Vattenfall Wind Power Ltd

Thanet Extension Offshore Wind Farm

Appendix 25, Annex K to Deadline 1 Submission: Pilot Transfer Bridge Simulation – Inception Report

Relevant Examination Deadline: 1

Submitted by Vattenfall Wind Power Ltd

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MARICO MARINE

GOBE CONSULTANTS LTD

THANET EXTENSION OFFSHORE WIND FARM: PILOT TRANSFER BRIDGE SIMULATION - INCEPTION REPORT

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MARINE AND RISK CONSULTANTS LTD

GOBE CONSULTANTS LTD

THANET EXTENSION OFFSHORE WIND FARM: PILOT TRANSFER BRIDGE SIMULATION - INCEPTION REPORT

Prepared for: GoBe Consultants Ltd
34 Devon Square
Newton Abbot
Devon
TQ12 2HH

Author(s): Jamie Holmes

Checked By: Ed Rogers

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Marine and Risk Consultants Ltd
Marico Marine
Bramshaw
Lyndhurst
SO43 7JB
Hampshire
United Kingdom

Tel. + 44 (0) 2380 811133

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ABBREVIATIONS

Abbreviation	Detail
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
CHA	Competent Harbour Authority
DW	Deep Water
EIA	Environmental Impact Assessment
ESL	Estuary Services Ltd
HW	High Water
IMO	International Maritime Organisation
Km	Kilometre
kt	Knot (unit of speed equal to nautical mile per hour, approx 1.15 mph)
LOA	Length Over-All
LW	Low Water
m	Metre
Marico Marine	Marine and Risk Consultants Ltd
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MW	Megawatt
nm	Nautical Mile
NRA	Navigation Risk Assessment
PEC	Pilotage Exemption Certificate
PLA	Port of London Authority
TEOW	Thanet Extension Offshore Wind Farm
UKC	Under Keel Clearance
VHF	Very High Frequency (radio communication)

VTS	Vessel Traffic Service
WTG	Wind Turbine Generator

1 INTRODUCTION

GoBe Consultants Ltd and Vattenfall Wind Power Ltd (Vattenfall) have commissioned Marine and Risk Consultants Ltd (Marico Marine) to undertake the Shipping and Navigation studies in support of the Environment Impact Assessment (EIA) for the proposed extension to the Thanet Offshore Wind farm.

In advance of the Navigation Risk Assessment (NRA), which is due to be undertaken in support of the EIA, a Pilotage Study was commissioned in order to further investigate concerns, raised by stakeholder consultees during the project feasibility and scoping stages. Concerns specifically relate to potential impact on the feasibility of Pilot boardings at North East Spit and Tongue Stations. Objectives for the Pilotage Study were defined as:

1. Identify the current pilotage operations around the existing wind farm; and
2. Consider the possible impacts that the extension would have upon these operations.

The Pilotage Study identified and recommended that a real time bridge navigation simulation study be undertaken to examine the navigation aspects of the proposed extension layout in further detail.

This document describes the real time bridge navigation simulation study that will be undertaken and should be read in conjunction with the following documents:

Reference	Title
TEOW-PLA_DB-0009	Scoping Report
16UK1255_001	TEOW - Pilotage Study – Technical Note
No Ref [HOLD]	Preliminary Environmental Impact Report (PEIR) – Shipping & Navigation

1.1 OBJECTIVES

The objectives of the real time bridge navigation simulation study are:

- Examine whether the Pilot Transfer operations are feasible at North East Spit Station with the extended wind farm;
- Assess the wind farm layouts and whether pilotage operations are feasible in a range of defined operational scenarios; and

- Understand the change in encounters and collision risk due to reduced sea room of the proposed layout. This will primarily be investigated by quantitative assessment using traffic flow modelling that is planned to be utilised within the EIA phase of works.

It should be noted that wider impacts on shipping and navigation, including issues relating to vessel routeing, anchorages, search and rescue and small boat traffic (such as fishing and recreational craft) will be considered within the full Navigation Risk Assessment (NRA) submitted as part of the EIA.

It should also be noted that the objectives are focussed on themes of navigation safety only and wider commercial operational aspects are being addressed separately and are therefore outwith of the objectives of the real time bridge navigation simulation.

