Tolmount East Development

Environmental Statement

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Notes	

EIA Quality Mark

This Environmental Statement (ES), and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development, was undertaken in line with the EIA Quality Mark Commitments.

The EIA Quality Mark is a voluntary scheme, operated by the Institute of Environmental Management and Assessment (IEMA), through which EIA activity is independently reviewed, on an annual basis, to ensure it delivers excellence in the following areas:

- EIA Management;
- EIA Team Capabilities;
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- EIA Content;

- EIA Presentation; and
- Improving EIA Practice.

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ENVIRONMENTAL STATEMENT

Section A: Administrative Information

A1 – Project Reference Number

Please confirm the unique ES identification number for the project.

Number: D/4265/2021

A2 - Applicant Contact Details

Company name: Premier Oil UK Limited

Contact name: Stuart Kirk

Contact title: Environmental Lead

A3 - ES Contact Details (if different from above)

As above

A4 - ES Preparation

Please confirm the key expert staff involved in the preparation of the ES:

Name	Company	Title	Relevant Qualifications/Experience
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Name	Company	Title	Relevant Qualifications/Experience
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

A5 - Licence Details

a) Please confirm licence(s) covering proposed activity or activities

Licence number(s): P1330

b) Please confirm licensees and current equity:

Premier Oil UK Limited: 50% equity

Dana Petroleum (E&P) Ltd.: 50% equity

Section B: Project Information

B1 - Nature of Project

a) Please specify the name of the project.

Name: Tolmount East Development

b) Please specify the name of the ES (if different from the project name).

Name: Tolmount East Development Environmental Statement

c) Please provide a brief description of the project.

Tolmount East is mainly a gas field, with some condensate, located in the Southern North Sea approximately 37 km east of Flamborough Head and approximately 152 km from the United Kingdom (UK)/Netherlands median line. The development comprises the sidetrack and recompletion of the existing appraisal well as a production well. The well will be protected by an individual Wellhead Protection Structure (WHPS) physically connected to the existing conductor caisson. A separate subsea manifold structure will be installed to allow connection of the single development well and up to 2 other future wells. This ES only assesses the base case single well development, and any additional wells to be drilled will be subject of a future ES. Gas, condensate and any produced water will be exported to the Tolmount Minimum Facilities Platform (MFP) (installed in 2020) via a new, 4 km long 12" flowline. Here, the exported fluid will comingle with Tolmount hydrocarbons and will be exported to the Centrica Storage Limited’s Easington Terminal (Easington Terminal) onshore via the Tolmount export pipeline. Premier proposes to progress field development with a view to achieving first gas by August 2023.

B2 - Project Location

a) Please indicate the offshore location(s) of the main project elements (for pipeline projects please provide information for both the start and end locations).

Quadrant number(s): 42

Block number(s): 42/28d

Subsea Manifold: Latitude: 0° 28' 43.5144"E; Longitude: 54° 3' 54.48599"N

Tolmount East Appraisal well and WHPS: Latitude: 0° 28' 42.44520"E; Longitude: 54° 3' 55.21679"N

Pipeline start (tie-in flange and Tolmount East subsea manifold): Latitude: 0° 28' 44.66640"E; Longitude: 54° 3' 27.32399"N

Pipeline end (Tolmount MFP): Latitude: 0°26’ 21.69” E; Longitude: 54°2’ 23.40” N

Distance to nearest UK coastline (km): 35 (from Tolmount end of pipeline)

Which coast: England

Distance to nearest international median line (km): 152

Which line: UK / Netherlands

B3 - Previous Applications

If the project, or an element of the project, was the subject of a previous consent application supported by an ES, please provide details of the original project.

Name of project: Tolmount Area Development Offshore Environmental Statement

Date of submission of ES: 10th November 2017

Identification number of ES: D/4203/2017

Name of project: Tolmount to Easington Pipeline Offshore Environmental Statement

Date of submission of ES: November 2018

Identification number of ES: D/4225/2018

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Acronyms

AA	Appropriate Assessment
ACA	Action Co-ordinating Authority
AIS	Automatic Identification System

API	American Petroleum Institute
BAT	Best Available Technique
Bbl	Barrels per million
BEIS	Department for Business, Energy and Industrial Strategy
BMAPA	British Marine Aggregate Producers Association
BOCC	Birds of Conservational Concern
BOP	Blowout Preventer
CCO	Channel Coastal Observatory
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CGF	Central Gathering Facility
CGR	Condensate to Gas Ratio
CH_4	Methane
CIEEM	Chartered Institute of Ecology and Environmental Management
CIMV	Chemical Injection Metering Valves
CO_2	Carbon Dioxide
CP	Cathodic protection
CPR	Continuous Plankton Recorder
CRA	Corrosion Resistant Alloy
Dana	Dana Petroleum E&P Ltd.
DDV	Drop Down Video
DEFRA	Department for Environment, Food and Rural Affairs
DP	Dynamically Positioned
DSV	Dive Support Vessel
E.ON	E.ON E&P UK Ltd
EEMS	Environmental and Emissions Monitoring System
EIA	Environmental Impact Assessment
ENVID	Environmental Issues Identification
EPS	European Protected Species
ES	Environmental Statement
EU ETS	Eu Emissions Trading Scheme
FDP	Field Development Plan
FEED	Front End Engineering Design
FLO	Fisheries Liaison Officer
FOCI	Features of Conservation Importance
GHG	Greenhouse gas
GIIP	Gas Initially In Place
GTA	Greater Tolmount Area
HMCS	Harmonised Mandatory Control Scheme
HPHT	High pressure high temperature
HPU	Hydraulic Power Unit
HRA	Habitats Regulations Appraisal
HSE	Health and Safety Executive
HSES	Health, Safety, Environment and Security
HSES – MS	Health, Safety, Environment and Security Management System
IAPP	International Air Pollution Prevention Certificate
ICES	International Council for the Exploration of the Seas
ICSS	Integrated Control and Safety System
IEMA	Institute of Environmental Management and Assessment
IOGP	International Association of Oil and Gas Producers

IPCC	Intergovernmental Panel on Climate Change
IROPI	Imperative Reason of Overriding Public Interest
IUCN	International Union for Conservation of Nature and Natural Resources
km	Kilometres
LAT	Lowest Astronomical Tide
LOLER	Lifting Operations and Lifting Equipment Regulations
LSE	Likely Significant Effect
LTOBM	Low toxicity oil-based mud
MAH	Major Accident Hazard
MarLin	Marine Life Information Network
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MCS	Master Control System
MCZ	Marine Conservation Zone
MDBRT	Measured Depth Below Rotary Table
MEI	Major Environmental Incidents
MFP	Minimum Facilities Platform
MMO	Marine Management Organisation
MMO	Marine Mammal Observer
MMscfd	Million Standard Cubic Feet Per Day
MoD	Ministry of Defence
MODU	Mobile Offshore Drilling Unit
MPA	Marine Protected Area
MRCC	Maritime Rescue Co-ordination Centre
Mt	Million Tonnes
NB	Nominal Bore
NBN	National Biodiversity Network
NFFO	National Federation of Fishermen's Organisation
NNR	Natural Nature Reserve
N_2O	Nitrous oxides
NO_2	Nitrogen dioxide
NORBRIT	Norway-United Kingdom Join Contingency
NORM	Naturally Occurring Radioactive Material
NO_x	Nitrogen Oxides
NUI	Normally Unattended Installation
O_3	Ozone
OCNS	Offshore Chemical Notification Scheme
OCR	Offshore Chemicals Regulations 2002
OD	Outside Diameter
OGA	Oil and Gas Authority
OGUK	Oil and Gas UK
OPEP	Oil Pollution Emergency Plans
OPPC	Oil Pollution Prevention and Control
OPRC	International Convention on Oil Pollution, Preparedness, Response and Co-operation
OPRED	Offshore Petroleum Regulator For Environment and Decommissioning
OSCAR	Oil Spill Contingency and Response
OSPAR Convention	Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic

OSRL	Oil Spill Response Limited
P&A	Plug and Abandon
PERF	Petroleum Environmental Research Forum
PMF	Priority Marine Feature
ppm	Parts per million
PWA	Pipeline Works Authorisation
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SCANS	Small Cetaceans in the European Atlantic and North Sea
SCM	Subsea Control Modules
SCOS	Special Committee on Seals
SDU	Subsea Distribution Unit
SEA	Strategic Environmental Assessment
SINTEF	Scandinavian Independent Research Organisation
SMRU	Sea Mammal Research Unit
SNH	Scottish Natural Heritage
SNS	Southern North Sea
SO_2	Sulphur dioxide
SOPEP	Shipboard Oil Pollution Emergency plan
SOSI	Seabird Oil Sensitivity Index
SO_x	Sulphur Oxides
SPA	Special Protection Area
TE flowline	Tolmount East flowline
Te	tonnes
THC	Total Hydrocarbon
TSHD	Trailing Suction Hopper Dredger
TUTU	Topside Umbilical Termination Unit
UK	United Kingdom
UKAPP	UK Air Pollution Prevention Certificate
UKCS	United Kingdom Continental Shelf
UKHO	UK Hydrographic Office
UKOOA	UK Offshore Operators Association
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UTA	Umbilical Termination Assembly
VOC	Volatile Organic Compound
WBM	Water-Based Mud
WHPS	Wellhead Protection Structure
WHS	World Heritage Site

SUMMARY OF DOCUMENT EDITS

The changes applied within this document are to account for the revised and optimised Tolmount East Development project design and to ensure compliance with the EIA Regulations 2020. A description of the changes, with the relevant section reference and the implication of the change are summarised in the table below.

Section Number	Section Name	Change	Implication
	Non-Technical Summary	Updated throughout to reflect the changes made in the project description, impact assessment and mitigation.	
1	Introduction		
1.1	Introduction to Premier Oil UK Limited and Dana Petroleum E&P Limited	Clarification of name of Harbour Energy Plc following merger with Chrysaor.	The Harbour Energy plc policies of climate change and health, safety and the environmental management are active. The management of the project will be under the Premier Management systems until transition.
1.2	Project background and status	Update to project timescales, with the majority of the installation occurring in 2023 and first gas expected in August 2023.	The revision of the project schedule changes the timing overlap with periods of environmental sensitivity. The potential environmental impacts resulting from schedule changes are assessed and presented in the ES.
1.3	Scope of Environmental Impact Assessment	Summary of the revised and optimised project description of relevance to the EIA.	Reduced scope of activities and footprint resulting in lower environmental impact.
1.7	Harbour Energy plc's Climate Change policy and Net Zero Commitment	Harbour Energy plc's Climate Change policy and Net Zero Commitment	Update to the climate change policy to also reflect Net Zero goals and commitment to these and new company name.
2	Project description		
2.1	Tolmount East development concept	Updated development concept covering the completion of the existing appraisal well as a production well, drilling of a sidetrack, installation of one WHPS and a 3 slot manifold connected to the WHPS.	Reduced scope of activities and footprint resulting in a reduction in impact pathways in the short and long term, with a lower environmental impact.

Section Number	Section Name	Change	Implication
2.2	Consideration of alternatives	Updated the sizing of the subsea infrastructure describing the smaller footprint, over trawlable WHPS and fishing friendly subsea manifold.	Optimised engineering design resulting in smaller seabed footprint, lower disturbance and physical impact to ecological species and less embedded carbon required for construction due to the smaller structures.
2.3	Development schedule	Updated Tolmount East activity schedule	The revision of the project schedule changes the timing overlap with periods of environmental sensitivity. The potential environmental impacts resulting from schedule changes are assessed and presented in the ES.
2.4	Reservoir characteristics	Description of the revised reservoir properties, based on additional surveys.	Update to the resource availability and GIIP.
2.5	Wells and drilling	Revised description of the well and drilling operations. This includes: • Revision of the drilling strategy for completion of the existing appraisal well; • Update to the discharges associated with the well completion; • Deleting sub-sections relating to drilling of a new well and the discharge of mud and cuttings; and • Updates to the cementing approach.	Optimised engineering design resulting in a reduction in the number of impact pathways and magnitude, with a lower environmental impact e.g. only one well to be re-entered now. This is as a result of the smaller seabed footprint, no piling or discharge of mud and cuttings and reduced number of construction days and vessel time.
2.6.1	[Subsea Infrastructure] Overview	Revised description of the subsea infrastructure, including the approach for the use of one WHPS and smaller subsea manifold.	Reduced seabed footprint and embedded carbon in structures resulting in a reduction in environmental impact.
2.6.2	WHPS and subsea manifold	Revised description of the subsea infrastructure. In particular removed reference to the drilling template and replaced with information regarding the WHPS. Updated information on the revised subsea manifold.	

Section Number	Section Name	Change	Implication
2.8.1	Production profiles	Updated the predicted production profiles for gas, condensate and produced water based on the revised project design and activity schedule.	Reduction in the peak production measures for gas and condensate over a longer period. Associated with this is an increase in produced water volume extended over the life of the field to 2044.
2.10	Decommissioning	Added relevant information from the revised and optimised project design that would affect the decommissioning.	Less infrastructure on the seabed to be removed at decommissioning, which are also non-permanent, thereby reducing permanent and decommissioning impacts.
3	Environmental Baseline		
3.2.1	Weather and sea conditions	Updated the Hornsea wave buoy to include data up to 2021	No change to impact assessment.
3.5.1	Commercial fisheries	Updated commercial fisheries to cover 2019 data and revision of the 2018 statistics where these had been revised.	No change to impact assessment.
4	EIA Methodology		
4.3	Scoping and consultation	Statement summarising changes to the impact assessment as a result of the revised project description and following consultation with consultees.	Identifying the fact that issues originally identified during consultation were no longer applicable. Reduced discharge to sea, underwater noise, seabed footprint and embedded carbon with the revised design.
4.7	Issues assessed	Update to the issues assessed and scoped out following the revised and optimised project description. Edited and deleted issues pertaining to: • Discharge of water-based drilling mud and cuttings to account for the fact that there would be no discharge to sea; and • Injury and disturbance to marine mammals as there would be no piling.	

Section Number	Section Name	Change	Implication
4.7.1	Issues scoped out	Scoped out underwater noise as there are no longer piling activities due to the optimised engineering design and any noise emissions associated with construction activities are not predicted to cause injury.	
5	Discharges to sea		
5.1	Introduction	Updated to reflect the planned construction activities due to the revised and optimised engineering design. This included information on the fact that: • There are no planned discharges to sea associated with drilling mud and cuttings associated with the sidetrack on the existing appraisal well; • All mud and cuttings associated with the sidetrack are to be skipped and shipped to shore; and • The only discharges to sea are from well cementing and clean-up chemicals and chemicals for the installation and commissioning of subsea infrastructure	Reduction in the environmental impact, associated with a smaller impact footprint and shorter duration of effect due to the limited discharge to sea. Confirmation of Premier's commitment in reducing environmental impact is provided as part of the mitigation and management.
5.3	Assumptions and data gaps	Updated to reflect the revised project description, including the fact that there are no data gaps in the assessment of discharges to sea from cementing and aqueous discharges.	
5.4	Description and quantification of potential impacts	What was originally sub-section 5.4.2 was deleted in its entirety following the revised project description as there was no discharge to sea of mud or cuttings.	
5.4.1	Drilling discharges	Updated to reflect the planned construction	

Section Number	Section Name	Change	Implication
		activities i.e. use of existing appraisal well and drilling strategy, whereby there are no discharges to sea of drill mud and cuttings, which are to be skipped and shipped to shore.	
5.5	Management and mitigation	Updated to reflect revised project description. Also added reference to the Harbour Energy plc's HSES policy	
5.9	Residual impacts	Updated the potential impacts to reflect that there are no discharges to sea expected.	
6	Seabed impacts		
6.1	Introduction	Updated to reflect the planned construction activities due to the revised and optimised engineering design. Changes involved: • No drill cuttings will be discharged as completing existing appraisal well and no drilling of new wells; • Update to reflect optimised subsea infrastructure; and • Adding further information regarding Premier's base case option for pipeline and umbilical, which is to bury and trench.	Reduction in the environmental impact, associated with a smaller seabed footprint, shorter duration of activities, no discharge to sea of mud and cuttings. Although construction of the subsea infrastructure coincides with the spawning period for sensitive species, the smaller seabed footprint, short duration of works and recovery of features in the season following completion of the works all act to limit any direct and indirect effects on the species.
6.5	Description and quantification of potential impacts	Updated to reflect the revised project description, including the calculated direct and indirect seabed impact areas in Table 6.2	
6.5.1.2	Effects on fish	Update to the assessment of direct impacts to the fish receptor following the revised project schedule. Updated information regarding spawning and nursery periods which coincide with the construction and installation of the subsea infrastructure.	

Section Number	Section Name	Change	Implication
6.5.2	Indirect impact	Removed information about drill cuttings from top hole sections as using the existing appraisal well and no new top hole section to be drilled.	
6.5.2.2	Effects on fish	Update to the assessment of indirect impacts to the fish receptor following the revised project schedule and revised project description. Updated to discuss indirect effects on fish and particularly sensitive BAP species, associated with the constructions programme and smaller seabed footprint of the WHPS and subsea infrastructure	
Previously Section 7	Underwater Noise	Deleted in its entirety due to the revised and optimised engineering design, negating the need for piling.	Reduction in underwater noise causing disturbance or injury as no pilling is required for the gravity base subsea infrastructure are.
8	Atmospheric Emissions		
8.2	Regulatory controls	Added information on global climate change considerations from the IPCC, ETS scheme and national Net Zero policy and targets in line with new EIA regulations. Also included information on Harbour Energy plc's Climate Change policy and Net Zero goals.	Lower atmospheric emissions due to the reduced and shorter project activities. Only completing the existing appraisal well and no drilling of new wells means smaller number of vessels over a shorter duration, thereby reducing environmental impact. Subsea development negates the need for operational flaring with minimal flaring during well clean up, thereby reducing atmospheric emissions. The optimised engineering design demonstrates Premier's effort in addressing the threat of climate change and implementation of
8.4	Description and quantification of potential emissions	Updated the atmospheric emissions associated with construction and operation vessels. This includes updating emission values in 8.5. relating to vessels, the MODU and flaring during well clean-up. Also updated to reflect revised activity schedule.	

Section Number	Section Name	Change	Implication
8.5	Achieving carbon neutral target for Scope 1 and Scope 2 GHG emissions	Described Premier's approach on improving GHG performance through minimising emissions from optimised design and carbon off-setting with the aim to be carbon neutral through the full lifecycle of the project for Scope 1 and Scope 2 GHG emissions. Edits were applied through the associated sub-sections.	Harbour Energy plc's Climate Change policy and Net Zero goals.
8.6	Management and mitigation	Added environmental management considerations, which included: • Monitoring atmospheric emissions against business performance contract; and • Subsea development means there is no requirement for operational flaring, with only minimal flaring during well clean-up and pre-commissioning.	
8.7.2	Global climate change	Updated this section to capture the 6th carbon budget.	
9	Accidental Events		
9.3.1	Events and likelihood of occurrence	Included information to reiterate that the majority of spills are less than 100 tonnes	No change to impact assessment
10	Environmental Management		
10.1	Premier HSE management system	Introduction and explanation regarding the integration of Premier and Chrysaor's HSE management, culminating in Harbour Energy plc's HSES policy, which is illustrated in Figure 1-2	Demonstration of Harbour Energy plc's Climate Change Policy.
10.2	Tolmount East Project environmental management and commitments	Updated commitments log to reflect revised and optimised engineering design and Premier's effort in working towards their Net Zero goals through	Consolidation of environmental mitigation and management commitments, thereby demonstrating adherence to Harbour

Section Number	Section Name	Change	Implication
		monitoring of emissions against annual target, no operational flaring and commitment to minimise emissions.	Energy plc's Climate Change Policy and Net Zero goals.
11	Conclusion		
11.4	Environmental impacts	Updated impact table based on information and changes listed above,	Reduction in environmental impact, due to smaller footprints and shorter duration of impact and effects as a result of: • Limited discharges to sea; • Reduced underwater noise; • Reduced drilling scope; • Smaller seabed footprint; • Lower embedded carbon; • No operational flaring; and • Lower number of construction vessels over a shorter construction period.

