

Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Annex D to Appendix 1 to Deadline 4B
Submission: Hazard information pack

Relevant Examination Deadline: 4B

Submitted by Vattenfall Wind Power Ltd

Date: April 2019

Revision A

Drafted By:	Vattenfall Wind Power Ltd
Approved By:	Daniel Bates
Date of Approval:	April 2019
Revision:	A

Revision A	Original document submitted to the Examining Authority

Copyright © 2019 Vattenfall Wind Power Ltd
All pre-existing rights retained

Thanet Extension Offshore Wind Farm

Addendum NRA: Hazard Workshop

Information Pack

This workshop pack includes:

- Workshop Details
- Details on the Risk Assessment Methodology including:
 - Draft Hazard Identification List
 - Existing risk control options list identified as part of original NRA
- Supplementary Information
 - Vessel Track Analysis
 - Incident Analysis
 - Other useful documents

Workshop Details

Time: 10:00 – 16:00

Date: 29th March 2019

Location:

St Bride Foundation
Bride Lane
Fleet Street
London
EC4Y 8EQ

Attendees:

Interested Parties	Organisation	Attending
Fena Boyle	Chamber of Shipping	Apologies sent
Trevor Hutchinson	DPWLG / POLTT	Yes
Vince Crocket	DPWLG / POLTT	Yes
Richard Jackson	Estuary Services Limited	Yes
Dave Ninnim	Estuary Services Limited	Yes
Andy Sims	London Pilot Council	Yes
Tony Evans	Maritime Coastguard Agency	TBA
Helen Croxson	Maritime Coastguard Agency	Apologies sent
Nick Slater	Maritime Coastguard Agency	TBA
Rakesh Pandit	Maritime Coastguard Agency	Yes
Catheryn Spain	Port of London Authority / Estuary Services Limited	Yes
Merlin Jackson	Thanet Fishermen's Association	Yes
Trevor Harris	Trinity House	Yes
Steve Vanstone	Trinity House	Yes
Roger Barker	Trinity House	Apologies sent

Applicant	Organisation	Attending 29th March
Dan Bates	Vattenfall	Yes
Sean Leak	GoBe	Yes
Simon Moore	Dover Marine Services	Yes
Ed Rogers	Marico	Yes
Jamie Holmes	Marico	Am only

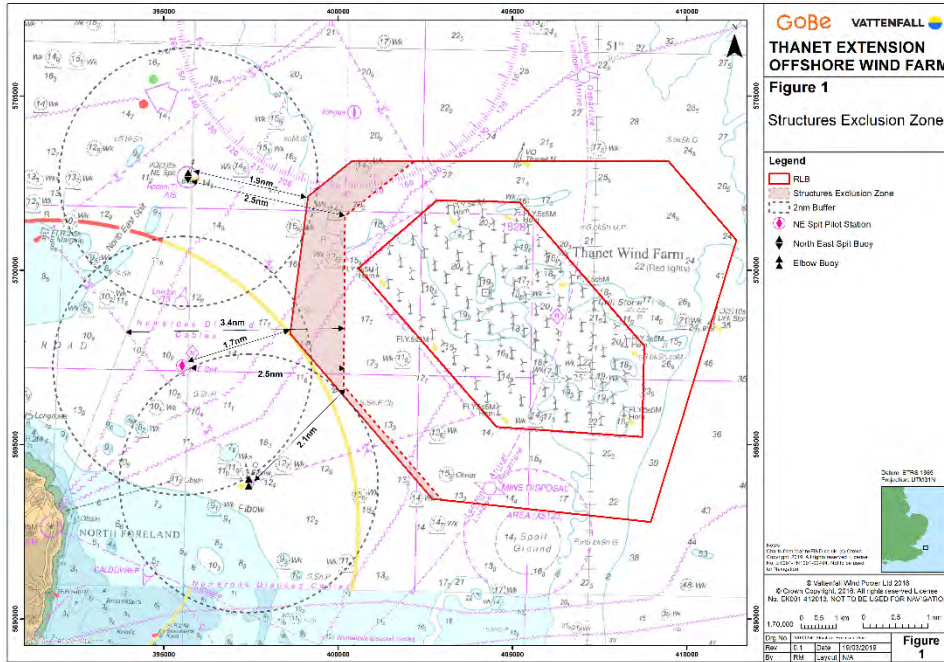
Draft Agenda:

- 10:00 Introductions
- 10:10 Workshop Methodology
- 10:30 Hazard Identification confirmation
- 11:00 Hazard Scoring – Baseline / Inherent / Residual (Operational phase only)
 - Hazard Likelihood
 - Hazard Consequence
- 13:00 Lunch
- 13:45 Continue hazard scoring
- 14:30 Risk Control Identification / Effectiveness
- 15:30 Hot Wash Up / Concluding Remarks

Workshop Risk Assessment Methodology

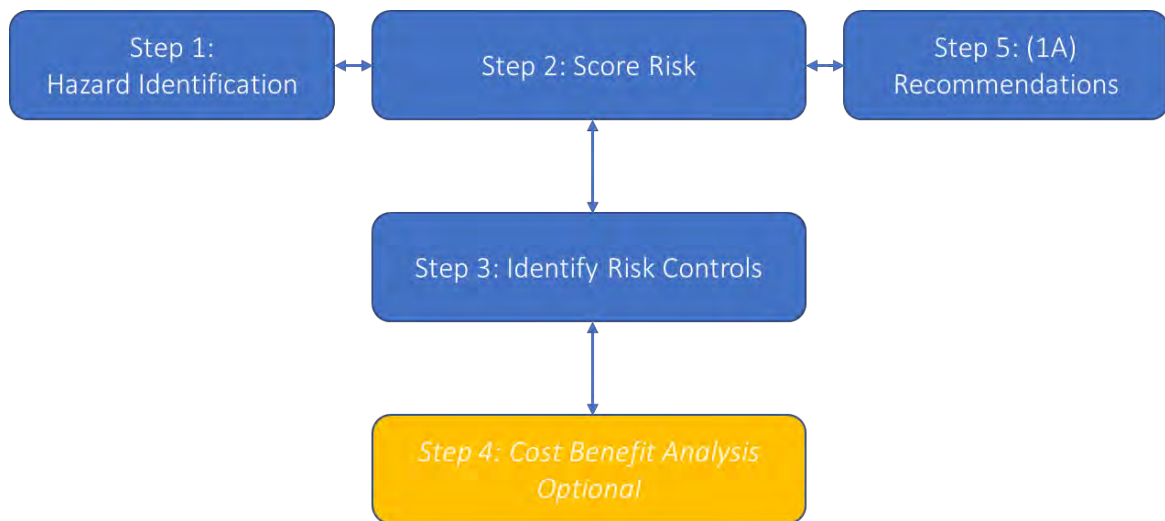
Methodology

The Addendum NRA aims to identify and quantify any change in navigational risk resulting from the TEOW project based on the submitted RLB with a defined Structures Exclusions Zone in place (see plot below).



TEOW with Structures Exclusion Zone

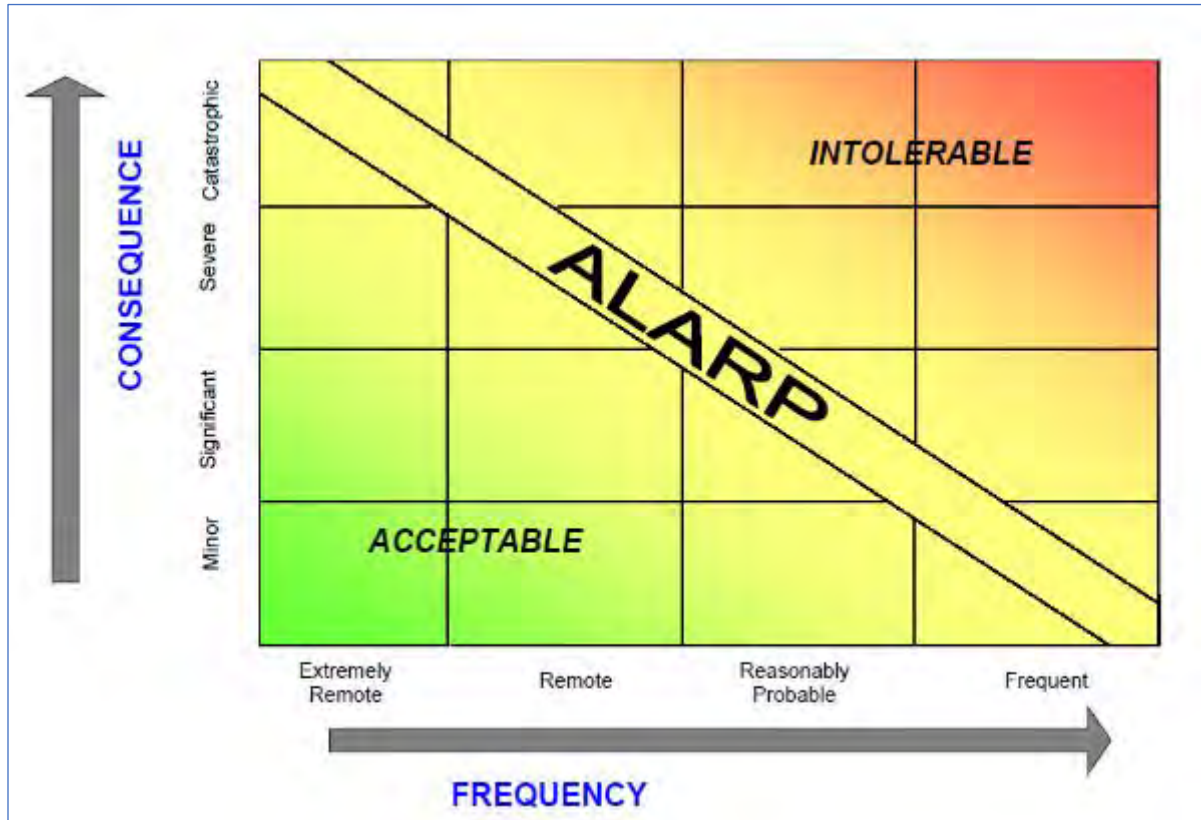
The proposed methodology is based on the International Maritime Organisation Formal Safety Assessment risk assessment methodology (see figure below) and is as documented in the original NRA and further described in Examination Deadline submissions.



Formal Safety Assessment Methodology

In summary the process starts with the identification of potential hazards. It then assesses the likelihood of a hazard occurring and considers the possible consequences of the hazard. It does so in respect of two scenarios, namely the “most likely” and the “worst credible” outcomes. The quantified values of frequency and consequence are then combined using a risk matrix (generic risk matrix shown below) to produce an individual risk score for each hazard. These are collated into a “Ranked Hazard List” from which the need for risk controls measures can be reviewed.