2 SITE OVERVIEW

The existing Thanet Offshore Wind Farm has been operational since 2010 and comprises 100 Vestas V90 3.0 MW turbines, situated 11 km off the Kent coast (black boundary in **Figure 1**). The proposed extension (red boundary in **Figure 1**) consists of up to 34 turbines (up to 12 MW) surrounding the existing wind farm with an approximate 20 km export cable to Kent. Pilot Stations relating to the site area are shown in **Figure 1**.

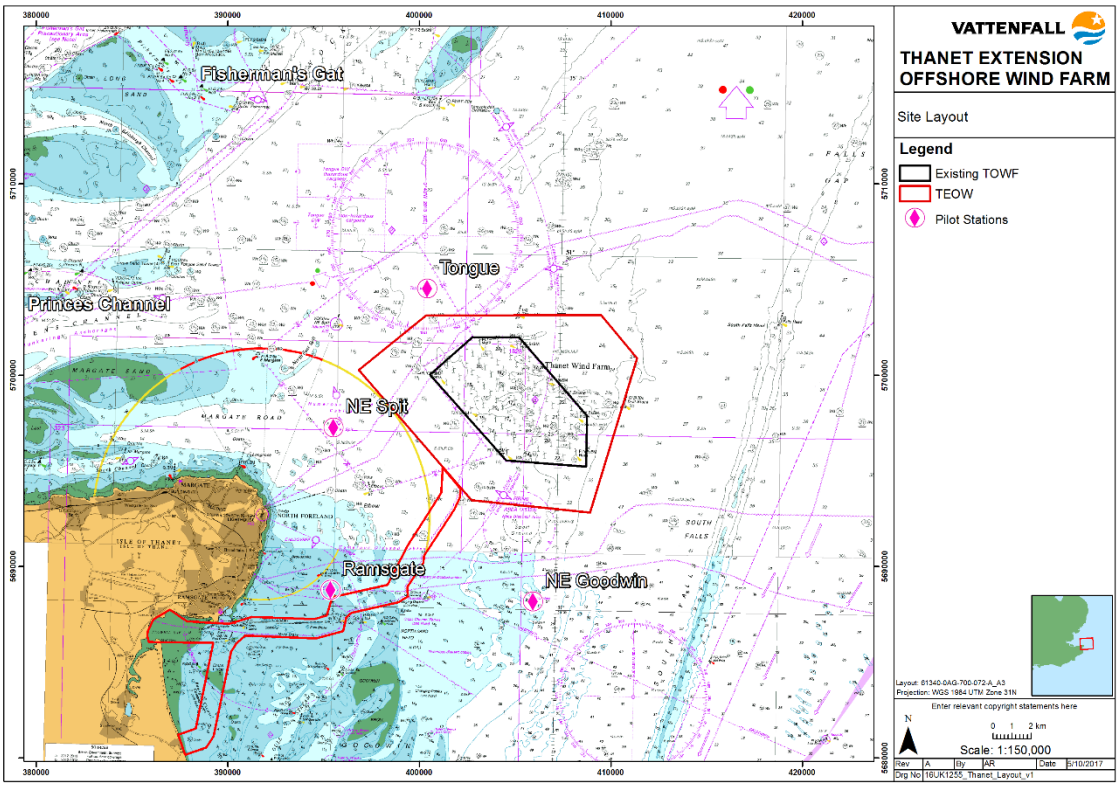

Figure 1: Site Location, Wind Farm layout and Pilot Stations.

3 SIMULATOR CONFIGURATION

The PLA Ship's Bridge Simulator has been put forward for usage in this assessment as the PLA are a key stakeholder consultee in relation to the themes being addressed and the simulator is suitably established in the area of interest.

The PLA Ship's Bridge Simulator is a full mission bridge simulator and is primarily used as a training tool for Pilots as well as a familiarisation and design tool to test new and updated vessels and infrastructure. The simulator was updated most recently in 2012 and summary key technical details are provided below:

- Includes full engine controls, bow and stern thrusters, radar, ECDIS, speed logs, a portable pilotage unit and Azimuth Control Device propulsion and steering;
- Variable parameters based on Thames hydrographic modelling, flood and ebb tide, wind speed and direction, meteorological conditions including fog, rain and snow;
- Over 70 ship types can be simulated;
- Record, pause and rewind allowing review and retry of scenarios; and
- Print outs of each exercise for post-exercise discussion and evaluation.

Figure 2: PLA Bridge Simulator.