NON-TECHNICAL SUMMARY

Introduction

This Non-Technical Summary provides an overview of the Environmental Statement (ES) for the Tolmount East Development. The ES presents the findings of the Environmental Impact Assessment (EIA) conducted for the development of the Tolmount East field, located in United Kingdom Continental Shelf (UKCS) Block 42/28d. The EIA is conducted by Premier Oil UK Limited (hereafter referred to as Premier) is a subsidiary of Harbour Energy plc. Harbour Energy plc was formed through an all-share merger between Premier and Chrysaor on the 1st April 2021.

In 2009, Premier acquired Oilexco which, along with a package of producing and development assets and exploration acreage, provided the Company with UK operatorship capabilities. Premier acquired its 50% operated interest in the pre-development Tolmount project in 2016 as part of its acquisition of E.ON E&P UK Ltd. Premier and its joint venture partners sanctioned the development of the Tolmount Main gas field in 2017 and subsequently drilled the Tolmount East well in 2019. Premier is now the 50% owner, with Dana Petroleum E&P Ltd. (Dana) (50%), of Block 42/28d within which the Tolmount East field and the nearby Tolmount field are located. Premier is the operator of both fields.

Tolmount East lies in the southern North Sea, approximately 37 km east of Flamborough Head and 152 km from the UK/Netherlands median line (Figure 1-1). It is primarily a gas field, with some condensate. Tolmount East will be developed using subsea infrastructure only, tied back to the Tolmount minimum facilities platform (MFP), which is located approximately 4 km south west of Tolmount East and currently under construction.

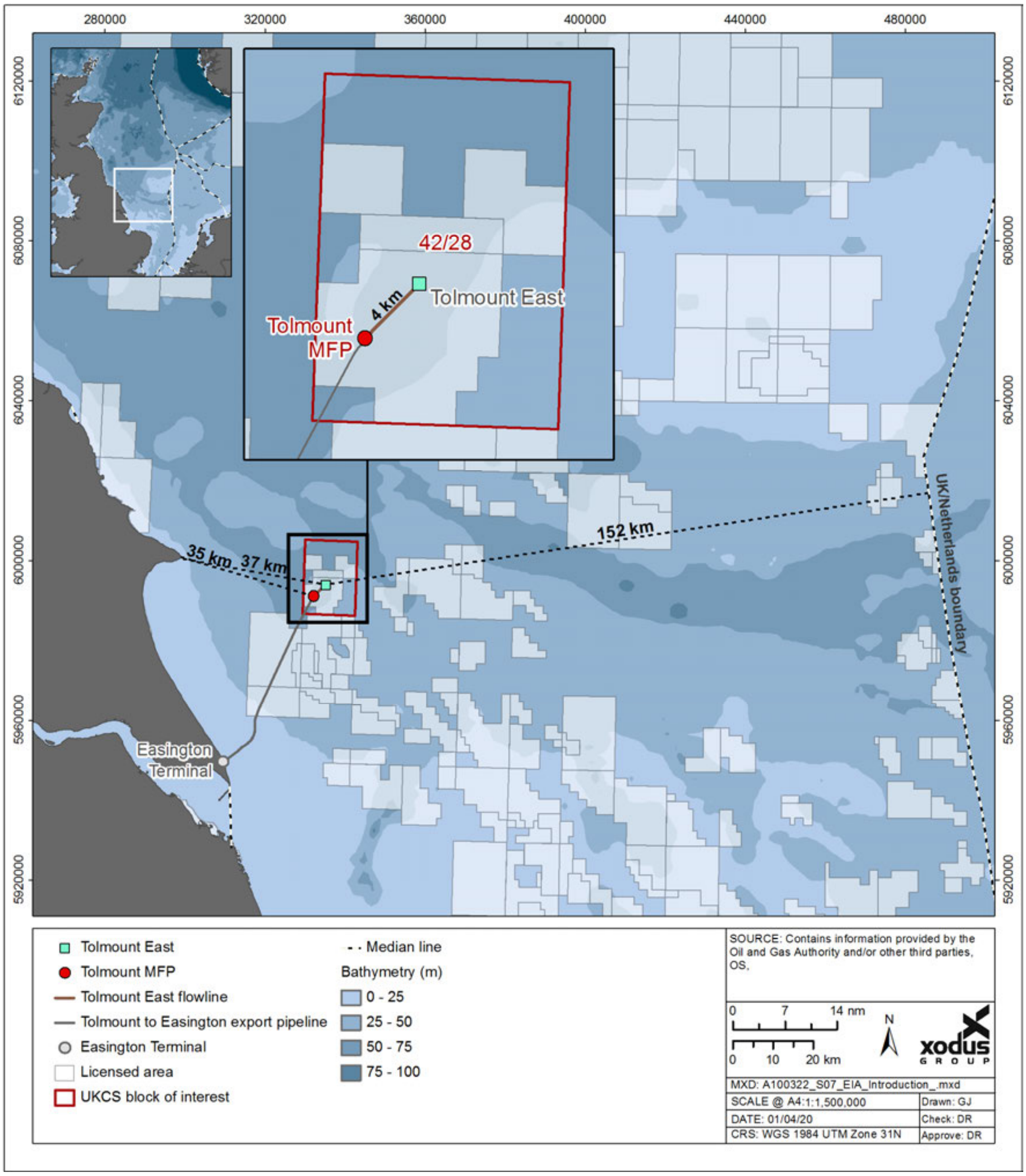


Figure 1 **Tolmount East Development in the context of the wider Tolmount Area Development**

Premier proposes to progress field development with a view to achieving first gas by August 2023. The Tolmount East Development has a number of economic benefits for the UK including generation of additional revenue to the UK Government, contribution to the security of the UK's clean energy supply and securing or adding to employment locally. The provision of additional pipeline infrastructure may also facilitate future developments in the area.

Consideration of Alternatives

The development option selected for Tolmount East was arrived at through a technical concept selection process involving consideration of a platform development or a subsea development, tied back to existing offshore infrastructure. The selection process took cognisance of environmental, health and safety, technical, project execution, and commercial issues and risks and included a comprehensive value assurance review. Environmental considerations have been part of the option selection process throughout, with views being sought via direct consultation with regulators and key stakeholders. Reservoir surveys, appraisal well and further well engineering studies demonstrated that one initial subsea development well and a converted appraisal well, with the gas being exported to shore via a subsea manifold and flowline to the Tolmount MFP, provides the optimum solution for initial development of the field.

Initial concept selection studies were undertaken when available information indicated the potential for production of significant volumes of water from the Tolmount East reservoir, and therefore the handling of produced water was the main issue to be addressed in selecting a development concept. Six options were considered, all of which involved routing of production to the Tolmount MFP with gas export to Easington Gas Terminal. The selected option involved the installation of a platform at Tolmount East to separate, treat and discharge the produced water offshore.

Subsequently, an appraisal well drilled into the reservoir in 2019 provided further information to inform the design process. In particular, the potential for produced water production was forecast to be much lower than originally anticipated and therefore development options that were previously ruled out were reassessed due to lower produced water rates. Since the water production rate is expected to be less than the available waste-water treatment capacity at the Easington Terminal, offshore water handling facilities are no longer required, and a subsea concept was selected. A subsea development concept has a significantly lower capital cost than a platform and has a significantly reduced environmental impact across its operational life.

Other key decisions considered during the design process included the sizing of the subsea infrastructure. The subsea WHPS and manifold sizes are being minimised to be as low as possible, subject to engineering and operational constraints. This work will continue through detailed design and so the ES presents the maximum dimensions, subject to further optimisation. Premier has also opened narrative with the National Federation of Fishermen's Organisations to discuss overtrawl requirements in order to reduce impacts of the WHPS and manifold on fisheries.

Regarding the 12” flowline to Tolmount MFP, different installation and protection measures are currently under consideration as part of the project planning and impact assessment. These include:

- Trench and burial along the entire route;
- Surface lay and burial under a single protective berm; and
- Surface lay and burial under two separate protective berms.

The base case is for the trench and burial of the entire length of the Tolmount East flowline and umbilical. However, as a worst case scenario, the ES also includes an assessment of the environmental impact of full rock protection berms along the length of the pipeline and umbilical. The final installation concept is under review and will be dependent upon the findings of engineering studies to be performed during the detailed design stage of the project.

Overview of Selected Option for the Tolmount East Development

The updated Tolmount East concept is for a single well development. Production from the Tolmount East field will be via an existing appraisal well which will be re-entered, sidetracked and completed as a producer well. The subsea facilities have been designed to allow further wells to be drilled and brought online as part of future developments, subject to required environmental assessments and approvals. The produced fluids will be transported via a new 12” subsea flowline to the Tolmount MFP, from where they will be directed (unseparated) straight into the existing gas export pipeline between Tolmount and the Easington terminal. Produced water from Tolmount East will be treated and disposed of at the Easington terminal. Production at Tolmount

East will be remotely monitored and controlled from the Easington terminal via a new umbilical to be installed between the Tolmount MFP and Tolmount East.

The proposed Development will comprise:

- The completion of the existing appraisal well with the installation of a Wellhead Protection Structure (WHPS) over the well;
- A three slot Tolmount East subsea manifold which will be connected to the WHPS via 6″ jumpers;
- A 12″ Tolmount East flowline, running from the subsea manifold to the Tolmount MFP;
- A new umbilical running from the Tolmount MFP to the Tolmount East subsea manifold, which will supply electrical power, control, methanol and other chemicals; and
- Additional controls equipment on the Tolmount MFP to supply Tolmount East with the subsea elements of the control system.

Total gas production from Tolmount East is predicted to peak in 2024 at approximately 2,520 (1,000 m^3 per day), before steadily declining over expected field life. Total condensate production is also predicted to peak in 2024, at 68 tonnes per day, before steadily declining over field life.

The preliminary schedule for the Tolmount East Development is illustrated in Figure 2. This programme may change subject to detailed scheduling, fabrication times of key pieces of equipment and availability of construction vessels. Construction is mainly to occur in 2023, with first gas expected by August 2023.

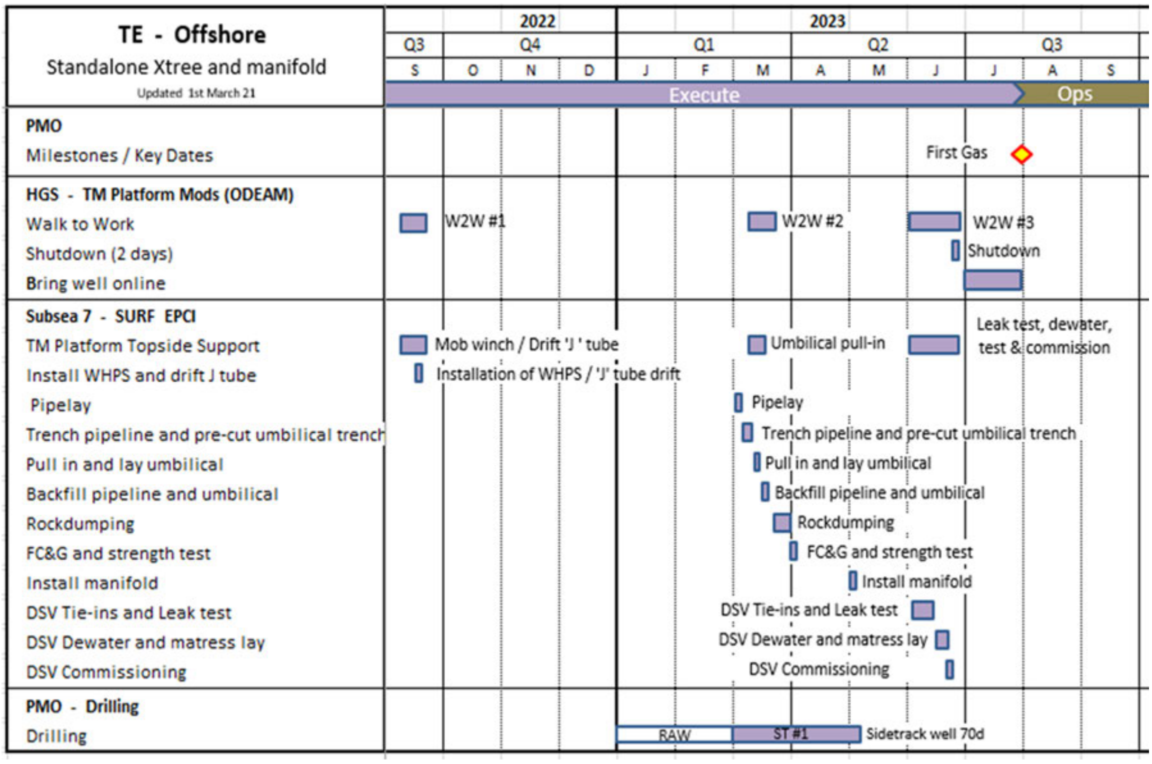


Figure 2 Tolmount East Development Offshore Activity Schedule

Well and Drilling

The development plan for the field will be to re-enter an existing appraisal well to drill a 6″ sidetrack into the reservoir, complete the well and tie it into production. Additional wells may be drilled in the future, however, they will be subject to a separate investment decision and EIA.

The existing appraisal well is expected to take approximately sixty-five days to sidetrack and complete. The well will be directionally drilled from a Mobile Offshore Drilling Unit (MODU). It is expected that a heavy-duty jack-up MODU will be used. Jack-up MODUs are generally not self-propelled and rely on tugs or heavy lift ships for transportation to the drilling location. The MODU will be positioned on location with the assistance of anchor handling vessels before being jacked up on its legs.

Completion of the existing appraisal well will entail the use of drilling muds to lubricate the drill mechanism, carry away rock cuttings and to maintain pressure to prevent the escape of gas from the drill hole.

A conductor is already in place at the existing Tolmount East appraisal well. A High Pressure (HP) riser will be connected to the conductor to act as a conduit for the mixture of cuttings and mud (returning back up the well bore from the sidetrack drilling) to be pumped up to the MODU. This enables cleaning and separation of the mud and cuttings mixture to take place, so that the drilling mud can be recycled and used again, and the cuttings waste will be skipped and shipped to shore.

For the 6″ hole section, an oil-based mud with low toxicity (called low toxicity oil-based mud, or LTOBM) will be used. The cuttings will be separated from the LTOBM on board the MODU, contained and shipped to shore for further cleaning prior to disposal. There will be no discharge of drill mud and cuttings to sea.

A small amount of cement will be discharged to sea during the cementing of the sidetrack and potentially during any aborted cement operation.

Prior to commencing production, the well will be cleaned up to remove any waste and debris remaining in the well, to prevent damage to the production facilities and flowline. Flaring of gas and condensate will be required during the clean-up period which is not expected to last more than two days per well (i.e. <48 hours) Less than 2,000 tonnes (Te) of combined hydrocarbons (gas and condensate) may be flared during clean-up of the sidetrack.

Subsea Infrastructure

The main subsea infrastructure at Tolmount East consists of a WHPS which is mechanically connected to the existing appraisal wellhead housing and a separate gravity based subsea manifold (which houses the subsea controls equipment). No piling will be required to install these structures. The in-field subsea structures will be installed using a construction vessel and a diving support vessel.

There will also be the 12" Tolmount East flowline to carry the produced fluids from the field, and the umbilical supplying chemicals, hydraulics, electrical power and communications to Tolmount East. The flowline and umbilical will both be approximately 4 km long, between the Tolmount East manifold and the Tolmount MFP.

The activities around construction and installation of the Tolmount East flowline are currently scheduled to take place between Q1 and Q2 2023. The construction and installation phase will involve the following activities:

- Boulder clearance (if required);
- Sweeping and dredging of the seabed as necessary along the flowline route corridor to clear it of obstructions and to smooth the seabed profile, reducing the risk of exposures, free spans and stresses;
- Installation of WHPS and subsea manifold;
- Pipelay from Tolmount East to the Tolmount MFP;
- Umbilical lay from the Tolmount MFP to Tolmount East including J-tube pull-ins;
- Subsea spool-piece installation, tie-ins and leak testing;
- Placement of concrete mattresses and rock armour for flowline/umbilical protection. Typically, this will comprise:
  - Mattresses across surface-laid spools and umbilical sections;
  - Rock armour (potentially underlain with mattresses) at trench transitions near the Tolmount MFP;
  - Rock armour at locations deemed susceptible to upheaval buckling[1] (flowline only); and
  - Rock armour at locations where existing backfill did not meet the required minimum burial depth, which is the assumed very much worst case.
- Flooding, cleaning, gauging, hydrotesting and leak-testing of the flowline;
- Pressure test of umbilical hydraulic, methanol and chemical cores, and test of electrical and fibre optic cores; and
- Dewatering of flowline.

Once the flowline has been laid on the seabed, the base case is to trench and bury. In the event that a minimum of 0.6 m depth of cover over the top of pipe is not achieved, ‘spot’ rock armour will be used to provide the required level of flowline protection and stabilisation. The umbilical will be installed separately along the same route and will

[1] Vertical buckling of the pipeline due to the pipeline being laid over a boulder or due to irregularities in the seabed profile, leading to exposure of the pipeline on the seabed.

also be trenched and buried (base case) or any sections not achieving the required depth of cover, subject to rock placement.

A worst case assumption of rock armour deposition along the whole 4 km route (with the umbilical and pipeline being protected under separate berms) has also been included. In this scenario, the worst-case rock volume required is estimated at 48,960 m^3, with a contingency volume of 20 %. This equates to a worst-case total weight 74,909 Te with the 20% contingency. The size of the pipeline berm is 1.4 m high x 9.4 m wide with a 1.07 m cover to the top of the flowline. The size of the umbilical berm is 1 m high x 5.9 m wide with a 0.76 m cover. As described above, this is not the base case option but will be investigated during engineering studies of umbilical and pipeline protection and stabilisation to be performed during detailed design.

Seabed sweeping and/or dredging may be required prior to installation of the flowline to flatten the crests of mega sand ripples present across much of the route. Detailed design will indicate which areas will require sweeping, which will be minimised as far as reasonably practicable. If required, seabed sweeping would be conducted using a trailing suction hopper dredger which sucks up a mixture of seabed sediments and water. This slurry is discharged into the hopper or hold of the vessel where most of the seawater drains out. Spoil from the hopper will be deposited at an approved location. Since the mega ripples are likely to reform, either the sweeping operation will be carried out shortly before the pipelay operations or maintenance sweeping by dredger will be required to maintain a lay corridor. The dredger will be dynamically positioned (DP) and will not require anchoring during dredging.

The flowline will be installed using a DP reel-lay vessel. The umbilical will be installed parallel to the export pipeline with minimal separation and will be installed by a construction vessel.

Once the Tolmount East flowline has been installed, it will be flooded with filtered seawater then cleaned and gauged by propelling a pig train from one end to the other. The pig train will be followed (and driven) by seawater treated with a mix of biocides and corrosion inhibitor, which will remain in the flowline until dewatering. Hydrotesting (strength testing) will then be undertaken by pumping further treated seawater into the flowline system and raising the pressure temporarily to ensure the system is structurally sound. On completion of subsea tie-in operations, the entire flowline system will be leak tested to ensure it is leak free and ready to be brought into service.