International Maritime Organisation (IMO) Guidelines define a hazard as “something with the potential to cause harm, loss or injury”, the realisation of which results in an accident, e.g. collision, contact and grounding.



General risk matrix.

The combination of consequence and frequency of occurrence of a hazard is combined using a risk matrix which enables hazards to be ranked and a risk score assigned (See above for generic risk matrix). The resulting scale can be divided into three general categories:

- Acceptable;
- As Low as Reasonable Practicable (ALARP); and
- Intolerable.

At the low end of the scale, frequency is extremely remote and consequence minor, and as such the risk can be said to be “acceptable”, whilst at the high end of the matrix, where hazards are defined as frequent and the consequence catastrophic, then risk is termed “intolerable”. Every effort should be made to mitigate all risks such that they lie in the “acceptable” range. Where this is not possible, they should be reduced to the level where further reduction is not practicable.

This region, at the centre of the matrix is described as the ALARP region. It is possible that some hazards will lie in the “intolerable” region, but can be mitigated by measures, which reduce their risk score and moves them into the ALARP region, where they can be tolerated, albeit efforts should continue to be made when opportunity presents itself to further reduce their risk score. The FSA methodology used in this NRA, determines where to prioritise risk control options for the navigational aspects of an offshore wind farm site.

Assessment of Risk

The assessment of risk will be undertaken as follows:

- **Baseline Risk:** Assessment of risk for the area with the current TOW in place.
- **Inherent Risk:** Assessment of risk for the area with the proposed TEOW in place including the Structures Exclusion Zone.
- **Residual Risk:** Assessment of risk for the area with the proposed TEOW in place including the Structures Exclusion Zone and any risk control or mitigation measures in place.

The following FSA Risk Assessment Steps will be undertaken for each hazard:

FSA Step	Baseline Risk	Inherent Risk	Residual Risk
1: Hazard Identification	✓	-	-
2. Hazard Scoring	✓	✓	
3. Identify and score Risk Controls	-	-	✓
4. Cost Benefit	-	-	✓
5. Recommendations	-	-	✓

FSA Step 1: Hazard Identification

Hazard identification is the first and fundamental step in the risk assessment process. A draft list is provided below and will be finalised at the Hazard Workshop.

Draft hazard list (icw = in collision with)

#	Hazard Type	Area	Haz # Collision Vls1	Workshop Priority
1	Collision	West TEOW	Class 1 & 2 Vessels icw. another vessel	Yes
2	Collision	West TEOW	Class 3 & 4 Vessels icw. another vessel	Yes
3	Collision	West TEOW	Fishing & Recreational icw. another vessel	No
4	Collision	West TEOW	WSV icw. another vessel	No
5	Collision	West TEOW	Pilot Launch icw. another vessel	Yes
6	Contact	West TEOW	Class 1 & 2 Vessels	Yes
7	Contact	West TEOW	Class 3 & 4 Vessels	Yes
8	Contact	West TEOW	Fishing & Recreational	No
9	Contact	West TEOW	WSV	No

10	Contact	West TEOW	Pilot Launch	Yes
11	Grounding	West TEOW	Class 1 & 2 Vessels	Yes
12	Grounding	West TEOW	Class 3 & 4 Vessels	Yes
13	Grounding	West TEOW	Fishing & Recreational	No
14	Grounding	West TEOW	WSV	No
15	Grounding	West TEOW	Pilot Launch	Yes

FSA Step 2: Hazard Risk Scoring

As indicated above, frequency of occurrence and likely consequence are assessed for the “most likely” and “worst credible” hazard outcome.

Frequencies are assessed according to the levels set out below – and determined based on hazard return rates.

Frequency criteria.

Scale	Description	Definition	Operational Interpretation
F5	Frequent	An event occurring in the range once a week to once an operating year.	One or more times in 1 year
F4	Likely	An event occurring in the range once a year to once every 10 operating years.	One or more times in 10 years 1 - 9 years
F3	Possible	An event occurring in the range once every 10 operating years to once in 100 operating years.	One or more times in 100 years 10 – 99 years
F2	Unlikely	An event occurring in the range less than once in 100 operating years.	One or more times in 1,000 years 100 – 999 years
F1	Remote	Considered to occur less than once in 1,000 operating years (e.g. it may have occurred at a similar site, elsewhere in the world).	Less than once in 1,000 years >1,000 years

Using the assessed notional frequency for the “most likely” and “worst credible” scenarios for each hazard, the probable consequences associated with each are assessed in terms of damage to:

- People - Personal injury, fatality etc.;
- Property – Wind farm site and third party;
- Environment - Oil pollution etc.; and
- Business - Reputation, financial loss, public relations etc.

The magnitude of each is assessed using the consequence categories given below. These have been set such that the consequences in respect of property, environment and business have similar monetary outcomes.

Consequence categories and criteria.

Cat.	People	Property	Environment	Business
C1	Negligible Possible very minor injury (e.g. bruising)	Negligible Costs <£10k	Negligible No effect of note. Tier1 <u>may</u> be declared but criteria not necessarily met. Costs <£10k	Negligible Costs <£10k
C2	Minor (single minor injury)	Minor Minor damage Costs £10k – £100k	Minor Tier 1 – Tier 2 criteria reached. Small operational (oil) spill with little effect on environmental amenity Costs £10K–£100k	Minor Bad local publicity and/or short-term loss of revenue Costs £10k – £100k
C3	Moderate Multiple minor or single major injury	Moderate Moderate damage Costs £100k - £1M	Moderate Tier 2 spill criteria reached but capable of being limited to immediate area within site Costs £100k -£1M	Moderate Bad widespread publicity Temporary suspension of operations or prolonged restrictions at wind farm Costs £100k - £1M
C4	Major Multiple major injuries or single fatality	Major Major damage Costs £1M -£10M	Major Tier 3 criteria reached with pollution requiring national support. Chemical spillage or small gas release Costs £1M - £10M	Major National publicity, Temporary closure or prolonged restrictions on wind farm operations Costs £1M -£10M
C5	Catastrophic Multiple fatalities	Catastrophic Catastrophic damage Costs >£10M	Catastrophic Tier 3 oil spill criteria reached. International support required. Widespread shoreline contamination. Serious chemical or gas release. Significant threat to environmental amenity. Costs >£10M	Catastrophic International media publicity. wind farm site closes. Operations and revenue seriously disrupted for more than two days. Ensuing loss of revenue. Costs >£10M

Risk scores are calculated using the matrix below for each individual hazard consequence for most likely and worst credible outcomes of the hazard.

Risk matrix used for hazard assessment.

Consequences	Cat 5	5.1	5.9	7.0	8.3	10.0
	Cat 4	4.1	4.9	5.9	7.4	9.4
	Cat 3	2.9	3.5	4.4	5.9	8.3
	Cat 2	1.5	1.8	2.4	3.5	5.9
	Cat 1	0	0	0	0	0
	Frequency	>1,000 years	100-1,000 years	10-100 years	1 to 10 years	Yearly

Where:

<i>Risk Number</i>	<i>Risk</i>
0 to 1.9	<i>Negligible</i>
2 to 3.9	<i>Low Risk</i>
4 to 6.9	<i>As Low as Reasonably Practical</i>
7 to 8.9	<i>Significant Risk</i>
9 to 10.0	<i>High Risk</i>

FSA Step 3: Identify Risk Controls

The project has to date identified the following risk controls, previously described as Embedded, Additional Recommended and Additional Non-recommended, which are shown below for the operational phase of the TEOW.

Mitigation measures that could be employed to reduce the inherent risk for high or ALARP level hazards either by reducing likelihood or consequence of the hazards occurring will be identified and implemented where necessary.

#	Risk Control	NRA Definition
1	Training	Embedded Risk Controls
2	ERCOP	Embedded Risk Controls
3	Promulgation/Ntm	Embedded Risk Controls
4	Reduction in RLB at PIER stage	Embedded Risk Controls
5	Aids to Navigation Plan	Embedded Risk Controls
6	Blade Clearance	Embedded Risk Controls
7	Continuous Monitoring	Embedded Risk Controls
8	Sufficient Cable/Burial Protection	Embedded Risk Controls
9	Cable Exclusion Area	Embedded Risk Controls

#	Risk Control	NRA Definition
10	Coordination with Leisure/Fishing	Additional - Recommended
11	Maintain Lines of Orientation	Additional - Recommended
12	Relocation of Buoyage	Additional - Recommended
13	Construction and Post-Construction Monitoring	Additional Not Recommended
14	Relocation of Pilot Boarding Area	Additional Not Recommended
15	Inc. Co-ordination & Sit. Awareness	Additional Not Recommended
16	Training Pilots, ESL & VTS	Additional Not Recommended

FSA Step 4: Cost Benefit

Cost benefit is an optional step of FSA process and is aimed at determining risk controls to justify As Low As Reasonable Practical (ALARP) judgements. This stage will be reviewed following the outcome of Steps 1 – 3.

FSA Step 5: Recommendations

Risk assessment recommendations will be drafted in the Addendum NRA report issued at Deadline 4a.

