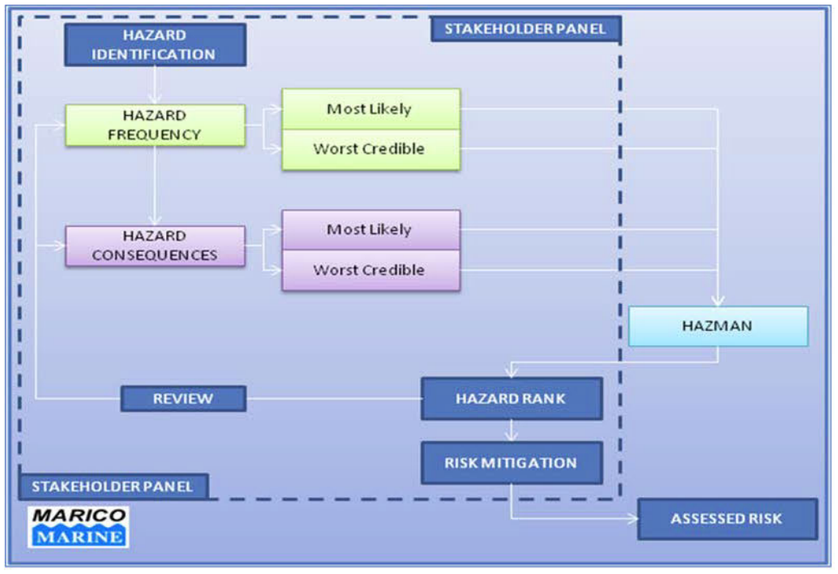


Figure 10.1 NRA Methodology.

10.5 Assessment criteria and assignment of significance

10.5.1 The ES utilises an overview impact assessment of the hazards identified for Thanet Extension. A simple 4 x 4 matrix of the likelihood and consequence of the hazards has been used to provide a measure of the significance that is compliant with MGN 543, and the Environmental Impact Assessment (EIA) Regulations 2017.

10.5.2 Table 10.3 defines the likelihood criteria used in the ES, from high to negligible. The consequence of the impact is defined in Table 10.4.

Table 10.3: Likelihood

Likelihood	Description/ reason
Likely	Likely to happen more than once during the project.
Probable	Reasonably probable that it will occur during the project.
Unlikely	Occasionally occurs nationally and unlikely to occur during project.
Extremely Unlikely	Occurs rarely nationally and therefore very unlikely to occur during the project.

Table 10.4: Consequence

Consequence	Definition
High	Fatalities, total loss of vessel, significant pollution or significant operational impact to wind farm or shipping.
Medium	Multiple major injuries, major damage to vessel, some pollution, some operational impact to wind farm or shipping.
Low	Multiple minor/ moderate injuries, minor damage to vessel, minor pollution, minimal operational impact to wind farm or shipping.
Negligible	Minor injury, negligible damage to vessel, no pollution, minimal operational impact.

Table 10.5: Significance of potential effects

		Consequence			
		High	Medium	Low	Negligible
Likelihood	Likely	*Unacceptable*	*Unacceptable*	*Tolerable*	*Minor*
	Probable	*Unacceptable*	*Tolerable*	*Tolerable*	*Minor*
	Unlikely	*Tolerable*	*Tolerable*	*Minor*	*Negligible*
	Extremely Unlikely	*Minor*	*Minor*	*Negligible*	*Negligible*

Table 10.6: Definition of Significance

Significance	Description/ reason	EIA Significance
Negligible	Risk is acceptable without additional mitigation.	Not Significant
Minor	Risks are acceptable, mitigation may be recommended but not required.	Not Significant
Tolerable	Risk is ALARP; tolerable if appropriate and proportional mitigation is put in place to manage and monitor the risks.	Not Significant
Unacceptable	Risks are intolerable. Significant in EIA terms.	Significant

10.6 Existing Environment

10.6.1 The baseline environment has been analysed and summarised in the following section and includes primary shipping routes and the behaviour of other traffic such as fishing and recreational vessels.

Thanet Offshore Wind Farm

10.6.2 The existing TOWF consists of 100 x 3 MW Vestas V90 Wind Turbine Generators (WTGs) up to 115 m in height with a total installed capacity of 300 MW. The site covers 35 km^2 with a maximum distance of 800 m between WTG and has been operational since 2010. An outline of the boundary is shown in Figure 10.2. Two export cables bring the electricity to shore at Pegwell Bay, Ramsgate. Water depths within the TOWF area range from 14 - 25 m.

10.6.3 The WTGs are painted, marked and fitted with navigation lights in accordance with their licence.

Existing Vessel Management

10.6.4 There are two pilot boarding stations within 10 km of the Thanet Extension; North-East Spit and Tongue. The locations of which in relation to TOWF and Thanet Extension are depicted in Figure 10.2. ESL is a private enterprise operating on behalf of the PLA from Ramsgate, servicing these stations.

10.6.5 Part of the extension lies within the PLA's Vessel Traffic Services (VTS) area. Furthermore, the study area lies adjacent but outside of the Channel Navigation Information Service (CNIS) area.

10.6.6 The cable corridor passes through the harbour limits of the Port of Ramsgate before making landfall in Pegwell Bay.

Vessel Traffic

10.6.7 Two months (1 December 2016 to 1 February 2017) of AIS data was provided by VWPL, collected via a receiver in Ramsgate. In addition, AIS and radar from two 14-day offshore vessel traffic surveys between 7th and 25th February 2017 and 15th and 29th June 2017, was analysed in the following section.

10.6.8 Analysis of vessel traffic in the vicinity of the TOWF, as recorded during the two 14 day seasonal surveys, is given in Figure 10.3 to Figure 10.9.

10.6.9 The overall density of traffic, all vessel types considered is shown in Figure 10.3. Preferred traffic routes are evident with a total of six within 5 nm of TOWF**.** The western boundary of Thanet Extension is located within a comparatively high-density shipping zone, with lower usage zones located to the south and south-west.

10.6.10 Commercial vessel transits are given in Figure 10.4 and Figure 10.5. Although both follow a similar pattern, there are more transits by cargo vessels than tankers.

10.6.11 Passenger vessel transits are given in Figure 10.6. All identified passenger vessels were cruise ships, utilising the NE Spit pilot station and there are no passenger ferry routes in the area.

10.6.12 Fishing vessel transits are shown in Figure 10.7. The majority of fishing vessels transiting or fishing in the area are based in Ramsgate, of which there are 20 commercial vessels, and are generally less than 15m LOA. Larger European trawlers can be found to the north east of the wind farm. It is known that fishing vessels are regularly active within the existing Thanet wind farm.

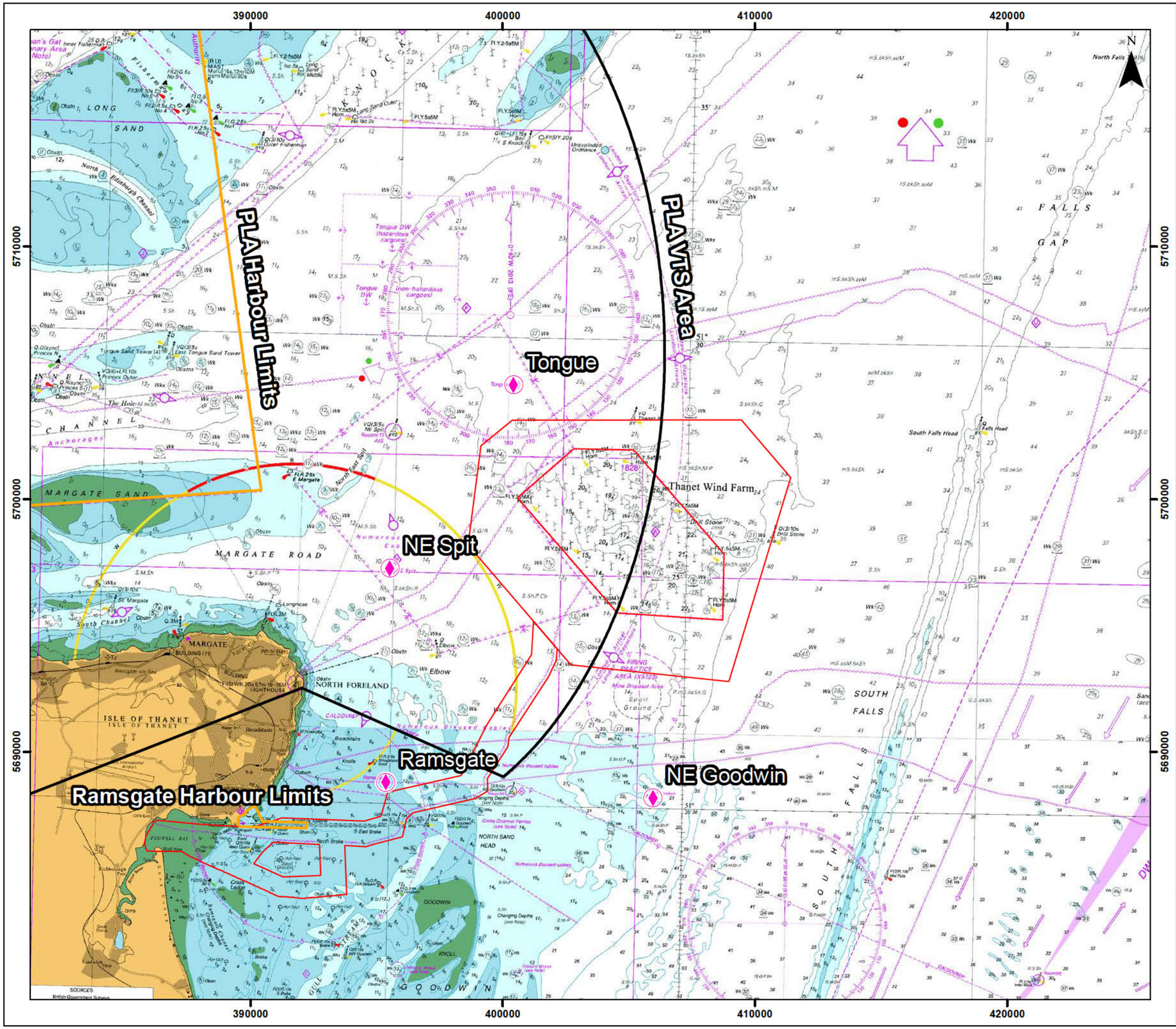
10.6.13 The tracks of Wind-Farm Support Vessels (WFSV) are shown in Figure 10.8. The WFSV operate between Ramsgate and TOWF, the Kentish Flats and London Array. With between two and four WRSV designated to each windfarm each day, WFSV constitute one of the major vessel types operating within the area.

10.6.14 Recreational vessel transit data was collected in the summer and winter surveys and is presented in Figure 10.9. Only one recreational vessel, a 13m yacht, transited within the existing windfarm boundary over the course of the survey period. Consultation with Royal Temple Yacht Club and the RYA identified that much of the activity is inshore and to the southwest of the wind farm.

10.6.15 Dredger vessel tracks are given in Figure 10.10. While there are a number of transits within 10 nm of the Thanet Extension, few pass within the site boundary and there are no aggregate extraction sites within the study area. Many of the dredgers have Pilotage Exemption Certificates.

10.6.16 Pilot vessel tracks are shown in Figure 10.11. The vast majority of transfers take place in the vicinity of NE Spit, with Tongue an NE Goodwin lightly utilised. Between 460 and 640 transfers take place each month driven by both demand and weather conditions.

10.6.17 Vessels have been categorised according to their length in Figure 10.12. The largest vessels to transit within 10 nm of the Thanet Extension site were up to 400m container ships, representing some of the largest ships in the world with a draw up to 15m. These vessels primarily utilise the shipping lane at the eastern boundary with only three vessels >250m transiting inshore of the wind farm over the survey period.



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THANET EXTENSION OFFSHORE WIND FARM

Figure 10.2

Location of Harbour Limits and Pilot Stations.

Legend

- PLA Vessel Traffic Services
- Harbour Limits
- Pilot Stations
- Offshore Array Red Line Boundary

Datum: ETRS 1989
Projection: UTM31N

1:150,000 0 1.5 3 km 0 0.85 1.7 nm

Drg No	16UK1255_ES_10_2_v3		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.2

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THANET EXTENSION OFFSHORE WIND FARM

Figure 10.3

Vessel Traffic Density (Winter and Summer Surveys)

Legend:

Offshore Array Red Line Boundary

Transits Per Day

- 0.03 - 0.25
- 0.26 - 0.50
- 0.51 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00
- 2.01 - 5.00
- 5.01 - 10.00

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_3_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.3

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THANET EXTENSION OFFSHORE WIND FARM

Figure 10.4

Vessel Traffic Survey - Cargo Tracks.