Before the flowline system comes into use it needs to be emptied of water (dewatered). Dewatering will be achieved by a pressure-driven pig train from the Tolmount East subsea manifold to the Tolmount MFP, with the treated water discharged at the platform. Following dewatering, the flowline will be left filled with nitrogen at low pressure until it is commissioned.

Operations and Maintenance

The Tolmount East produced hydrocarbons (gas and condensate) will flow back to the Tolmount MFP, where they will be co-mingled with the Tolmount field fluids, and then exported onwards via the Tolmount export pipeline for processing at the Easington terminal. Metering for Tolmount East is undertaken at the manifold.

The subsea facilities at Tolmount East will be remotely monitored and controlled from the Easington terminal.

During its operational lifetime, the Tolmount East flowline will be subject to several inspections (called in-line inspections) to examine integrity as part of the pipeline integrity management strategy. External inspections will take place through a combination of remotely operated underwater vehicles and towed sonar. Internal inspections using intelligent pigging operations will be performed as required.

Receiving Environment

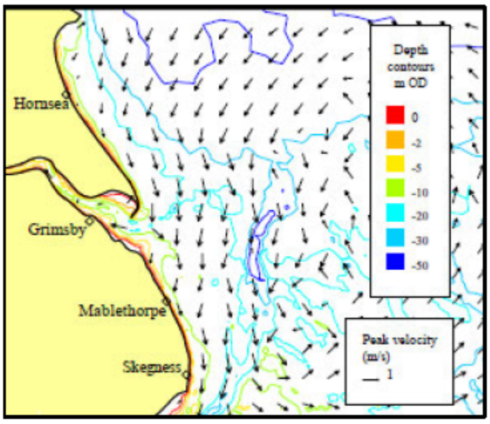
Information about the environment in the Project area (Tolmount East subsea development location and the flowline and umbilical route between Tolmount East and the Tolmount MFP) and its surroundings was collated to allow an assessment of those features that might be affected by the proposed Project activities, or which may influence the impact of the operations. Key information, derived from published sources and project specific surveys and studies of the areas, is summarised in Table 1.

Table 1 Environmental sensitivities in the area of the proposed Tolmount East Development

Bathymetry and metocean characteristics

The mean annual wind speed in the southern North Sea (SNS) where the Tolmount East Development is located generally ranges between 1 m/s and 32 m/s, and winds from south-southwest are prevalent. In the summer months wind speeds generally lie between 1-11 m/s, while gale -force winds of 14-32 m/s are more common in winter.

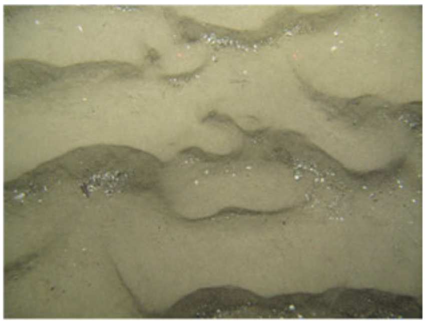
This region of the North Sea is dynamic, characterised by shallow, well-mixed waters, which undergo large seasonal temperature variations. The SNS receives significant freshwater input from the surrounding land masses, making it less saline than other parts of the North Sea and subject to nutrient-rich inputs.



Currents in the North Sea circulate in an anti-clockwise direction, driven by inflows from the Atlantic via the northern North Sea down the UK east coast and through the English Channel, and outflow northwards along the Norwegian coast. The direction of residual water movement at the Tolmount location in the SNS is generally to the south, following the coastline. The seabed is frequently subject to disturbance by both waves and currents. Wave action is generally from within the north-east sector.

The SNS is particularly shallow, with water depths mostly less than 50 m. Water depth at the Tolmount East location is 50 m.

Sediment type and seabed features



Seabed features in the SNS include active sandbanks and sand waves which are maintained by the tidal and current regimes descr bed above. Examples of such features include the North Norfolk sandbanks, active systems that are thought to be progressively elongating in a north-easterly direction and which are maintained and developed by sediment transported offshore, and the less active Dogger Bank, a large sublittoral sandbank formed by glacial processes before being submerged through sea level rise.

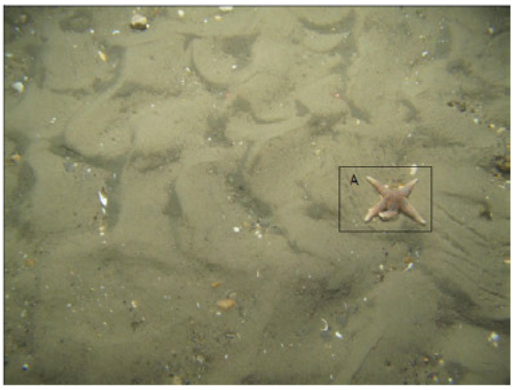
Seabed sediments recorded between Tolmount East and the Tolmount MFP were generally fine to medium sand with shells, shell fragments, gravel and cobbles. Sandwaves were observed near the proposed Tolmount East WHPS location, and megaripples were observed along the entire route with crests orientated east-northeast to west-southwest. The proportion of mud (silt and clay) in the samples ranged from zero to 4.2% (mean - 1.86%).

Plankton

Phytoplankton abundance within the SNS fluctuates less than in the central and northern North Sea, and winter levels are higher than further north. Monitoring between 1997 and 2007 has shown that whilst phytoplankton numbers increase in May, the spring peak in biomass is lower than that observed in central or northern areas of the North Sea. Analysis of data provided by Continuous Plankton Recorder surveys suggest that the most abundant zooplankton in the North Sea are calanoid copepods.

The copepod *Calanus finmarchicus* has historically dominated the zooplankton of the North Sea and is used as an indication of zooplankton abundance. Overall abundance of *C. finmarchicus* has declined significantly over the last 60 years. This has mainly been attributed to changes in seawater temperature and salinity. *C. finmarchicus* has been replaced by boreal and temperate Atlantic and neritic species; in particular, a relative increase in the populations of *C. helgolandicus* has occurred.

Seabed habitats and species



The environm ental survey of the Tolmount East area reported a generally low abundance and diversity of epifauna with occasional hermit crabs with commensal hydroids, the common sea star and brittle stars. Epifaunal diversity and abundance increased slightly wherever pebbles and cobbles were present, to include tube-dwelling serpulid polychaetes (especially the keel worm), hydroids and bryozoans. Occasional fish were observed, including skate, red gurnard and unidentified flatfish.

Infauna within the survey area showed low to moderately high richness and diversity. Annelids (mostly polychaete worms) were the most abundant type of invertebrate, both in terms of abundance and number of taxa present, with molluscs, crustaceans and echinoderms accounting for lower numbers of species and individuals. While annelids were dominant overall, the single most abundant taxon present was the pea urchin, followed by the bivalve *Kurtiella bidentata*. The next eight most abundant taxa (not in order) were a species of nemertean worm, four polychaete species, two species of amphipod crustacean and a brittle star.

Biotope classification based on seabed photography indicated that all infield stations were most consistent with the EUNIS biotope complex A5.14 - 'Circalittoral coarse sediment', which is defined as 'coarse sands, gravel and shingle' Review of the dominant infaunal taxa supported a different interpretation of the biotopes in the infield area. The infaunal community was best represented by the EUNIS biotope A5.251 - '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sands'.

Fish and shellfish

A number of commercially important fish species occur in the vicinity of the Project, which is located within the nursery area of cod (high intensity), herring, lemon sole , whiting (high intensity), blue whiting, mackerel, anglerfish, sandeels , spur dog and sprat.

Spawning activity is generally regarded as representing a higher sensitivity than nursery areas. Tolmount East is located within spawning grounds of for cod, herring, lemon sole, plaice (high intensity), sandeels and sprat.

A herring spawning assessment survey was commissioned as part of the environmental survey work carried out over the Tolmount area. It concluded that the majority of sediments within the survey area were 'unsuitable' for herring spawning due to low proportions of gravel (<10%), indicating low spawning potential.

Other fish types known from the region include horse mackerel, pollack, saithe, seabreams (species unknown), Atlantic salmon, sea trout, bass, pouting, shad, haddock, hake, gurnards (various species), John dory, greater weever, turbot, flounder, brill, dab, starry smooth hound, tope, thornback ray, spotted ray and blonde ray. Several shellfish types occur in the region including cockles, scallops, cuttlefish, squid and octopus, together with brown crab, lobster, brown shrimp, pink shrimp, Norway lobster, spider crabs and the velvet or swimming crab.

Seabirds

Many bird species are known to occur in the vicinity of the Tolmount East Development including northern fulmar, pomarine skua, Artic skua, great skua, black-legged kittiwake, little gull, great black backed gull, common gull, lesser black backed gull, herring gull, glaucous gull, sandwich tern, common tern, Arctic tern, common guillemot, razorbill and Atlantic puffin.

In the vicinity of the Tolmount East field, seabirds sensitivity is very high in February to April (using data from March to cover a data gap in April) and June, high in May and July to November (using data from September to cover a data gap in October), medium in December and low in January. There are periods of concern relating to seabird vulnerability to surface pollution for the months of February, March, April and June, as highlighted by the JNCC. This is in relation to drilling activities for Block 42/28. Seabirds are most vulnerable to oil spills during moulting, when they become flightless and spend time on the sea surface.

Marine mammals

Compared to the CNS and NNS, the SNS generally has a relatively low density of marine mammals, with the likely exception of harbour porpoise. While over ten species of cetacean have been recorded in the SNS, only harbour porpoise and white-beaked dolphin can be considered as regularly occurring throughout most of the year, and minke whale can be considered a frequent seasonal visitor. Bottlenose dolphin and Atlantic white-sided dolphin can be considered uncommon visitors.

The Southern North Sea Special Area of Conservation (SAC), designated due to the presence of harbour porpoise, is located 1.1 km east of the Development as described below.

Grey and harbour seals may be present in the vicinity of the Project area.

Conservation

Tolmount East is not situated in any sites of conservation importance (Figure 3). The closest site of conservation impotance is the Southern North Sea SAC, located 1.1 km east of the Project. Other sites of conservation importance in the region include the Holderness Offshore Marine MCZ, Flamborough Head SAC and Greater Wash SPA.

The Southern North Sea SAC has been designated due to the presence of harbour porpoise. The SAC ranges in depth from mean low water down to 75 m and made up predominantly of coarse sediments. These physical characteristics are thought to be preferred by harbour porpoise, likely due to availability of prey.

The Holderness Offshore MCZ is located approximately 10.9 km south west of the Project. The designation of this site was recommended due to the presence of ocean quahog and the EUNIS broad scale habitats 'Subtidal coarse sediment' (A5.1) and 'Subtidal mixed sediments' (A5.4). The site is also significant for crustaceans, including edible crabs and common lobster.

The Flamborough Head SAC is located 39 km west of the Project. The site is an area of partly vegetated high chalk cliffs, caves and a chalk reef extending up to 6 km offshore. The qualifying features of the site are the following Annex I habitats, reefs, vegetated sea cliffs of the Atlantic and Baltic coast and submerged or partially submerged sea caves.

The Greater Wash SPA is located 27.1 km west of the Project. The Greater Wash area is known to provide areas of importance for over-wintering red-throated diver, little gull and common scoter during the winter period (October to April). The area is a designated SPA to protect these areas. In addition, the Greater Wash SPA provides protection to important foraging areas for common, Sandwich and little tern, which breed along the adjacent coastline.

A number of marine species in UK waters have been identified for protection under Annex II of the European Habitats Directive. Annex II species recorded in the offshore areas of the UK that qualify for protection include the grey seal, harbour seal, harbour porpoise and bottlenose dolphin. All these Annex II species are likely to occur in the Project area. The diadromous fish Atlantic salmon and sea lamprey are also listed on Annex II. These species migrate between fresh and sea water and it is possible that will be encountered to some extent in the vicinity of the Project.

Harbour porpoise and the dolphin and whale species which may occur in the area are designated European Protected Species (EPS). The European sturgeon and leatherback turtle are also classed as EPS and occur in UK waters, although they are not expected to be present in significant numbers in the vicinity of the Project. Some species featuring on the OSPAR list of threatened and/or declining species, are also l kely to be present in the area including the black-legged kittiwake, cod and harbour porpoise.

Fisheries and shipping

The Tolmount East field is located in International Council for Exploration for the Seas (ICES) statistical rectangle 37F0. The area is fished by UK and international vessels, and is rated from high to low in terms of fishing value and effort. The main species landed are shellfish – lobsters, crabs, whelks and scallops - though demersal and pelagic fish species are also targetted. Fishing occurs throughout the year, mainly using static gear, and activity is mainly governed by weather and tidal conditions rather than season.

A shipping intensity study indicated that there are 46 routes within a 10 nm radius of the Tolmount East location, used by an estimated 7,837 vessels per year. This represents an average of 21 vessels per day.

Other sea users

There are several active oil and gas fields in the vicinity of Tolmount East, the closest active fields being Rough, Minerva, Neptune, Ravenspurn, Neptune and York fields, located between 14 km and 39 km away. Tolmount East is proposed as a subsea tieback to the Tolmount Development currently under construction by Premier

There are a number of wind farm licensed areas and wind farm projects under development in the SNS.

The Project does not cross any pipelines or cables. There are several pipelines in the vicinity of the Project, the nearest being PL1929 which runs between Wollaston and Whittle installations and is situated approximately 5 km away. The nearest cable to the propsed project is associated with the Westernmost Rough Wind farm, situated >28 km in a southerly direction.

A geophysical survey identified one wreck located approximately 280 m west-northwest of Tolmount East. There were no other wrecks identified during geophysical survey of the proposed Project Area or pipeline route, and UKHO data do not indicate any other wrecks in the near vicinity.

The nearest licenced aggregate extraction sites occurs approximately 44 km south of Tolmount East.

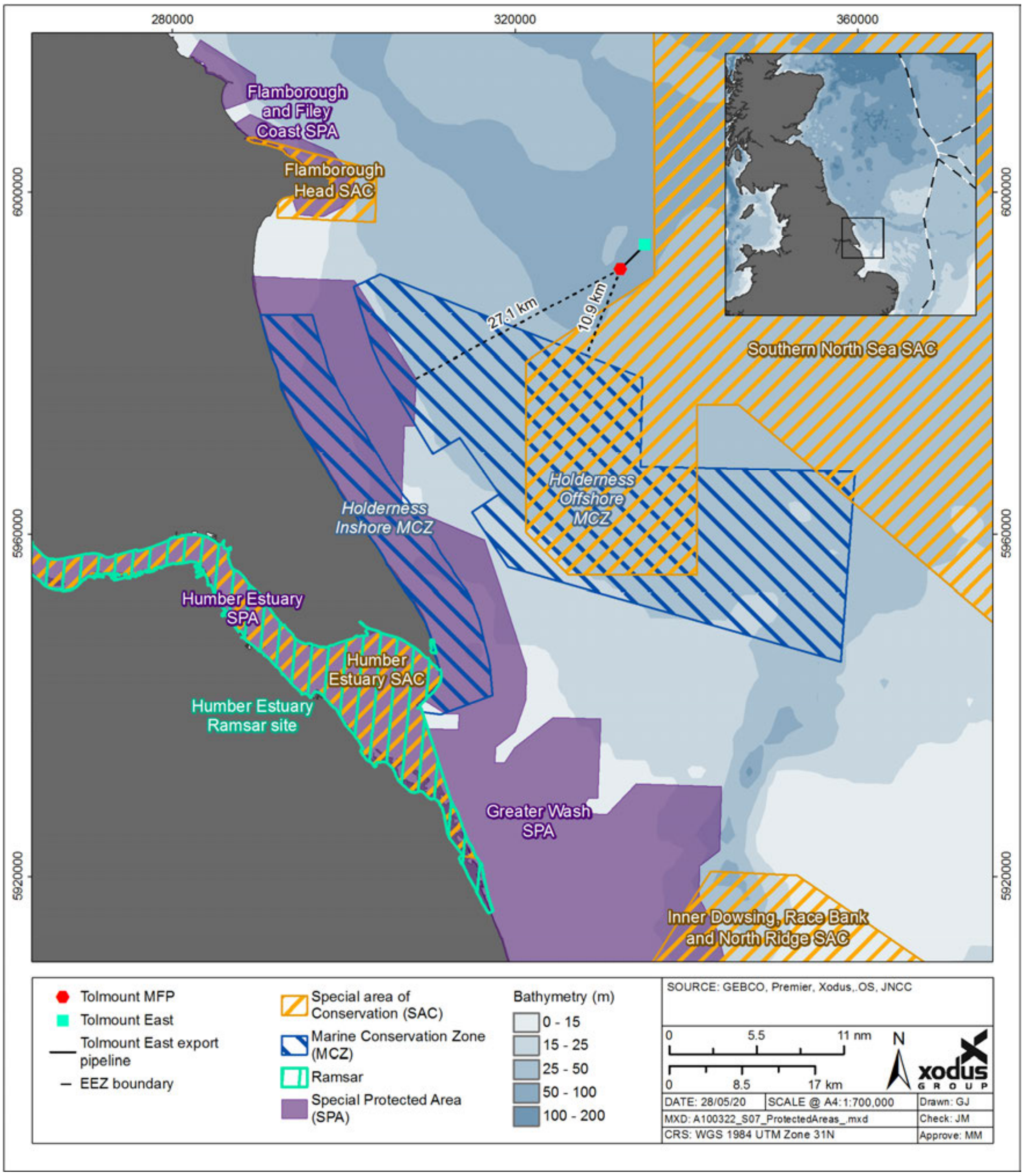


Figure 3 Sites of conservation interest in the vicinity of the Tolmount East Development

Environmental Impact Assessment Methodology

Offshore activities can involve a number of environmental interactions and impacts due, for example, to operational emissions and discharges and general disturbance. The objective of the EIA process is to incorporate environmental considerations into the Project planning, to ensure that best environmental practice is followed and, ultimately, to achieve a high standard of environmental performance and protection. The process also allows for any potential concerns identified by stakeholders to be addressed appropriately. In addition, following the EIA process will ensure that the planned Tolmount East Development is compliant with legislative requirements and the Harbour Energy Health, Safety and Environment policy.

The main processes used to identify which potential impacts this EIA process should concentrate on were 'environmental issues identification' workshops, based on the accumulated experience of relevant engineers and environmental specialists, and agreed through scoping and consultation with the main offshore regulator the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) and its advisors: the Joint Nature Conservation Committee (JNCC) and Natural England and the Marine Management Organisation (MMO). Together, these approaches led to the identification of the following key issues for assessment:

- Discharges to sea;
- Seabed disturbance;
- Physical presence;
- Atmospheric emissions; and
- Accidental events.

To help inform these assessments, the following specialist supporting studies were also conducted:

- Site-specific environmental surveys of the seabed;
- Oil spill modelling;
- Pipeline dewatering study;
- Offshore cultural heritage assessment; and
- A fisheries intensity study.

Impact Assessment Summary

The majority of the impacts occur during drilling and the installation of subsea infrastructure, with minimal impacts during the operation of the Project. Following the workshops and further engineering optimisation, the requirement for piling was removed from the project design, via the use of a gravity base foundation for the subsea manifold and elimination of the four slot drilling template. As a result, the impact assessment requirement for underwater noise was scoped out on the basis that the main noise source would be from vessels, which would not be significantly higher than the background noise properties characteristics to this part of the SNS.

A summary of the assessment made for each of the main issues identified through environmental issues identification and scoping is provided in the sections below.

Discharges to Sea

Due to the ongoing project optimisation, there will be limited discharges to sea associated with the Tolmount East Development during construction and operation. During construction, all drilling mud and cuttings from the sidetrack of the existing appraisal well will be skipped and shipped onshore for processing and disposal. During operation all produced water will be piped onshore to the Easington Terminal. The discharges to sea associated with the Tolmount East are in relation to cementing of the sidetrack, or the discharge of chemicals used in pipeline flooding, cleaning, gauging and hydrotesting. These discharges may lead to potential impacts to the seabed or water column through the following mechanisms:

- Increased suspended solids in the water column; and
- Potential toxic impacts from the chemicals, in both the water column and at the seabed.