Supplementary Data

Vessel Traffic Data

1. Plot of vessel traffic by Class (defined by length)
2. Plot of vessel traffic by length
3. Plot of vessel traffic by type
4. Table of vessel movements at NE Spit Racon Buoy and Elbow Buoy
5. Pilotage transfer distribution plot

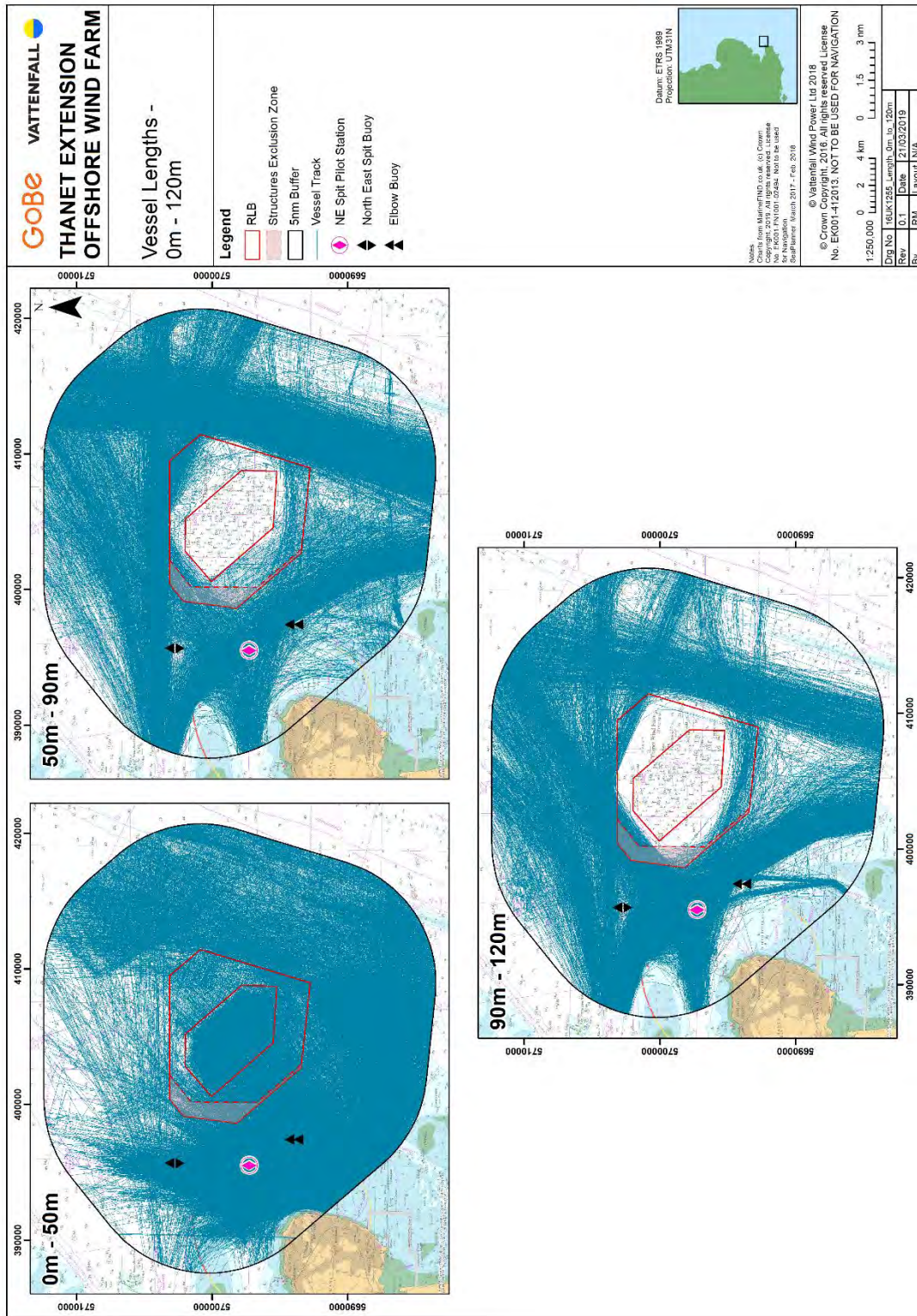
Vessel Traffic Incidents

1. MAIB incidents – plot of incidents
2. PLA / ESL incidents

Ancillary Information:

1. Port of London Authority: 2015 Safety of Navigation at North East Spit Navigation Risk Assessment
2. Details of incident involving recent Wind Farm Service Vessel – <https://www.4coffshore.com/news/updates-on-vessel-collision-nid11264.html>

Vessel Traffic Plots



Vessel Lengths -
 120m - 333m

- Legend**
- RLB
 - Structures Exclusion Zone
 - 5mm Buffer
 - Vessel Track
 - NE Spit Pilot Station
 - North East Spit Buoy
 - Elbow Buoy

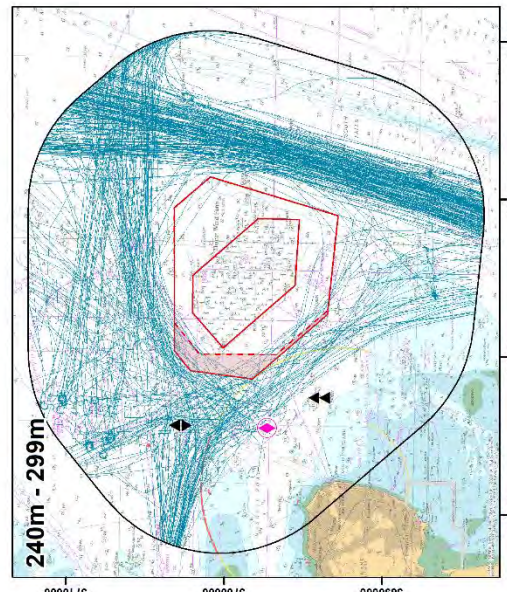
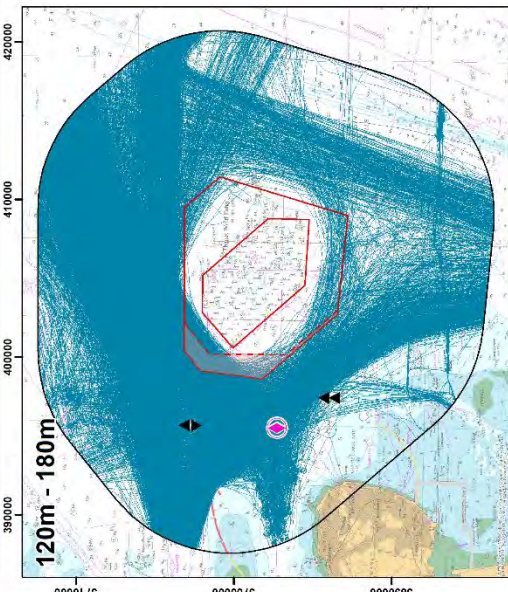
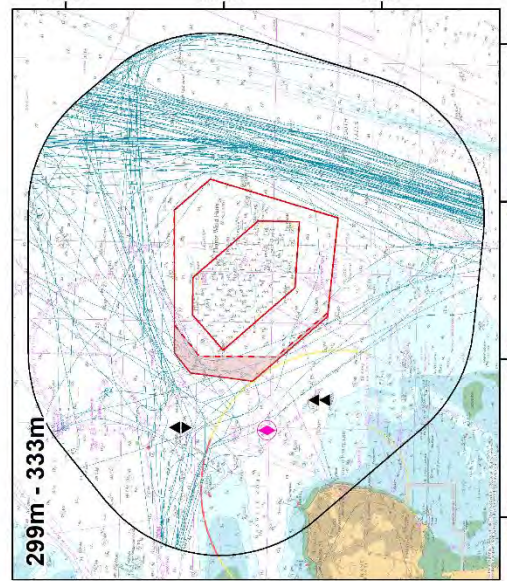
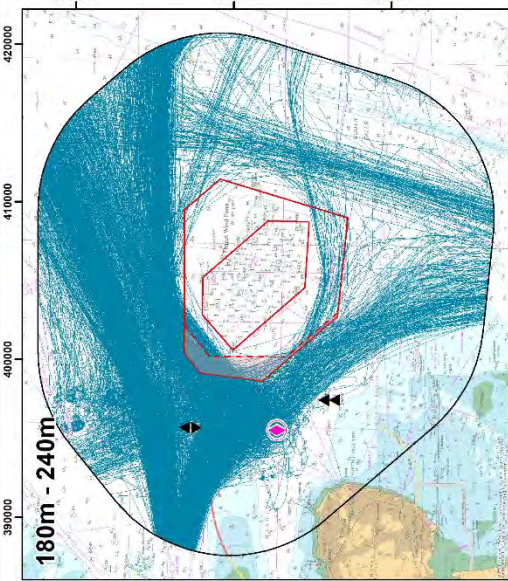


Date: ETRS 1989
 Projection: UTM31N

Notes:
 Charts from HydroUK.co.uk. © Crown Copyright. 2015. All rights reserved. License for Navigation.
 © Vattenfall Wind Power Ltd 2018
 No. EK001-41/2013. NOT TO BE USED FOR NAVIGATION

Dwg No	10007255_Layout_00_233m
Rev	01
Date	27/03/2019
By	RM
Layout	N/A

1:250,000	0	2	4	6	8	10	12	14	16	18	20



Vessel Lengths -
333m - > 400m

- Legend**
- RLB
 - Structures Exclusion Zone
 - 5nm Buffer
 - Vessel Track
 - ◆ NE Spit Pilot Station
 - ▲ North East Spit Buoy
 - ▲ Elbow Buoy

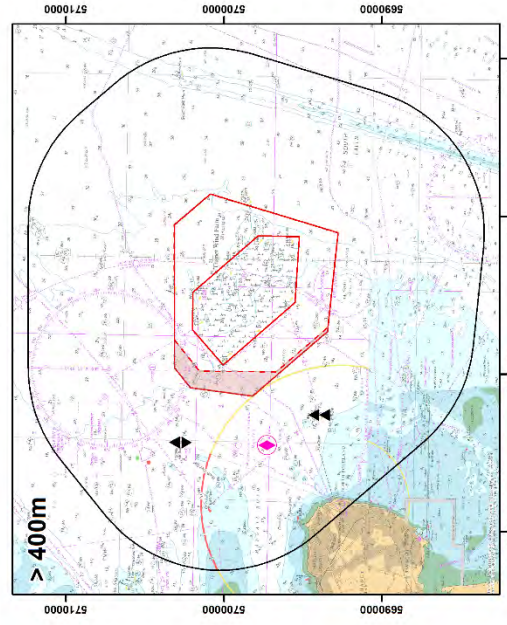
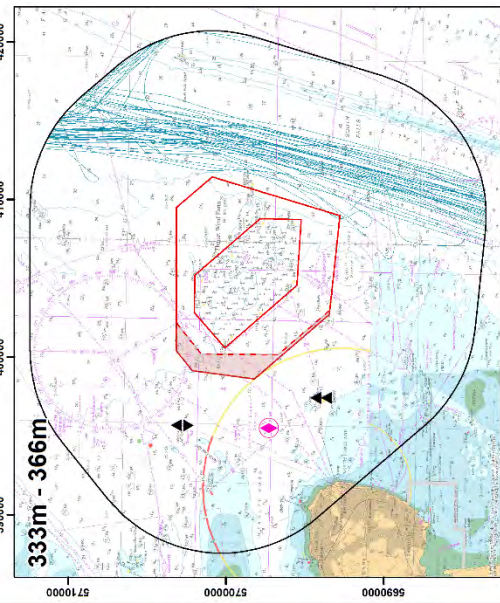
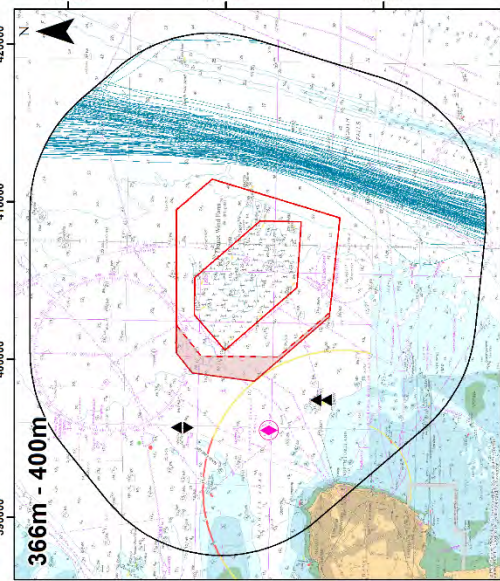