3.1 SIMULATOR LAYOUT AND VISUAL REPRESENTATION

The area represented in the PLA simulator is shown in **Figure 3.** It should be noted that the simulator area does not currently extend to include the southern portion of the existing or proposed wind farm area (area not included is shown hatched). Enlarging this area was not achievable in the timescale and, given that the study focus is on North East Spit which is situated principally within the area of coverage, this has been accepted. This should be reviewed during the setup day to confirm that this does not cause complications and limit the assessment.

The wind farm is visually represented using WTG's which provide an important visual scaled representation for the simulation team. It is understood the existing wind farm (inner red boundary of **Figure 3**) is currently represented in the simulator and, although enquiries have been made to revise the simulator in order to represent the wind farm extension with additional WTG's it is understood that the PLA do not have the functionality to do this in house and the simulator

developer is not able to make the modifications within the available timescale. Therefore, it has been proposed to represent the wind farm extension using a combination of buoyage and/or moored ships to provide adequate visual representation. This will be developed prior to the setup day and confirmed with the simulation team prior to commencement of the assessment.

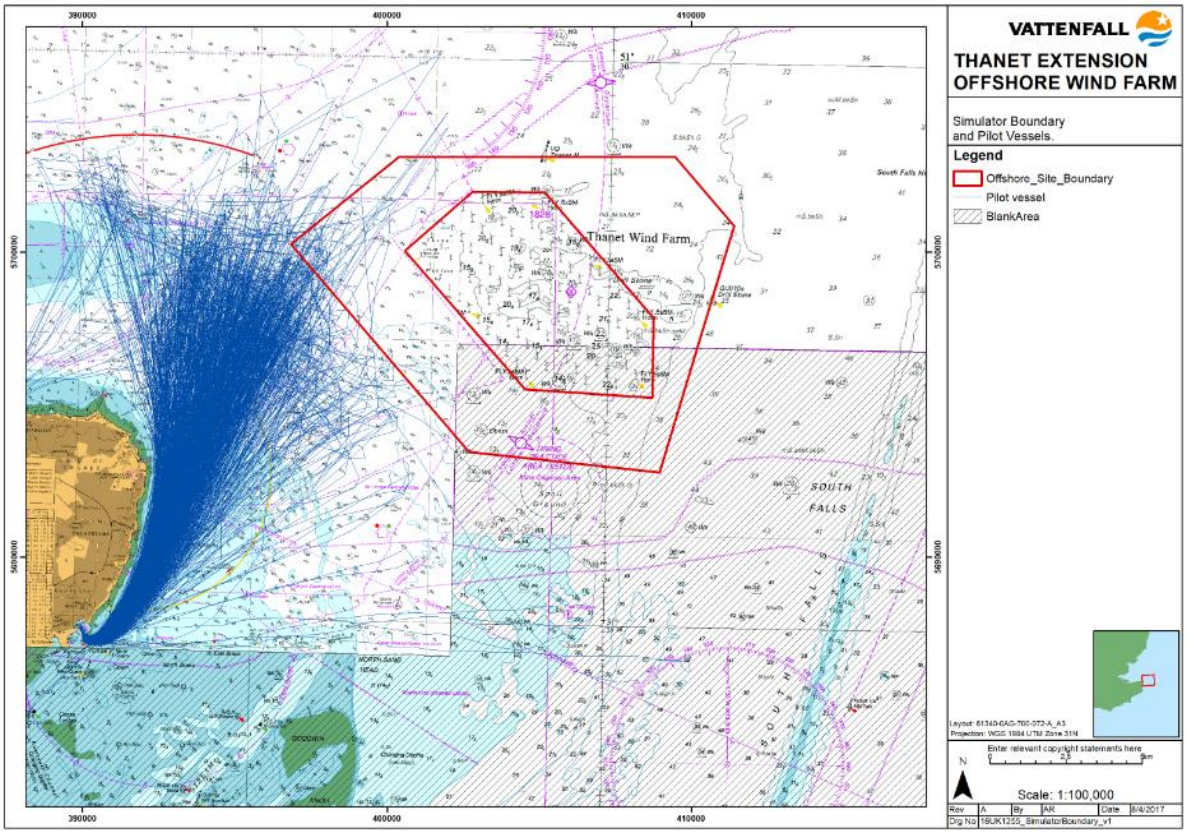

Figure 3: PLA Simulator extent (ESL Pilot Launch tracks also shown - demonstrating area of activity for North East Spit Station).