With regards to impacts on the water column from the cementing process, the actual concentration of chemicals in the water column is predicted to be low and rapidly diluted. Considering the mainly planktonic receptor species (with inherently high natural mortality rates), the transience of measurable impact in the short term, with low volume and short duration of activities, the overall impact magnitude is likely to be negligible and hence not significant.

During pipeline pre-commissioning, there will be discharges of chemically treated seawater. This is likely to cause a small and short-lived plume which potentially could contain toxic levels of some of the chemicals used during pipeline installation. The actual potential for toxic impacts on marine organisms depends on the duration of exposure, i.e. the period over which organisms would need to be present in the plume and to remain within it before experiencing acute toxicity. The key receptor for this impact is the plankton, as this largely cannot avoid unfavourable conditions. This type of discharge is closely regulated both in terms of the chemicals selected for use and their concentration and will be subject to permitting closer to the time of the actual activity. With a dynamic receiving environment, receptor transience and small plume size, no significant impact is expected to the water column and the organisms within it.

Operational discharges of produced water will not occur as part of the process, as all fluids will be comingled at Tolmount MFP and sent to shore for processing. Here the treatment and monitoring systems at the Easington terminal, and the close regulatory oversight and permitting system governing this type of waste, will ensure that no significant impact occurs onshore.

Discharges associated with the Project will not be made directly into any protected area. In addition, the modelling of discharges demonstrates that they do not spread sufficiently far to interact with any protected areas. As such, there is considered to be no Likely Significant Effect (LSE) on SACs, SPAs and MCZs and hence no impact on any conservation objectives or site integrity.

The limited quantity of chemicals discharged during the life of Project, and the use of appropriate management and mitigation measures, limits the likelihood of any measurable impacts. For this reason, no significant cumulative impacts are expected due to chemical discharges. Given the distance to the median line between the UK and the Netherlands (152 km), and the expected rapid dispersion of any discharge, no transboundary impacts are expected.

There will be limited potential for decommissioning activities to impact negatively the marine environment through discharges to sea.

The consequence of the potential impacts resulting from discharges to sea is considered to be negligible and not significant for any phase of the Project.

Seabed Impacts

The drilling of the sidetrack for the development well is likely to be conducted using a heavy duty jack-up MODU which will sit on the seabed and which will also be moored using four anchors during installation and removal. A small area of seabed where each anchor is placed will be compressed as the anchors sink into the seabed; in addition, sections of the associated anchor lines will lie on the seabed and cause abrasion as they move from side to side. This will cause localised direct damage to habitats and species for the duration they remain in position.

The installation of the WHPS and subsea manifold will also result in temporary disturbance during installation and the long-term placement of protection material (e.g. mattresses).

Physical disturbance is also likely to be caused during installation of the flowline, rock and other subsea structures which can cause mortality or displacement of benthic species in the direct footprint. The significance of direct habitat loss or mortality of sessile seabed organisms depends on the size of the area of disturbance, the level of tolerance of the affected habitat and species to direct disturbance, the conservation value of the affected habitat or species and the uniqueness of the affected habitats or species assemblages in the area.

In addition to the direct loss and/or disturbance of benthic habitats caused by seabed disturbance, such activities will also lead to sediment suspension and re-settlement, potentially leading to the smothering of benthic species and habitats around the areas of direct impact. Exposure to higher than normal loads of suspended sediment has the potential to affect negatively the adjacent habitats and species.

Along the pipeline route, seabed preparation activities will disturb a corridor up to approximately 40 m wide, with disturbance including removal of boulders, flattening of the seabed profile, displacement of sediment and overturning of sediment layers.

An assumed worst case 0.066 km^2 of new hard substrate will be created in the form of rock-armour and concrete mattresses installed for flowline and spool protection and mitigation against scour and any areas of unexpected upheaval buckling, should rock armour protection be required along the full length of the pipeline. The disturbance of sediment during pipelay operations can be considered to be a temporary impact, but the creation of new hard substrate in the form of rock armour is likely to be a permanent impact.

Consequences to benthic habitats and fauna

During environmental surveys of the Project area, biotope classification based on seabed photography indicated that all infield stations were most consistent with the EUNIS biotope complex A5.14 - 'Circalittoral coarse sediment', which is defined as 'coarse sands, gravel and shingle'. It is inevitable that there will be both direct and indirect impacts on this biotope as a result of the Project. Some of these impacts will be permanent in nature (i.e. where new infrastructure is located, existing habitat will be lost); some will be temporary, for example anchoring mounds and sediment disturbance caused by installation vessels. Recovery times will vary for the species and habitats present; however, it is expected that the sediment infauna and epifauna along the disturbance corridor and at the anchoring and dredge spoil sites will recover in the short to medium term, as will the epifauna that is damaged or disturbed during any boulder clearance. Any rock armour that is deposited will become populated with encrusting fauna in the medium term (within 10 years). Surveys of the wider area indicate that species and habitats identified during the Project surveys are a good representation of those found in the wider environment. It is therefore considered that given the expected recovery, proposed management and mitigation and the representation of species and habitats in the wider environment no significant impacts will occur.

Consequences to fish

Direct seabed impacts to adult and sub-adult fish and shellfish will be limited to disturbance or mortality from crushing or smothering during subsea and flowline installation activities. Fish are generally highly mobile and sensitive to pressure changes and visual stimuli, and it is therefore expected that the majority of fish in the path of the proposed operations will move before they are physically damaged. Given the wide area of similar habitat available and the temporary nature of the operations it is expected that fish will move outside the area of disturbance while Project activities are ongoing, and the Project area will be rapidly re-colonised following the cessation of activities. For less mobile shellfish species recovery is expected to be rapid (as indicated by ongoing fishing activities in the area).

WHPS and subsea manifold pipeline installation coincide to varying degrees with known spawning periods for cod, lemon sole, herring, sprat, sand eel and plaice. The majority of these species spawn over large areas, therefore the proposed operations will only affect a small proportion of the spawn and juveniles of each affected species. Spawning and recruitment for these species is not expected to be affected beyond one year after cessation of the Project installation activities, and recovery is therefore expected to be rapid.

Whilst most fish species spawn into the water column of moving water masses over extensive areas, benthic spawners such as herring have very specific habitat requirements, and therefore their spawning grounds are relatively limited and potentially vulnerable to seabed disturbance and change. A herring spawning assessment survey was commissioned as part of the environmental survey work carried out over the wider Tolmount area. It concluded that the majority of sediments within the survey area were ‘unsuitable’ for herring spawning due to low proportions of gravel (<10%), indicating low spawning potential. It is considered unlikely that the Project will have a significant direct impact on herring spawning due to the short duration of operations and the recovery of features in the season following completion of the works. Should delays occur in the installation programme, thereby extending the period of concurrence with the spawning period, it is still the case that the Project is unlikely to have a significant direct impact for the same reasons stated above.

Consequences to marine archaeology

Seabed preparation may impact known and potential cultural heritage assets by causing direct physical damage. The marine archaeological baseline environment within the wider Tolmount East Development area comprises just one known wreck, located approximately 280 m to the west-northwest of the Tolmount MFP. As this wreck does not lie within the Project footprint, no effects on its integrity are expected.

Protected sites

Tolmount East is not situated in any sites of conservation importance. The closest site of conservation importance is the Southern North Sea SAC, located 1.1 km east of the Project. Other sites of conservation importance in the region include the Holderness Offshore Marine MCZ, Flamborough Head SAC and Greater Wash SPA.

No cumulative or transboundary impacts are predicted in relation to the seabed impacts as a result of the Tolmount East Project.

Based on the assessment of the potential seabed impacts described above, noting that there will be limited impact on protected sites or on species from protected sites and that the footprint of the Project for the life of field will be localised, **the residual consequence of seabed disturbance is considered to be low and not significant.**

Interactions with Other Sea Users

Use of the sea by the oil and gas, fishing, shipping and other offshore industries brings with it the potential for interactions. Impacts arising from this interaction can include direct and indirect exclusion of fishing or shipping from certain areas, snagging risks for fishing gear, and damage to oil and gas industry subsea facilities by fishing gear. The impact assessment was supported by a vessel collision risk assessment and navigational impact assessment.

Although there will be an increase in the number of vessels in the area during the drilling, installation and commissioning of the Tolmount East Project, these activities will be of a relatively limited duration. The completion of only the existing appraisal well means the time required for drilling is reduced, resulting in less vessel and rig time at the site. Standard communication and notification procedures will be in place to ensure that all vessels operating in the area are aware of the activities, including the presence of the MODU. Once the project is operational, vessel use will be limited to that required for maintenance activities on the subsea facilities.

When the MODU arrives infield, a 500 m safety zone will be initiated and will remain in effect until the end of the drilling campaign. In addition, the dredging, pipelay and rock placement vessels will exclude other sea users around their immediate vicinity during flowline installation works. The purpose of the safety zones is to ensure the safety of all personnel involved in the drilling and installation activities and to minimise the risk of collisions between Project vessels and other vessels in the area. For the production phase, Premier will be applying for a safety zone for subsea infrastructure at Tolmount East. The intention of the safety zone is to reduce the potential for collision risk, though the closure of the area may impact other sea users.

Although many shipping routes transect the Project area, there is sufficient sea space in the wider area for all vessels to avoid the Project without significant alterations to routes. Mariners are expected to become aware of the subsea infrastructure over time through updated charts.

As outlined above, the establishment of a temporary safety zone around dredging and pipelay vessels, and around the MODU when on location, will mean exclusion of other sea users, particularly shipping and fishing, from an area of approximately 0.8 km^2 (per safety zone) for the length of time that the activities occur. Pipeline installation works will lead to temporary and very short-term exclusion to other sea users from the immediate vicinity of the installation and pipelay vessels. In addition, the establishment of a permanent (life of field) safety zone around the Tolmount East subsea infrastructure would lead to the long-term exclusion of other sea users from an area of approximately 0.8 km^2.

Fishing effort in the vicinity of the Project occurs throughout the year and is dominated by static gear (traps) although dredging also occurs. The 0.8 km^2 area of a 500 m safety exclusion zone represents a very small proportion of the total area available to fisheries.

During drilling operations, there is the potential for the formation of mounds due to the deployment and recovery of the MODU anchors. Over-trawling such anchor mounds with fishing gear could result in sediment being retained in fishing nets with potential damage of nets and equipment, affecting catches, and posing a threat to the safety of the vessel. These mounds are most likely to form in areas where sediments at or near the surface contain heavy clay. As the seabed sediments in the Project area mostly comprise sand and gravel and the Project location is within a high energy environment, any anchor mounds that may form are likely to persist only in the short-term.

The flowline and umbilical may be protected with rock berms (under the worst-case assumption) and there will be no physical restriction on ability to fish in the Project area in that respect. However, the physical presence of the rock berms and the presence of subsea facilities on the seabed have the potential to interact with fishing gear through the introduction of potential snagging hazards. The use of rock berms designed to be overtrawlable, and regular maintenance and pipeline route survey inspections during the Project lifetime, will ensure the pipeline remains in a favourable condition with minimal snagging risks.

No cumulative impacts are predicted. Fishing vessels from a range of nationalities utilise the area and any impacts to these vessels in terms of exclusion and snagging risk can be considered transboundary in nature. However, no impacts are anticipated to the fishing fleet in the area including those with origins out with the UK, therefore no transboundary impacts will occur. In addition, no impacts to any protected sites or species of conservation importance is predicted as a result of the physical presence of the Project.

Any potential impacts as a result of the physical presence of the Tolmount East Development are not expected to cause long term degradation, hardship, or impair the function and value of any of the receptors identified within the area. **The consequence of the potential impacts is therefore considered to be low and not significant for any phase of the Project.**

Atmospheric Emissions

The emission of gases to the atmosphere from the Tolmount East Development could potentially result in impacts at a local, regional, transboundary and global scale. Local, regional and transboundary issues include the potential generation of acid rain from nitrogen and sulphur oxides (NO_X and SO_X) released from combustion, and the human health impacts of ground level nitrogen dioxide (NO_2), sulphur dioxide (SO_2), both of which will be released from combustion) and ozone (O_3), generated via the action of sunlight on NO_X and volatile organic compounds (VOCs). On a global scale, concern with regard to atmospheric emissions is increasingly focused on global climate change and the management of greenhouse gas emissions.

Atmospheric emissions from the Tolmount East Development will be related largely to fuel consumption by the MODU, installation vessels and flaring activities during well clean up. Emissions from drilling, installation and commissioning vessels will be transitory and low level and also lower due to the reduced drilling time. During the operational phase, there will be no increase in fuel consumption at the Tolmount MFP as a result of the Tolmount East well coming online. Emissions from operational activities are limited to vessel use during regular inspections and maintenance and will be at a low level throughout the life of the field.

Given the temporally restricted nature of the majority of the atmospheric emissions from the Project and taking into account the distance from any potentially sensitive receptors, it is not expected that atmospheric emissions will negatively impact local air quality.

The Project area is too remote from other industrial activities (including other offshore oil and gas activity) for there to be any cumulative effects in terms of local air quality. Whilst there may flaring at the MODU as part of well clean up, the additional potential emissions are sufficiently low that no cumulative impact on local air quality is expected. The activities associated with the Tolmount East Development will be at closest 152 km from the UK/Netherlands median line, and therefore there will be no significant transboundary impacts on air quality.

In terms of global climate change (i.e. cumulative and transboundary impacts), the Project will add a relatively small increment to the overall offshore emissions of the UK, and the release of greenhouse gases into the environment and their contribution to global warming will be negligible or minor in relation to those from the wider offshore industry and outputs at a national or international level. Premier aims to achieve carbon neutral status for the Tolmount East Development in line with its Climate Change Strategy. Any cumulative impact is therefore considered not to have a direct impact on climate change.

Overall, the assessment shows that the potential emissions from the Tolmount East Development will likely have a limited cumulative effect in the context of the release of greenhouse gases into the environment and their contribution to global climate change. This is in accordance with Harbour Energy's Climate Change Policy and Net Zero goals towards the reduction of Scope 1 and 2 emissions by 2035.

Based on the calculated emissions expected from the Project, including that there will be no impact on protected sites or on species from protected sites, the even lower residual consequence of atmospheric emissions is ranked as negligible. The majority of emissions will occur during the sidetrack drilling and well clean-up and offshore installation phases. **As a result, the residual risk from atmospheric emissions from the Tolmount East Project will be negligible and therefore not significant.**

Accidental Events

The risk of an accidental hydrocarbon spillage to the sea is often one of the main environmental concerns associated with oil-industry activities. Spilled hydrocarbons at sea can have a number of environmental and economic impacts, the most conspicuous of which are on seabirds and coastal areas. The actual impacts depend on many factors, including the location, volume and type of hydrocarbon spilled, the sea and weather conditions at the time of the spill, and the oil spill response. The expected hydrocarbon from Tolmount East well is gas condensate and the following worst-case events have been identified as having the potential to cause a hydrocarbon spill:

- Release of condensate in the event of an uncontrolled well blow-out;
- Instantaneous pipeline inventory loss of condensate; and
- Inventory loss of marine diesel from the MODU.

As Tolmount East is only 4 km northeast of the Tolmount MFP and further from shore, has the same expected hydrocarbons (gas and condensate) and will use the same or a similar MODU, the results from the most up-to-date modelling scenarios undertaken for the Tolmount MFP Development were used, where applicable, in the impact assessment, as they represent worse cases.

Well blowout modelling conducted for a release scenario of 97,052 m^3 over 95 days (a larger volume than would occur for Tolmount East well) predicts a high probability of surface oiling over part of the SNS in the UKCS, with a very low probability of crossing into the Netherlands waters during spring and summer. Surface oiling will be very thin, less than 5 µm, across most of the potentially contaminated area. Whilst the stochastic modelling predicts a probability of shoreline contamination along the east coast of England from this worst-case release scenario, the actual amount of any condensate on the shore will be mitigated by the high volatility and biodegradability of the condensate, resulting in it rapidly evaporating from the sea surface and degrading in the environment.

As the new flowline between Tolmount East and Tolmount MFP is only 12” diameter and lies further offshore, the assessment is based on modelling of releases from three points along the Tolmount to Easington export pipeline as these represent the worst case for a pipeline release. The modelling takes account of the export of combined fluids from both Tolmount and Tolmount East.

Stochastic modelling for pipeline release scenarios at different parts of the pipeline shows a low probability of sea surface oiling apart from in the immediate vicinity of the release. The maximum time-averaged thickness over the sea surface is predicted to be thickest close to the release location and is <50 µm across most of any potentially contaminated area. The releases are not predicted to cross any maritime boundaries. The highest predicted probability of shoreline contamination is 41% in the East Riding of Yorkshire during the spring scenario and for the closest release to shore (15 km); however, the actual quantity onshore would be undetectable as condensate is highly volatile and biodegradable.

The stochastic modelling for the marine diesel release from the MODU shows that for all four seasons, the probability of surface oiling is low apart from in the immediate vicinity of the MODU. The maximum time-averaged thickness over the surface of the sea is predicted to be greatest close to the release location and is very thin (<50 µm) across most of the potentially contaminated area. The release is not predicted to cross any maritime boundaries. The maximum probability of beaching is predicted in the East Riding area of Yorkshire (51%) during the summer scenario. Marine diesel (similarly to condensate) is highly volatile and amenable to biodegradation, thus within 12 to 48 hours of a release the diesel would be expected to be undetectable in the environment.

The highest risk of a spill during drilling is associated with hose failure during transfer of diesel between the MODU and supply vessel. These spills are expected to be small in volume and procedures will be in place to reduce the risk of spillage, in particular written procedures, and regular inspection of equipment and provision of spill kits. Hydrocarbons released during a blowout could reach the coastline, but are considered to be remote events, i.e. of very low probability. The consequences of a significant release of hydrocarbons from the Tolmount East field will vary depending on factors such as wind speed and direction and sea state, as well as the time of year.

Even with comprehensive prevention measures in place, the residual risk of spill remains, and integral to offshore operations is the formulation of detailed and fully tested contingency response plans. Premier has in place a range of response/mitigation measures to address such risks. All activities will be covered by approved Oil Pollution Emergency Plans (OPEPs) and Shipboard Oil Pollution Emergency Plans (SOPEPs) as appropriate. The OPEP (or SOPEP) sets out the responses required and the available resources for dealing with all spill sizes. Premier has access to specialist oil spill response services provided by Oil Spill Response Limited (OSRL). A Shoreline Response Strategy Plan is also in place to assist the mitigation of oil spills from the Tolmount area impacting the east coast of England and the associated environmental and socio-economic sensitivities. Additionally, as members of OPOL, Premier can demonstrate economic responsibility should there be the need to drill a relief well.

There is also the risk of a chemical spill. Chemical spills may occur during chemical transfer, chemical/mud handling (drilling only), or through mechanical failure. Given the high energy marine environment of the Project, chemical spills are expected to disperse rapidly with a negligible to minor localised and transient potential impact on plankton or fish egg/larvae, depending on the season.

Spill prevention measures will encompass chemicals as well as hydrocarbon spills. The planning, design and support of all activities for the Tolmount East Development will aim to eliminate or minimise potential environmental risks. These impacts will be mitigated through equipment design, spill risk reduction measures and provision of appropriate spill response arrangements. Premier's management processes will ensure that these mitigation commitments are implemented and monitored.