Legend:

- Offshore Array Red Line Boundary
- All Tracks
- Cargo Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_4_v1			**Figure 10.4**
Rev	0.1	Date	5/25/2018	
By	AR	Layout	N/A	

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Figure 10.5

Vessel Traffic Survey - Tanker Tracks.

Legend:

- Offshore Array Red Line Boundary
- All Tracks
- Tanker Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_5_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.5

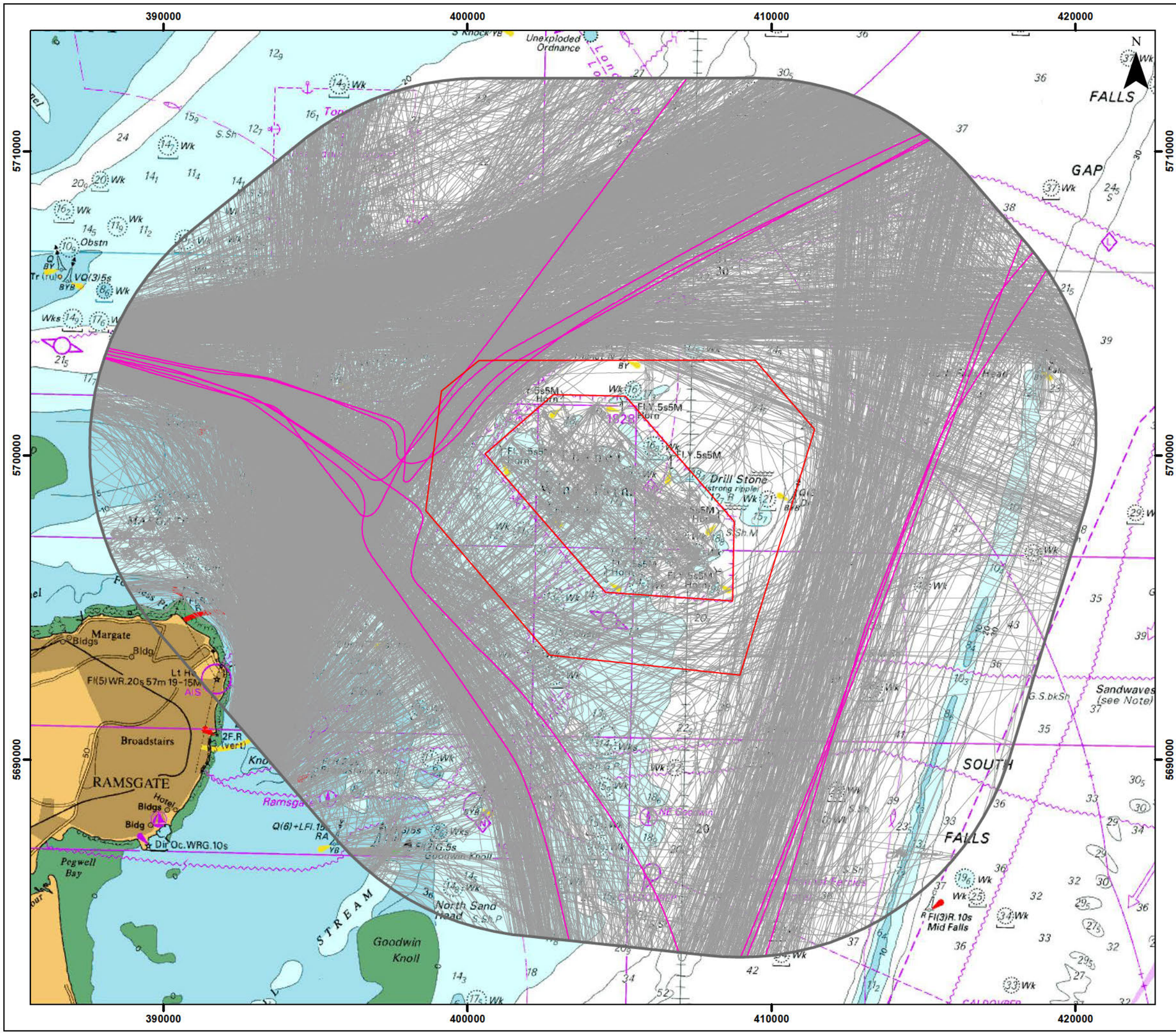

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Figure 10.6

Vessel Traffic Survey - Passenger Tracks.

Legend:

- Offshore Array Red Line Boundary
- All Tracks
- Passenger Vessel Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_6_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.6

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Figure 10.7

Vessel Traffic Survey - Fishing Tracks.

Legend:

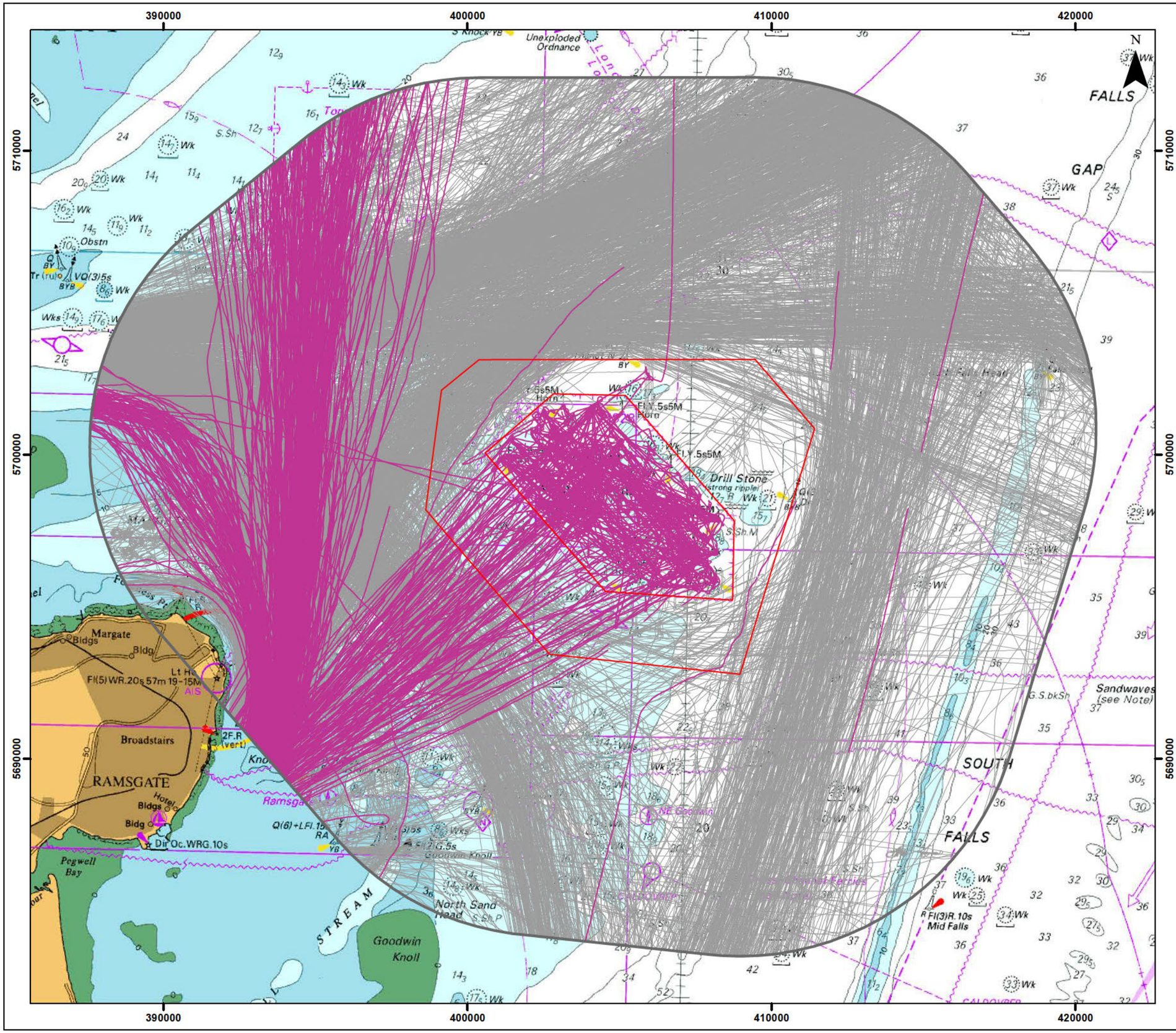
- Offshore Array Red Line Boundary
- All Tracks
- Fishing Vessel Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_7_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.7



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THANET EXTENSION OFFSHORE WIND FARM

Figure 10.8

Vessel Traffic Survey - Wind Farm Service Vessel Tracks.

Legend:

- Offshore Array Red Line Boundary
- Wind Farm Service Vessels
- Other Vessel Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_8_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.8

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Figure 10.9

Vessel Traffic Survey - Recreational Tracks.

Legend:

- Offshore Array Red Line Boundary
- Other Vessels
- Recreational Vessel Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_9_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.9

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Figure 10.10

Vessel Traffic Survey - Dredger Tracks.

Legend:

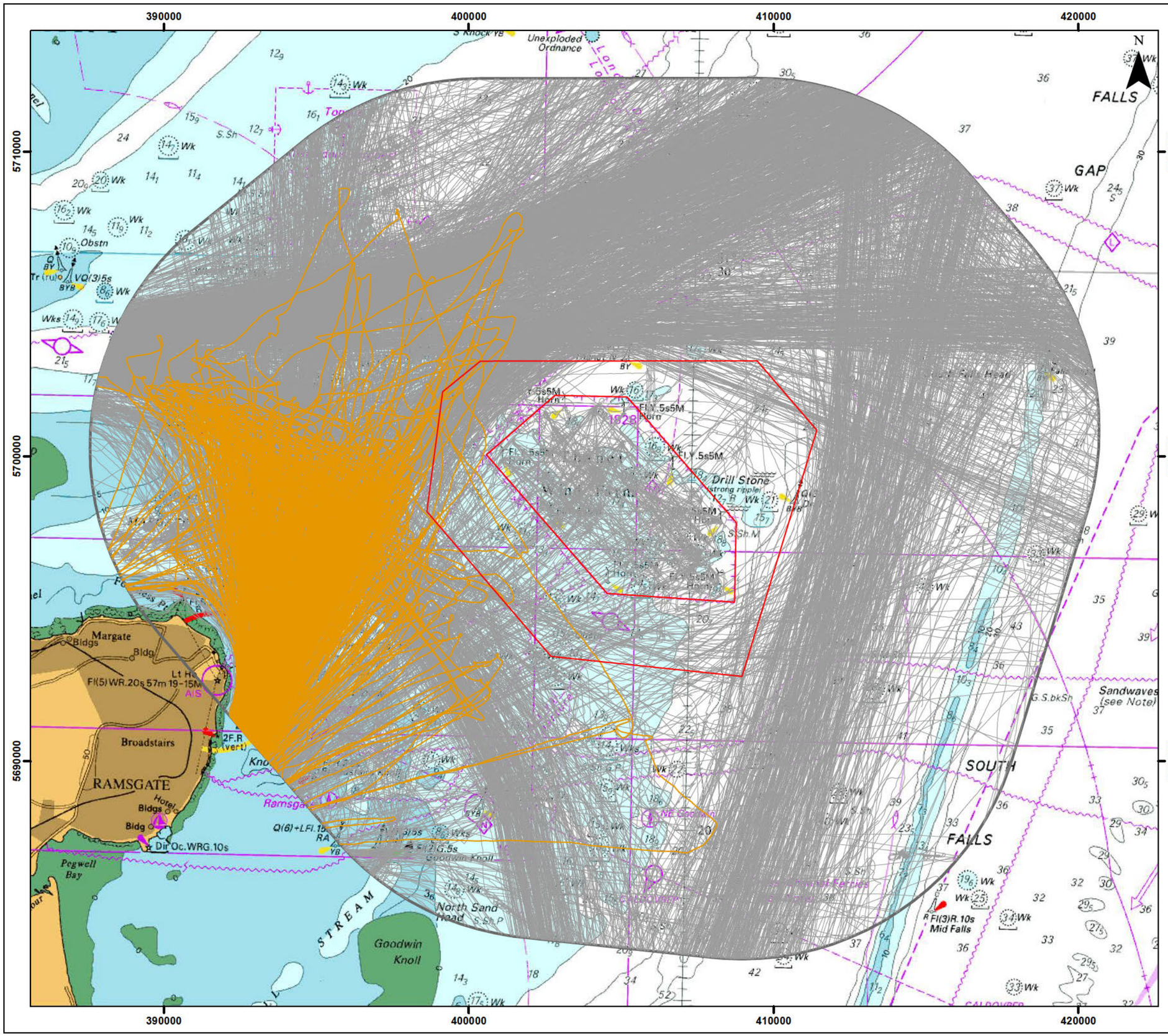
- Offshore Array Red Line Boundary
- All Tracks
- Dredger Vessel Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_10_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.10



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THANET EXTENSION OFFSHORE WIND FARM

Figure 10.11

Vessel Traffic Survey - Pilot Tracks.