Date: ETRS 1989
 Projection: UTM31N

Notes:
 Charts from MarineFIND.co.uk. © Crown Copyright, 2016. All rights reserved. License for Navigation.
 © Crown Copyright, 2016. All rights reserved. License No. EK001-412013. NOT TO BE USED FOR NAVIGATION.
 Republished March 2017 - Feb. 2018

© Vattenfall Wind Power Ltd 2018
 © Crown Copyright, 2016. All rights reserved. License No. EK001-412013. NOT TO BE USED FOR NAVIGATION

DWG No	10007255_Length_333m_to_400m
Rev	01
Date	27/03/2019
By	RN
Layout	N/A



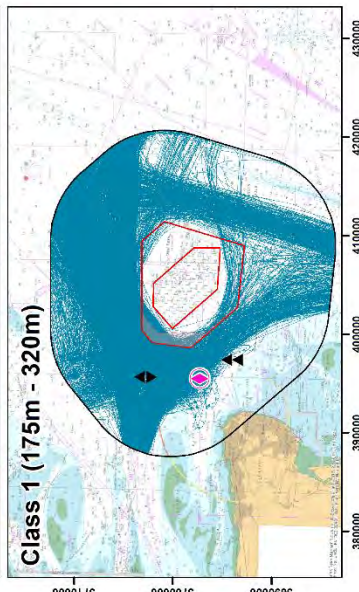
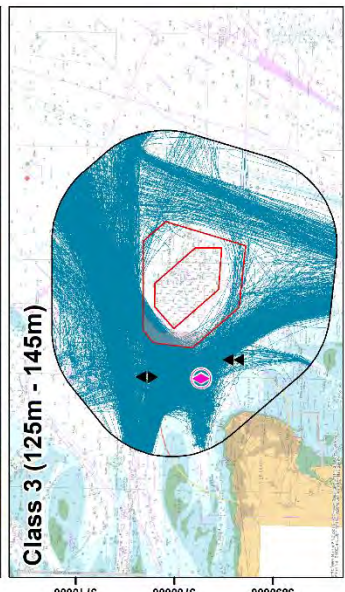
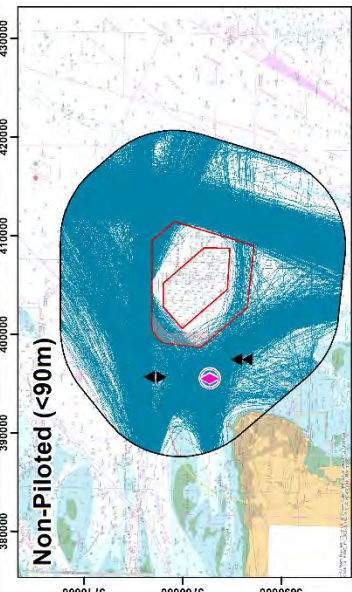
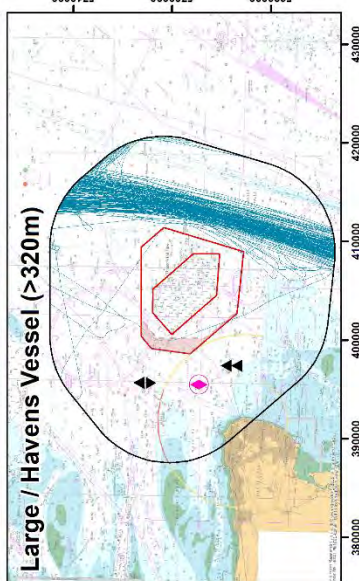
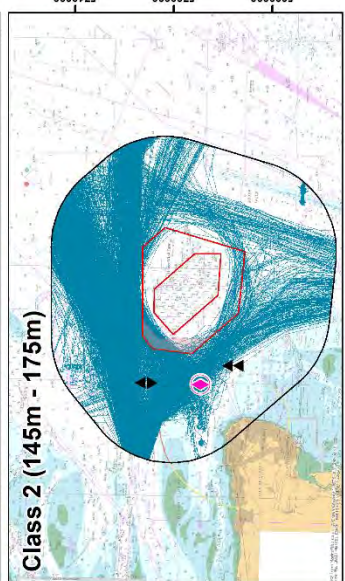
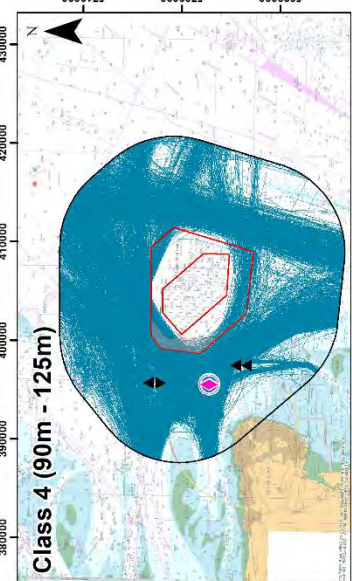
Commercial By Pilotage Class

- Legend**
- RLB
 - Structures Exclusion Zone
 - 5nm Buffer
 - Vessel Track
 - NE Spit Pilot Station
 - North East Spit Buoy
 - Elbow Buoy



© Vattenfall Wind Power Ltd 2018
 © Crown Copyright, 2016. All rights reserved. License No. EK001-41/2013. NOT TO BE USED FOR NAVIGATION

Draw No	17057/255 Commercial Wind Vessels
Rev	01
Date	26/03/2019
By	RNI
Layout	N/A



Scale: 1:400,000
 Datum: ETRS 1989
 Projection: UTM31N

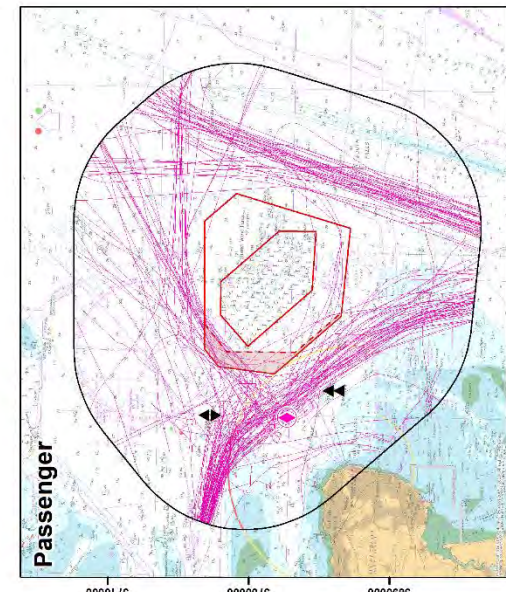
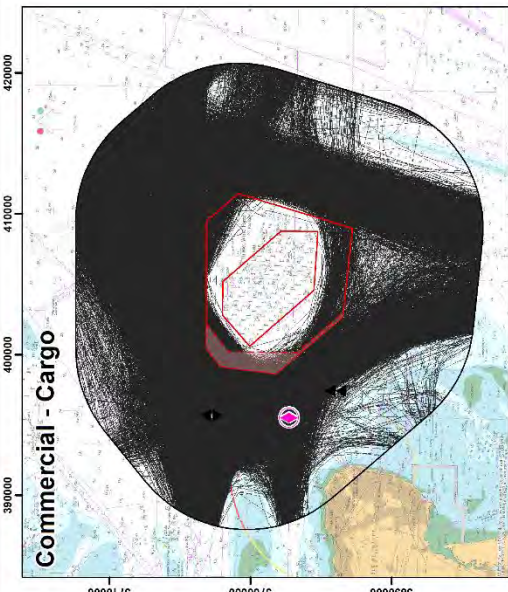
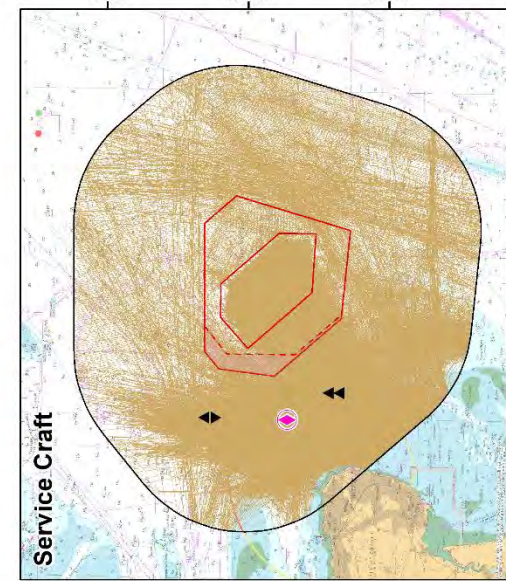
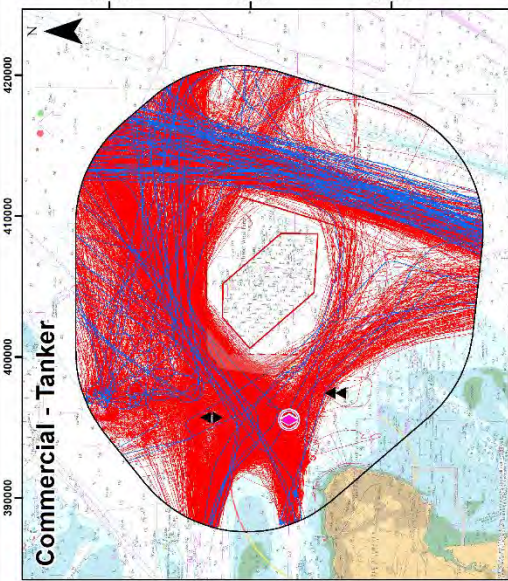
Vessel Types - Cargo, Tanker, Passenger & Service Craft

- Legend**
- RLB
 - Structures Exclusion Zone
 - 5nm Buffer
 - NE Spit Pilot Station
 - North East Spit Buoy
 - Elbow Buoy
- Vessel Types**
- Commercial - Cargo
 - Commercial - Tanker
 - Commercial - LNG / LPG Tanker
 - Passenger
 - Service Craft



© Vattenfall Wind Power Ltd 2018
 © Crown Copyright, 2016. All rights reserved. License No. EK001-41/2013. NOT TO BE USED FOR NAVIGATION