3.2 MET-OCEAN CONDITIONS

A combination of met-ocean conditions will be selected to ensure that a representative sample of 'normal' and 'challenging' met-ocean conditions are represented when North East Spit Station would typically be 'on station'. The conditions and spectrum of the operating limit for the North East Spit Station will be agreed during the setup day and will incorporate the parameters as defined below and tabled during the meeting held on 14-Aug-2017 (**Annex A**).

3.2.1 Winds

Wind conditions will be selected on the setup day.

Wind conditions that create a cross channel ship direction (ie: the ship is travelling perpendicular to channel direction) for Pilot transfer are likely to be selected as the priority. This is likely to be directions from North / South and in 10kt increments with an upper limit of 40kt TWS.

3.2.2 Waves

Wave conditions (defined by significant wave height and direction) will be selected on the setup day and will be within operational return period conditions.

Noted that wave conditions may be a composite of long period (swell) and short period (locally wind generated) and should be selected in parallel with the wind condition to ensure the scenario is realistic and not unfeasibly compounded.

3.2.3 Tide/Current

Tide, primarily as relates to current direction, will be selected during the setup day. The interrelationship with wave conditions and sea state is noted.

3.2.4 Water depth

Water depths will be as charted with the state of tide as per the simulation run. Where lower water levels may affect a vessel Under Keel Clearance (UKC) then this should be identified.

3.2.5 Visibility

Simulated runs may include conditions of restricted visibility or night although focus will be given to day time conditions.

3.3 VESSELS

3.3.1 Ship Models

Existing PLA manoeuvring models will be utilised in the assessment and selected to reflect the range of vessels for which Pilot transfers are normally undertaken. Vessels will be confirmed on the setup day and selected from the PLA vessel database. It is assumed this will include the following vessels as discussed on 14-Aug-2017 (**Annex A**) and will be prioritised as best to focus the assessment within the available time.

No	Vessel Type	LOA (m)	Draft (m)	Notes
1	Ro-Ro	240	10	High windage, shallow draught
2	Container Vessel	140-200	10	
3	Dredger	130	7.5	Noting longer time for Pilot Transfer
4	Tug & Tow **[HOLD]**			**[HOLD]**

3.3.2 Pilot Launch

The ESL Pilot Launch Coxswain will be incorporated into the simulation run (located in a second bridge space) and communicating using normal operational procedures with the Ship. It is accepted that the initial setup transfer dialogue on VHF between the Pilot Launch and the Ship would normally take place at a range of at least 3 Nm.

The Pilot Launch Coxswain will be responsible for making clear statements and instructions at various points of the for the conduct of the transfer and these will be recorded in the run log.

3.3.3 Baseline Vessel Traffic

Underlying commercial vessel activity will be populated in the simulation and it is envisaged that, in some runs, this vessel activity may require the simulation team to respond according to normal operational procedures.

It is noted that emergency ship based procedures will not be tested within the scope of this simulation.

3.3.4 Verificiation of Simulator

Time will be allocated on setup day for the simulation team to verify the simulator and establish procedures and communications within the simulator. A familiarisation run may be performed.

4 SIMULATION OPERATION

4.1 PROCEDURE FOR SIMULATION RUN SEQUENCE

A draft procedure of event sequencing for each simulation run is proposed below and will be agreed on the setup day. For planning purposes a 45 minute cycle for each run has been assumed which will equate to between 8 – 10 runs per day.

Serial No.	Activity
0	Prior to each run a short briefing will be held to confirm the simulation parameters (**Annex B**) with the simulation team.
1	The Pilot Launch Coxswain will provide instruction to the Ship on their requirements for Pilot Transfer (assumed time on station, location, heading, speed and ladder side). It is recognised this may have an element of pre-planning and the communication between Pilot Launch and ship may normally occur circa minimum 3 nautical miles from the liaison point.
2	The simulation run will commence with the ship circa 1 nautical mile from the start point in order to provide adequate time for the model to settle and the Pilot to adjust the ship parameters. At run start, the Pilot Launch Coxswain will confirm the intended transfer course and speed on VHF.
3	The Ship will confirm once it is steady on transfer course and speed.
4	The Pilot Launch will approach the ship and the Coxswain confirm the following milestones as per normal operating procedures: • Making approach • Alongside • Approval for Pilot Transfer
5	Transfer will be represented by time allowance of the transfer (inc. time for Pilot to get to/from Ship bridge). A range of timings for Pilot Transfer will be confirmed on the setup day
6	The simulation run will complete when the Pilot transfer is complete and the Ship has recovered to its onwards heading with the Pilot taking the con or if the run is deemed a failure.