Legend:

- Offshore Array Red Line Boundary
- All Tracks
- Pilot Vessel Tracks

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_11_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.11

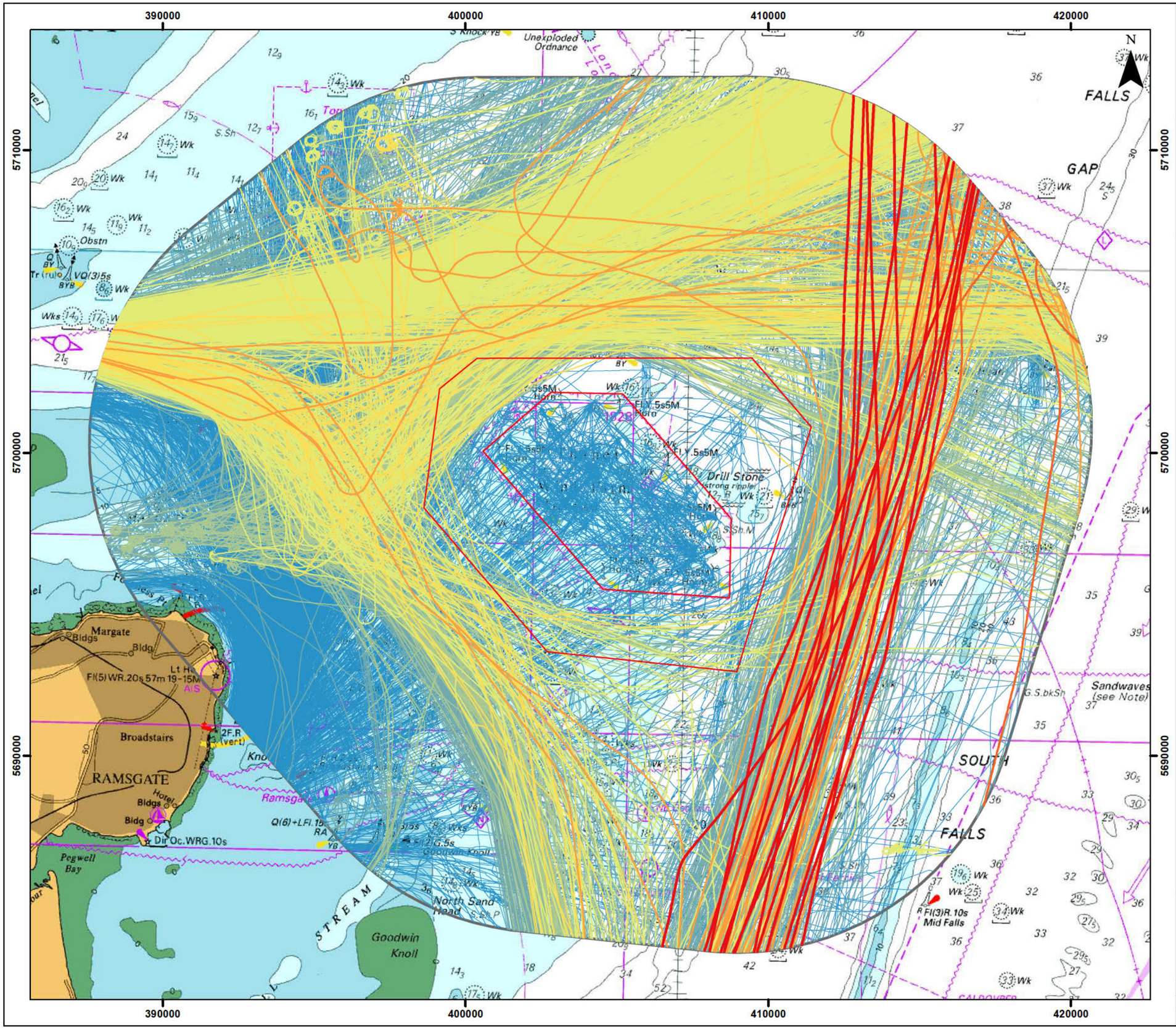

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Figure 10.12

Vessel Traffic Survey - Vessel Length (Metres).

Legend:

- Offshore Array Red Line Boundary
- 0.0 - 50.0
- 50.1 - 100.0
- 100.1 - 150.0
- 150.1 - 200.0
- 200.1 - 250.0
- 250.1 - 300.0
- 300.1 - 350.0
- 350.1 - 400.0

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_12_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.12

10.7 Gate Analysis

10.7.1 A series of gates were constructed to assess the frequency and distribution of traffic flow within nearby shipping routes, shown as bar graphs in the direction of travel through each gate. Five gates were constructed as shown within Figure 10.13 and Figure 10.14 across the December 2016 to February 2017 AIS data.

10.7.2 Gates A and E show the inshore traffic route of the existing wind farm. Much of the traffic in Gate A is clear of the extension, whilst Gate E traffic passes through the western boundary. The combined number of movements between the two highlights the significance of vessels using the NE Spit Pilot station. Gate D, shown in Figure 10.14, is mostly the routes of wind farm service vessels and pilot boats from Ramsgate.

10.7.3 Two traffic routes converge at Gate C; however, the presence of the Cardinal mark keeps vessel traffic clear of the extension footprint.

10.7.4 Figure 10.15 shows the number of transits per day through each of the gates by vessel type. The routes to the east and south of the extension have only 10 transits per day, whilst the routes to the north and to/from Ramsgate are more significant with between 25 and 30 transits per day. The seasonality of transits varies significantly by gate, however, generally there are more transits in summer than in winter. This is particularly evident within inshore gates D and E.

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Figure 10.13

Vessel Traffic Survey - Transits/Month.

Legend:

Offshore Array Red Line Boundary

Vessel Transits Per Month

- 0.7 - 5.0
- 5.1 - 10.0
- 10.1 - 15.0
- 15.1 - 20.0
- 20.1 - 25.0
- 25.1 - 30.0
- 30.1 - 35.0
- 35.1 - 40.0

Datum: ETRS 1989
Projection: UTM31N

1:90,000 0 1 2 km 0 0.55 1.1 nm

Drg No	16UK1255_ES_10_13_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.13

390000 395000 400000

5700000 5695000 5690000

MARGATE
Cliftonville
NORTH FORELAND
LIGHTHOUSE
BROADSTAIRS
Westwood
Northwood
Dumpton
Whitehall
Saint Lawrence
GRANVILLE
Walpole Rks
Palm Bay
Forbes Point
Kingsgate Bay
Kingsgate
Hackemdown Pt
Golf Course
East Cliff
South Cliff
Dumpton Point
Dumpton Gap
Colburn
KNOLLS
Ramsgate
Broadstairs Knoll LB
Thane
Numerous subsea cables
Offshore Array Red Line Boundary

Vessel Traffic Survey - Transits/Month.

Legend:

Vessel Transits Per Month

- 0.3 - 5.0
- 5.1 - 10.0
- 10.1 - 15.0
- 15.1 - 20.0
- 20.1 - 25.0
- 25.1 - 30.0
- 30.1 - 35.0

Datum: ETRS 1989
Projection: UTM31N

1:50,000 0 0.5 1 km 0 0.25 0.5 nm

Drg No	16UK1255_ES_10_14_v1			**Figure 10.14**
Rev	0.1	Date	5/25/2018	
By	AR	Layout	N/A	

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Figure 10.14

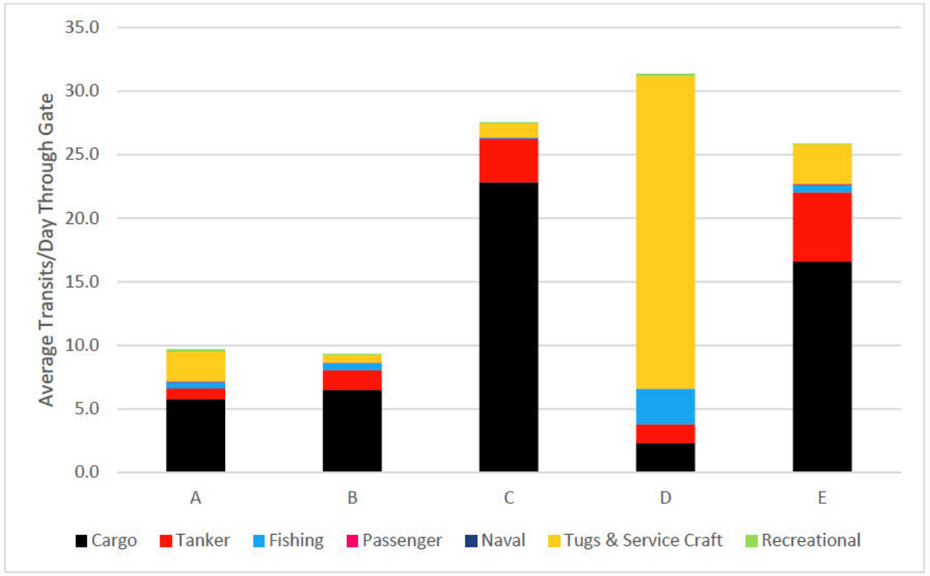

Figure 10.15: Transits per day through each gate by type.

10.8 Incidents

10.8.1 An analysis of historical marine incidents within 5 nm of the Thanet Extension is shown in Figure 10.16 and Figure 10.17.

10.8.2 The principal incident type is mechanical failures on board ships and hazardous incidents (near misses). A notable mechanical failure occurred in 2009 with the loss of power on the *Maersk Nottingham* which required tugs working on the Thanet wind farm to assist the vessel to prevent a contact with a WTG.

10.8.3 There are few navigationally significant incidents (collisions, contacts and groundings) with approximately one of these incidents every two years. Three collisions were recorded in the dataset one involving two tankers and two collisions involving fishing vessels and yachts, neither of which resulted in injuries. The baseline collision rate is therefore once every six years across all vessel types.

10.8.4 Several incidents were anecdotally reported, particularly two contacts between navigating fishing vessels and WTGs at the Thanet site, both of which resulted in only minor damage.

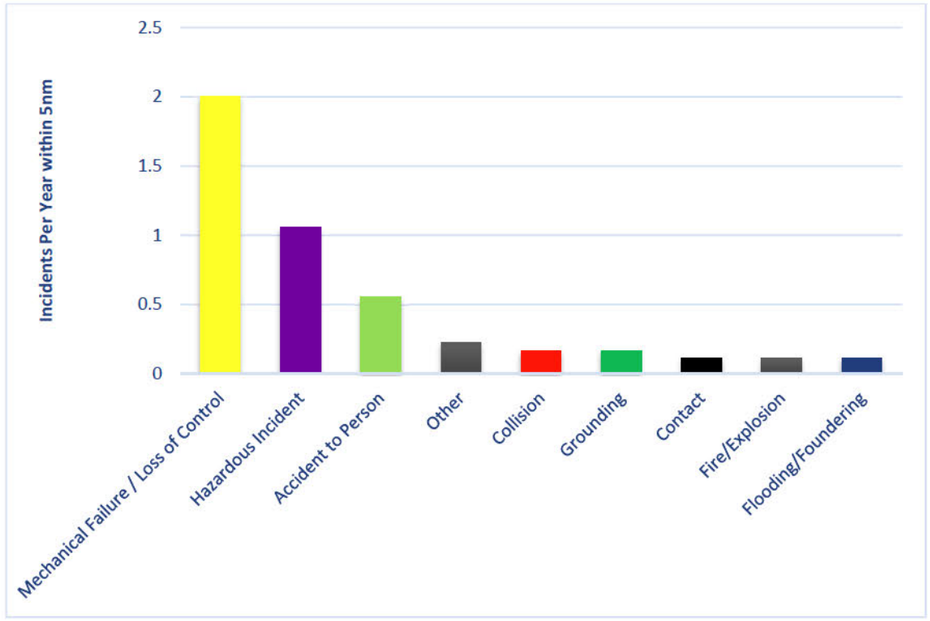

Figure 10.16: Analysis of Incidents per Year within 5 nm of Thanet Extension.