Information on specific chemical use and associated environmental impact assessment will be provided in the relevant permitting (e.g. Master Application Template/Subsidiary Application Template) required prior to the commencement of activity. Premier endeavours to use chemicals with a good environmental profile (PLONOR, Cefas OCNS group E or Gold banded chemicals) where possible to reduce potential impacts from these chemicals on the marine environment.

Any potential release of liquid hydrocarbon from Project would be either condensate or diesel fuel and this would readily evaporate and disperse. Comprehensive prevention and spill response measures will be in place to minimise the consequence of any potential impacts resulting from accidental events; **accidental events are therefore considered to be negligible and not significant for any phase of the Project.**

Environmental Management

Following creation of the enlarged Harbour Energy plc company, the Harbour Energy Health, Safety, Environment and Security policy has been adopted. However, work is underway to integrate the pre-existing Premier and Chrysaor Oil Health, Safety, Environment and Security Management System (HSES-MS). Until the integration is completed, the Premier management system will take precedence for this development. The Premier HSES-MS exists to provide a systematic approach to the management of HSES issues in order to protect people and the environment and comply with UK legislation. Premier considers that health, safety, environment and security is paramount above other business drivers. Safe working practices and due consideration of environmental impact are vital to the overall efficiency and continued success of the business.

Premier's HSES-MS is based on the industry model prepared by the International Association of Oil and Gas Producers (IOGP) and embraces the principles of quality management as found in the ISO 14001:2015 and ISO 45001:2018 international standards. The environmental elements within the management system have been independently verified by approved certification bodies in March 2014 and April 2017 and will continue to be independently verified on a two-yearly basis in addition to internal monitoring and assessment. During the most recent audit the Environmental Management System (EMS) was in compliance with ISO 14001:2015.

Premier have prepared a combined Health, Safety, Environment Plan which is aligned with the HSES-MS above. This will ensure that Premier's MS requirements, and specific environmental requirements, as identified through the EIA, are managed; this will include placing obligations on contractors to take account of specific environmental features or sensitivities.

Climate Change Policy

Premier, and its parent company Harbour Energy plc, are committed to meeting the ambitions of the Paris Agreement and supporting the transition to a lower-carbon economy. As global energy demand grows, Harbour Energy wants to support the twin objectives of providing affordable energy to a growing global population whilst mitigating effects of our emissions. This forms part of our overall commitment to carrying out all that Harbour Energy does efficiently and with care for the environment.

Harbour Energy's Climate Change Policy sets out our commitment to attaining a goal of Net Zero no later than 2035. This commitment includes our share of Scope 1 (direct) and Scope 2 (related to purchased electricity) emissions from operated and non-operated assets.

Conclusions

The Tolmount East Project is an offshore single well gas condensate development in the SNS being developed through subsea infrastructure tied back to Tolmount MFP. From here the gas, condensate and any produced water will join and co-mingle with fluids in the main Tolmount export pipeline prior to it being transported to shore.

Most of the impacts associated with the project will occur during drilling and installation of the subsea infrastructure and flowline to Tolmount MFP. The pipeline installation activities are considered to represent the largest potential impact from the Project, which will primarily impact the seabed and any sensitive habitats. The Project is not situated in any sites of conservation importance. Premier has undertaken a range of measures to minimise these impacts as far as reasonably practicable; these include detailed seabed surveys along the flowline installation corridor and route optimisation.

Other potential impacts from installation activities include the following which are not unique to an offshore installation project of this type. Premier will plan and conduct activities to ensure the consequences of potential impacts are minimised as far as practicable:

- Discharges of cementing;
- Water discharges containing chemicals used to test the flowline ahead of use;
- Atmospheric emissions from the MODU and installation vessels – these emissions will take place over the drilling and installation period, but constitute the majority of the total emissions from the project throughout its life; and
- Disruption to other sea users during drilling and installation due to the presence of rig and vessels offshore.

Longer-term impacts that will occur during the lifetime of the Tolmount East Development include:

- Potential snagging risk as there will be no exclusion to fisheries along the flowline route, though snagging risks will be minimised by ensuring rock protection placed over the flowline is overtrawlable;
- Potential snagging risk with the subsea infrastructure, though snagging risks will be minimised by ensuring all infrastructure is overtrawlable, and Premier will apply for a safety zone to further reduce the risk of any interactions with fishing gear.

In addition to the routine type of impacts discussed above, there is also the risk of an accidental hydrocarbon or chemical spill. A well blowout from Tolmount East during drilling may result in a significant release of liquid hydrocarbons (condensate) to sea, though the likelihood is considered remote to extremely remote. A hydrocarbon release from the 12” flowline once operational is also considered extremely unlikely but may occur if the flowline was to rupture. An accidental release of the hydrocarbon inventory (diesel fuel) from the MODU caused by mechanical failure, operational failure or human error could also occur. Oil on the sea surface can affect the structure of birds’ feathers and therefore could result in an impact on birds floating on the sea surface. These releases also have the potential to contaminate the shoreline, though a release from the MODU is likely to be far smaller. To reduce the risk of a release, the MODU will be fitted with a blow-out preventer, and all activities related to the Tolmount East

Development will be covered by appropriate OPEPs and SOPEPs. Premier also has access to specialist oil spill response services provided by OSRL.

Based on the fact that any release of liquid hydrocarbon from Tolmount East would be condensate which would readily evaporate and disperse, the potential to cause significant adverse impacts is low and not predicted to constitute a Major Environmental Incident.

Accidental chemical spills may also occur during chemical transfer, chemical/mud handling, or through mechanical failure, with the potential to impact plankton or fish egg/larvae. However, given the high energy marine environment of the wider area, any chemical spills are expected to rapidly disperse in the offshore marine environment; similar mitigation measures (OPEP and access to OSRL) as implemented for drilling and other installation activities would be in place.

Premier's EMS will ensure that all the measures described in the Tolmount East Development Environmental Statement to minimise and mitigate against environmental impact will be delivered by the Project through the establishment of an EMP for the installation, commissioning and production operations of the Tolmount East Development.

Overall, it is concluded that the proposed Tolmount East Development will not result in any significant long-term environmental impacts.

1 INTRODUCTION

1.1 Introduction to Premier Oil UK Limited and Dana Petroleum E&P Limited

Premier Oil UK Limited (hereafter referred to as Premier) is a subsidiary of Harbour Energy plc. Harbour Energy plc was formed through an all-share merger between Premier and Chrysaor on the 1st April 2021.

Producing assets in the North Sea were obtained by Premier in May 2009 through the acquisition of Oilexco North Sea Limited. Further assets, including Tolmount East, were obtained by Premier in April 2016 through the acquisition of E.ON E&P UK Ltd (E.ON).

Blocks 42/28d and 42/29b were originally awarded to Dana Petroleum E&P Ltd. (Dana) in the UK's 23rd Seaward Licensing Round. Through a farm-in, E.ON acquired 50% equity from Dana in 2010 and took operatorship. In 2011, E.ON and Dana relinquished the whole of Block 42/29b and part of an eastern section of Block 42/28d, now known as 42/28e. Premier is now the 50% owner, with Dana (50%), of Block 42/28d within which the Tolmount East field is located. Premier is the operator of the Tolmount East field.

1.2 Project background and status

Premier is seeking to exploit the gas reservoirs of the Tolmount East field, located in the Southern North Sea (SNS). The field is located in Block 42/28d, approximately 37 km east of Flamborough Head and 152 km from the United Kingdom (UK)/Netherlands median line (Figure 1-1). Following exploration and appraisal drilling activities, further work carried out by Premier and Dana has determined that economic development of the Tolmount East reservoir is possible. Consequently, Premier proposes to progress field development with a view to achieving first gas by August 2023.

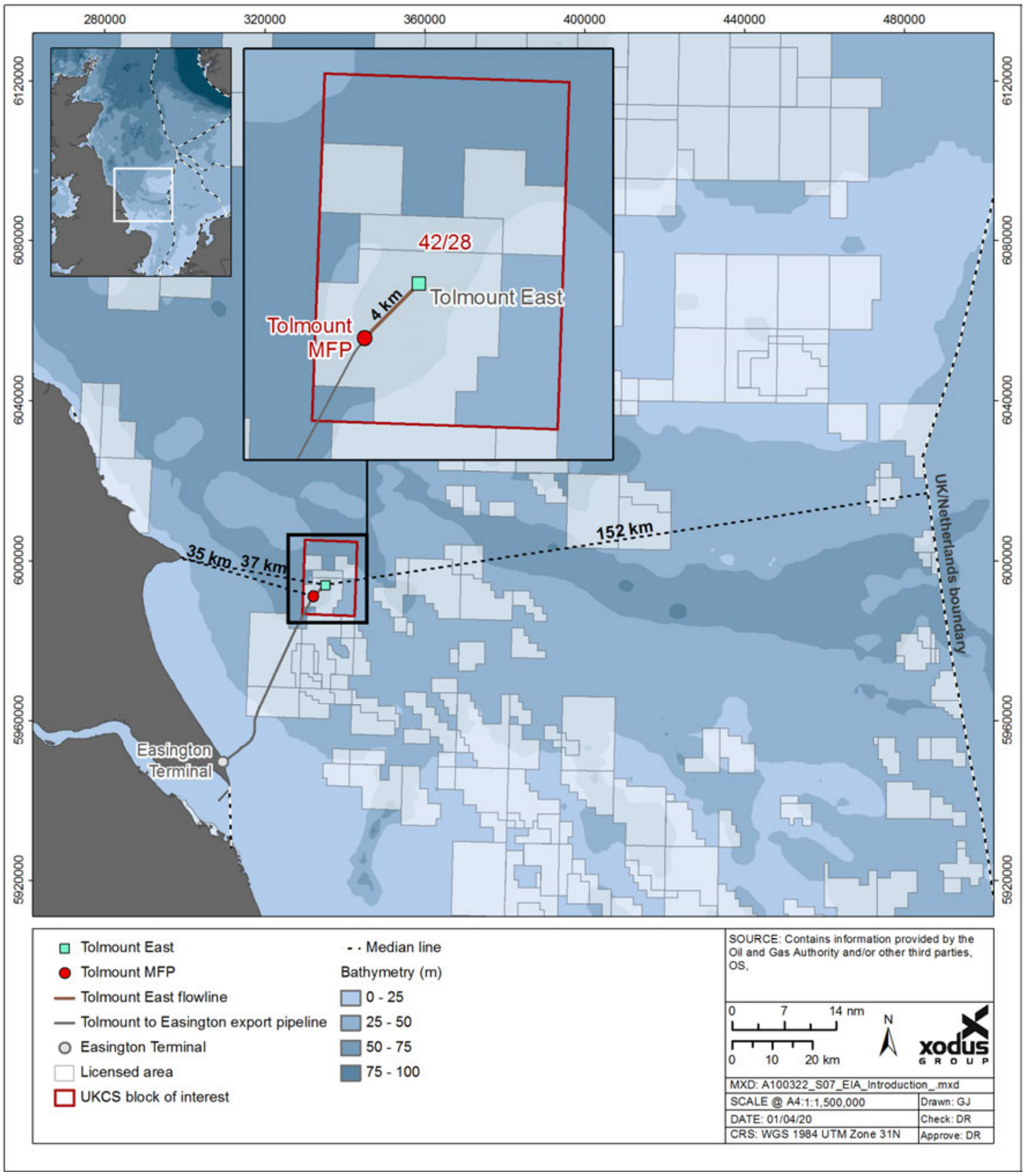


Figure 1-1 Location of the Tolmount East Development in the context of the wider Tolmount Area Development

The Tolmount East reservoir has an estimated range for 'gas initially in place' (GIIP) of 1.98 – 7.33 billion m^3. The Tolmount East Development (the Development) basis of design is currently on a maximum production rate of 89 million standard cubic feet per day (MMscfd) (approximately 2.5 million m^3/d) of gas; it therefore has a number of economic benefits for the UK:

- Generation of additional revenue to the UK Government from increased oil and gas production;
- Contribution to the security of the UK's energy supply;
- On a local and national scale, the Project may secure or add to the employment in the area, in particular during the installation phase; and
- Provision of additional pipeline infrastructure which may facilitate future developments in the area.

Premier had initially planned for the Tolmount East development to be centred around a minimum facilities platform (MFP). However, in February 2020, it was decided that Tolmount East will be developed using subsea infrastructure only, tied back to the Tolmount MFP which is currently under construction, lying approximately 4 km south west of Tolmount East. The Tolmount East Environmental Statement therefore supports the Tolmount Field Development Plan Amendment. The Tolmount MFP will be operated as a Normally Unattended Installation (NUI). Tolmount MFP, installed in 2020, will handle wet gas production from four platform wells and act as a central gathering facility (CGF) with four pre-installed risers and dedicated J-Tubes, available to accept future tiebacks from the Greater Tolmount Area (GTA), including Tolmount East.

Production from Tolmount East will be mainly gas, with condensate and produced water. The fluids from the Tolmount East well will be transported via a new 12" subsea flowline to the Tolmount MFP where they will bypass the Tolmount MFP separator and be directed straight into the gas export pipeline. Production will then be exported by the Tolmount 20" Gas Export pipeline from Tolmount MFP to the Easington terminal. Produced water from Tolmount East will be treated and disposed of onshore at the Easington Terminal.

The Concept Selection for the Tolmount East Development has been completed. Front End Engineering Design (FEED) has commenced, with an expected completion date of Q3 2021. The detailed design phase will commence after the EPCI is awarded and is expected to commence from Quarter 3 2021. Offshore activities are likely to begin in Quarter 3 2022. First gas is expected to be produced by August 2023. This programme may change subject to detailed scheduling, fabrication times of key pieces of equipment and availability of construction vessels.

1.3 Scope of Environmental Impact Assessment

The overall aim of the Environmental Impact Assessment (EIA) is to assess the potential environmental impacts that may arise from the Development and to identify the measures that will be put in place to reduce these potential impacts.

The EIA process is integral to the Development, assessing potential impacts and alternatives, as well as identifying design and operational elements to help reduce the potential impacts as far as reasonably practical. The process also provides for stakeholder involvement so that issues can be identified and addressed as appropriate at an early stage, ensuring that activities associated with the Development comply with legislative requirements and with Premier's environmental policy.

The EIA scope includes installation, commissioning, operation and decommissioning activities over which Premier has operational control. These include:

- Installation, commissioning, operation and maintenance of the subsea infrastructure including the Wellhead Protection System (WHPS), subsea manifold, flowline and umbilical, which will involve the following:
- Sidetrack and recompletion of the existing appraisal well as a production well;
- Installation of the WHPS for well protection; and
- Installation of a separate subsea manifold structure to allow connection of the single development well and up to 2 future wells.
- Vessel activities occurring within the Project area[2]; and
- Decommissioning of the Tolmount East Development (including the well, WHPS, subsea manifold, flowline and umbilical).

The EIA considers both routine and accidental events where there are potential environmental impacts. This ES only assesses the base case single well development. Any additional wells to be drilled will be subject of a future ES.

The following activities are outside the scope of the EIA:

[2] The Development area is defined as the sidetrack of the existing appraisal well, an individual WHPS, three slot subsea manifold and the pipeline route from the Tolmount East to the Tolmount MFP.

- Transport of hydrocarbons following co-mingling with Tolmount hydrocarbons on the Tolmount MFP;
- Pre-construction, maintenance and transport of infrastructure outside the Development area (e.g. at ports); and,
- Further activities that might be undertaken at potential future prospects for which the Development could act in any supporting manner. Such activities, should they occur, would be the subject of any necessary additional environmental assessment and approval from the UK Regulatory Authorities.

This Environmental Statement (ES) reports the EIA process for the Tolmount East Development and the results of the assessment. The scope of the EIA was developed in conjunction with stakeholders; full details of the method applied during the EIA process are described in Chapter 4.

Key elements of this ES include the following:

- A non-technical summary of the ES;
- Description of the background to the Development, role of the EIA and legislative context (this section);
- Description of the Development, including alternative options considered and the process leading to confirmation of the selected option (Chapter 2);
- Description of the baseline environment and identification of the key environmental sensitivities which may be impacted by the Development (Chapter 3);
- Description of the methods used to identify and evaluate the potential environmental impacts, including consultation undertaken during the EIA (see Chapter 4);
- Detailed assessment of key potential impacts, including assessment of potential cumulative and transboundary impacts (see Chapters 5 to 9);
- Description of the environmental management measures that will be implemented (see Chapter 10);

- Conclusions (see Chapter 11); and
- Appendices containing information to support the impact assessment.

This ES is submitted to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED - the Regulator) to inform the decision on whether or not the Tolmount East Development may proceed, based on the residual levels of potential impact. The ES is also subject to formal public consultation.

1.4 Regulatory context

The EIA reported in this ES has been carried out in accordance with the requirements of the following regulations:

- Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999, as amended (the 1999 EIA Regulations); and
- The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 (the 2020 EIA Regulations).

These Regulations require the undertaking of an EIA and the production of an ES for certain types of offshore oil and gas developments likely to have a significant impact on the environment. An EIA is mandatory for any Development expected to produce more than 500,000 m^3 of gas per day. The Tolmount East Development triggers a mandatory EIA on the grounds of gas production rate.

Approval of the ES by OPRED is required before approval can be granted to the Field Development Plan (FDP) by the Oil and Gas Authority (OGA) under the Petroleum Act 1998. Similarly, the ES is required in support of the pipeline works authorisation (PWA), also issued by the OGA under the Petroleum Act 1998. The EIA has been completed in accordance with the latest OPRED Guidance, issued 1st December 2020.

There are a number of other key regulatory drivers applicable to the Project, with the key legislation provided in Table 1-1.

Table 1-1 Key environmental legislation

Environmental Legislation
The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020
Petroleum Act 1998
Petroleum Licensing (Production) (Seaward Areas) Regulations 2008
Energy Act 2008, as amended
Marine and Coastal Access Act 2009
The Conservation of Offshore Marine Habitats and Species Regulations 2017 (outside 12 nautical miles (nm))
The Conservation of Habitats and Species Regulations 2017 (within 12 nm)
Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended)
Offshore Chemicals Regulations 2002 (as amended)
Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended)
Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008 (as amended)
Merchant Shipping (Oil Pollution Preparedness, Response & Co-operation Convention) Regulations 1998 (as amended)
Offshore Installations (Emergency Pollution Control) Regulations 2002
Merchant Shipping (Prevention of Oil Pollution) Regulations 1996 (as amended)
Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008
The Marine Strategy Regulations 2010 (which implement the European Marine Strategy Framework Directive)
Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015

The EIA Regulations require that the EIA consider the likely significant impacts of a project on the environment; the potential impacts that have been considered in the EIA were selected following formal scoping with the Regulator, environmental issues identification (ENVID) and consultation with a number of stakeholders. Following this, the decision process related to defining whether or not a project may potentially significantly impact on the environment is the core principle of the EIA process. The EIA Regulations themselves do not provide a specific definition of significance, but they indicate that the methods used for identifying and assessing potential impacts should be transparent and verifiable. Despite this being inherently a subjective process, a defined methodology has been developed to make the assessment as objective as possible.

Distinct from, but closely related to the EIA Regulations, are the requirements under international and national legislation to consider impacts to certain protected sites. European Union Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive), which provides protection to European sites known as Special Areas of Conservation (SACs), and Directive 2009/147/EC (the Birds Directive), which protects sites important for wild bird populations known as Special Protection Areas (SPAs), collectively referred to as Natura 2000 or European sites, are applicable to the Project. Under Article 6(3) of the Habitats Directive, "any plan or project which is not directly connected with or necessary to the management of a European site but would be likely to have a significant impact on such a site, either individually or in-combination with other plans and projects, shall be subject to an appropriate assessment of its implications for the European site in view of the site's conservation objectives."