DWG No	160KX755 - Vessel Types 1
Rev	01
Date	21/03/2019
By	RM
Layout	N/A



Vessel Types - Fishing, Recreation, Dredgers & Military

- Legend**
- RLB
 - Structures Exclusion Zone
 - 5nm Buffer
 - NE Spit Pilot Station
 - North East Spit Buoy
 - Elbow Buoy
- Vessel Types**
- Fishing
 - Recreation
 - Dredger
 - Military

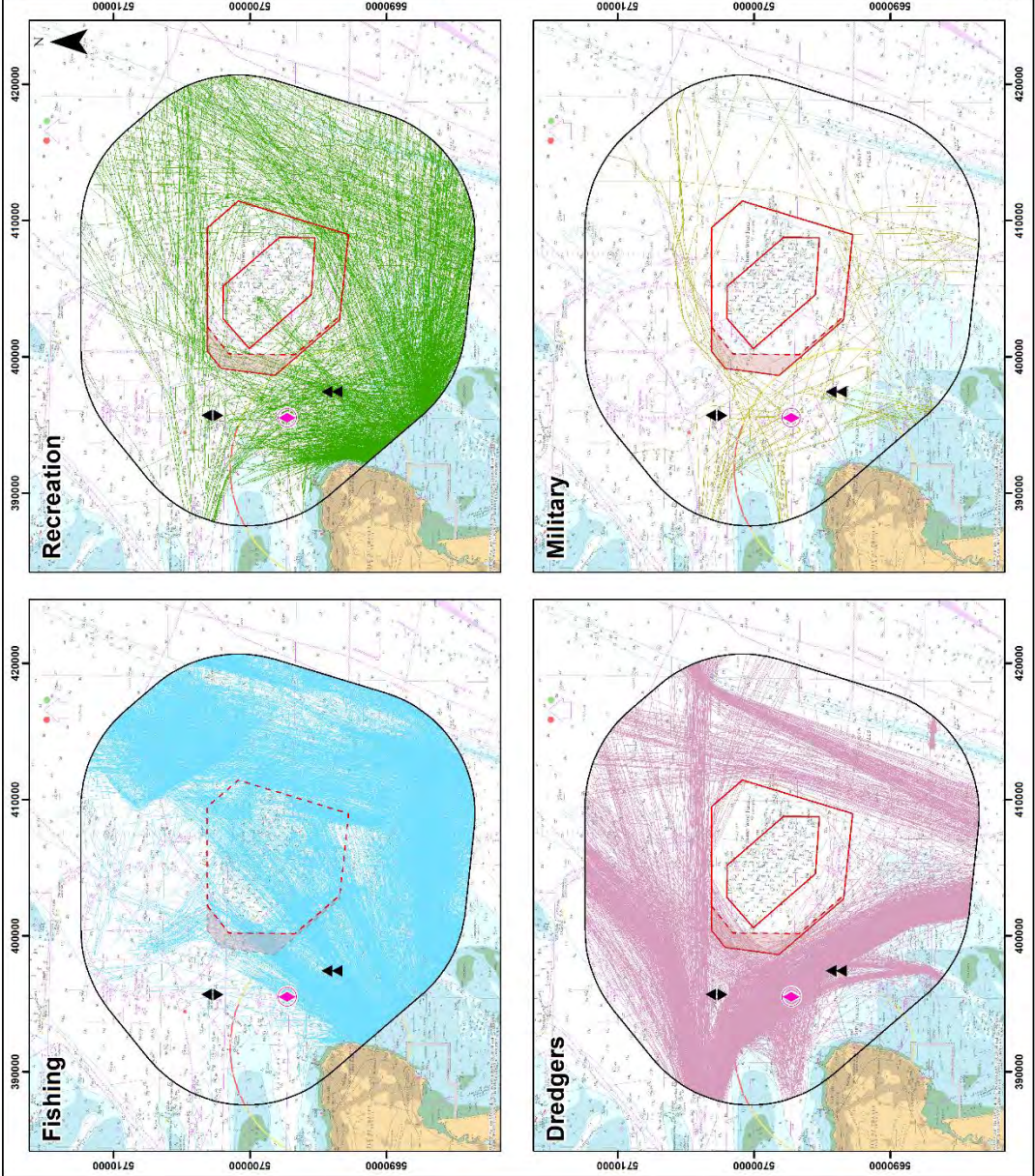
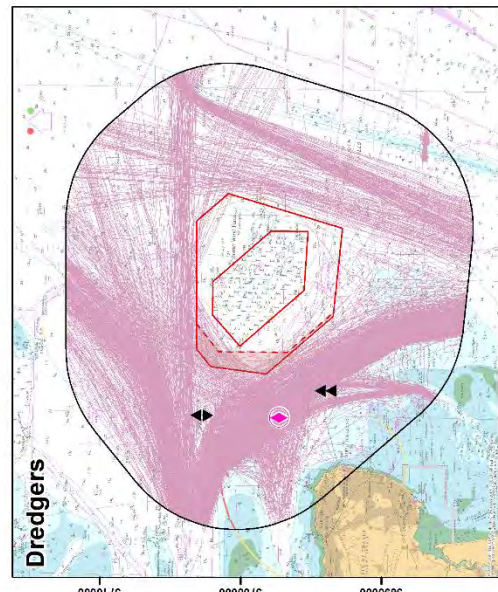
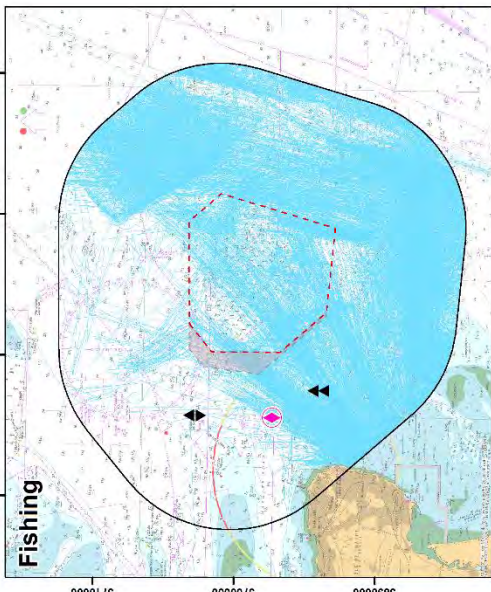
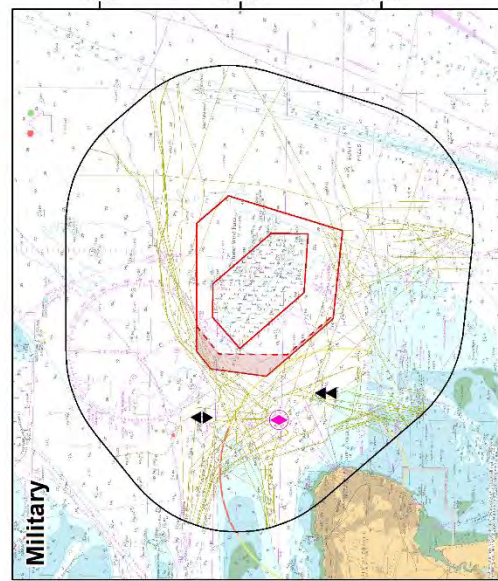
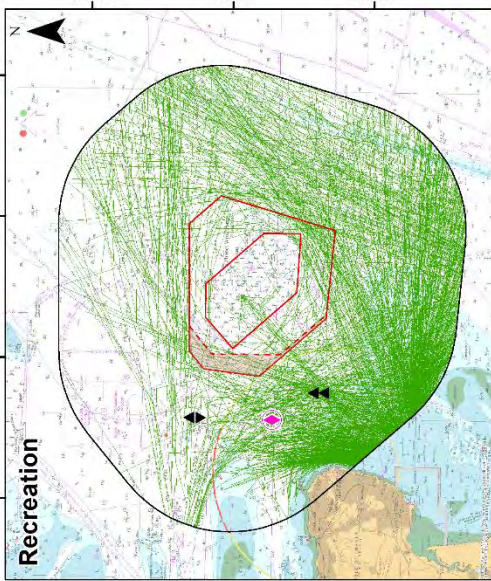


Date: ETRS 1989
 Projection: UTM31N

Charts from Admiralty to UK (© Crown Copyright, 2016. All rights reserved. License for Navigation. Supersedes March 2017 - Feb. 2018)

© Vattenfall Wind Power Ltd 2018
 © Crown Copyright, 2016. All rights reserved. License No. EK001-41/2013. NOT TO BE USED FOR NAVIGATION

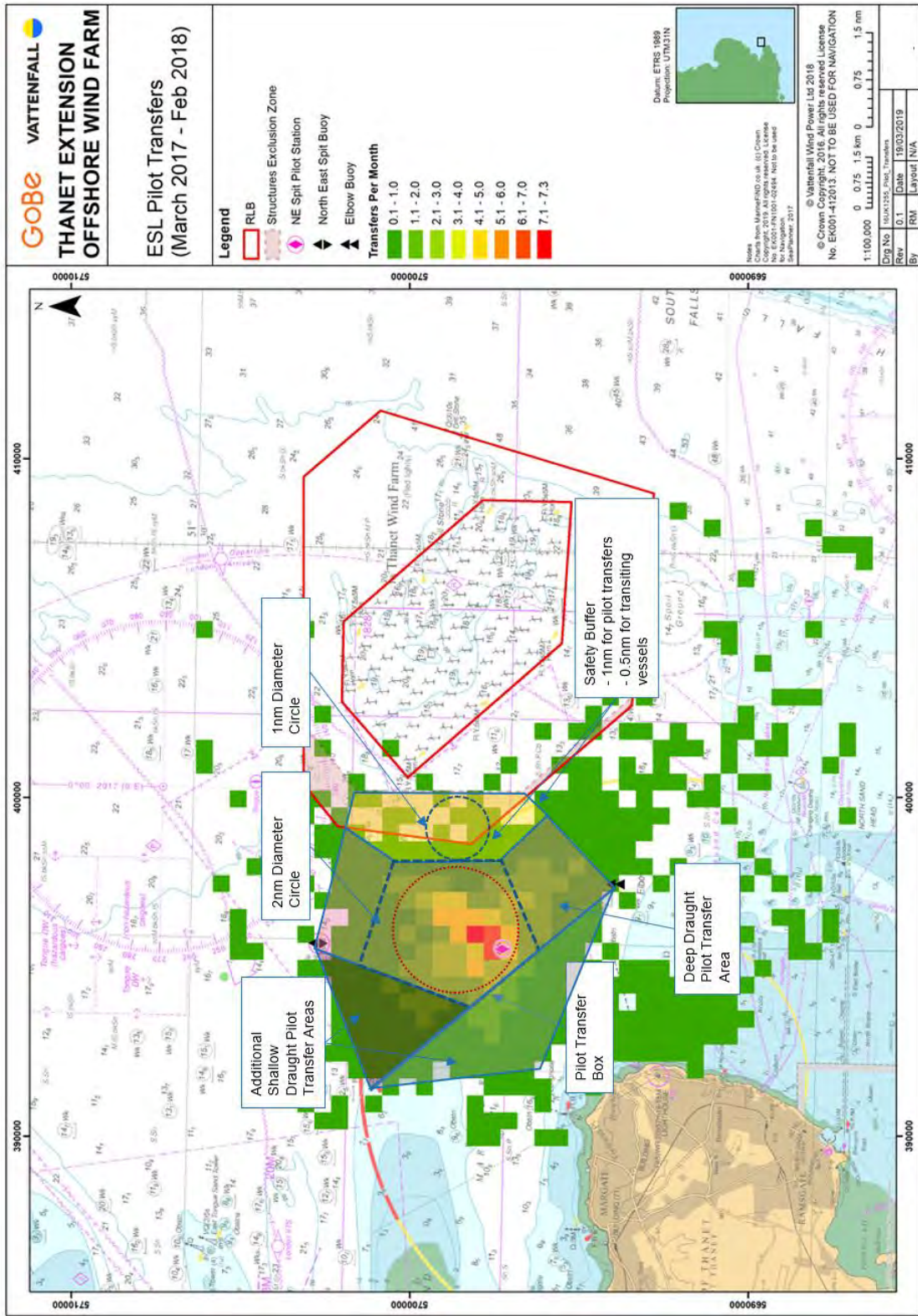
DWG No	160K155 - Vessel Types 2
Rev	01
Date	21/03/2019
By	RM
Layout	N/A