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Figure 10.17

MAIB Incidents, 1997 to 2015.

Legend:

- Offshore Array Red Line Boundary
- Other Incident Types
- Accident to Person
- Capsize/Flooding/Foundering
- Collision
- Contact
- Grounding
- Hazardous Incident
- Mechanical Failure / Loss of Control

Datum: ETRS 1989
Projection: UTM31N

1:125,000 0 1 2 km 0 0.7 1.4 nm

Drg No	16UK1255_ES_10_17_v1		
Rev	0.1	Date	5/25/2018
By	AR	Layout	N/A

Figure 10.17

10.9 Key parameters for assessment

10.9.1 A review of the baseline environment, the layout of the proposed development and responses received from consultees has identified the possible impacts of Thanet Extension on shipping and navigation and are listed in Table 10.7.

Table 10.7: Design envelope scenario assessed

Potential effect	Maximum design scenario assessed	Justification
Construction and Decommissioning		
Impact on ship collision risk	• Up to 48 additional construction vessels; • 34 WTGs plus one Offshore Substation (OSS) and met mast over 68 km² area; • Up to four export cables installed within OECC.	Driven by the number of additional construction vessels increasing crossing encounters and restriction of available sea room due to increased footprint of the wind farm.
Impact on ship contact risk	• 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows.	Driven by size and number of structures and extent over which they are spread. Worst-case scenario assumes adoption and utilisation of maximum possible development area with minimal possible spacing between WTGs.
Impact on vessel traffic routeing	• 34 WTGs plus one OSS and met mast over 68 km² area; • All commercial vessels deviate around wind farm. • Up to four export cables installed within export cable corridor, rolling 500 m safety zone around construction vessels.	The worst-case scenario assumes that all shipping currently passing through Thanet Extension boundary would be forced to take alternative routes, increasing transit time.
Impact on pilotage operations	• Up to 48 additional construction vessels; • 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • Up to four export cables installed within OECC, rolling 500 m safety zone around construction vessels.	The worst-case scenario assumes pilotage transfer locations remain unchanged. Driven by the number of additional construction vessels increasing crossing encounters and restriction of available sea room due to increased footprint of Thanet Extension.
Impact on recreational vessel activity	• Up to 48 additional construction vessels; • 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • All structures have a 500 m safety zone; • 22 m air draught above MHWS.	The worst-case assumes recreational activity remains unchanged within Thanet Extension. Driven by the number of additional construction vessels increasing crossing encounters and restriction of available sea room due to increased footprint of the wind farm. Worst-case scenario assumes adoption and utilisation of maximum possible development area.
Impact on fishing vessel activity	• Up to 48 additional construction vessels; • 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • All structures have a 500 m safety zone.	The worst-case assumes fishing effort remains unchanged within Thanet Extension. Driven by the number of additional construction vessels increasing crossing encounters and restriction of available sea room due to increased footprint of the wind farm. Worst-case scenario assumes adoption and utilisation of maximum possible development area.

Potential effect	Maximum design scenario assessed	Justification
Impact on navigation during cable laying	• Four export cables; • 23 km cable corridor. • Reasonable disruption during laying from metocean conditions.	The worst-case assumes maximum number of cables over maximum corridor length.
O&M		
Impact on ship collision risk	• Up to two additional maintenance vessel transits per day; • 34 WTGs plus one OSS over 68 km² area.	Assumes maximum number of service vessels increasing crossing encounters and restriction of available sea room due to use of maximum footprint of the wind farm. Impact on visual navigation.
Impact on ship contact risk	• 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • 220 m rotor diameter, 22 m above MHWS.	Driven by size and number of structures and extent over which they are spread. Worst-case scenario assumes adoption and utilisation of maximum possible development area and maximum number of WTGs with minimum separation.
Impact on vessel traffic routeing	• All commercial vessels deviate around wind farm.	The worst-case assumes that all shipping currently passing through the Thanet Extension boundary would be forced to take alternative routes.
Impact on pilotage operations	• Up to two additional maintenance vessel transits per day; • 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • 220 m rotor diameter, 22 m above MHWS.	The worst-case scenario assumes pilotage transfer locations remain unchanged. Driven by restriction of available sea room due to increased footprint of Thanet Extension.
Impact on recreational vessel activity	• Up to two additional maintenance vessel transits per day; • 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • 220 m rotor diameter, 22 m above MHWS; • All structures have a 50 m operational safety zone.; • 22 m air draught above MHWS.	The worst-case assumes recreational activity remains unchanged within Thanet Extension. Driven by the number of additional construction vessels increasing crossing encounters and restriction of available sea room due to increased footprint of the wind farm. Worst-case scenario assumes adoption and utilisation of maximum possible development area.
Impact on fishing vessel activity	• Up to two additional maintenance vessel transits per day; • 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • 220 m rotor diameter, 22 m above MHWS; • All structures have a 50 m operational safety zone.	The worst-case assumes fishing effort remains unchanged within the Thanet Extension area. Driven by the number of additional construction vessels increasing crossing encounters and restriction of available sea room due to increased footprint of the wind farm. Worst-case scenario assumes adoption and utilisation of maximum possible development area.
Impact on marine navigation and communication systems	• 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • 220 m rotor diameter.	Driven by size and number of structures and extent over which they are spread. Worst-case scenario assumes maximum number of large WTGs over maximum possible development area.

Potential effect	Maximum design scenario assessed	Justification
Impact on SAR	• 34 WTGs plus one OSS and met mast over 68 km² area; • 418 m separation between WTGs; • 760 m separation between rows. • 220 m rotor diameter.	Driven by size and number of structures and extent over which they are spread. Worst-case scenario assumes adoption and utilisation of maximum possible development area.
Impact on existing aids to navigation	• 34 WTGs plus one OSS and met mast over 68 km² area;	The worst-case assumes the utilisation of the maximum footprint impacting the maximum number of navigation buoys.
Impact on vessel anchorages	• 34 WTGs plus one OSS and met mast over 68 km² area;	The worst-case assumes the utilisation of the maximum footprint and maximum possible restriction sea room.
Impact associated with cable	• Four export cables; • Cable protection; • 23 km cable corridor.	The worst-case assumes maximum number of cables at maximum height above chart datum over maximum corridor length.
Cumulative effects		
Cumulative impact due to increased vessel activity	• Multiple projects operational or under construction at the same time.	Significant increase in works and construction vessels near to the development.
Cumulative impact on vessel routeing	• Maintenance vessels for London Array excluded from Thanet Extension.	Increased journey time and collision risk for maintenance vessels. Possibility of contact risk with Thanet Extension WTGs.
Cumulative impact from cable route	• Cables cross in areas of shallow water.	Reduction in depth of water.

10.10 Embedded Mitigation

10.10.1 Embedded mitigation measures to reduce the risks associated with the proposed development are listed in Table 10.8. Additional mitigation measures that reduce the risks to ALARP where necessary are considered in section 10.15.

Table 10.8: Embedded mitigation relating to shipping and navigation

Parameter	Mitigation measures
Design changes	
Array boundary	Following formal consultation on the PEIR and draft NRA the project array boundary has been reduced by a quarter in the north-west corner to reduce interaction with a range of sensitive receptors inclusive of the sensitive shipping and navigation receptors.
OECC boundary	Following formal consultation on the PEIR and draft NRA the OECC boundary has been amended in proximity to Ramsgate harbour and the approach channel to reduce interaction with a range of sensitive receptors, inclusive of sensitive shipping and navigation receptors.
Construction, Operational and Decommissioning Phases	
Promulgate information to local stakeholders	Information dissemination via Notice to Mariners and Navigation Information Broadcasts to ensure construction/decommissioning and maintenance activities are widely known and passage plans are assessed accordingly.
Aids to Navigation management plan (Marking and Lighting) to be submitted to MCA/TH for approval prior to construction.	WTGs to be marked in accordance with MGN 543 and to comply with IALA standards at all project stages. Lighting plan for the extension will be designed to align with the existing lights of TOWF.
Formulation and implementation of Emergency Response Co-operation Plan (ERCoP)	ERCoP to outline general safety procedures and provide guidance on emergency response procedures to include emergency rotor shut down guidance in the event of SAR operations.
Mark wind farm and cable routes on navigational charts.	Inclusion of Thanet Extension and its associated cable routes on navigational charts so vessels are aware of areas to be avoided.

Parameter	Mitigation measures
All construction/decommissioning, operational and maintenance operations are to be fully compliant with legislation, guidance and best practice.	Suitable vessels to be selected for construction/decommissioning and maintenance and personnel to receive suitable training. All those involved in construction/decommissioning, operational and maintenance operations are to be trained and competent persons. Use of appropriate Personal Protective Equipment (PPE) by personnel.
Incidents and near misses Reporting	Incidents and near misses are reported and investigated by developer and operators.
Layout Plan	Layout Plan to be submitted to MCA/HMCG for approval prior to construction.
Competent and Trained Personnel	All those involved in construction/decommissioning, operation and maintenance operations are to be trained and competent persons, using appropriate PPE, with appropriate qualifications given their activities.
Site Monitoring	Continuous watch of site by radar, AIS, VHF, DSC and CCTV during construction/decommissioning.
Planning and coordination between developer and operators.	Ensure communication is upheld and construction/decommissioning is effectively coordinated to ensure best practice and reduce risks.
Minimum 22 m above MHWS blade clearance	Minimum safe air clearance (between MHWS and WTG rotors) of 22 m in accordance with MGN 543 to mitigate against ship contact risk.
Inter-array / export cables to be buried to the depth agreed which provides sufficient protection without compromising UKC.	Adherence to the appropriate burial depths will reduce risks associated with cable snagging and ensure an appropriate UKC is maintained.
Cable Burial Risk Assessment	Cable Burial Risk Assessment to determine level of protection or burial along cable route. Protection should not exceed 5% UKC.
Cable inspection	Periodic inspections to be undertaken over the cables life to ensure that the cable does not become exposed.

10.11 Environmental Assessment: construction and decommissioning phase

10.11.1 As listed in Table 10.7, a number of possible impacts during the construction and decommissioning phase are given. The construction and decommissioning phase of an offshore wind farm share similar impacts to shipping and navigation and are mitigated using similar means, for this reason they have been presented together below. The significance of each are scored below with the embedded mitigation implemented but without additional mitigation implemented.

Impact on Ship Collision Risk

10.11.2 Increased vessel activity in the vicinity of Thanet Extension site and cable route due to construction/decommissioning vessels will increase the occurrence of vessel crossing encounters and navigational risk. Construction/decommissioning works vessels will be on station at the wind farm for several years, posing a hazard to passing vessels. Furthermore, vessels associated with cable laying will be present in the busier inshore area, but for a shorter duration. The reduction of available sea room due to the increased footprint of the wind farm will increase navigational risk by increasing the likelihood of passing vessels encountering one another, especially inshore of the western boundary.

10.11.3 Approximately ten commercial vessels pass inshore of the Thanet Extension each day and their route would be constricted resulting in an increase in vessel traffic density. This is particularly evident in the north-west portion of Thanet Extension where the available sea room will reduce by approximately 25%. In addition, approximately 500 pilot transfers occur at NE Spit each month, for which the navigable space will be reduced to conduct these transfers. This risk is further increased due to the presence of small craft such as fishing and recreational users, albeit they are located mostly further inshore.

10.11.4 Collision risk modelling was undertaken to assess the relative change in collision risk as a result of the extension. The assessment found that the historical incident rate is for one collision every six years within 5 nm of the development. As a result of the extension this was modelled to increase by 54% to once every four years, without additional mitigation.

10.11.5 A collision between vessels can have serious consequences, resulting in pollution, loss of life and the loss of a vessel. The more likely outcome would be damage to both vessels with only minor injuries.

10.11.6 The NRA identified impacts associated with ship collision risk during construction/decommissioning as a key hazard. Of the top 10 hazards identified in the NRA four were impacts associated with ship collision risk. Specifically, the identified hazards were:

- Collisions between large commercial vessels (2nd);
- Collisions between large commercial vessels and recreational craft (3rd);
- Collisions between recreational craft (6th); and
- Collisions between construction/decommissioning vessels (8th).