The Habitats Directive applies the precautionary principle to these sites and projects can only be permitted when it is ascertained that there will be no adverse impact on the integrity of any European-designated site(s). Where adverse impacts are identified, a project may only be permitted in the absence of alternative solutions if there is an Imperative Reason of Overriding Public Interest (IROPI) for the project to go ahead. Where this is the case, Member States are required to take all compensatory measures necessary to ensure that the overall coherence of the Natura 2000 network is protected.

For offshore areas oil and gas projects the requirements of the Habitats and Birds Directives are transposed through the Offshore Petroleum Activities (Conservation of Habitats) Regulations (2001) as amended. In accordance with these Regulations, the impacts of a project on the integrity of a European site are assessed and evaluated as part of the Habitat Regulations Assessment (HRA) process.

In an analogous process, the Marine and Coastal Access Act 2009 requires the potential for significant risk to the conservation objectives of Marine Conservation Zones (MCZs) being achieved to be assessed.

Relevant technical information required by OPRED as part of the consideration of impact on protected sites and species is provided within the Impact Assessment sections of this ES.

1.5 Marine planning context

The East Inshore and East Offshore Marine Plans came into force in April 2014. The aim of Marine Plans is to help ensure sustainable development of the marine area through informing and guiding regulation, management, use and protection of the area. The key principles of the Marine Plan policies considered relevant to the Project are summarised below, with comment on the degree to which the Project is aligned with such objectives and policies provided in Chapter 11:

- Co-existence: Opportunities for co-existence should be maximised wherever possible;
- Biodiversity: Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence including on habitats and species that are protected or of conservation concern in the East Marine Plans and adjacent areas (marine and terrestrial);
- Air quality: Proposals for development should minimise emissions of greenhouse gases as far as is appropriate;
- Fishing: Proposals should seek to minimise impacts on the fishing industry as much as possible;
- Heritage assets: Proposals that may affect heritage assets should seek to minimise compromising or harming elements which contribute to the significance of the heritage asset as far as possible;
- Navigational safety: Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance should not be authorised in International Maritime Organization designated routes;

- Socio-economic: Proposals for development should demonstrate that during construction and operation, adverse impacts on tourism and recreation activities should be minimised as far as possible; and
- Cumulative impacts: Cumulative impacts affecting the ecosystem of the East Marine Plans and adjacent areas (marine and terrestrial) should be addressed in decision-making and plan implementation.

1.6 Premier's environmental policy and management system

The pipeline installation will be delivered by Premier. Once operational, the pipeline (and subsea infrastructure) may be managed by an appointed Installation Operator and Duty Holder for the Tolmount East Development.

Premier is committed to managing all environmental impacts associated with its activities on the United Kingdom's Continental Shelf (UKCS). Continuous improvement in environmental performance is sought through effective project planning and implementation, emissions reduction, waste minimisation, waste management, and energy conservation. Premier's Health, Safety, Environment and Security (HSES) policy and details of its HSES Management System are presented in Chapter 10.

1.7 Harbour Energy's Climate Change Policy and Net Zero Commitment

Premier, and its parent company Harbour Energy, are committed to meeting the ambitions of the Paris Agreement and supporting the transition to a lower-carbon economy. As global energy demand grows, Harbour Energy wants to support the twin objectives of providing affordable energy to a growing global population whilst mitigating effects of our emissions. This forms part of our overall commitment to carrying out all that Harbour Energy does efficiently and with care for the environment.

Harbour Energy's Climate Change Policy (Figure 1-2) sets out our commitment to attaining a goal of Net Zero no later than 2035. This commitment includes our share of Scope 1 (direct) and Scope 2 (related to purchased electricity) emissions from operated and non-operated assets.

Harbour Energy's commitment will be delivered through the implementation of a Harbour Energy Climate Change Strategy which will be guided by the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD)[3]; the legacy Premier Oil Climate Change Strategy (CP-CP-PMO-CSR-ZZ-RE-0008); and, Premier's UKBU Climate Change Strategy (AB-UK-PMO-HS-ZZ-RE-0196).

These strategy documents provide a platform for Premier to understand its climate-related risks and opportunities enabling it to engage with its stakeholders, whilst recognising the need continually to advance its efforts in climate-related governance, risk management, action and disclosure.

- Responsibility for climate change matters ultimately rests with Harbour Energy's Board of Directors, and the Chief Executive Officer (CEO) has executive responsibility. To oversee our climate change response, Harbour Energy have established a dedicated Climate Change Committee of cross-disciplinary experts that reports to the CEO.

[3] Recommendations of the Task Force on Climate-related Financial Disclosures (Final Report), June 2017

Climate Change
Policy

Harbour Energy is an independent, global oil and gas exploration and production company with a role to play in meeting the world's energy needs through the safe, efficient and sustainable production of hydrocarbons whilst delivering competitive returns for shareholders.

As global energy demand grows, Harbour Energy wants to support the twin objectives of providing affordable energy to a growing global population whilst mitigating effects of our emissions. This forms part of our overall commitment to carrying out all that Harbour Energy does efficiently and with care for the environment.

Harbour Energy is committed to attaining a goal of Net Zero no later than 2035. This commitment includes our share of Scope 1 (direct) and Scope 2 (related to purchased electricity) emissions from operated and non-operated assets.

To achieve this, Harbour Energy will:

- Establish time-bound targets that support the ambitions of the Paris Agreement.
- Identify and pursue opportunities to minimise our carbon footprint and greenhouse gas emissions within our operations
- Participate with industry partners in the development of viable CO_2 capture and sequestration projects
- Invest, to the extent that we cannot reduce all of our Scope 1 and 2 emissions, in Carbon-offsets, so as to achieve our net zero ambitions
- Communicate with internal and external stakeholders in a transparent manner our climate change related performance and our associated governance, risk management and target-setting
- Integrate carbon pricing and scenario analysis into decision-making across our asset portfolio, to test the robustness of our investments and strategy
- Collaborate with industry and other associations on climate change adaptation and mitigation
- Identify, manage and mitigate the physical and transitional climate change risks associated with our activities
- Include emissions related targets in the incentive compensation programme

Responsibility for climate change matters ultimately rests with Harbour Energy Plc's Board of Directors, and the Chief Executive Officer (CEO) has executive responsibility. To oversee our climate change response, Harbour Energy have established a dedicated Climate Change Committee of cross-disciplinary experts that reports to the CEO.

This Policy will be continually reviewed and updated alongside our business strategy as our understanding of climate-related risks, new technologies, and associated regulations evolves.

Linda Z Cook
CEO Harbour Energy Plc
01 April 2021

Figure 1-2 Harbour Energy's Climate Change Policy

1.8 Consultation

Consultation with statutory bodies and other interested parties is an important part of assessing the environmental impacts of a proposed development. The aim of the consultation process has been to ensure that the views of key stakeholders were identified early on in the EIA process, and that communication was maintained as necessary throughout the EIA process. Further information on consultation undertaken for the Project is provided in Chapter 4.

1.9 Data gaps and uncertainties

A number of assumptions have been made to define a basis for impact assessment, since there is still some uncertainty regarding some of the Project specifics. The ES has assumed the 'worst case' scenario for impact assessment, and these assumptions are detailed within the Project Description (see Chapter 2) and within the relevant assessment sections. In addition, any gaps in the understanding of the receiving environment have been highlighted in the relevant impact assessment section.

1.10 Contact address

Any questions, comments or requests for additional information regarding this ES should be addressed to:

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2 PROJECT DESCRIPTION

2.1 Tolmount East development concept

Tolmount East will be developed using subsea infrastructure only, tied back to the Tolmount MFP.

Gas and condensate will be exported to the Tolmount MFP (installed in 2020) via a new 12" pipeline approximately 4 km in length. A new umbilical will also be installed to provide electrical power, control, methanol and other chemicals to the subsea manifold from the Tolmount MFP. Methanol will be injected into the production stream at Tolmount East and recovered at the Easington Terminal for re-use. The base case is for the Tolmount East pipeline and umbilical to both be trenched and buried. However, as a worst scenario, Premier has included an assessment of rock armour protection along the entire length of the pipeline and umbilical route should process and ground conditions necessitate this. The umbilical will terminate at a control skid valve located on the subsea manifold where a Subsea Distribution Unit (SDU) will be located to distribute hydraulic fluid, chemicals, electrical power and data communications signals between the subsea equipment. The Tolmount East Development is a single well development, which is the focus of this ES. The development will however contain additional facilities to control up to an additional two future wells, including a control skid valve, subsea accumulation module, subsea control modules and chemical injection metering valves. Should additional wells be required for the development in the future, these will be the subject of a separate impact assessment and ES.

The fluids from the Tolmount East well will be transported via a subsea flowline to Tolmount MFP where they will bypass the Tolmount MFP separator and be directed straight into the gas export pipeline. Production will then be exported by the existing 20" NB pipeline from Tolmount MFP to the onshore Easington Terminal.

The proposed subsea Development will comprise:

- Completion of the appraisal well as a producer, requiring re-entering the well, the drilling of a 6” sidetrack and installation of a WHPS incorporating a DrilQuip 13 5/8th monobore tree;
- A 3 slot Tolmount East subsea manifold which will be connected to the monobore tree via 6” jumpers;

- A 12” Tolmount East flowline, running from the subsea manifold to the Tolmount MFP;
- A new umbilical running from the Tolmount MFP to the Tolmount East subsea manifold, which will supply electrical power, control, methanol and other chemicals; and
- Additional controls equipment on the Tolmount MFP to supply Tolmount East with the subsea elements of the control system.

Although the installed facilitiies will have the potential to include two future wells, these wells do not fall under the scope of this ES or the accompanying Tolmount FDP Amendment.

2.2 Consideration of alternatives

The Tolmount Area Environmental Statement (Premier Oil, 2017) identified that further production wells in the future at other locations within the Tolmount Area may be developed as subsea tiebacks to the Tolmount MFP, and that these would be the subject of future studies and environmental impact assessments as the need arose. Tolmount East is one such development which was identified as a future prospect at the time of the initial Tolmount development.

The development options review for Tolmount East began in early 2019. The final selected option for Tolmount East was arrived at through a technical concept selection process involving consideration of a platform development, or a subsea development, tied back to existing offshore infrastructure. The selection process took cognisance of environmental, health and safety, technical, project execution, and commercial issues and risks, and included a comprehensive value assurance review. Environmental considerations and development optimisation have been part of the option selection process throughout, with views being sought via direct consultation with regulators and key stakeholders for the initial platform development.

2.2.1 Initial concept selection work (prior to appraisal well drilling)

The Concept Select phase for the Tolmount East Development began in early 2019, prior to the drilling of the Tolmount East appraisal well in August 2019.

The reservoir models and production profiles available at that time indicated the potential for production of significant volumes of water from the reservoir – up to 95.4 m^3 per day (600 barrels per day (BPD). The handling of this produced water was the main issue to be addressed during the Concept Selection for the Tolmount East Development.

During the Initial Concept Selection studies, six development options were considered as shown in Table 2-1 and Figure 2-1. For all options, production would be routed to the Tolmount MFP (installed in 2020 (covered under the Tolmount Area Development Environmental Statement D/4203/2017)), with gas export via the dedicated Tolmount 20″ gas export pipeline to Easington Gas Terminal (covered under Tolmount to Easington Pipeline Environmental Statement Document Number: AB -TO-XGL-HS-SE-SN-0002).

Table 2-1 Initial Concept Options for Produced Water Separation

Development	Easington Terminal	Tolmount MFP	Tolmount East
	Onshore	Offshore	
Subsea	1	3	5
Platform	2	4	6

For Options 1 and 2, any produced water would be treated at Easington Terminal.

For Options 3 and 4, all production would be sent to the Tolmount MFP, where any water would be separated, treated and disposed of overboard, via the existing produced water treatment package.

For Options 5 and 6, water would be separated, treated and disposed of at Tolmount East.

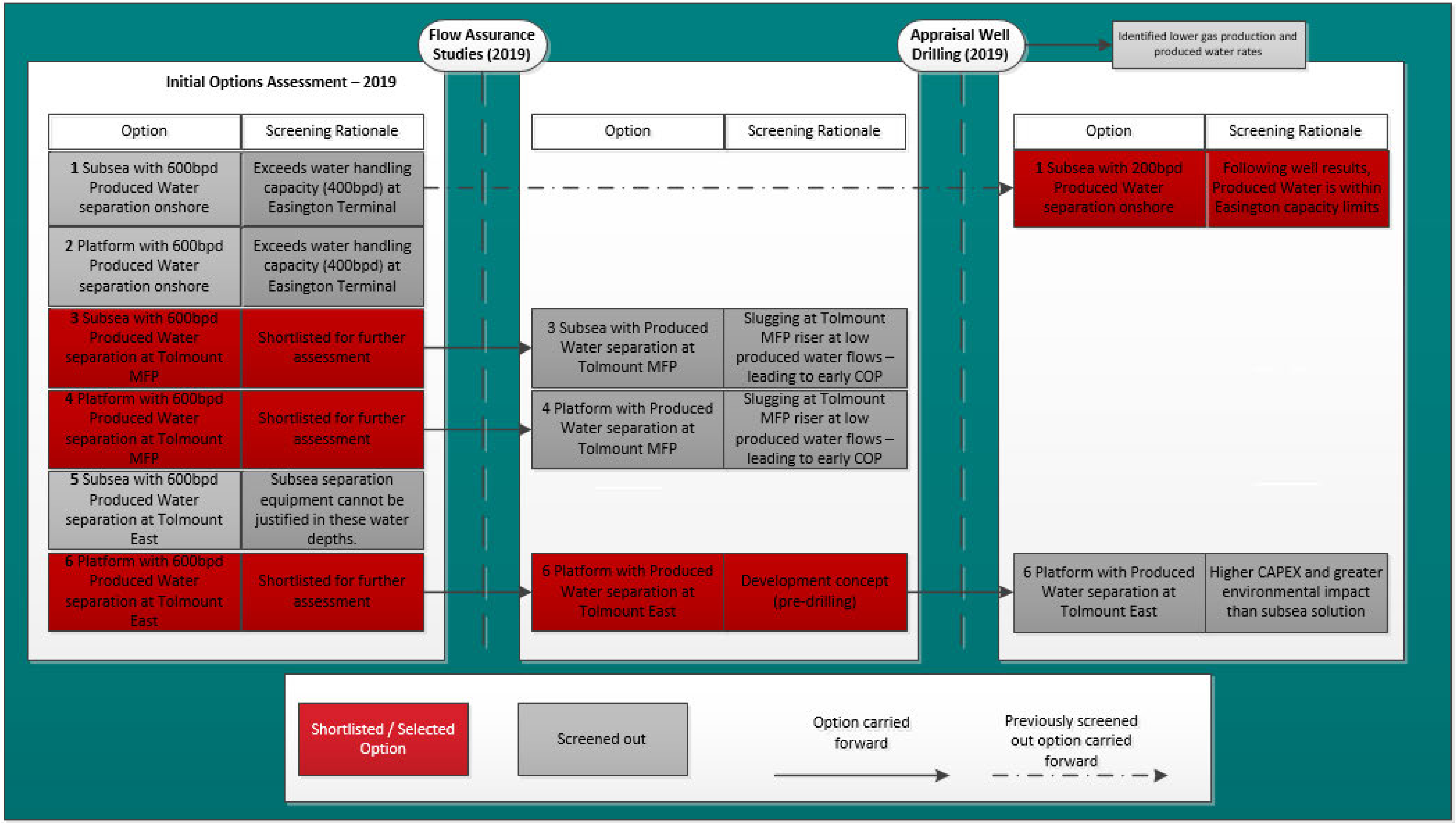


Figure 2-1 Initial Concept Selection development options

2.2.2 High level Screening

Option 1

The water handling capacity at Easington is 63.6 m^3 per day (400 BPD). Since the peak water production from Tolmount East could exceed this value, this option was rejected.

Option 2

The water handling capacity at Easington is 63.6 m^3 per day (400 BPD). Since the peak water production from Tolmount East could exceed this value, this option was rejected.

Option 3

Option was shortlisted for further assessment. See below.

Option 4

Option was shortlisted for further assessment. See below.

Option 5

Subsea separation equipment cannot be justified in these water depths. Option Rejected.

Option 6

Option was shortlisted for further assessment. See below.

2.2.3 Further assessment of shortlisted options

Flow assurance (hydraulic) studies on the pipeline from Tolmount East to Tolmount MFP were performed as part of the Concept Selection studies in 2019 in order to support and define development options.

The flow assurance analysis determined that, with 95.4 m^3 per day (600 BPD) of water in the pipeline, unstable flow (slugging) will occur in the Tolmount platform riser at low flows. This causes problems for the Tolmount MFP Production Separator, which is not designed to handle these high volume liquid ‘slugs’. This ruled out Option 4.

This unstable flow effect would also require production to be curtailed early (earlier than if the water was removed at Tolmount East). The impact of this early cessation of production would be to leave a large volume of gas in the reservoir, which significantly impacts the project economics. For this reason, Options 3 and 4 were rejected.

Based on the anticipated production profiles (and in particular the expectation of up to 95.4 m^3 per day (600 BPD) of produced water) a fixed platform concept was selected, equipped with facilities to separate, treat and dispose (overboard) of the produced water. This is Option 6.

The proposed concept was that gas and condensate production would be exported from the Tolmount East platform to the existing Tolmount MFP in a 4 km long, 12” pipeline. There it would be mixed with the Tolmount production and exported in the existing 20” pipeline to the Easington Terminal.

2.2.4 Subsequent concept selection work (post-appraisal well)

Analysis of the data gathered during drilling and testing of the appraisal well in 2019 significantly revised the basis for the Tolmount East Concept Selection studies. The Tolmount East reservoir is now expected to be somewhat different to what was expected prior to drilling. In particular, the potential for produced water production is now forecast to be much lower (up to 31.8 m^3 per day (200 BPD)).

The capacity of the waste water treatment facilities at the Easington Terminal is up to 63.6 m^3 per day (400 BPD). Approximately 200 BPD of that capacity is required to treat water arriving in the Tolmount to Easington pipeline, meaning the remaining 200 BPD of capacity is available to treat produced water from Tolmount East. Therefore, development options that were previously ruled out were reassessed due to lower produced water rates.

A subsea development concept has a significantly lower capital cost than a platform and has a significantly reduced environmental impact across its operational life. The main driver for selecting the platform option previously was to allow for water-handling facilities at Tolmount East. Since the water production rate is now expected to be less than the available waste water treatment capacity at the Easington Terminal, those water handling facilities are no longer required, and a subsea concept can be selected.

Consequently, the selected concept was revised to be a subsea development, with all production (gas/condensate/water) routed to the Tolmount Platform, where it will be mixed with the Tolmount production downstream of the MFP separator and exported in the existing 20” pipeline to the Easington Terminal.

Tolmount East subsea well will be supplied with power and chemicals and be controlled from the Tolmount MFP. The produced water from Tolmount East will be treated and disposed of onshore at the Easington Terminal, thus ensuring minimal discharges and impacts to the offshore environment from the Tolmount East Development.

2.2.5 Sizing of the subsea infrastructure

Contractors have optimised design by reviewing and minimising the well options and manifold sizes to as low as possible, subject to engineering and operational constraints. This work will continue through detailed design and so what is presented in the ES will be the maximum dimensions, subject to optimisation.

Further development optimisation following the concept selection work involved reducing the Tolmount East subsea development to a single well with a WHPS. The changes to the subsea development have resulted in a considerably smaller seabed footprint.

Premier have also opened narrative with NFFO to discuss overtrawl requirements in order to reduce impacts of the well option and manifold on fisheries. The present concept of the WHPS is overtrawlable and physically connected to the well conductor, while the manifold is fishing friendly. In combination the design of the subsea infrastructure is such that it minimises impacts on fisheries.