4.2 SIMULATION RUN GRADING

Immediately after each simulation run the Facilitator will, in communication with the simulator team, grade the run as successful, marginal or fail. This will be according to the following proposed criteria and recorded in the run summary sheet **(Annex C)**:

Grade	Criteria No.	Criteria Description
Successful	1	Ship remains under full control to the satisfaction of the Pilot and Master and is able to continue to manoeuvre safely at all times
	2	Ship retains acceptable clearances to Wind Farm (inc. buffer) as relates to Contact Risk
	3	Ship retains acceptable Under Keel Clearance (UKC) as relates to Grounding Risk
	4	Ship retains acceptable clearance to other vessels as relates to Collision Risk *(*noting through traffic included)*
	5	Time available for 1 person Pilot transfer (constant heading and speed) is >5 min
	6	Capacity for ship to respond to emergency is not compromised
Marginal	1	Ship is at limit of full control at assessment of the Pilot and Master and is not able to continue to manoeuvre safely at all times
	2	Ship remains clear of Wind Farm but not to acceptable clearances (buffer) as relates to Contact Risk
	3	Ship Under Keel Clearance (UKC) become unacceptably low as relates to Grounding Risk
	4	Ship does not retain acceptable clearance to other vessels as relates to Collision Risk *(*noting through traffic included)*
	5	Time available for 1 person Pilot transfer (constant heading and speed) is between 3 and 5 min
	6	Capacity for ship to respond to emergency is compromised
	1	Ship loses control and is unable to manoeuvre safely
	2	Ship breaches Wind Farm boundary as relates to Contact Risk
	3	Ship comes out of fairway and grounds as relates to Grounding Risk
	4	Ship collides with other vessels as relates to Collision Risk *(*noting through traffic included)*

Fail	5	Time available for 1 person Pilot transfer (constant heading and speed) is < 3 min
	6	Ship does not have capacity to respond to emergency

4.3 SIMULATION AGENDA

The simulation will be held at the Port of London Bridge Simulator located at London River House, Royal Pier Road, Gravesend, Kent DA12 2BG.

Each day will commence with an agenda and will complete with a hot wash-up.

Date	Time	Activity
Fri-15-Sep-2017	**1030 - 1600**	Setup Day: • Review Objectives and Agenda • Confirmation of Simulator Configuration • Selection of Runs and Parameters • Setup study area layout (wind farm layouts) • Verification of Simulator / Familiarisation
Wed-20-Sep-2017	**1030 - 1700**	Simulation Session Day 1 • Simulation Runs No. 1 – 10 (estimated)
Thu-21-Sep-2017	**0900 - 1700**	Simulation Session Day 2 • Simulation Runs No. 11 – 20 (estimated)

4.4 SIMULATION PARTICIPANTS – ROLES AND RESPONSIBILITIES

The Simulation Team will be comprised of personnel below:

Name	Organisation	Role/Responsibility	Location
Capt Richard Flynn	PLA	Simulator Manager/ Operator	Control Room

TBC - Capt Cerwyn Phillips	PLA	Ship Pilot	Ship Bridge
Cdr Paul Brown	Marico	Ship Master	Ship Bridge
Richard Jackson	ESL	Pilot Launch Coxswain 1	Bridge 2
David Ninnim	ESL	Pilot Launch Coxswain 2	Bridge 2
Dr Ed Rogers	Marico	Project Director/ Facilitator	Ship Bridge / Obs room
Jamie Holmes	Marico	Project Manager/ Facilitator	Ship Bridge / Obs room
Capt Mike Vanstone	Vattenfall	Client Representative	Observation Room

5 DELIVERABLES / PRESENTATION OF RESULTS

Each simulation run will be reported with a summary track plot and log of key vessel and bridge commands (to be provided by PLA). The session facilitator will record key observations on a run summary sheet **(Annex C)** and also lead a short debrief.

On completion of the simulations a short document will present and summarise all the runs and provide a narrative of key results and conclusions.

Deliverables will be utilised as a reference during the EIA for the Shipping and Navigation.