10.11.7 All of these hazards were scored within ALARP with embedded risk controls.

10.11.8 The NRA has considered that the likelihood of a collision as a result of the construction/decommissioning of the project is Unlikely and the consequence is High. The significance of a ship collision incident during construction and decommissioning is, therefore, considered to be **Tolerable** which is not-significant in terms of the EIA regulations. Additional mitigation measures to reduce the significance is presented in Table 10.11.

Impact on Ship Contact Risk

10.11.9 The impact on ship contact risk assumes, in the worst-case, the utilisation of the maximum possible development area and the maximum number of WTGs (and an OSS, and met mast) with minimal possible spacing between.

10.11.10 There are six key routes that pass the footprint of the extension. Vessels would naturally leave additional space from the extension, where they are able, although it is likely that transiting vessels would be required to pass closer to the western boundary than they currently do. Construction/decommissioning vessels operating in close proximity to the WTGs are much more exposed to the risk of a contact than passing vessels, albeit their slow speed will minimise the consequence. Furthermore, partly constructed WTGs may not be lit or marked correctly and, therefore, are a hazard in poor visibility.

10.11.11 There are no recorded contacts within TOWF or Thanet Extension areas since the TOWF became operational in 2010. Anecdotally, it has been suggested that there have been two contacts between fishing vessels and WTGs at the TOWF, both of which resulted in little damage. A powered ship colliding with a WTG would cause catastrophic damage to the WTG and may result in the loss of the ship. The most likely vessel type to contact a WTG are the maintenance and construction/decommissioning vessels which are capable of high speeds and will be working in close proximity with partially constructed WTGs.

10.11.12 There were nine recorded mechanical failure incidents since 2010, suggesting the risk of contact resulting from drifting vessels is the most likely, albeit with a much lower consequence. During the construction of the TOWF, tugs were required to assist the *Maersk Nottingham* following a power failure to the north of the construction site.

10.11.13 The NRA identified the risk of contact as a key hazard during the construction/decommissioning phase. Of the top 10 hazards identified in the NRA:

- Contact between small construction/decommissioning vessel and a WTG (1st),
- Contact between a fishing vessel and a WTG (4th); and
- Large commercial vessel in contact with WTG (7th).

10.11.14 All of these hazards were scored within ALARP with embedded risk controls.

10.11.15 Due to the proximity of construction/decommissioning vessels and partially constructed WTGs, a contact with a WTG is Probable and would be of a Medium impact. The significance is therefore assessed to be of **Tolerable** significance, which is considered to be non-significant in terms of the EIA regulations. Further mitigation measures are presented in Table 10.11.

Impact on Vessel Traffic Routeing

10.11.16 The impact to vessel traffic routeing assumes, in the worst-case, the adoption of the maximum red line boundary area and that all shipping currently passing within the Thanet Extension boundary would need to take alternative routes.

10.11.17 Four of the six commercial shipping would be impacted by the construction/decommissioning of the wind farm. The north-west portion of the Thanet Extension area represents the greatest impact upon traffic routeing, encroaching on the north-east/ south-west going traffic lane. This route is frequently used by vessels transiting to and from the Thames, Margate and the Margate Roads Anchorage (Figure 10.2). The north-west portion of Thanet Extension results in the displacement of approximately eight commercial vessels per day, based on the analysis of AIS data and a reduction in traffic lane width by approximately 25%.

10.11.18 Re-routing of vessel traffic will carry a commercial impact upon ships and pilotage services by extending transit times, however, the relative increase in distance travelled is negligible and should therefore not make routes uncompetitive.

10.11.19 The impact is judged to be Likely but of Negligible magnitude. The significance of the impact on vessel traffic routeing during construction and decommissioning is considered to be of **Minor** significance, which is not significant in terms of the EIA Regulations.

Impact on Pilotage Operations

10.11.20 The impact on pilotage operations has been a key theme assessed as part of the NRA, particularly at the NE Spit station which accounts for between 500 and 600 transfers each month for vessels entering or departing the Thames Estuary.

10.11.21 Adoption of the Thanet Extension maximum footprint will reduce the available sea room, at the most westerly edge of Thanet Extension, from 7.9 to 6.1 km, reducing the sea room for pilotage transfers, reducing the margin of error and increasing the likelihood they will encounter other navigating vessels.

10.11.22 To assess this a pilotage study and pilotage simulation study was conducted to test the feasibility of pilotage at NE Spit, following the construction/decommissioning of the wind farm. The simulation was conducted with the PLA and ESL, with scenarios developed at a workshop involving all parties to test critical vessel types and Metocean conditions. Each scenario was tested and evaluated by all parties on completion to test whether it was a success or failure. Of the tested scenarios, all but one were judged to be successful, with the exception being marginal due to proximity to the Margate Roads Anchorage.

10.11.23 The pilotage assessment concluded that pilotage operations would be feasible with the extension in place, albeit this would increase the risk of an incident by reducing the margin for error. Risk control options have been identified to reduce this risk, many of which should be considered with or without Thanet Extension. If as some stakeholders have stated, the increase in risk is unacceptable, pilotage operations could be transferred to alternative locations or managed under greater control, but this would incur operational and financial impacts and have therefore not been taken forward as recommendations.

10.11.24 During the construction/decommissioning period, these impacts would be greater due to the increased numbers of construction/decommissioning vessels which would increase the traffic density around the NE Spit pilot station. Additional risk controls are recommended at this time.

10.11.25 The impact is judged to be Probable and of Medium magnitude. The significance of the impact on pilotage operations during construction and decommissioning is considered to be **Tolerable** which is not-significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11.

Impact on Recreational Vessel Activity

10.11.26 Driven by the number of additional construction/decommissioning vessels increasing crossing encounters and the restriction of available sea room due to increased footprint of the wind farm. The worst-case scenario assumes the adoption and utilisation of the maximum possible development area.

10.11.27 The vessel traffic survey identified that few recreational vessels navigate through the existing Thanet Wind Farm or within the area of the proposed extension. This is supported by the RYA sailing intensity dataset which shows low to moderate activity within the Thanet Extension area but a much higher intensity further inshore where cable installation will take place and so the impacts would be higher here, particularly during summer months.

10.11.28 The NRA identified risks to recreational users during the construction/decommissioning phase. Of the top 10 hazards:

- Collision between a large commercial vessel and a recreational craft (3rd) and
- Collision between two recreational users (5th).

10.11.29 Both of these hazards were scored within ALARP with embedded risk controls.

10.11.30 Adherence to safety zones will minimise the increased risk to recreational vessels and the separation between WTGs should be sufficient to prevent a significant increase in risk to recreational vessels. Adherence to the minimum 22 m blade tip clearance above MHWS will mitigate against contact with blades. A recreational vessel colliding with a WTG can result in serious consequences to the vessel, although is unlikely to result in fatalities. A contact between a yacht and an under-construction WTG or construction/decommissioning vessel is unlikely but could result in major injuries.

10.11.31 Furthermore, during construction cable laying activities and the movement of construction/decommissioning vessels near to Ramsgate Harbour would both disrupt and pose a risk to recreational craft moving in this area.

10.11.32 The impact is judged to be Probable and of Medium magnitude. The significance of the impact on recreational activity during construction and decommissioning is considered to be of **Tolerable** significance, which is not significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11.

Impact on Fishing Vessel Activity

10.11.33 The worst-case assumes fishing effort remains unchanged within the Thanet Extension area and is driven by the number of additional construction/decommissioning vessels increasing crossing encounters and restriction of available sea room due to the increased footprint of the wind farm. The worst-case also assumes the utilisation of the maximum possible footprint and construction of the maximum number of WTGs with minimal spacing.

10.11.34 Fishing effort within the Thanet Extension area is low at < 20,000 kW/hours per year (UK fishing vessels > 15 m). Fishing effort is greatest to the east of Thanet Extension. Fishing activity is greater further inshore where the cable laying works will be conducted and therefore the impacts may be greater here. Fishing vessels are more likely to be operating in and around the extension than recreational vessels, so whilst the consequences would be similar, the likelihood is greater.

10.11.35 Fishing vessels are involved in the greatest number of incidents within the vicinity of Thanet Extension, of which 31% were collisions and 69% were mechanical failures. The risk of fishing vessel collision and contact with a construction/decommissioning vessel or under-construction WTG resulting from drifting therefore represent the greatest risk. It was reported during consultation that fishing vessels had been involved in contacts with Thanet WTGs.

10.11.36 The NRA identified risks to fishing users during the construction/decommissioning phase. Of the top 10 hazards identified in the NRA:

- Contact between a fishing vessel and a WTG (4th); and
- Grounding of a fishing vessel (10th).

10.11.37 Both of these hazards were scored within ALARP with embedded risk controls.

10.11.38 The impact is judged to be Probable and of Medium magnitude. The significance of the impact on fishing during construction and decommissioning is considered to be of **Tolerable** significance, which is not significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11. Further consideration of the potential for interactions with commercial fisheries vessels is also given in Volume 2, Chapter 9: Commercial Fisheries (Document Ref 6.2.9).

Impact on Navigation During Cable Laying

10.11.39 A key concern raised by stakeholders based in Ramsgate, was the impacts during cable laying of the export cable for the Thanet Extension. This followed the highly disruptive laying of the Nemo Interconnector between Pegwell Bay and Nemo during 2017.

10.11.40 The cable corridor is clear of charted anchorages however, cross a fishing ground and within the harbour limits of Ramsgate. The cable laying activity will necessitate a temporary safety zone for the protection of the vessel and the newly laid cable which will disrupt the activities of Ramsgate, and its fishing and leisure users. It is recommended that the project engages with local stakeholders to time the laying with off-peak seasons or times and utilises a less disruptive rolling 500m safety zone.

10.11.41 The impact is judged to be Probable and of Medium magnitude. The significance of the impact as a result of cable laying during construction and decommissioning is considered to be of **Tolerable** significance, which is not-significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11.

10.12 Environmental Assessment: Operational Phase

10.12.1 As listed in Table 10.7, a number of possible impacts during the operational phase of the wind farm are given below. The significance of each are considered assuming the implementation of embedded mitigation measures but without the implementation of additional mitigation measures.

10.12.2 In general the impacts during the operational phase are less significant than those during the construction/decommissioning phases due to the lower numbers of project vessels and the greater familiarity of other users in and around the project site.

Impact on Ship Collision Risk

10.12.3 During the operational phase there would be less project related craft, however additional maintenance vessels would be active from Ramsgate. The additional traffic in combination with the reduction in sea room on the western corner would result in additional encounters between vessels and increase collision risk.

10.12.4 The NRA identified collisions during the operational phase as a key hazard. In the top 10 hazards identified in the NRA:

- Collisions between large commercial vessels (1st),
- collisions between large commercial vessels and recreational craft (2nd);
- Collisions between recreational craft (4rd).

10.12.5 These risk scores, whilst lower than during the construction/decommissioning phase, were still judged to fall within ALARP with embedded risk controls in place.

10.12.6 The NRA has considered that the likelihood of a collision as a result of the operational phase of the project is Unlikely and the consequence is High. The significance of a ship collision incident the operational phase is, therefore, considered to be **Tolerable** which is not-significant in terms of the EIA regulations. Additional mitigation measures which reduce the significance is presented in Table 10.11.

Impact on Ship Contact Risk

10.12.7 During the operational phase, there are relatively fewer project vessels operating in the wind farm and the turbines are fully constructed and well-marked. The risk of a project related vessel contacting a turbine is therefore less than during the construction/decommissioning phase.

10.12.8 For passing vessels there are six key routes that pass the footprint of the extension. With the reduction in the Red Line Boundary, there would be sufficient sea room to accommodate these routes and therefore the likelihood of a passing vessel contacting a turbine is judged to be low, albeit the consequence of a contact would be high. Fishing vessels will however start to operate within the area following construction, for which there has been anecdotal accounts of historical contacts at the existing wind farm.

10.12.9 The NRA identified the risk of contact as a key hazard during the operational phase. Of the top 10 hazards:

- Contact between large commercial vessel and a WTG (4th),
- Contact between a fishing vessel and a WTG (5th); and
- O&M vessel in contact with WTG (6th).

10.12.10 All of these hazards were scored within ALARP with embedded risk controls.

10.12.11 The risks associated with a contact between a vessel and a WTG is Unlikely and would be of a Medium impact. The significance is therefore assessed to be of **Tolerable** significance, which is considered to be not-significant in terms of the EIA regulations. Further mitigation measures are presented in Table 10.11.

Impact on Vessel Traffic Routeing

10.12.12 Re-routing of vessel traffic will carry a commercial impact upon ships and pilotage services by extending transit times, however, the relative increase in distance travelled is negligible and should therefore not make routes uncompetitive. Analysis of the vessel routes suggests that there is sufficient sea room for all impacted routes to be offset without making them un-navigable.