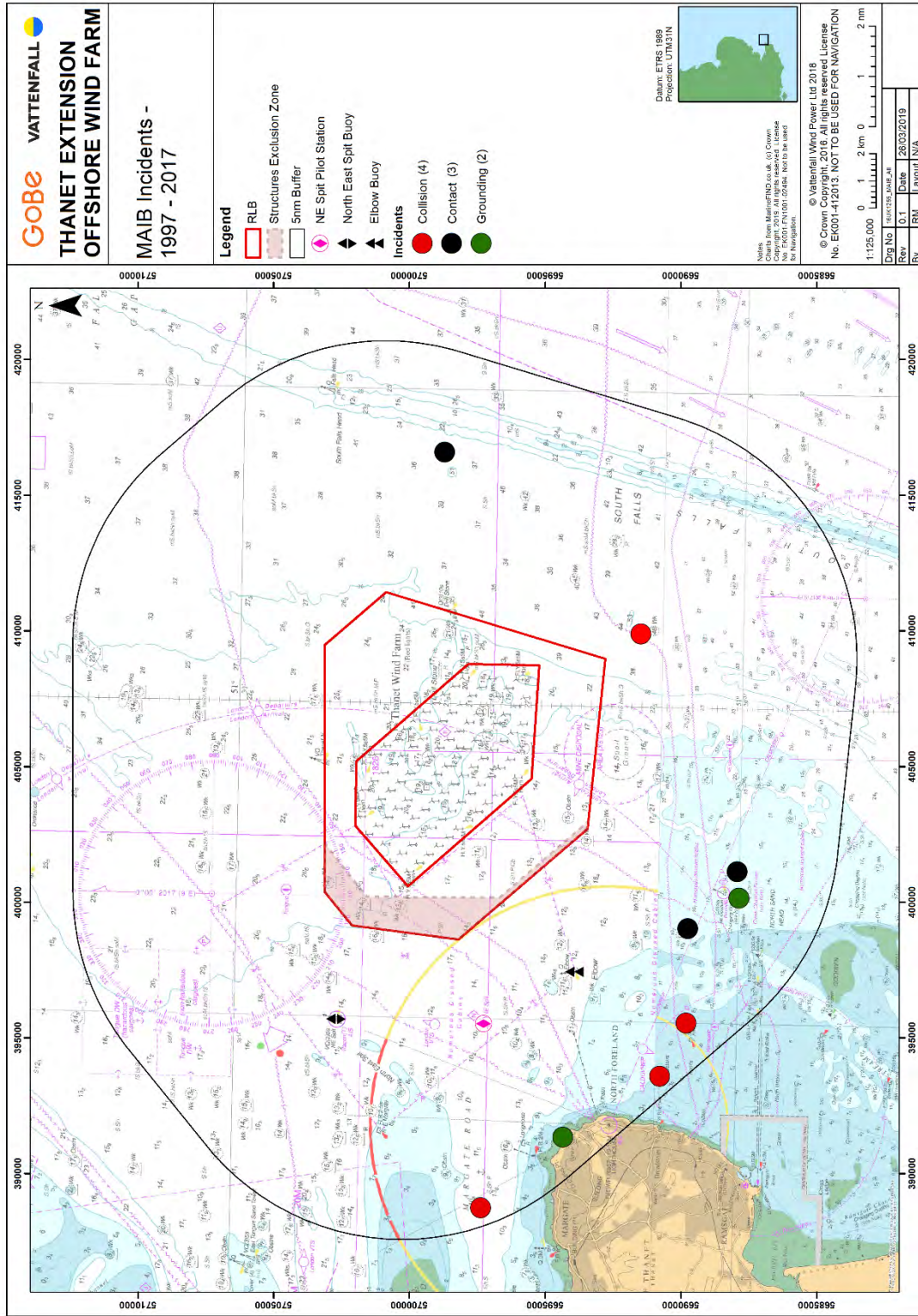
Vessel traffic counts based on AIS data

Elbow Buoy to RLB/SEZ			NE Spit Buoy to RLB/SEZ		
Ship Length [m]	March 2017 - Feb 2018		Ship Length [m]	March 2017 - Feb 2018	
	No	%		No	%
0 – 50	433	11%	0 – 50	554	11%
50 – 90	790	20%	50 – 90	421	8%
90 – 120	1523	38%	90 – 120	1089	22%
120 – 180	885	22%	120 – 180	2049	41%
180 – 240	293	7%	180 – 240	790	16%
240 - 299	44	1%	240 - 299	65	1%
299 - 333	10	0%	299 - 333	13	0%
333 - 366	0	0%	333 - 366	0	0%
366 - 400	0	0%	366 - 400	0	0%
400 -	0	0%	400 -	0	0%
Total	3978		Total	4981	
*180 (<5%) tracks missing length			*126 (<3%) tracks missing length		

Pilotage Transfer Plot based on Pilot Launch speeds



MAIB Incidents



MAIB Accidents (Collision, Contact, Grounding – 5nm of TOW)

Date Of Casualty	Type	Lat_DD	Long_DD	Vessel Type	Length Overall	Damage	Pollution Caused
11/10/1997	Collision	51.35	1.5	Fishing vessel	9.98	Material Damage	
02/11/1998	Grounding	51.3333333	1.56666667	Ro-ro/lo-lo, freight only (< 12 drivers)	109.71		
08/04/2001	Contact	51.4333333	1.8	Cargo ship	77.63	Material Damage	
24/05/2003	Collision	51.3583333	1.47166667	Recreational craft	0.01	Material Damage	
18/11/2004	Grounding	51.39	1.43833333	Cargo ship	96.17	Minor Damage	
15/12/2008	Collision	51.4166667	1.4	Tanker	109.1	Minor Damage	No
23/05/2010	Contact	51.35	1.55	Cargo ship	91.44	No Damage	No
27/05/2012	Contact Floating object	51.334	1.58066667	Sailboat (sail only)	13.1	Damage - Minor	
13/11/2016	Collision	51.367333	1.7055	Recreational craft	8.48	Damage - Minor	

PLA NE Spit Incidents (9 years of data – presented as frequency per year)

Frequency [Year] Incident Synopsis Category	East Margate Buoy	Margate Roads Anchorage	NE Spit Deep Water Pilot Boarding/Landing	NE Spit Pilot Boarding/ Landing	North East Spit	Toungue Anchorage	Toungue Sand Towers	Total [yr]
Pilot Ladder Deficiency	-	-	-	3.4	2.6	-	-	6.0
Other	0.1	0.1	0.2	0.1	0.1	-	-	0.7
Navigation Equipment Failure	0.1	0.1	-	0.1	-	-	-	0.3
Near Miss Collision	0.1	-	-	0.6	0.3	0.1	0.1	1.2
Fishing in Channel	-	-	-	-	-	-	0.1	0.1
Mechanical Failure	0.1	0.1	-	0.4	0.3	0.1	0.4	1.6
Near Miss Grounding	0.1	-	0.1	0.1	-	0.1	-	0.4
Personal Injury	-	-	-	0.1	0.1	-	-	0.2
Near Miss	-	-	-	-	-	-	0.1	0.1
Hull Failure	-	0.1	-	-	-	-	-	0.1
Total [yr]	0.6	0.4	0.3	4.9	3.4	0.3	0.8	10.8