2.2.6 Alternatives considered for flowline installation

For the EIA process, Premier have assessed the worst case option for installation of the pipeline and umbilical. Different installation and protection measures are being considered as part of the project planning and impact assessment. These include:

- Trench and burial along the entire route;
- Surface lay and burial under a single protective berm; and
- Surface lay and burial under two separate protective berms

The ES currently assesses the environmental impact of full rock protection berms along the length of the Tolmount East pipeline and umbilical. This is presented as the worst case option for the pipeline and umbilical installation, but it is not the final installation concept. The final installation concept will not be determined for some time (during detailed design). To this extent studies are ongoing with pipeline and engineering contractors to develop the design and in particular the pipeline and umbilical protection options. The base case option is ploughing (trenching) and backfilling of both the pipeline and umbilical into a trench, which is then filled in with natural seabed material previously excavated from that trench. In this case significantly less rock would be used (only at the pipeline ends and at occasional locations along the pipeline to mitigate against upheaval buckling and locations where the required depth of burial and backfill to protect the products had not been achieved). Since these assessments and optimisation study outputs will not be available until detailed design is undertaken, the ES is currently presenting an 'upper bound' (worst case and maximum possible rock dump) option for installation, on the basis that any optimisations (reductions in rock volume) will be assessed in subsequent pipeline operation permits for installation.

2.3 Development schedule

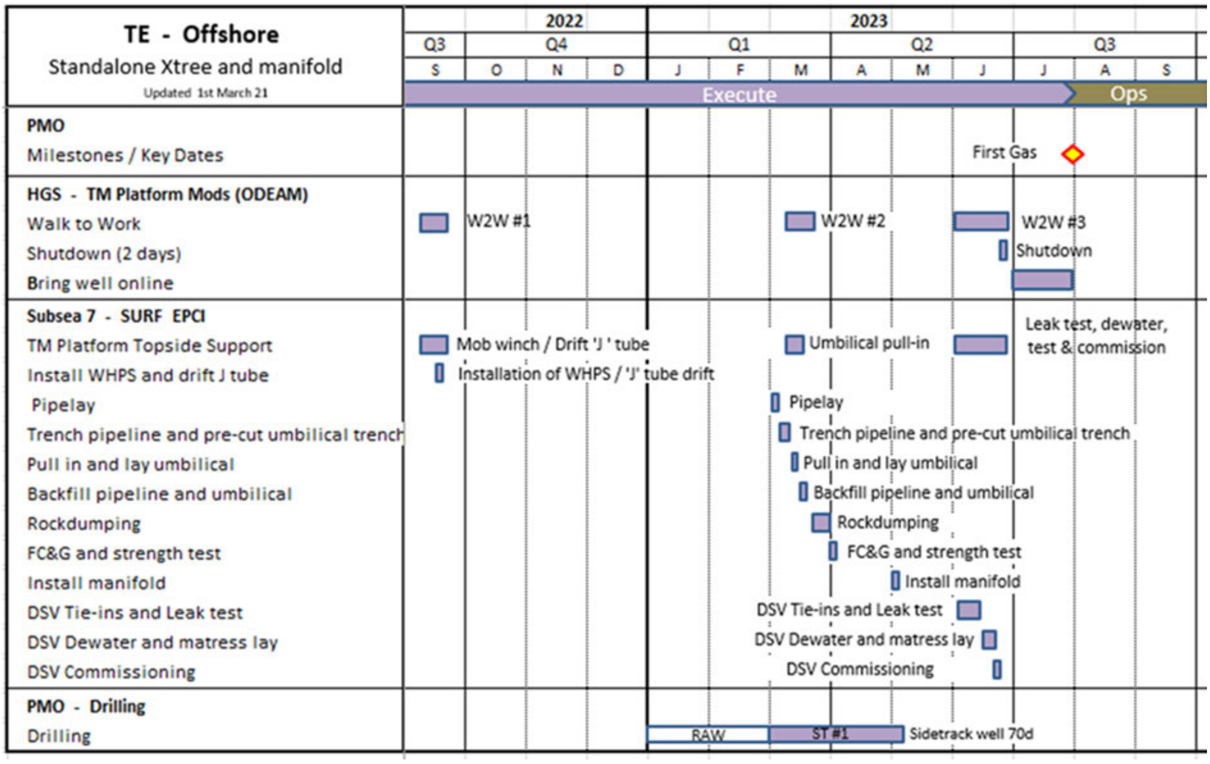


Figure 2-2 summarises the schedule of activity for Tolmount East, through to first gas.

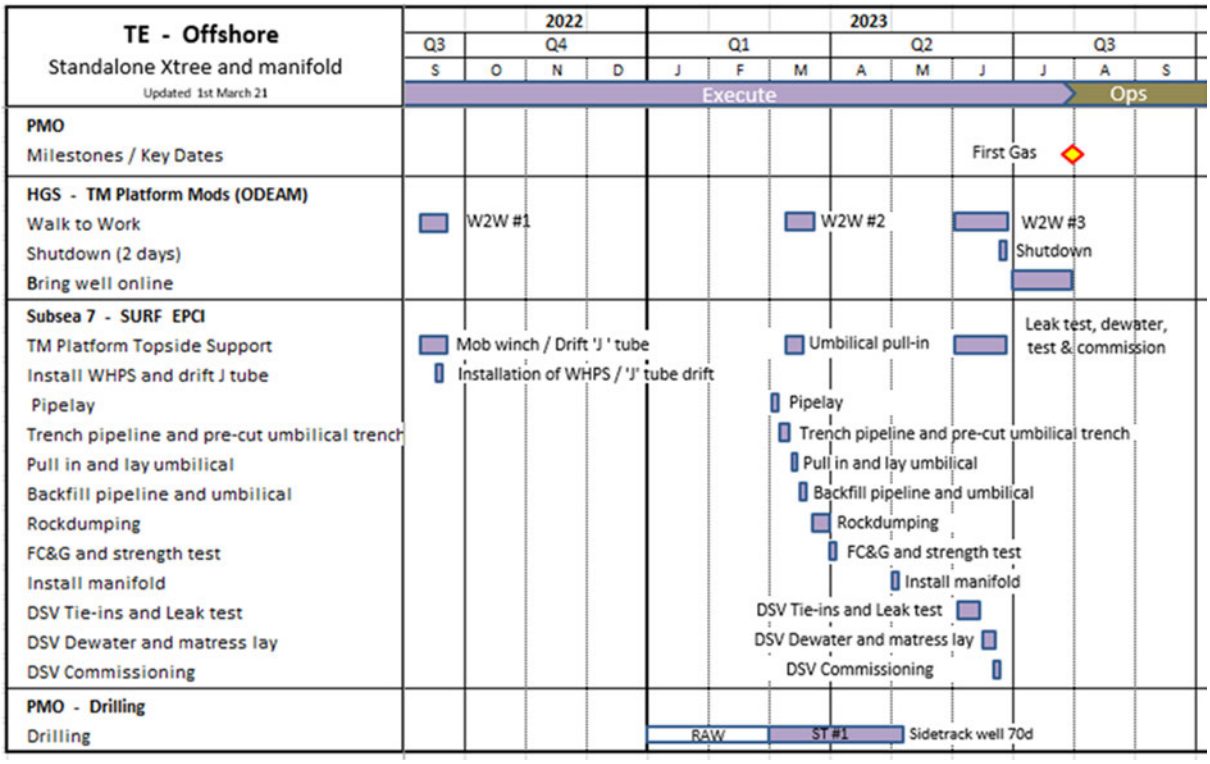


Figure 2-2 Tolmount East Offshore Activity Schedule

2.4 Reservoir characteristics

The Tolmount East reservoir is in the Permian Lower Leman Sandstone Formation and has an estimated GIIP range of 1.98 – 7.33 billion m^3, which is a revised estimated following information obtained from the Tolmount East appraisal well (42/28d-14).

The Tolmount fluid has been characterised using well and sampling information from the appraisal well (42/28d-14) open hole samples from 10,162 ft measured depth below rotary table (MDBRT) and 10,244 ft MDBRT. The condensate to gas ratio (CGR) has been determined as around 6.6 bbl/MMscf from the 42/28d-14. Data from Tolmount MFP 42/28d-12 well test measured a CGR of 12.8 barrels per millions of standard cubic feet (bbl/MMscf) (approximately 0.00007 m^3 condensate/m^3 gas), which will be used as an analogue. The fluid characterised from the 42/28d-12 well test is predicted to reach a minimum CGR of 6 bbl/MMscf (approximately 0.00003 m^3 condensate/m^3 gas) as the field is produced and depletes in pressure. The actual volumes of final condensate product are expected to be in a range of CGR slightly higher than predicted via the well test results, as onshore processing yields a final export gas that is leaner than that established during the well test.

The reservoir fluids are assumed to be saturated with water at measured reservoir conditions. Indicatively, the water to gas ratio is approximately 0.5 to 0.8 bbl/MMscf (approximately 0.000002 to 0.00004 m^3 water/m^3 gas). The main produced fluids constituents and properties are shown in Table 2-2.

Table 2-2 Tolmount East hydrocarbon properties

Produced fluid constituents	
Condensate	6 to 12.8 bbl/MMscf
Water	0.5 to 0.8 bbl/MMscf
Methane	91 mol%
Carbon Dioxide (CO2)	0.6 mol%
N2	1.5%
H2S	None
Condensate properties	
Specific gravity	0.8 (g cm-3)
American Petroleum Institute (API)	62.8
Dynamic viscosity (cP at 15°C)	1.02

Sand is expected to become mobile within the Tolmount East reservoir at some point during field life. Sand management is discussed in Section 2.8.2.3.

2.5 Well and drilling

2.5.1 Drilling strategy

The subsea infrastructure is designed for up to three wells in total, however this ES only assesses the single well development option where the existing appraisal well is sidetracked. The development plan for the field will be to re-enter, sidetrack and complete the existing appraisal well, drilled in 2019, and tie it into production. Any aditional wells tied into this facility will be the subject of a separate ES and are not included here. Therefore, the maximum extent of the drilling programme will entail re-entry, sidetrack and completion of the existing appraisal well on Tolmount East.

It is expected that a heavy-duty jack-up MODU will be used. Jack-up MODUs are generally not self-propelled and rely on tugs or heavy lift ships for transportation to the drilling location. The MODU will be positioned on location with the assistance of anchor handling vessels before being jacked up on its legs.

The existing Tolmount East appraisal well will be re-entered, sidetracked and completed. For the only section to be drilled (i.e. 6″ sidetracked hole), an oil-based mud with low toxicity (low toxicity oil-based mud, or LTOBM) will be used.

To eliminate discharges of LTOBM from the rig, an HP riser will be in place between the seabed and the drilling deck, the mixture of cuttings and mud returning back up the well bore can be pumped up to the MODU. This enables cleaning and separation of the mud and cuttings mixture to take place, so that the drilling mud can be recycled and used again, and the cuttings waste retained for onshore disposal. The sidetrack drilling of the well is scheduled for Quarter 1 2023, and is expected to take sixty-five days to complete

2.5.2 Drilling rig

Although the rig contract has not been finalised, a heavy duty jack-up MODU is expected to be used for re-entering, sidetracking and recompleting the existing Tolmount East appraisal well as a development well The Project will potentially use one of the ENSCO 120 series MODU (Figure 2-3) although alternatives are still being evaluated. A jack-up MODU is a mobile self-elevating drilling platform that consists of a buoyant hull fitted with three movable legs. The buoyant hull enables transportation of the unit between locations. Once on location the hull can be raised to the required elevation above the sea surface by jacking itself up on its legs. The legs of such units are typically fitted with enlarged footings (termed spud cans) to provide stable support and to limit penetration into the seabed as the hull is jacked up. Jack-up rigs are generally not self-propelled and rely on tugs and anchor handlers for transportation to the drilling location.

Figure 2-3 Example of jack-up MODU to be used for drilling at Tolmount East: ENSCO 120 series

Positioning of the MODU is generally undertaken in two stages. The MODU will be jacked up and soft-pinned at a stand-off location close to its final position. A four-point anchoring system will be installed by the anchor handling vessels, the MODU will then be unpinned, jacked down into the water and winched into its final position.

Once in its final position, the MODU will pre-load the legs on the seabed and when complete the moorings will be recovered and the MODU jacked up to its working elevation and skidding the drilling package to the final position over the well location. On completion of drilling operations, the anchor handling vessels will return and re-lay the anchors to ensure the MODU is able to jack down safely; this is a similar process to the MODU positioning described above but in reverse. The anchor handling vessels will then remove the anchors and tow the MODU from the Tolmount East field.

Given the water depth at Tolmount East (approximately 50 m), the maximum anchor spread radius will extend to approximately 500 m, of which approximately 100 m of each anchor line will lie on the seabed (Figure 2-4).

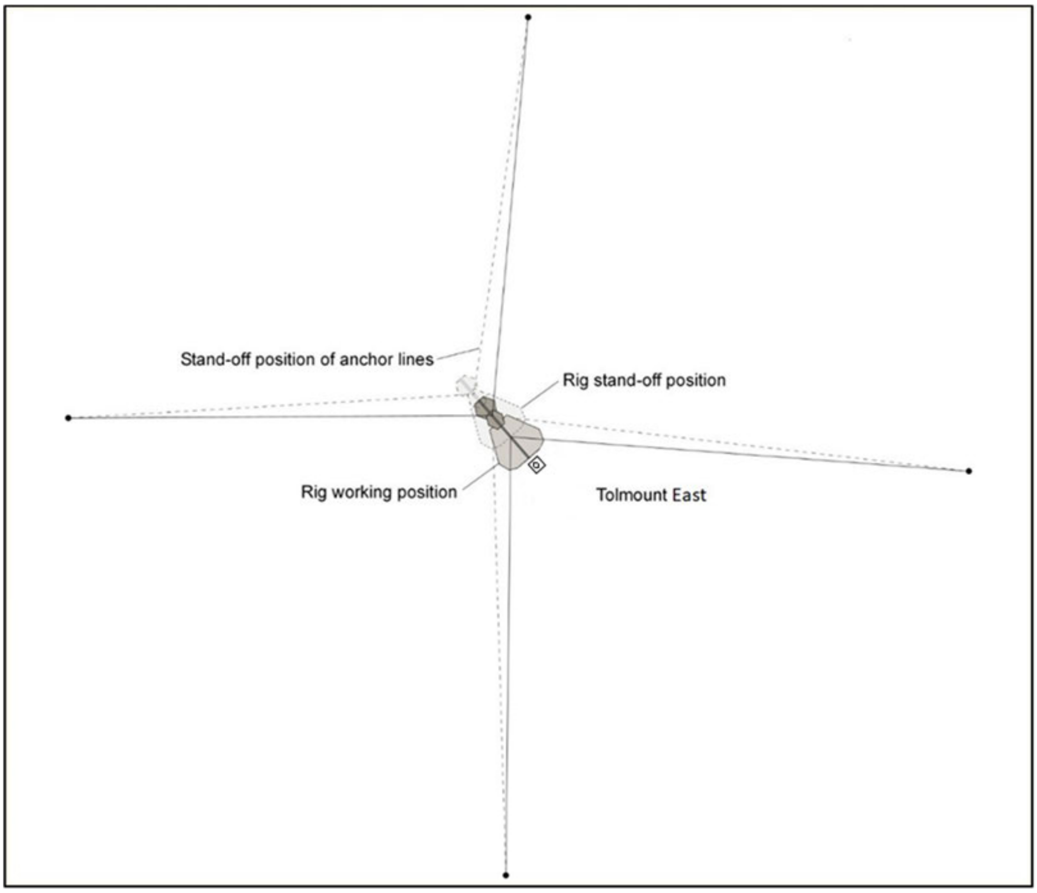


Figure 2-4 Example schematic of jack-up MODU anchor lines and positioning sequence

2.5.3 Re-entry and sidetrack of existing appraisal well

In August 2019, Premier drilled an appraisal well in the Tolmount East field following the well design illustrated in Figure 2-5. This existing well (Figure 2-6) will be re-entered by retrieving temporary abandonment caps and tying back the mudline suspension system profiles to the rig surface equipment. With pressure containment in place, the suspension plugs will be drilled out and the well sidetracked in the reservoir, drilling a 6" hole. A subsea wellhead will be connected to the existing conductor on the existing appraisal well in order to commence the re-entry.

LTOBM drilling mud will be used to lubricate the drill mechanism, bring rock cuttings to surface and to maintain pressure to prevent the escape of gas from the drill hole. An HP riser will connect the subsea wellhead to the drill rig and provide the conduit for LTOBM cuttings to be recovered to surface for recovery of LTOBM and segregation of LTOBM-contaminated cuttings into skips for backloading ashore for treatment and disposal.

Steel casings will be installed in the 6” well section to provide structural strength and bore stability, and to isolate unstable formations, different formation fluids and varying down-hole pressure regimes. Each steel casing will be cemented into place to provide a structural bond and an effective seal between the casing and surrounding formation. The MODU’s drilling equipment will be connected to the well via a HP riser and through which the mixture of cuttings and mud returning back up the well bore can be pumped up to the MODU. This enables cleaning and separation of the mud and cuttings mixture to take place, so that the drilling mud can be recycled and used again, and the cuttings waste either discharged overboard or retained for onshore disposal.

The LTOBM cuttings will be separated from the LTOBM on board the MODU, contained and shipped to shore for further cleaning prior to disposal. This means that there will be no discharges of drilling cuttings to sea.

The MODU will be fitted with a blowout preventer (BOP). The function of the BOP is to prevent uncontrolled flow from the well by closing in the well at the seabed if required. The BOP is made up of a series of hydraulically operated rams that can be closed in an emergency from the drill floor and from a safe location elsewhere on the MODU.

The overall target depth for each well is approximately 10,100 ft (3,070 m) true vertical depth subsea (TVDSS). Completion thereafter will be via conventional open hole gravel pack as described in Section 2.5.6.