10.12.13 The impact is judged to be Likely but of Negligible magnitude. The significance of the impact on vessel traffic routeing during the operational phase is considered to be of **Minor** significance, which is not significant in terms of the EIA Regulations.

Impact on Pilotage Operations

10.12.14 The impact on pilotage operations has been a key theme assessed as part of the NRA, particularly at the NE Spit station which accounts for between 500 and 600 transfers each month for vessels entering or departing the Thames Estuary.

10.12.15 As has been previously discussed, the reduction in sea room as a result of the extension would reduce the sea room available for pilotage operations. This was investigated using simulation with the PLA and ESL and the results suggested that pilotage would remain feasible but with a reduced margin of error. Since conducting the simulation, the project has reduced the footprint of the western boundary to create an additional one nautical mile of available water to the west of the Extension, further reducing this impact.

10.12.16 Whilst there would be some maintenance vessels active to and from Ramsgate, the level of additional traffic is relatively low to that during the construction phase and therefore disruption in this regard would not be significant.

10.12.17 The impact is judged to be Probable and of Low magnitude. The significance of the impact on pilotage operations during the operational phase is considered to be of **Tolerable** significance, which is not-significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11.

Impact on Recreational Vessel Activity

10.12.18 The vessel traffic study and consultation showed that the site of the Extension is a relatively low density recreational area, given the distance offshore, and that no major cruising routes pass through the site. A potential impact would however be for the commercial shipping routes to be offset closer towards the recreational routes.

10.12.19 During the operational phase there should be relatively little impact to recreational users inshore and near to Ramsgate, except during infrequent times of cable maintenance or survey.

10.12.20 The NRA identified risks to recreational users during the operational phase. Of the top 10 hazards;

- Collision between a large commercial vessel and a recreational craft (2nd) and
- Collision between two recreational users (3rd).

10.12.21 Both of these hazards were scored within ALARP.

10.12.22 The impact is judged to be Unlikely and of Low magnitude. The significance of the impact on recreational activity during the operational phase is considered to be of **Minor** significance, which is not significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11.

Impact on Fishing Vessel Activity

10.12.23 Ramsgate is host to more than 20 fishing vessels, with larger international trawlers operating in the outer Thames Estuary. The impact on fishing users is most significant during the construction phase with the safety zones and cable installation activities. During the operational phase, fishermen would be able to operate at the project site, except whilst maintenance is ongoing which requires an exclusion area.

10.12.24 Given the increased activities in close proximity to the WTGs, the risk of a contact increases. Some fishermen may choose to avoid the wind farm entirely which may offset them towards shallow water and the hazard of grounding.

10.12.25 The NRA identified risks to fishing users during the operational phase. Of the top 10 hazards:

- Contact between a fishing vessel and a WTG (6th) and
- Grounding of a fishing vessel (10th).

10.12.26 Both of these hazards were scored within ALARP with embedded risk controls.

10.12.27 The impact is judged to be Probable and of Medium magnitude. The significance of the impact on fishing during the operational phase is considered to be of **Tolerable** significance, which is not-significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11.

10.12.28 Further consideration of the potential for interactions with commercial fisheries vessels is also given in Volume 2, Chapter 9: Commercial Fisheries.

Impact on Marine Navigation and Communication Systems

10.12.29 The WTGs for the Thanet Extension have the potential to impact upon the equipment used for marine navigation and communications. For example, structures can interfere with radar systems, causing echoes/ ghosts that may prevent two vessels from identifying one another and posing a risk of collision, particularly in poor weather/ reduced visibility.

10.12.30 Several trials have been conducted into the effect of WTGs on marine radar systems, including at North Hoyle, Kentish Flats and Belgium wind farms. The results have indicated that radars may be subject to similar effects produced by passing vessels (QinetiQ, 2004; Marico, 2007). Experienced mariners would therefore interpret the artefacts correctly and the effects are unlikely to result in any collisions. It should however be noted that many of these studies were conducted more than 10 years ago and so the results may be dated. More recent work conducted by Marico to compare the previous studies to larger WTG sizes, indicates that in general larger WTGs have fewer effects on marine radars.

10.12.31 Impacts to AIS, VHF and GPS as a result of WTGs have also been investigated and the results are generally considered to be negligible.

10.12.32 The impact is judged to be Likely and of Negligible magnitude. The significance of the impact to marine navigation and communication systems is considered to be **Minor** which is not significant in terms of the EIA Regulations.

Impact on SAR

10.12.33 The incident rate within the Thanet Extension area between 2010 and 2015 is low at approximately one incident per year with the highest density of incidents located closer to the coast.

10.12.34 The requirement for the generation of an ERCoP outlining general safety procedures and providing guidance on emergency response procedures (to include emergency rotor shut down guidance in the event of SAR operations) will ensure impacts are lessened.

10.12.35 In addition, the presence of crew transfer or maintenance vessels associated with the project would have a beneficial purpose in assisting another vessel in distress, long before traditional SAR assets could reach them.

10.12.36 The impact is judged to be Probable and of Low magnitude. The significance of the impact to marine navigation and communication systems is considered to be **Tolerable** which is not significant in terms of the EIA Regulations. Further mitigation which reduces the significance is presented in Table 10.11.

Impact on Existing Aids to Navigation and Marking

10.12.37 The worst-case assumes the utilisation of the maximum footprint impacting the maximum number of navigation buoys.

10.12.38 Two navigational buoys, Thanet North and Drill Stone, fall within the Thanet Extension footprint and will likely require relocating in agreement with Trinity House and Vattenfall. These are located to the east and north, where there is available sea room to offset the marks from the extension without unduly impacting traffic flow. The need to and locations as to where these buoys will be moved must be determined following the finalisation of the site layout.

10.12.39 Existing aids to navigation at the Thanet site, will require alterations. It is likely that the extension will be marked in accordance with industry guidance and the main navigational lighting for the Thanet wind farm will be extinguished. A marking and lighting plan will be prepared and consulted with the MCA and Trinity House prior to construction of the wind farm.

10.12.40 The impact is judged to be Likely and of Negligible magnitude. The significance of the impacts to existing navigation aids is considered to be **Minor** which is not significant in terms of the EIA Regulations.

Impact on Vessel Anchorages

10.12.41 The worst-case assumes the utilisation of the maximum footprint of the project site and the maximum cable corridor. There are two anchorages in close proximity to Thanet Extension and the OECC. The Tongue Deep Water anchorage to the north and the Margate Roads Anchorage to the west.

10.12.42 The impacts to vessel anchorages are driven by the reduction in sea room and the routing of the export cable. The reduction in sea room will increase navigational risk by increasing the vessel traffic density in the vicinity of the anchorages. The impact to the Margate Roads anchorage will be greater than to the Tongue Deep Water Anchorage given the greater proximity to the Extension and level of traffic. It is noted that in bad weather, up to 20 vessels may seek shelter in the Margate Roads anchorage, further reduces the available sea room to the west of the extension. The reduction in the RLB to the west of the Extension opens up the area and reduces the impact of the project on anchorages.

10.12.43 The OECC is well clear of all charted anchorages in the region and therefore no commercial vessel should anchor in close vicinity to the export cable. Vessels may anchor in an emergency, such as a steering or engine failure, however the probability of this occurring along the cable route is low.

10.12.44 The impact is judged to be Unlikely and of Low magnitude. The significance of the impacts on vessel anchorages is considered to be **Minor** which is not significant in terms of the EIA Regulations.

Impacts Associated with Cable

10.12.45 The worst-case assumes maximum number of cables at minimum cable burial depth over the maximum corridor length. Cable burial depth or protection measures to be determined by a cable burial risk assessment which will include an anchor penetration study. Anchors can be deployed routinely in an anchorage, accidently release or in an emergency to avoid a further hazard. The latter two of which are rare occurrences, especially when there is clear water around them to drift. This hazard may therefore be particularly prevalent when the wind farm or the cable landfall are lee shores.

10.12.46 A vessel's anchor or fishing gear could damage the export cable of the wind farm. This would require additional maintenance vessels on site to repair it which are an obstruction to other vessels. Furthermore, if a fishing vessel were to become snagged on a cable this may result in capsize and, therefore, loss of life. These instances are rare and, therefore, unlikely to occur at Thanet Extension, particularly due to the promulgation activities of the project to local users.

10.12.47 The cable routes clear of charted anchorages but through a busy shipping route and fishing ground. There is therefore the potential for an incident which could result in significant damage to the export or inter-array cables. This would be mitigated through cable burial for much of the route or where required, protection which would be determined using a Cable Burial Risk Assessment.

10.12.48 The exclusion of the cable route from the Ramsgate approach channel would minimise the risks and disruption for vessels navigating in and out of the harbour.

10.12.49 The impact is judged to be Unlikely and of Medium magnitude. The significance of the impacts resulting from the presence of a cable is considered to be **Tolerable** which is not significant in terms of the EIA regulations. Further mitigation which reduces the significance is presented in Table 10.11.

10.13 Environmental Assessment: cumulative effects

10.13.1 Cumulative effects refer to effects upon receptors arising from Thanet Extension when considered alongside other proposed developments and activities and any other reasonably foreseeable project proposals. In this context the term projects is considered to refer to any project with comparable effects and is not limited to offshore wind projects.

10.13.2 The approach to cumulative assessment for Thanet Extension takes into account the Cumulative Impact Assessment Guidelines issued by RenewableUK in June 2013, together with comments made in response to other renewable energy developments within the Southern North Sea, and the Planning Inspectorate (PINS) 'Advice Note 9: Rochdale Approach'. This approach and the suggested tiers, has been agreed within the PEIR.

10.13.3 In assessing the potential cumulative impact(s) for Thanet Extension, it is important to bear in mind that for some projects, predominantly those 'proposed' or identified in development plans etc. may or may not actually be taken forward. There is thus a need to build in some consideration of certainty (or uncertainty) with respect to the potential impacts which might arise from such proposals. For example, relevant projects/ plans that are already under construction are likely to contribute to cumulative impact with Thanet Extension (providing effect or spatial pathways exist), whereas projects/ plans not yet approved or not yet submitted are less certain to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors.

10.13.4 For this reason, all relevant projects/ plans considered cumulatively alongside Thanet Extension have been allocated into 'Tiers', reflecting their current stage within the planning and development process. This allows the cumulative impact assessment to present several future development scenarios, each with a differing potential for being ultimately built out. Appropriate weight may therefore be given to each scenario (Tier) in the decision-making process when considering the potential cumulative impact associated with Thanet Extension (e.g. it may be considered that greater weight can be placed on the Tier 1 assessment relative to Tier 2).

10.13.5 The projects and plans selected as relevant to the assessment of impacts shipping and navigation are based upon an initial screening exercise undertaken on a long list. Each project, plan or activity has been considered and scoped in or out on the basis of effect–receptor pathway, data confidence and the temporal and spatial scales involved.

10.13.6 The proposed tier structure that is intended to ensure that there is a clear understanding of the level of confidence in the cumulative assessments provided in Thanet Extension is as follows:

Tier 1

10.13.7 Thanet Extension considered alongside other projects/ plans currently under construction and/ or those consented but not yet implemented, and/ or those submitted but not yet determined where data confidence for the projects falling within this category is high.

10.13.8 Built and operational projects will be included within the cumulative assessment where they have not been included within the environmental characterisation survey, i.e. they were not operational when baseline surveys were undertaken, and/ or any residual impact may not have yet fed through to and been captured in estimates of 'baseline' conditions or there is an ongoing effect.

Tier 2

10.13.9 All projects included in Tier 1 plus other projects/ plans consented but not yet implemented and/ or submitted applications not yet determined where data confidence for the projects falling into this category is medium.

Tier 3

10.13.10 The above plus projects on relevant plans and programmes (the PINS Programme of Projects and MMO 'Marine Case Management System' being the source most relevant for this assessment). Specifically, all projects where the developer has advised PINS in writing that they intend to submit an application in the future were considered.

10.13.11 The specific projects scoped into this cumulative impact assessment, and the tiers into which they have been allocated are presented in Table 10.9 below. The operational projects included within the table are included due to their completion/ commission subsequent to the data collection process for Thanet Extension and as such not included within the baseline characterisation.