Annex A Minutes

Minutes of Meeting held on 14-Aug-17

Client:	GoBe Consultants
Project:	16UK1255 Thanet Extension Offshore Wind Farm (TEOW)
Venue:	Port of London Authority (PLA), London River House, Gravesend
Date of Meeting:	14-Aug-17 1000 – 1400

Present:	PLA	Cerwyn Phillips (CP)
	PLA	Richard Flynn (RF)
	ESL	Ian Lord (IL)
	ESL	Richard Jackson (RJ)
	ESL	Dave Ninnim (DNM)
	Marico Marine	Jamie Holmes (JH)

Item	Action item / Notes for the record	
1	**Introduction**	
	Introductions of those present, project roles and outline of meeting agenda	
2	**Project overview: Thanet extension Offshore Windfarm (TEOW)**	
	JJH provided overview of Marico Marine role delivering Shipping & Navigation Chapter of EIA. Key dates were outlined as understood. ESL noted that this was the first contact since the consultation undertaken with them by Vattenfall in early 2017 during the scoping study early discussions. ESL explained they are unclear on the regulatory and approval process and the opportunities for them to provide input as stakeholders at the relevant design development opportunities. Action: GoBe/Vattenfall to provide ESL & PLA with project overview	
3	**Pilotage Study - Presentation of work to date / confirmation of conclusions**	
	JJH outlined that Pilotage Study was commissioned separate to the main Navigation Risk Assessment that will be undertaken in Q3/Q4 2017 and input to the Shipping & Navigation Chapter of the EIA. The objective of the Pilotage Study was defined in the meeting between PLA and Marico Marine on 05-Apr-17 (see separate minutes) to 'more comprehensively understand the use of the pilot stations, including the frequency and types of vessel using it'. 3 Months of AIS data was provided to Marico Marine by Vattenfall (Nov-16 – Feb-17) on which the pilotage study was undertaken. The outline Pilotage Study report was issued to PLA in May for	

	review/distribution and presented to PLA and ESL on 03-Jul-17 (see separate minutes) at which minor comments on report itself were received and the themes of concern were discussed. Agreed actions to be progressed were: 1. Further assessment to establish whether reduction in sea room impacts vessel traffic flow and pilot transfers to acceptable/unacceptable levels 2. Investigate relocation of NE Spit pilot boarding station 3. Investigate design layout options in order to mitigate impacts Two methods were identified to investigate Action 1: • Traffic flow modelling: Undertake computational modelling to quantify encounters in reduced sea room and collision risk • Pilot boarding assessment through bridge simulation to test layout against defined scenarios. JJH explained the objective of this meeting was to map out the bridge simulation requirements, noting that traffic flow modelling was being considered under the NRA.	
4	**Pilotage – ESL/PLA input/discussion**	
4.1	ESL outlined they have concerns with the proposed layout as it relates to navigation safety, operations and commercial implications. ESL provided feedback on the report at this point. Comments include: • The report presents a complex overall operation. • Dredgers – RJ explained that significant numbers of dredgers do not have PEC's. Around 59 acts of pilotage involving dredgers were undertaken during the period. • Vessel traffic gates (as per p8 of report) were clarified. Typographical errors inc. p10 Fig 9/para 2 east/west, p18 Fig 18 MV Astrid Shulte • ESL confirmed their 6 vessels have different speed characteristics (2 have maximum speeds of 25kts and 4 have maximum speeds of 22 kts). Planning operational speeds are 20kts as confirmed in pilotage report. • Time taken for pilot transfer is variable (as noted in report) for various reasons including weather, tripping pilots etc… ESL agreed to provide annotative log based evidence for the transfer acts reported to further understand transfer time. • NE Spit affords excellent weather protection with low numbers of restrictions and is rarely off- station. ESL agreed to provide annotative log based evidence of instances of these periods. • Weather (wind, waves and visibility) and associated considerations should be considered in the assessment – noting also that operations are impacted (seek to service multiple trips in adverse weather). • Concerns on the data utilized as the period of data used was relatively benign winter. JJH noted the EIA will be supplemented by a vessel traffic survey (winter and summer) including radar and	