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place			Risk Reduction							Results	Control Actionee	Complete		
										Likelihood	Consequence	Baseline Risk	Risk Control ID	Additional Risk Control (RC) Measures	Cross-reference Consequence Likelihood	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Residual Risk Score with RC in place					
																			Likelihood Return Period [yr]				Consequence Cost [£]	Cumulative Risk Score
1	1	2			Collision during or preparing for Pilot boarding/landing operations		Damage to vessels		Inappropriate Pilot Cutter scheduling	3	4	12.0		Baseline with no additional risk controls					10.0	£1,000,000	12.0	Baseline Risk		
							Pollution (Tier 2)		Inadequate traffic management				1	ESL/PLA/MPA Pilot cutter scheduling and monitoring process	Yes	60%	20%	25.0	£800,000	10.2	12.0			
							Minor to moderate injuries		Failure to apply COLREGS				2	Coordination of Pilot cutter operations on VHF Ch 69	Yes	60%	60%	62.4	£320,000	7.7				
							Reputational harm		Conflict with other vessels boarding/landing/transiting				3	Where practicable, prioritise embarking vessels	Yes	40%	20%	104.0	£256,000	6.8	Baseline Level			
							Corporate liability		Loss of situational awareness (including radar interference)				4	Planning of critical/high risk vessels with ESL/Pilot/VTS	Yes	10%	20%	115.6	£204,800	6.4	High			
							Disruption to port operations		Inadequate/insufficient passage planning				5	Additional met sensors closer to NES	Yes	5%	5%	121.7	£194,560	6.3				
									Use of inappropriate Pilot boarding/landing position				6	Provision of charted Pilot boarding grounds to enhance traffic separation	Yes	30%	20%	173.8	£155,648	5.6	Residual Risk			
									Mechanical failure				7	Prohibited anchorage area	Yes	10%	5%	193.1	£147,866	5.4	5.3			
									Onboard deficiency				8	Additional advice in Admiralty products	Yes	10%	0%	214.6	£147,866	5.3				
									Adverse weather conditions				9	Dedicated VTS Operator	No	70%	40%	214.6	£147,866	5.3				
													10		No	0%	0%	214.6	£147,866	5.3	Residual Level			
													11		No	0%	0%	214.6	£147,866	5.3	Moderate			
													12		No	0%	0%	214.6	£147,866	5.3				
													13		No	0%	0%	214.6	£147,866	5.3	Risk Reduction			
													14		No	0%	0%	214.6	£147,866	5.3	6.7			
													15		No	0%	0%	214.6	£147,866	5.3				
													16		No	0%	0%	214.6	£147,866	5.3				
													17		No	0%	0%	214.6	£147,866	5.3				
													18		No	0%	0%	214.6	£147,866	5.3				
													19		No	0%	0%	214.6	£147,866	5.3				
													20		No	0%	0%	214.6	£147,866	5.3				
													21		No	0%	0%	214.6	£147,866	5.3				
													22		No	0%	0%	214.6	£147,866	5.3				
													23		No	0%	0%	214.6	£147,866	5.3				
													24		No	0%	0%	214.6	£147,866	5.3				
													25		No	0%	0%	214.6	£147,866	5.3				
													26		No	0%	0%	214.6	£147,866	5.3				
													27		No	0%	0%	214.6	£147,866	5.3				
													28		No	0%	0%	214.6	£147,866	5.3				
													29		No	0%	0%	214.6	£147,866	5.3				
													30		No	0%	0%	214.6	£147,866	5.3				
													31		No	0%	0%	214.6	£147,866	5.3				
													32		No	0%	0%	214.6	£147,866	5.3				
													33		No	0%	0%	214.6	£147,866	5.3				
													34		No	0%	0%	214.6	£147,866	5.3				
													35		No	0%	0%	214.6	£147,866	5.3				
													36		No	0%	0%	214.6	£147,866	5.3				
													37		No	0%	0%	214.6	£147,866	5.3				
													38		No	0%	0%	214.6	£147,866	5.3				
													39		No	0%	0%	214.6	£147,866	5.3				
				40		No	0%	0%	214.6	£147,866	5.3													

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place			Risk Reduction							Results	Control Actionee	Complete		
										Likelihood	Consequence	Baseline Risk	Risk Control ID.	Additional Risk Control (RC) Measures	Cross-reference Consequence Likelihood	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Residual Risk Score with RC in place					
																			Likelihood Return Period [yr]				Consequence Cost [£]	Cumulative Risk Score
2	2	1			Collision between vessels in transit		Damage to vessels		Failure to apply COLREGS	2	4	8.0		Baseline with no additional risk controls					100.0	£1,000,000	8.0	Baseline Risk		
							Pollution (Tier 2)		Inadequate traffic management				1	Precautionary area/exclamation mark	No	20%	5%	100.0	£1,000,000	8.0	8.0			
							Minor to moderate injuries		Loss of situational awareness (including radar interference)				2	Enhanced Pilotage/PEC navigational guidance/lessons identified	Yes	10%	0%	111.1	£1,000,000	7.8				
							Reputational harm		Inadequate/insufficient passage planning				3	Additional advice in Admiralty products	Yes	10%	0%	123.5	£1,000,000	7.6	Baseline Level			
							Corporate liability		Conflict with other vessels boarding/landing/transiting				4	Single channel VHF operations	Yes	60%	30%	308.6	£700,000	5.8	Moderate			
							Disruption to port operations		Use of inappropriate Pilot boarding/landing position				5	Prohibited anchorage area/control of anchorage	Yes	5%	5%	324.9	£665,000	5.7				
									Mechanical failure				6	Where practicable, prioritise embarking vessels	Yes	10%	10%	361.0	£598,500	5.4	Residual Risk			
									Onboard deficiency				7	Dedicated VTS Operator	No	50%	30%	361.0	£598,500	5.4	5.4			
									Adverse weather conditions				8		No	0%	0%	361.0	£598,500	5.4				
													9		No	0%	0%	361.0	£598,500	5.4				
													10		No	0%	0%	361.0	£598,500	5.4	Residual Level			
													11		No	0%	0%	361.0	£598,500	5.4	Moderate			
													12		No	0%	0%	361.0	£598,500	5.4				
													13		No	0%	0%	361.0	£598,500	5.4	Risk Reduction			
													14		No	0%	0%	361.0	£598,500	5.4	2.6			
													15		No	0%	0%	361.0	£598,500	5.4				
													16		No	0%	0%	361.0	£598,500	5.4				
													17		No	0%	0%	361.0	£598,500	5.4				
													18		No	0%	0%	361.0	£598,500	5.4				
													19		No	0%	0%	361.0	£598,500	5.4				
													20		No	0%	0%	361.0	£598,500	5.4				
													21		No	0%	0%	361.0	£598,500	5.4				
													22		No	0%	0%	361.0	£598,500	5.4				
													23		No	0%	0%	361.0	£598,500	5.4				
													24		No	0%	0%	361.0	£598,500	5.4				
													25		No	0%	0%	361.0	£598,500	5.4				
													26		No	0%	0%	361.0	£598,500	5.4				
													27		No	0%	0%	361.0	£598,500	5.4				
													28		No	0%	0%	361.0	£598,500	5.4				
													29		No	0%	0%	361.0	£598,500	5.4				
													30		No	0%	0%	361.0	£598,500	5.4				
													31		No	0%	0%	361.0	£598,500	5.4				
													32		No	0%	0%	361.0	£598,500	5.4				
													33		No	0%	0%	361.0	£598,500	5.4				
													34		No	0%	0%	361.0	£598,500	5.4				
													35		No	0%	0%	361.0	£598,500	5.4				
													36		No	0%	0%	361.0	£598,500	5.4				
													37		No	0%	0%	361.0	£598,500	5.4				
													38		No	0%	0%	361.0	£598,500	5.4				
													39		No	0%	0%	361.0	£598,500	5.4				
				40		No	0%	0%	361.0	£598,500	5.4													

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place			Risk Reduction									Results	Control Actionee	Complete
										Likelihood	Consequence	Baseline Risk	Risk Control ID.	Additional Risk Control (RC) Measures	Cross-reference Consequence Likelihood	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Residual Risk Score with RC in place					
																			Likelihood Return Period [yr]	Consequence Cost [£]	Cumulative Risk Score			
3	5	4			Contact with anchored vessel		Damage to vessels		Failure to apply COLREGS	1	3	3.0		Baseline with no additional risk controls				1000.0	£100,000	3.0	Baseline Risk			
							Pollution (Tier 2)		Inadequate traffic management				1	Modification of Tongue Anchorage location	No	20%	0%	1000.0	£100,000	3.0	3.0			
							Minor to moderate injuries		Vessels anchored close to prevailing traffic flows				2	Formal charting of Margate Roads Anchorage	No	10%	0%	1000.0	£100,000	3.0				
							Reputational harm		High density of vessels anchored due to adverse weather				3		No	0%	0%	1000.0	£100,000	3.0	Baseline Level			
							Corporate liability		Inadequate/insufficient passage planning				4		No	0%	0%	1000.0	£100,000	3.0	Minor			
									Loss of situational awareness (including radar interference)				5		No	0%	0%	1000.0	£100,000	3.0				
									Conflict with other vessels boarding/landing/transiting				6		No	0%	0%	1000.0	£100,000	3.0	Residual Risk			
									Use of inappropriate Pilot boarding/landing position				7		No	0%	0%	1000.0	£100,000	3.0	3.0			
									Mechanical failure				8		No	0%	0%	1000.0	£100,000	3.0				
									Onboard deficiency				9		No	0%	0%	1000.0	£100,000	3.0				
									Adverse weather conditions				10		No	0%	0%	1000.0	£100,000	3.0	Residual Level			
													11		No	0%	0%	1000.0	£100,000	3.0	Minor			
													12		No	0%	0%	1000.0	£100,000	3.0				
													13		No	0%	0%	1000.0	£100,000	3.0	Risk Reduction			
													14		No	0%	0%	1000.0	£100,000	3.0	0.0			
													15		No	0%	0%	1000.0	£100,000	3.0				
													16		No	0%	0%	1000.0	£100,000	3.0				
													17		No	0%	0%	1000.0	£100,000	3.0				
													18		No	0%	0%	1000.0	£100,000	3.0				
													19		No	0%	0%	1000.0	£100,000	3.0				
													20		No	0%	0%	1000.0	£100,000	3.0				
													21		No	0%	0%	1000.0	£100,000	3.0				
													22		No	0%	0%	1000.0	£100,000	3.0				
													23		No	0%	0%	1000.0	£100,000	3.0				
													24		No	0%	0%	1000.0	£100,000	3.0				
													25		No	0%	0%	1000.0	£100,000	3.0				
													26		No	0%	0%	1000.0	£100,000	3.0				
													27		No	0%	0%	1000.0	£100,000	3.0				
													28		No	0%	0%	1000.0	£100,000	3.0				
													29		No	0%	0%	1000.0	£100,000	3.0				
													30		No	0%	0%	1000.0	£100,000	3.0				
													31		No	0%	0%	1000.0	£100,000	3.0				
													32		No	0%	0%	1000.0	£100,000	3.0				
													33		No	0%	0%	1000.0	£100,000	3.0				
													34		No	0%	0%	1000.0	£100,000	3.0				
													35		No	0%	0%	1000.0	£100,000	3.0				
													36		No	0%	0%	1000.0	£100,000	3.0				
													37		No	0%	0%	1000.0	£100,000	3.0				
													38		No	0%	0%	1000.0	£100,000	3.0				
													39		No	0%	0%	1000.0	£100,000	3.0				
				40		No	0%	0%	1000.0	£100,000	3.0													