Table 10.9: Projects related to shipping and navigation for cumulative assessment

Development type	Project	Status	Data confidence assessment/ phase	Tier
OWF	Thanet	Operational	High	1
OWF	Gunfleet Sands	Operational	High	1
OWF	Kentish Flats	Operational	High	1
OWF	Kentish Flats Extension	Operational	High	1
OWF	London Array	Operational	High	1
OWF	Belgium Offshore Wind Farms	Various	Medium	1
OWF	Dunkerque	Planning	Low	2
Cable	Thanet Export Cable	Operational	High	1
Cable	Nemo Interconnector	Operational	High	1
Cable	Thanet Cable Replacement	Planned	Medium	2
Marine Aggregate and Disposal	Nemo Disposal	Operational	Medium	1
Marine Aggregate and Disposal	Pegwall Bay	Operational	Medium	2
Marine Aggregate and Disposal	Ramsgate Harbour	Operational	High	2
Marine Aggregate and Disposal	Area 524, 509/3, 510/1, 108/3, 510/2, 508, 509/2, 446, 509/1, 447, 501/2	Operational	High	1

10.13.12 The cumulative impacts and Rochdale Envelope are described in Table 10.10.

Table 10.10: Cumulative Rochdale Envelope

Impact	Scenario	Justification
Cumulative Impact due to Increased Vessel Activity	Multiple offshore developments require construction and maintenance vessels. The numerous projects that are active in the Thames Estuary would likely increase vessel activity as they transit to and from their bases of operation.	Potential increases in collision risk and possible congestion issues.
Cumulative Impact on Vessel Routeing	Commercial shipping, fishing boats and recreational craft must all operate to avoid these developments and any works taking place. This reduces the available sea room available, concentrating them in smaller areas, potentially bringing them into conflict.	Change in vessel routeing across multiple sites due to multiple developments.
Cumulative Impact from Cable Routes	Multiple cable routes that cross over one another will reduce the navigable depth of water in these locations.	Reduction in depth and increased maintenance works vessels.

Cumulative impact due to increased vessel activity

10.13.13 Thanet Extension, Kentish Flats and London Array service vessels will likely interact with one another, increasing risk along the route and possibly resulting in congestion at Ramsgate Harbour. These impacts would be greatest during the construction/decommissioning phase of the wind farm, when more vessels will be operating from Ramsgate and the cable laying activities are ongoing.

10.13.14 Management and cooperation between developers will be necessary to reduce conflicts and identify best management practices.

10.13.15 The impact is judged to be Probable and of Low magnitude. The significance of the impacts on vessel anchorages is considered to be **Tolerable** which is not significant in terms of the EIA Regulations.

Cumulative Impact on Vessel Routeing

10.13.16 Several wind farms and other developments are located in the Thames Estuary which act as obstacles for the flow of vessel traffic. Due to engineering requirements, the majority of these are already located in areas of shallow water outside of the main shipping lanes. The cumulative impact of these developments will result in a slight loss of sea room around TOWF which may be rerouted into other lanes, increasing the risk elsewhere.

10.13.17 This rerouting may impact other activities such as aggregate dredgers and maintenance vessels. For example, vessels servicing London Array would have to transit through or around Thanet Extension, causing disruption to their operations.

10.13.18 The impact is judged to be Unlikely and of Low magnitude. The significance of the impacts on vessel anchorages is considered to be **Minor** which is not significant in terms of the EIA Regulations.

Cumulative Impact from Cable Routes

10.13.19 Multiple cable routes are located inshore of Thanet Extension which may cross one another. Where these cables cross it would likely result in a decrease in the navigable depth of water. Given the depth of water and the likely loss of depth, this percentage is small and will not pose a hazard to shipping with the exception of near to where the cable makes landfall in Pegwell Bay. Best practice is to ensure that the cable protection does not exceed 5% UKC and therefore the hazard to vessels is reduced. A coordinated approach to cable crossings and their protection will be necessary, and each will need to be risk assessed on a case by case basis.

10.13.20 The impact is judged to be Probable and of Low magnitude. The significance of the impacts on vessel anchorages is considered to be **Tolerable** which is not significant in terms of the EIA Regulations.

10.14 Inter-relationships

10.14.1 Shipping and navigation may interrelate with other physical, environmental and human parameters assessed within other chapters within the ES. The key inter-relationship is with fishing activity and how the navigation and work of fishermen is disrupted by the extension. To a lesser extent the impacts of recreational users may be disrupted by the extension of the wind farm.

10.14.2 In terms of navigational safety, these impacts are not considered significant given the level of activity and adopted risk controls of the project.

10.14.3 For further consideration of the potential effects on commercial fisheries receptors reference should be made to Volume 2, Chapter 9, Document Ref: 6.2.9. For further consideration of the potential effects on tourism and recreation receptors reference should be made to Volume 3, Chapter 4, Document Ref: 6.3.4.

10.15 Additional Mitigation to Reduce Risks to ALARP

10.15.1 Additional mitigation measures to reduce the impacts of the development to ALARP are listed in Table 10.8. These measures have been suggested by stakeholders, considered as part of the NRA and are recommended for the Thanet Extension.

Adopt Safety Zones

10.15.2 It is recommended that the developer applies for 500m safety zones during construction/decommissioning under Section 95 of the Energy Act 2004. These will be fixed during construction around the WTGs and other offshore structures. A rolling safety zone should be considered around the cable laying vessel to minimise disruption to stakeholders. There should also be appropriate means for the operator to notify, and provide evidence of, the infringement of any safety zones.

10.15.3 This risk control would be effective at reducing the risks of collision with construction vessels by excluding other vessel traffic from the areas they operate. Whilst it would also reduce the risks of collision and contact with recreational craft and fishing vessels, it would be disruptive on their activities and therefore has limited effectiveness at reducing the wider impact for these vessel types. No residual reduction is therefore achievable for these impacts from this risk control.

10.15.4 Safety zones would be most effective to mitigate the risk of contact between navigating vessels and turbines, as they may be partially constructed and/or lit at this time. In conjunction with other risk controls, a residual risk of **Minor** could be achieved.

10.15.5 Safety zones are not proposed during the operational phase and therefore have no effectiveness on hazards at that time.

Guard vessel to monitor passing traffic during construction

10.15.6 The employment of a guard vessel or multiple guard vessels equipped with a site-specific collision risk management plan would be able to monitor passing vessel traffic and intervene if necessary, particularly in cases of drifting vessels. Guard vessels may notify of any safety zone infringements.

10.15.7 Guard Vessels are applicable to a number of identified impacts to a greater or lesser extent. Through the action of enforcing safety ones during construction, they can limit the risks of collision with construction vessels or contact with turbines by passing vessel traffic. Furthermore, they can ensure that site craft are clear of pilotage areas to minimise disruption on pilotage operations.

10.15.8 Guard vessels may also monitor areas of exposed/ unburied cable preventing contact with and damage to the cable during construction. By keeping passing traffic clear of the cable installation, the impact during cable laying could be mitigated to **Minor**.

10.15.9 Guard Vessels are not proposed during the operational phase and therefore have no effectiveness on hazards at that time.

Co-operation during Cable Laying with Port of Ramsgate

10.15.10 A number of stakeholders voiced concerns over the impacts that cable laying and the required safety zones would have on navigation to/from Ramsgate, particularly whilst the cable is installed close to the channel. This impact has been minimised through amendments to the RLB (cable exclusion area) and will further be minimised by liaising with the port to time installation in this critical section with off-peak seasons / times of day to minimise disruption to the port and its users.

10.15.11 Cooperation during cable laying is effective at reducing the impact on recreational and fishing users as well as general impacts during the cable laying activities. All three of these impacts can be reduced to **Minor** significance as a result of this risk control in combination with others.

10.15.12 Safety zones are not proposed during the operational phase and therefore have no effectiveness on hazards at that time.

Develop Co-operation Plan with PLA

10.15.13 The project should have a regular and formalised means to coordinate with PLA VTS during construction and maintenance to ensure that the PLA, VTSOs and pilots are aware of the hazards, operations and movements at the site on a day to day basis. This information can then be provided to vessels to aid their safe passage. Liaison should be between the project and both the Harbour Master (Lower) and Duty Port Control.

10.15.14 The following information should be provided:

- A schedule of activities, timescales and construction methodology;
- Details of construction vessels including name, size, MMSI, telephone numbers etc.
- Any restrictions in place, such as safety zones;
- Contact details for project's Marine Coordinator;
- Regular charts of installed infrastructure e.g. turbines/cables – overlaid on navigational chart to show progress;
- Notification of any navigational incidents which occur or any hazards to navigation (e.g. dropped objects) which may compromise navigable depths;

- A copy of the project's ERCOP and Layout Plan.

10.15.15 This information would allow the PLA to do the following:

- Issue PLA notice to mariners;
- Include any significant activities or vessel moves in routine traffic broadcasts;
- Provide timely information to pilots of expected activities.

10.15.16 In addition, the project should attend River User Consultative Forum (Lower & Estuary) to share information on the project and planned works and listen to feedback from stakeholders.

10.15.17 The implementation of such a plan would have a high level of effectiveness at minimising the impact on commercial users across a range of impacts, particularly during the construction phase. In particular, the impacts to ship contact risk, during cable laying and the impacts to pilotage could be better managed with this control, however it would not be considered enough to mitigate the impact to **Minor** levels.

Communication between project, sub-contractors and fishermen/leisure groups

10.15.18 It is important to maintain a dialogue between the developers and fishing and leisure stakeholder groups, particularly during construction and cable-laying. This would enable a transfer of information and experiences, such as planned maintenance or any adverse impacts on their operations.

10.15.19 This builds upon an existing promulgation strategy of Vattenfall. A fisheries liaison officer would be in place for the project to liaise with the local fishing organisations, inform them of ongoing works and discuss any concerns. In addition, Vattenfall would continue to attend monthly harbour user meetings in Ramsgate to discuss the state of the project with wider stakeholders and consider any impacts.

10.15.20 Vattenfall should also engage with the committee at Royal Temple Yacht Club, particularly during cable laying or cable maintenance to make sure targeted information on these impacts can be passed to recreational sailors. Project status updates should also be passed to the RYA for publishing in their monthly magazine and on their website to engage with a wider recreational audience.

10.15.21 This control applies across all impacts and at all phases of the development to manage the impacts to recreational and fishing users which can be reduced to **Minor** significance as a result.

Maintain line of orientation and symmetry in the wind farm design

10.15.22 In order to aid both SAR and general navigation within the wind farm, a line of orientation and symmetry should be maintained in line with MGN 543. This would require integration between the turbine spacing of the TOWF and the proposed extension, given the different sizes of WTG. Turbine numbering should also be logical and consistent. The outcome of this should be included within the layout plan and submitted to the MCA for review.

10.15.23 Maintaining line of orientation and symmetry applies to only two impacts. Firstly, a regular pattern would partly reduce the impact on marine navigation and communication equipment by allowing radar penetration through the site, however the impact is **Minor** without this control. Secondly, the key benefit is for SAR purposes to aid helicopter search routes. This control would reduce the impact to **Minor** significance.

Relocation of Buoyage

10.15.24 The existing wind farm is marked by two Cardinal marks; Thanet North (to the north) and Drill Stone (to the east). Both marks keep vessel traffic at least one nautical mile from the boundary of the existing wind farm and would require relocation or removal. The relocation of these would be determined following the finalisation of the WTG positions and the development of the layout plan.

10.15.25 The relocation of buoyage has a limited effect at reducing the significance of a variety of hazards. The requirement for and application of this risk control would be determined following the finalisation of the site layout.

10.16 Residual Impacts

Residual Impact on Ship Collision Risk

10.16.1 The impact on ship collision risk was scored as **Tolerable** for both the construction/decommissioning and operational phases. The risk assessment has shown that this risk has increased, due to the reduction in sea room and increased vessel traffic, but the hazards falls within ALARP.

10.16.2 With additional mitigation, such as safety zones, guard vessels, cooperation plans with the PLA and communication with stakeholders, this impact can be reduced. However, given the reduction in sea room a residual impact remains and therefore the significance with additional controls is considered to remain at **Tolerable**.

Residual Impact on Ship Contact Risk

10.16.3 The impact on ship contact risk was scored as **Tolerable** for both the construction/decommissioning and operational phases. The risk assessment has shown that this risk has increased, due to the reduction in sea room and increased vessel traffic, but the hazards falls within ALARP.

10.16.4 With additional mitigation, such as safety zones, guard vessels, relocation of buoyage and communication with stakeholders, this impact can be reduced. However, the reduction in significance would not be reduced below ALARP and is therefore considered to remain at **Tolerable** significance.