	visual (i.e.: non AIS vessels). • Noted the inter-dependency of all traffic (AIS and otherwise) on the pilotage. JJH noted this observation and explained that will be reviewed in the traffic modelling in combination with the pilot simulation. Non AIS traffic (and varying seasonality) will be analysed in the NRA and on receipt of the vessel traffic survey. • ESL do not accept the relevance and basis of comparison with other pilot boarding areas in other ports. IL emphasized importance of operational contingency across all the pilot boarding station and noted that NE Spit provides this (for vessels able to navigate west of the existing wind farm) when the other pilot stations are restricted or off station. ESL utilize a 'planning diamond' tool to inform the ship direction to create lee appropriate to ship for strength and direction of waves and wind. Noted that this is always subject to change based on the individual nature of any act and the judgement of the pilot boat coxswain. Comments on adverse weather: • Wind: NE wind for prolonged period • Current/Waves: Spring tide and current run direction will increase sea state • ESL also undertake considerable attendance work as part of their wider operations – JJH noted this as an operational consideration and beyond scope of navigation risk assessment.	
5	**Simulator overview & capability**	
	RF introduced simulator and all attendees visited the bridge simulator and witnessed a vessel transiting to the north of the study area.	
6	**Simulation Session Design**	
	Discussion was held about structuring the session to ensure that an objective assessment can be undertaken to inform the understanding of sea room required for pilot transfer. Given the available resource and time available - there will necessarily be some assumptions and focus on specific cases/scenarios. JJH to prepare an inception note for circulation and include a 'run sheet' to include the below items. A setup day will be required involving all parties.	
6.1	Attendees: • ESL wish to provide 1x or 2x coxswains • PLA to provide 2x pilots • Marico to provide session lead	
6.2	Study Area: • Study area to be utilized will be existing area as represented in PLA simulator. No extension to the simulator area coverage required given the study area focus (note PLA/Marico had reviewed this	

	prior to meeting). • PLA to confirm visual representation of existing wind farm as this was not observed when visiting the bridge simulator. • TEOW (extension) to be represented by placement of buoys or ships and 'turned on/off' as required – noting it may be possible to utilize turbines in the visual scene.	
6.3	Priority Vessel Types • JJH noted the requirement to select and focus on representative ships and then identify similar types from PLA simulator library. This will be a balance of regular vessels against those which are less maneuverable (likely to be driven by wind area/draft and maneuverability). These were reviewed together and likely to be selected from below - tbc: • 140m LOA container ship • 200m LOA 10m draft container ship • 130m LOA x 7.5m draft dredger • 240m LOA 10m draft ro-ro / car carrier • Tug and tows are noted PLA to review above list against availability of vessels in simulator database.	
6.4	Vessel routing should consider: • Whether trip is inbound/outbound • Note starting/finish location of vessel (and therefore general approach and departure direction) should consider to/from below 4 areas: 1. Margate road anchorage 2. Princes Channel 3. South 4. North-East	
6.5	Priority Metocean condition (wind, wave, current, visibility) to be selected from the following based on threshold of acceptability: • Wind directions – consider from 8 compass points • Wind strength – consider in 10kt increments • Swell / Wave – consider in 8 compass points • Visibility – fog and day/night	
6.6	Representation of pilot transfer act • Ladder side should be determined • Heading of ship during transfer (as mandated by ESL) should be determined • Space required for vessel to swing onto transfer heading should be noted • Duration of typical transfer should be assumed (ranging from 2 – 6	

	mins and occasionally 8 mins) and at constant speed	
6.7	Contingency / Dealing with Change ESL queried how 'background traffic' and interaction with act of pilotage will be represented. ESL noted that runs will often be paused or re-started for issues such as: • Ladder wrong side or rigged incorrectly • Ship has not manoevered correctly and/or lee not adequate • Other vessel traffic affects run JJH explained that focus on background traffic as relates to general capacity and collision will be assessed separately although recognized that representative/occasional passing traffic may be included.	
6.7	Agreed assessment criteria Runs will be judged on whether successful transfer (or time available for transfer on heading) can be undertaken without breaching agreed limits to West and East: • Proximity on East to wind farm (note buffer) • Proximity to West – identify depth contour	
7	**Schedule – Simulator availability**	
	RF explained significant demands on pilot resource and simulator availability and dates may be subject to change: Post meeting dates for setup and workshop were proposed as below: • Setup day: Fri-15-Sep • Simulation workshop: 20-21-Sep	
8	**Actions / Further Work/ AOB** Actions as per above minutes	

Annex B Run Parameters

Run No.	Met-Ocean Characteristics						Vessel Direction			Pilot transfer			
	Wind Direction (from)	Wind Strength (kts)	Swell direction (from)	State of tide (HW relative)	Visibility	Vessel type	Outbound /Inbound	Start Area	Finish Area	Ladder Side	Vessel Heading for transfer	Vessel speed for transfer	Time required for Pilot Transfer
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Annex C Run Summary Sheet [HOLD]