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place			Risk Reduction							Results	Control Actionee	Complete		
										Likelihood	Consequence	Baseline Risk	Risk Control ID.	Additional Risk Control (RC) Measures	Cross-reference Consequence Likelihood	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Residual Risk Score with RC in place					
																			Likelihood Return Period [yr]				Consequence Cost [£]	Cumulative Risk Score
4	5	4			Contact with windfarm or other fixed structure		Damage to vessels	Failure to apply COLREGS	1	3	3.0	Baseline with no additional risk controls						1000.0	£100,000	3.0	Baseline Risk			
							Pollution (Tier 2)	Inadequate traffic management				1	Use of encounter prediction VTS software	No	60%	5%	1000.0	£100,000	3.0	3.0				
							Minor to moderate injuries	Inadequate/insufficient passage planning				2		No	0%	0%	1000.0	£100,000	3.0	Baseline Level				
							Reputational harm	Loss of situational awareness (including radar interference)				3		No	0%	0%	1000.0	£100,000	3.0	Minor				
							Corporate liability	Use of inappropriate Pilot boarding/landing position				4		No	0%	0%	1000.0	£100,000	3.0					
							Damage to infrastructure	Mechanical failure				5		No	0%	0%	1000.0	£100,000	3.0	Residual Risk				
								Onboard deficiency				6		No	0%	0%	1000.0	£100,000	3.0	3.0				
								Adverse weather conditions				7		No	0%	0%	1000.0	£100,000	3.0					
												8		No	0%	0%	1000.0	£100,000	3.0					
												9		No	0%	0%	1000.0	£100,000	3.0					
												10		No	0%	0%	1000.0	£100,000	3.0	Residual Level				
												11		No	0%	0%	1000.0	£100,000	3.0	Minor				
												12		No	0%	0%	1000.0	£100,000	3.0					
												13		No	0%	0%	1000.0	£100,000	3.0	Risk Reduction				
												14		No	0%	0%	1000.0	£100,000	3.0	0.0				
												15		No	0%	0%	1000.0	£100,000	3.0					
												16		No	0%	0%	1000.0	£100,000	3.0					
												17		No	0%	0%	1000.0	£100,000	3.0					
												18		No	0%	0%	1000.0	£100,000	3.0					
												19		No	0%	0%	1000.0	£100,000	3.0					
												20		No	0%	0%	1000.0	£100,000	3.0					
												21		No	0%	0%	1000.0	£100,000	3.0					
												22		No	0%	0%	1000.0	£100,000	3.0					
												23		No	0%	0%	1000.0	£100,000	3.0					
												24		No	0%	0%	1000.0	£100,000	3.0					
												25		No	0%	0%	1000.0	£100,000	3.0					
												26		No	0%	0%	1000.0	£100,000	3.0					
												27		No	0%	0%	1000.0	£100,000	3.0					
												28		No	0%	0%	1000.0	£100,000	3.0					
												29		No	0%	0%	1000.0	£100,000	3.0					
												30		No	0%	0%	1000.0	£100,000	3.0					
												31		No	0%	0%	1000.0	£100,000	3.0					
												32		No	0%	0%	1000.0	£100,000	3.0					
												33		No	0%	0%	1000.0	£100,000	3.0					
												34		No	0%	0%	1000.0	£100,000	3.0					
												35		No	0%	0%	1000.0	£100,000	3.0					
												36		No	0%	0%	1000.0	£100,000	3.0					
												37		No	0%	0%	1000.0	£100,000	3.0					
												38		No	0%	0%	1000.0	£100,000	3.0					
												39		No	0%	0%	1000.0	£100,000	3.0					
		40		No	0%	0%	1000.0	£100,000	3.0															

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place			Risk Reduction							Results	Control Actionee	Complete					
										Likelihood	Consequence	Baseline Risk	Risk Control ID.	Additional Risk Control (RC) Measures	Cross-reference Consequence Likelihood	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Residual Risk Score with RC in place								
																			Likelihood Return Period [yr]				Consequence Cost [£]	Cumulative Risk Score			
5	3	6			Grounding of a vessel not at anchor		Damage to vessels		Inadequate/insufficient passage planning					Baseline with no additional risk controls					100.0	£100,000	6.0	Baseline Risk					
							Pollution (Tier 2)		Inadequate traffic management			1	ESL/PLA/MPA Pilot cutter scheduling and monitoring process		Yes	50%	10%				200.0	£90,000	5.0	6.0			
							Minor to moderate injuries		Use of inappropriate Pilot boarding/landing position			2	Where practicable, prioritise embarking vessels		Yes	40%	30%				333.3	£63,000	4.1				
							Reputational harm		Loss of situational awareness (including radar interference)			3	Planning of critical/high risk vessels with ESL/Pilot/VTS		Yes	80%	20%				1000.0	£50,400	2.7	Baseline Level			
							Corporate liability		Action taken to avoid collision			4			No	0%	0%				1000.0	£50,400	2.7	Moderate			
							Disruption to port operations		Mechanical failure			5			No	0%	0%				1000.0	£50,400	2.7				
												6	Onboard deficiency			No	0%	0%				1000.0	£50,400	2.7	Residual Risk		
												7	Adverse weather conditions			No	0%	0%				1000.0	£50,400	2.7	2.7		
												8			No	0%	0%				1000.0	£50,400	2.7				
												9			No	0%	0%				1000.0	£50,400	2.7				
												10				No	0%	0%				1000.0	£50,400	2.7	Residual Level		
												11				No	0%	0%				1000.0	£50,400	2.7	Minor		
												12				No	0%	0%				1000.0	£50,400	2.7			
												13				No	0%	0%				1000.0	£50,400	2.7	Risk Reduction		
												14				No	0%	0%				1000.0	£50,400	2.7	3.3		
												15				No	0%	0%				1000.0	£50,400	2.7			
												16				No	0%	0%				1000.0	£50,400	2.7			
												17				No	0%	0%				1000.0	£50,400	2.7			
												18				No	0%	0%				1000.0	£50,400	2.7			
												19				No	0%	0%				1000.0	£50,400	2.7			
												20				No	0%	0%				1000.0	£50,400	2.7			
												21				No	0%	0%				1000.0	£50,400	2.7			
												22				No	0%	0%				1000.0	£50,400	2.7			
												23				No	0%	0%				1000.0	£50,400	2.7			
												24				No	0%	0%				1000.0	£50,400	2.7			
												25				No	0%	0%				1000.0	£50,400	2.7			
												26				No	0%	0%				1000.0	£50,400	2.7			
												27				No	0%	0%				1000.0	£50,400	2.7			
												28				No	0%	0%				1000.0	£50,400	2.7			
												29				No	0%	0%				1000.0	£50,400	2.7			
												30				No	0%	0%				1000.0	£50,400	2.7			
												31				No	0%	0%				1000.0	£50,400	2.7			
												32				No	0%	0%				1000.0	£50,400	2.7			
												33				No	0%	0%				1000.0	£50,400	2.7			
												34				No	0%	0%				1000.0	£50,400	2.7			
												35				No	0%	0%				1000.0	£50,400	2.7			
												36				No	0%	0%				1000.0	£50,400	2.7			
												37				No	0%	0%				1000.0	£50,400	2.7			
												38				No	0%	0%				1000.0	£50,400	2.7			
												39				No	0%	0%				1000.0	£50,400	2.7			
						40				No	0%	0%				1000.0	£50,400	2.7									

Hazard ID	Baseline Hazard Rank	Residual Hazard Rank	Hazard Area	Hazard Category	Hazard Title	Credible Hazard Outcome ID [Consequence]	Credible Hazard Outcome [Consequence]	Hazard Causes ID [Likelihood]	Hazard Causes [Likelihood]	Baseline Risk - with existing risk controls in place			Risk Reduction							Results	Control Actionee	Complete		
										Likelihood	Consequence	Baseline Risk	Risk Control ID.	Additional Risk Control (RC) Measures	Cross-reference Consequence Likelihood	Include Risk Control	% Likelihood Reduction	% Consequence Reduction	Residual Risk Score with RC in place					
																			Likelihood Return Period [yr]				Consequence Cost [£]	Cumulative Risk Score
6	4	3			Grounding of a vessel at anchor (Margate Roads or Tongue)		Damage to vessels		Failure to maintain anchor watch	2	2	4.0		Baseline with no additional risk controls				100.0	£10,000	4.0	Baseline Risk			
							Pollution (Tier 1)		Insufficient VTS oversight				1	Formal charting of Margate Roads Anchorage	No	10%	0%	100.0	£10,000	4.0	4.0			
							Reputational harm		Mechanical failure				2	Undertake responsibility to monitor vessels in Tongue and Margate Roads (VTS Anchor Watch)	No	40%	0%	100.0	£10,000	4.0				
							Corporate liability		Onboard deficiency				3		No	0%	0%	100.0	£10,000	4.0	Baseline Level			
							Disruption to port operations		Adverse weather conditions				4		No	0%	0%	100.0	£10,000	4.0	Minor			
									High density of vessels anchored due to adv				5		No	0%	0%	100.0	£10,000	4.0				
													6		No	0%	0%	100.0	£10,000	4.0	Residual Risk			
													7		No	0%	0%	100.0	£10,000	4.0	4.0			
													8		No	0%	0%	100.0	£10,000	4.0				
													9		No	0%	0%	100.0	£10,000	4.0				
													10		No	0%	0%	100.0	£10,000	4.0	Residual Level			
													11		No	0%	0%	100.0	£10,000	4.0	Minor			
													12		No	0%	0%	100.0	£10,000	4.0				
													13		No	0%	0%	100.0	£10,000	4.0	Risk Reduction			
													14		No	0%	0%	100.0	£10,000	4.0	0.0			
													15		No	0%	0%	100.0	£10,000	4.0				
													16		No	0%	0%	100.0	£10,000	4.0				
													17		No	0%	0%	100.0	£10,000	4.0				
													18		No	0%	0%	100.0	£10,000	4.0				
													19		No	0%	0%	100.0	£10,000	4.0				
													20		No	0%	0%	100.0	£10,000	4.0				
													21		No	0%	0%	100.0	£10,000	4.0				
													22		No	0%	0%	100.0	£10,000	4.0				
													23		No	0%	0%	100.0	£10,000	4.0				
													24		No	0%	0%	100.0	£10,000	4.0				
													25		No	0%	0%	100.0	£10,000	4.0				
													26		No	0%	0%	100.0	£10,000	4.0				
													27		No	0%	0%	100.0	£10,000	4.0				
													28		No	0%	0%	100.0	£10,000	4.0				
													29		No	0%	0%	100.0	£10,000	4.0				
													30		No	0%	0%	100.0	£10,000	4.0				
													31		No	0%	0%	100.0	£10,000	4.0				
													32		No	0%	0%	100.0	£10,000	4.0				
													33		No	0%	0%	100.0	£10,000	4.0				
													34		No	0%	0%	100.0	£10,000	4.0				
													35		No	0%	0%	100.0	£10,000	4.0				
													36		No	0%	0%	100.0	£10,000	4.0				
													37		No	0%	0%	100.0	£10,000	4.0				
													38		No	0%	0%	100.0	£10,000	4.0				
													39		No	0%	0%	100.0	£10,000	4.0				
				40		No	0%	0%	100.0	£10,000	4.0													