Residual Impact on Vessel Traffic Routeing

10.16.5 The impact on vessel traffic routeing was scored as **Minor** for both the construction/decommissioning and operational phases. The NRA showed minimal disruption to vessel routes.

10.16.6 Limited additional risk controls were identified and the residual significance is considered to remain at **Minor** levels.

Residual Impact on Pilotage Operations

10.16.7 The impact on pilotage operations was identified as a key impact of the project and scored as **Tolerable** for both the construction/decommissioning and operational phases, as pilotage which was shown to still be feasible.

10.16.8 With the reduction in the RLB to increase the available sea room to the west, but without the implementation of additional management controls, the impact is judged to remain at **Tolerable** significance.

Residual Impact on Recreational Vessel Activity

10.16.9 The impact on recreational users was scored as **Tolerable** during construction/decommissioning and **Minor** during the operation of the Thanet Extension, principally due to the greater activities and disruption associated with cable laying and vessel movements near to Ramsgate in the construction phase.

10.16.10 The adoption of safety zones, guard vessels, cooperation plans and communication with stakeholders during construction would reduce the residual impact to **Minor** for the construction phase. For the operational phase, only communication was identified as a control which does not reduce the impact below **Minor**.

Residual Impact on Fishing Vessel Activity

10.16.11 The impact on fishing vessel activity was scored as **Tolerable** for both the construction/decommissioning and operational phases. The level of significance is considered greater during construction due to the due to the increased activities and loss of navigable area.

10.16.12 The adoption of safety zones, guard vessels, cooperation plans and communication with stakeholders during construction would reduce the residual impact to **Minor/Tolerable** for the construction phase. For the operational phase, only communication was identified as a control but this reduces the relatively lower level of significance to **Minor**.

Residual Impact on Navigation During Cable Laying

10.16.13 The impact on navigation as a result of the cable laying was considered to be **Tolerable.**

10.16.14 The implementation of guard vessels, cooperation with the Port of Ramsgate and the PLA as well as stakeholder communication would be effective at reducing this level of significance to **Minor**.

Residual Impact on Marine Navigation and Communications Equipment

10.16.15 The impact on marine navigation and communications equipment was shown to be **Minor** as a result of the project. This impact can be further reduced by maintaining lines of orientation/symmetry and educating local users, however the residual impact would remain at **Minor** levels.

Residual Impact on SAR

10.16.16 The impact on SAR was shown to be **Tolerable** as a result of the project. This impact can be further reduced by maintaining lines of orientation/symmetry and this would be effective at reducing the residual impact to **Minor** levels.

Residual Impact on Existing Aids to Navigation and Marking

10.16.17 The impact on aids to navigation was shown to be **Minor** as a result of the project, and there may be a requirement to relocate two navigational buoys, with the residual significance remaining at **Minor**.

Residual Impact on Vessel Anchorages

10.16.18 The impact to the anchorages at Margate and Tongue was shown to be **Minor** with the reduction in the RLB. No additional significance was identified to further reduce this impact and therefore the residual impact remains at **Minor**.

Residual Impacts Associated with Cable

10.16.19 The routeing of the cable would have a **Tolerable** impact on marine users, particularly in close proximity to Ramsgate Harbour. The education of fishing and recreational users would reduce this impact to **Minor** significance by ensuring they are aware of its route and what actions to take in the event of snagging.

Residual Cumulative Impact Due to Increased Vessel Activity

10.16.20 The cumulative impact as a result of increased vessel traffic associated with the Extension and other projects was judged to be of **Tolerable** significance, particularly during the construction of the Extension. Increased awareness of local users could reduce the risks to **Minor** significance.

Residual Cumulative Impact on Vessel Routeing

10.16.21 The cumulative impact as a result of the Extension and other projects was judged to be of **Minor** significance. The level of significance is assessed to remain at **Minor** levels with relocation of buoyage.

Residual Cumulative Impact from Cable Route

10.16.22 The cumulative impact as a result of cables associated with the Extension and other projects was judged to be of **Tolerable** significance, particularly in areas where the cables cross. Increased awareness of local users could reduce the risks to **Minor** significance.

10.17 Transboundary statement

10.17.1 The proposed extension is within 12 nm of the UK coast and a further 13 nm from the UK/ France marine border. Whilst shipping is a multinational industry with vessels of many nationalities transiting passed the extension, they abide by international regulations and when in territorial or port waters, by local regulations. These impacts are therefore inherently included within this assessment.

10.18 Summary of effects

10.18.1 This ES has considered the possible impacts of Thanet Extension on shipping and navigation, and possible mitigation measures that should be implemented to reduce those impacts. Table 10.11 provides a summary of those impacts and mitigation measures, with all impacts assessed to be Tolerable or below.

10.18.2 The study has drawn upon evidence from vessel traffic data and consultation with stakeholders to provide a thorough assessment of these impacts. Additional evidence has been drawn from conducting pilotage simulation trials with the PLA and ESL, as well as collision risk modelling to examine the change in encounters between vessels.

10.18.3 The assessment concludes that the extension would heighten the risks to navigation in the southern Thames Estuary. These risks of collision and contact with the WTGs, whilst heightened, are considered to fall within "As Low as Reasonably Practicable". Whilst pilotage operations at NE Spit may become more operationally challenging, it is concluded that they will remain feasible. To further mitigate these impacts, the project has reduced the footprint of the RLB to the west, and therefore additional controls which have been considered are not deemed necessary to manage the risks to ALARP.

Table 10.11: Summary of impacts of Thanet Extension.

Description of impact	Embedded Mitigation	Likelihood	Consequence	Impact	Additional Mitigation to Reduce the Risks to ALARP	Residual impact
Construction/ Decommissioning						
Impact on Ship Collision Risk	• Reduction in RLB; • Promulgation; • Planning and coordination between developer and operators; • Incident/Near-miss reporting; • ERCOP; and • Competent and Trained Personnel.	Unlikely	High	**Tolerable**	• Adopt safety zones; • Guard Vessel(s); • Develop Co-operation Plan with PLA; and • Communication between project, sub-contractors and fishermen/leisure groups.	**Tolerable**
Impact on Ship Contact Risk	• Reduction in RLB; • Promulgation; • Incident/Near-miss reporting; • ERCOP; • Aids to Navigation Plan; • Layout Plan; • Update navigational charts; • Competent and Trained Personnel; and • Maintaining lines of orientation and symmetry.	Probable	Medium	**Tolerable**	• Adopt safety zones; • Guard Vessel(s); • Communication between project, sub-contractors and fishermen/leisure groups; and • Relocation of buoyage.	**Tolerable**
Impact on Vessel Traffic Routeing	• Planning and coordination between developer and operators.	Likely	Negligible	**Minor**	• Develop Co-operation Plan with PLA; • Communication between project, sub-contractors and fishermen/leisure users.	**Minor**
Impact on Pilotage Operations	• Reduction in RLB.	Probable	Medium	**Tolerable**	• Guard Vessels; • Develop Co-operation Plan with PLA; and • Communication between project, sub-contractors and fishermen/leisure groups.	**Tolerable**

Description of impact	Embedded Mitigation	Likelihood	Consequence	Impact	Additional Mitigation to Reduce the Risks to ALARP	Residual impact
Impact on Recreational Vessel Activity	• Reduction in RLB; • Reduction in OECC; • Promulgation; • Incident/Near-miss reporting; and • Maintaining lines of orientation and symmetry.	Probable	Medium	**Tolerable**	• Adopt safety zones; • Guard Vessel(s); • Cooperation during Cable Laying with Port of Ramsgate; and • Communication between project, sub-contractors and fishermen/leisure groups.	**Minor**
Impact on Fishing Vessel Activity	• Reduction in RLB; • Reduction in OECC; • Promulgation; • Incident/Near-miss reporting; • Aids to Navigation; • Update navigational charts; and • Maintaining lines of orientation and symmetry.	Probable	Medium	**Tolerable**	• Adopt safety zones; • Guard Vessel(s); • Cooperation during Cable Laying with Port of Ramsgate; and • Communication between project, sub-contractors and fishermen/leisure groups.	**Minor** to **Tolerable**
Impact on Navigation During Cable Laying	• Reduction in OECC; and • Promulgation.	Probable	Medium	**Tolerable**	• Guard Vessel (s); • Co-operation during cable laying with the Port of Ramsgate; • Develop Co-operation Plan with PLA; and • Communication between project, sub-contractors and fishermen/leisure groups.	**Minor**
Operational Phase						
Impact on Ship Collision Risk	• Reduction in RLB; • Promulgation; • Planning and coordination between developer and operators; • Incident/Near-miss reporting; • ERCOP; and • Competent and Trained Personnel.	Unlikely	High	**Tolerable**	• Develop Co-operation Plan with PLA; and • Communication between project, sub-contractors and fishermen/leisure groups.	**Tolerable**

Description of impact	Embedded Mitigation	Likelihood	Consequence	Impact	Additional Mitigation to Reduce the Risks to ALARP	Residual impact
Impact on Ship Contact Risk	• Reduction in RLB; • Promulgation; • Incident/Near-miss reporting; • ERCOP; • Aids to Navigation Plan; • Blade Clearance; • Layout Plan; • Update navigational charts; • Competent and Trained Personnel; and • Maintaining lines of orientation and symmetry.	Unlikely	Medium	**Tolerable**	• Communication between project, sub-contractors and fishermen/leisure groups; and • Relocation of buoyage.	**Tolerable**
Impact on Vessel Traffic Routeing	• Reduction in RLB; and • Planning and coordination between developer and operators.	Likely	Negligible	**Minor**	• Communication between project, sub-contractors and fishermen/leisure users.	**Minor**
Impact on Pilotage Operations	• Reduction in RLB.	Probable	Low	**Tolerable**	• Communication between project, sub-contractors and fishermen/leisure groups; and • Develop Co-operation Plan with PLA.	**Tolerable**
Impact on Recreational Vessel Activity	• Promulgation; • Incident/Near-miss reporting; • Blade Clearance; and • Maintaining lines of orientation and symmetry.	Unlikely	Low	**Minor**	• Communication between project, sub-contractors and fishermen/leisure groups.	**Minor**

Description of impact	Embedded Mitigation	Likelihood	Consequence	Impact	Additional Mitigation to Reduce the Risks to ALARP	Residual impact
Impact on Fishing Vessel Activity	• Revision to OECC; • Promulgation; • Incident/Near-miss reporting; • Cable burial/protection; • Aids to Navigation; • Periodic cable inspections; • Update navigational charts; and • Maintaining lines of orientation and symmetry.	Probable	Medium	**Tolerable**	• Communication between project, sub-contractors and fishermen/leisure groups.	**Minor**
Impact on Marine Navigation and Communication Systems	• Reduction in RLB; • Promulgation; and • Layout Plan.	Likely	Negligible	**Minor**	• Communication between project, sub-contractors and fishermen/leisure groups; and • Maintaining lines of orientation and symmetry.	**Minor**
Impact on SAR	• Promulgation; • Planning and coordination between developer and operators; • ERCOP; and • Layout Plan.	Probable	Low	**Tolerable**	• Maintaining lines of orientation and symmetry in the wind farm.	**Minor**
Impact on Existing Aids to Navigation	• Layout Plan; and • Aids to Navigation management plan.	Likely	Negligible	**Minor**	• Relocation of buoyage.	**Minor**
Impact on Vessel Anchorages	• Reduction in RLB; and • Cable burial/protection.	Unlikely	Low	**Minor**	N/A	**Minor**
Impact Associated with Cable	• Reduction in OECC; • Promulgation; • Cable burial/protection; • Periodic cable inspections; and • Update navigational charts.	Unlikely	Medium	**Tolerable**	• Communication between project, sub-contractors and fishermen/leisure groups.	**Minor**

Description of impact	Embedded Mitigation	Likelihood	Consequence	Impact	Additional Mitigation to Reduce the Risks to ALARP	Residual impact
Cumulative effects						
Cumulative Impact due to Increased Vessel Activity	• Promulgation; • Planning and coordination between developer and operators; and • Incident/Near-miss reporting.	Probable	Low	**Tolerable**	• Communication between project, sub-contractors and fishermen/leisure groups.	**Minor**
Cumulative Impact on Vessel Routeing	• Promulgation.	Unlikely	Low	**Minor**	• Relocation of buoyage.	**Minor**
Cumulative Impact from Cable Route	• Reduction in OECC; • Promulgation; • Cable burial/protection; • Periodic cable inspections; and • Update navigational charts.	Probable	Low	**Tolerable**	• Communication between project, sub-contractors and fishermen/leisure groups.	**Minor**

10.19 References

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