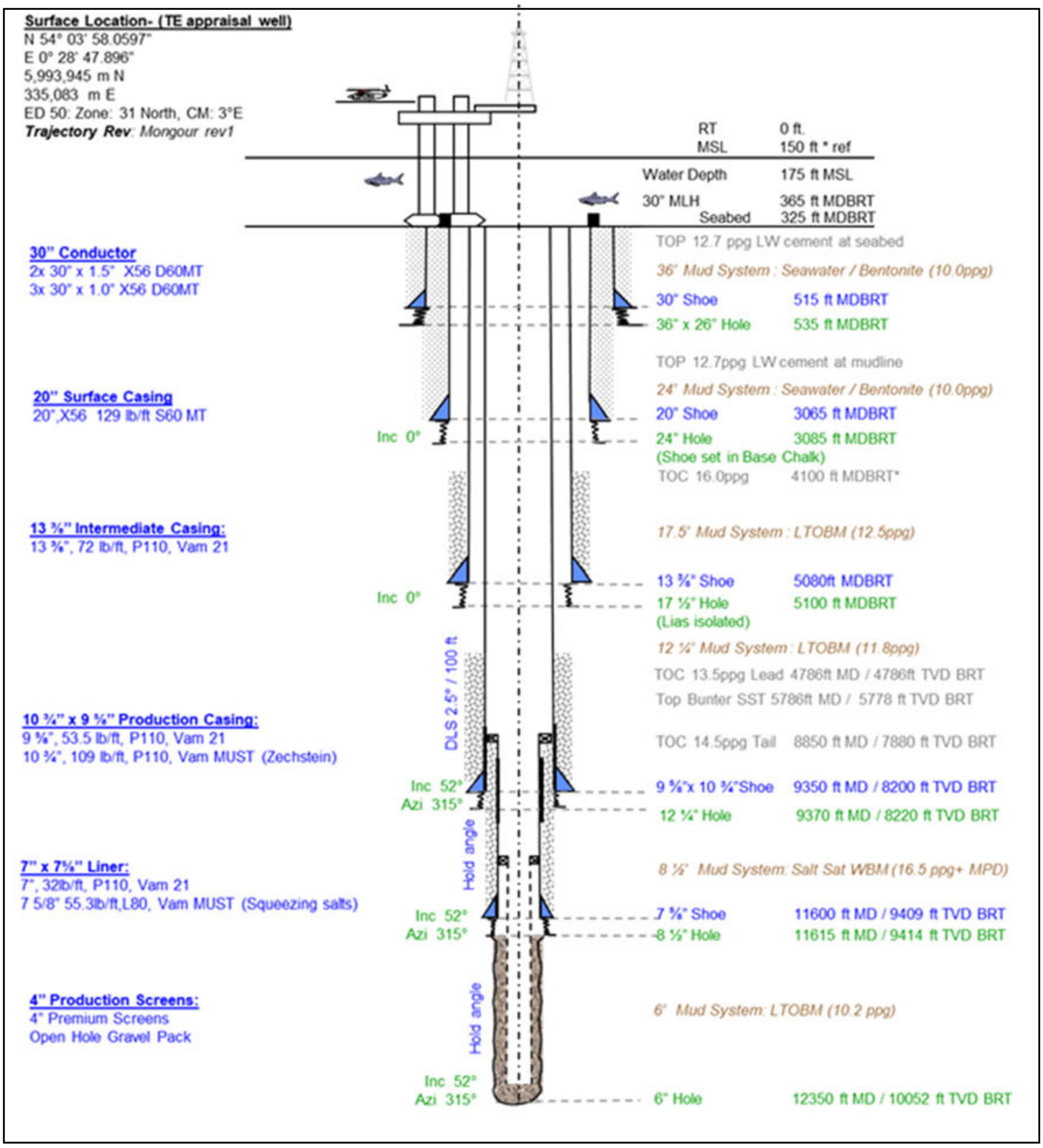


Figure 2-5 Proposed well design for Tolmount East well

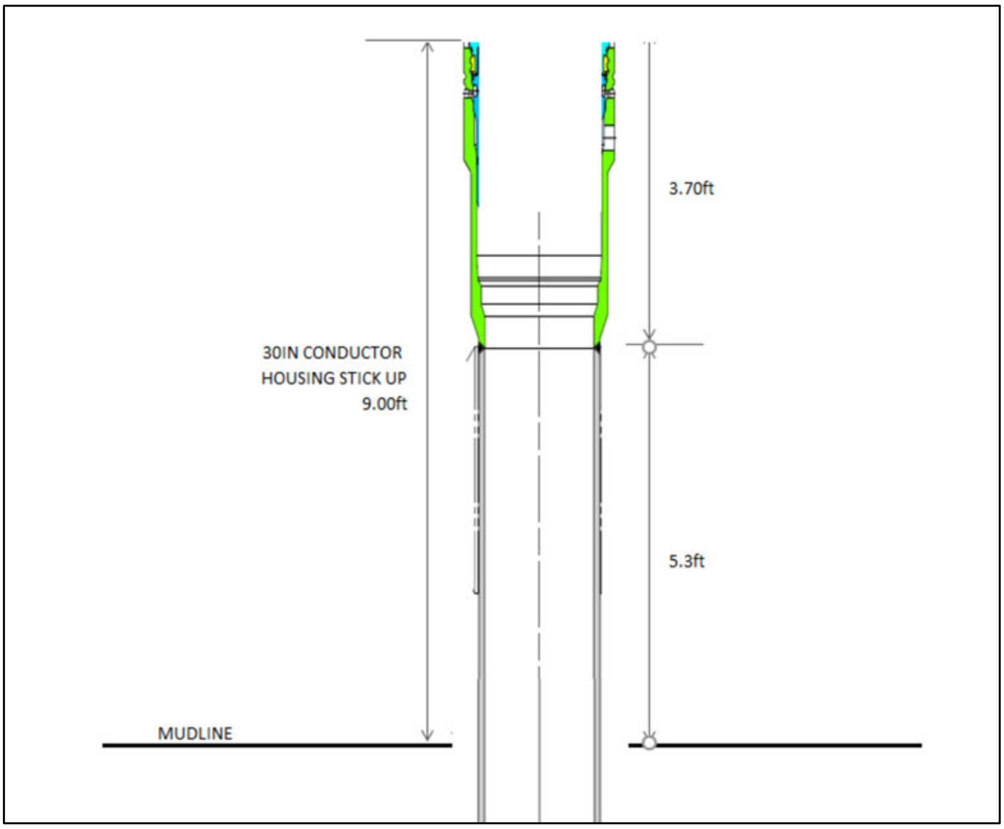


Figure 2-6 Existing appraisal well stick up above seabed at Tolmount East

2.5.4 Mud systems and cuttings

Drilling fluids ('muds') used whilst drilling a well have a number of functions, including:

- Maintenance of downhole pressure to avoid formation fluids flowing into the wellbore (also called "a kick");
- Wellbore stability;
- Removal of drill cuttings from the drill bit to permit further drilling and transporting cuttings to the surface cuttings handling equipment;
- Lubricating and cooling the drill bit, bottom hole assembly and drilling string; and
- Deposition of a mudcake on the walls of the well bore, which seals and stabilises the open hole formations.

Drilling fluids can consist of various materials including weighting agents and other chemicals to achieve the required weight, viscosity, gel strength, fluid loss control and other characteristics to meet the technical requirements of drilling and completing the well. Various chemicals can then be added to either type of drilling fluid system to achieve specific functions, which are mainly driven by formation pore pressures and fracture gradients, downhole temperatures, geological characteristics etc.

The 6" sidetrack on the existing appraisal well will use low toxicity oil based mud (LTOBM). The cuttings will be separated from the LTOBM fluid using shale shakers, contained and shipped to shore for further treatment and ultimately disposal. The recovered LTOBM fluid will be treated and recycled back into the LTOBM system for re-use. Table 2-3 details the drilling mud requirements for the well, noting that there will be no discharge to sea of LTOBM or drill cutting.

The drilling will programme, and associated chemicals will be subject to the appropriate risk assessment and approval prior to commencing the drilling via the drilling permit application for the well sidetrack.

Table 2-3 Tonnages of drilling mud components

Component	6" sidetrack
Diameter (in)	6
Length (m)	280
Mud type	LTOBM
Fate of mud/fluid/cuttings	Zero discharge skipped and shipped to shore for disposal
Non-PLONOR chemical additives	75 litres
Estimated weight of cuttings (tonnes)	15

2.5.5 Cementing and other chemicals

A kick off cement plug will be set during the drilling phase of the re-entry and sidetrack of the appraisal well. The sidetrack will be drilled, cleaned up and the open hole completed with an open hole gravel pack (OHGP). There remains potential of remedial cementing operations if issues are encountered in the drilling phase, although this is relatively unlikely.

Low volumes of excess cement may be mixed during cementing operations. In this case, cement will be discharged to sea. To limit discharge of cement, it is anticipated that all cement will be mixed as required, and therefore discharges should only routinely occur during the washing down of equipment. Table 2-4 provides the reasonable worst case volumes of mixed cement that may be discharged from each well section.

Table 2-4 Estimated mixed cement discharges per well section

Cement discharged	6" sidetrack
Barrels	20
m^3	3.2

All chemicals to be used within the cement will be selected based on their technical specifications and environmental performance. Chemicals with substitution warnings (those chemicals that contain substances hazardous to the marine environment and their use and/or discharge selected for phase-out) will be avoided where technically possible. The cementing chemicals to be used have not yet been determined but will be selected to ensure that the additives chosen will comply with OSPAR and UK Offshore Chemical Regulations (2011), in order to ensure minimal potential environmental impact.

2.5.6 Well completion clean-up and testing

During completion operations (the point at which the downhole equipment is assembled to enable production from the well), it is expected completion fluids will be used to displace the drill mud remaining in the annulus. This will be recovered to the MODU, retained in skips and shipped to shore for treatment and disposal. Sand production will be managed by open hole gravel packs (effectively filters) installed in the well completion.

During well clean-up, any waste and debris remaining in the well will be removed to prevent damage to the pipeline or topsides production facilities once production starts. This will involve filtration of completion fluids and overboard discharge from the MODU (upon meeting overboard criteria); debris will be retained in skips and shipped to shore for treatment and disposal.

Flaring of gas and condensate will be required during the clean-up period which is not expected to last more than two days per well (i.e. <48 hours), during which time less than 2,000 tonnes (Te) of combined hydrocarbons (gas & condensate) will be flared per well. Flaring will be required until the well is producing within pipeline specification. The exact operational requirements will be confirmed prior to the drilling of the well.

Following well clean-up, the well will be handed over to the production team who will take the well through hook up and commissioning procedures.

No well testing or vertical seismic profiling (VSP) is planned for the development well.

2.5.7 Well workovers and interventions

Well workovers refer to any kind of well intervention involving major maintenance or remedial treatments. In many cases, workover implies the removal and replacement of the production tubing string after the flow from the well has been stopped and a workover rig has been placed on location. No well workovers are planned during the production phase. However, an unplanned well workover might be expected over the life of the field. Such a workover would last around 15 days and require a rig in place. The anticipated environmental impacts and emissions for this activity would be calculated at the time of relevant permit applications.

Well interventions are less invasive operations than workovers and do not require a workover rig. Normally, wells require well intervention at some point between five and ten years from first production. Premier will be doing everything possible to reduce the requirement for subsea intervention. However, it is assumed one intervention will be required. The well intervention would require halting production for a brief period.

At the end of field life, the well will be plugged and abandoned (P&A); utilising a jack-up MODU to complete the work. The P&A operation is estimated to take 34 days and the atmospheric emissions from this planned activity have been included within Table 8-1.

2.6 Subsea Infrastructure

2.6.1 Overview

The subsea infrastructure at Tolmount East (Figure 2-8), will include a subsea manifold, a WHPS (protecting a DrilQuip 13.5/8th monobore tree) over the well, and the 12" flowline and umbilical connecting the Tolmount East manifold to the Tolmount MFP. The following description of the subsea infrastructure assumes a maximum number of three well at Tolmount East.

As described in Section 2.5.1, the subsea infrastructure is designed for three wells in total. The Tolmount East project will re-enter, sidetrack and complete the existing appraisal well. This will leave two optional slots: one in case of drilling failure and a slot for the future development that is yet to be decided (and outside of the scope of this EIA).

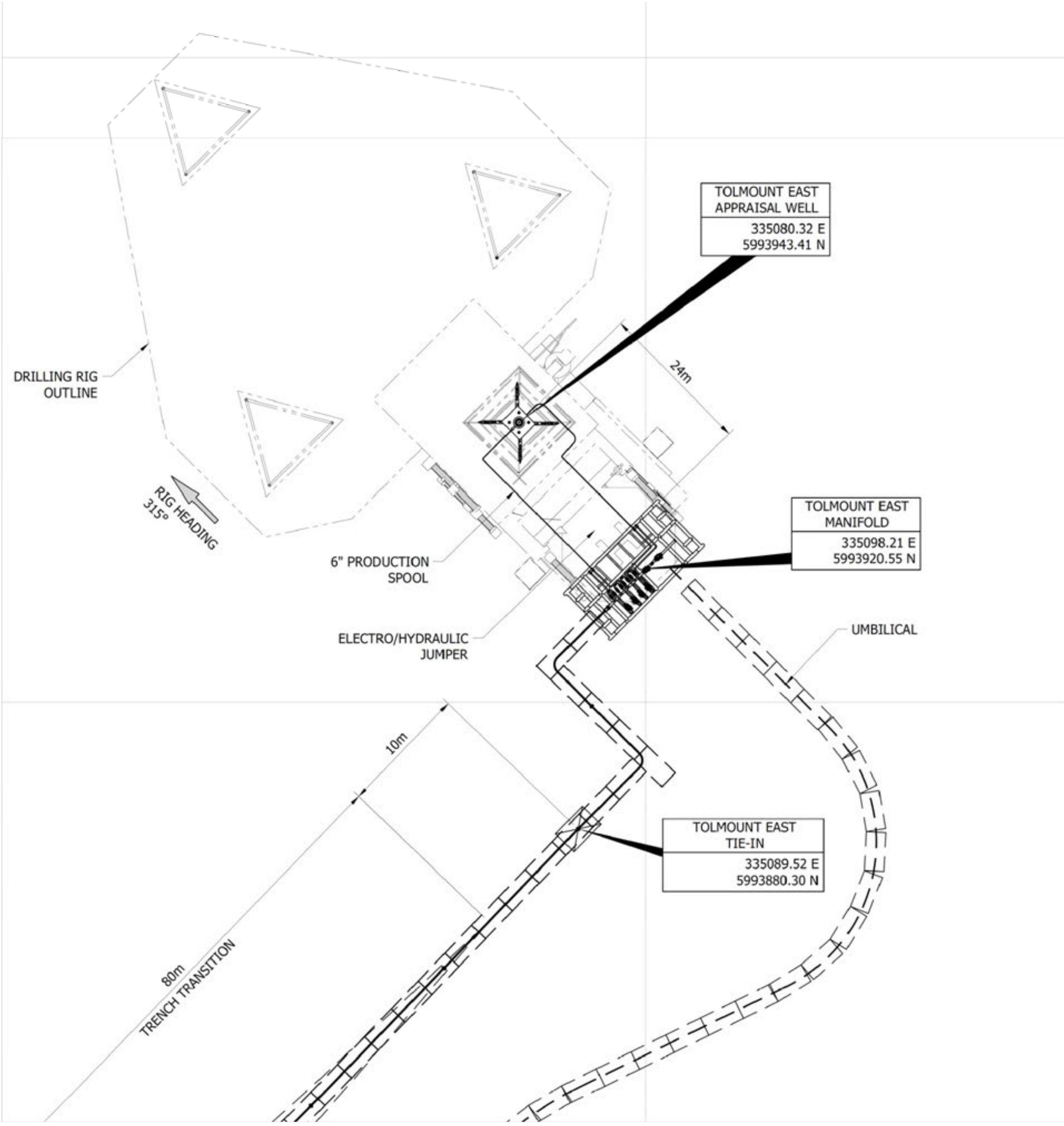


Figure 2-7 Drilling rig and subsea structure layout at Tolmount East

The completed well (protected by the WHPS) will be tied back to the subsea manifold via a 6" jumper. The Tolmount East subsea manifold will be a gravity base foundation, negating the need for any piling works.

The 12" flowline between the Tolmount East manifold and the Tolmount MFP will export combined hydrocarbons (gas and condensate), plus any produced water to the Tolmount MFP. An umbilical containing power, methanol (MeOH) cores/tubes, fibre optic bundles, hydraulic fluid cores and chemical cores/tubes will also be installed separately along the same route. The base case option is for the flowline and umbilical to both be trenched and buried. However, under the worst case scenario, the flowline and umbilical may be surface laid and rock dumped along their full length (two separate berms) to achieve a 0.6 m cover over the top of pipe/umbilical.

All controls equipment including a SDU, three Subsea Control Modules (SCMs), three Chemical Injection Metering Valves (CIMVs) and a Subsea Accumulator Module (SAM) if required will be housed within a controls skid which will utilise the manifolds foundation base and protection frame. The umbilical will terminate at an Umbilical Termination Unit (UTA) which will be connected to the SDU on the controls skid via hydraulic/chemical/electrical flying leads between manifold and each individual tree. Additionally, there are individual flow meters in the manifold on each 6” branch to the respective tree.

Spool-pieces will be used to tie in the export pipeline end to the subsea flanges at the Tolmount MFP and the Tolmount East subsea manifold as well as for the 6" rigid spools connecting the subsea manifold to the WHPS. These spools will be installed on the seabed surface by divers. The spools, the exposed pipeline ends and the 6" jumpers and flying leads will be protected by concrete mattresses.

The Tolmount East umbilical (and its subsea termination arrangement) will be specified to allow its extension to future developments further East. The number/rating of the cores in the umbilical will be selected to facilitate its extension to service up to ten wells in total. This future expansion capability also applies to the other elements of the subsea control system, i.e. HPU, MCS and EPU.

The umbilical end will be pulled up to the Tolmount MFP topsides via a dedicated J-tube. The umbilical sections on the surface of the seabed will be protected by concrete mattresses up to the point where the rock berm starts.

Once the Tolmount East flowline (TE flowline) is commissioned, the Tolmount East produced hydrocarbons (gas and condensate) and produced water will be metered (subsea) and flow back to the Tolmount MFP, where they will be comingled with the

Tolmount field fluids and exported onwards via the Tolmount export pipeline for processing at the onshore Easington Terminal.

The construction and installation phase will involve the following activities:

- Boulder clearance (if required);
- Sweeping and dredging of the seabed as necessary along the route corridor to clear it of obstructions and to smooth the seabed profile, reducing the risk of exposures, free spans and stresses (Section 2.6.7);
- Installation of the WHPS with monobore tree and subsea manifold (Section 2.6.2);
- Direction of pipelay will be confirmed at a later date (Section 2.6.8.1);
- Umbilical lay from the Tolmount MFP to Tolmount East including J-tube pull-ins (Section 2.6.8.2);
- Subsea spool-piece installation, tie-ins and leak testing;
- Placement of concrete mattresses and rock armour for pipeline/umbilical protection (Section 2.6.8.3). Typically, this will comprise:
    - Mattresses across surface-laid spools and umbilical sections; and
    - Rock armour along the entire pipeline and umbilical routes, forming two separate rock berms (as the worst case scenario assessed in this EIA), noting that the base case for the Tolmount East Development is to trench and bury the pipeline and umbilical;
- Flooding, cleaning, gauging, hydrotesting and leak-testing of the export pipeline (Section 2.6.11);
- Pressure test of umbilical hydraulic, methanol and chemical cores, and test of electrical and fibre optic cores;
- Dewatering of pipeline and spools (Section 2.6.11);
- Hook-up flying lead between manifold and tree; and
- Commissioning support.

The installation philosophy is based on:

- Diver operations to perform subsea tie-ins, flying lead hook-up, aid umbilical pull-in and protection mattress installation; and
- Remotely operated vehicle (ROV) support vessel to perform surveys, and cleaning, gauging and hydrotesting operations.

2.6.2 WHPS and subsea manifold

Following the 6” sidetrack, the existing Tolmount East appraisal well will be completed with a DrilQuip 13.5/8th monobore tree. The WHPS will be mechanically connected to the subsea wellhead and will have an overall seabed footprint of approximately 9 m x 9 m. The WHPS will have a total height of around 6 m above the seabed and is designed to be overtrawlable.

The subsea manifold incorporates a production header with a double block and bleed isolation arrangement to facilitate pre-commissioning of the flow line as well as the tie in of a future development well without interruption to the Tolmount East production. The manifold will have three 6" well tie – in slots. However, for the Tolmount East development (as currently envisaged), only one development well tie-in will be connected to the planned well via 6" tie-in spools. The other two manifold tie-in slots are one spare and one potentially for future development. Hydraulic, chemical and electrical flying leads will also connect the subsea trees to the SCM.

The manifold will be a gravity base, fishing friendly structure with a worst case seabed footprint of approximately 20 m x 20 m and a height above the seabed of 6 m. No piles will be required for the subsea infrastructure, thereby negating the need for any piling works and minimising underwater noise impacts. Overall, the smaller structures associated with the development means a reduction in the embedded carbon associated with the development.

Installations of these structures will be from a construction vessel. The 6" jumpers, spools and flying leads connecting the monobore tree to the subsea manifold will be deployed by a diving support vessel.

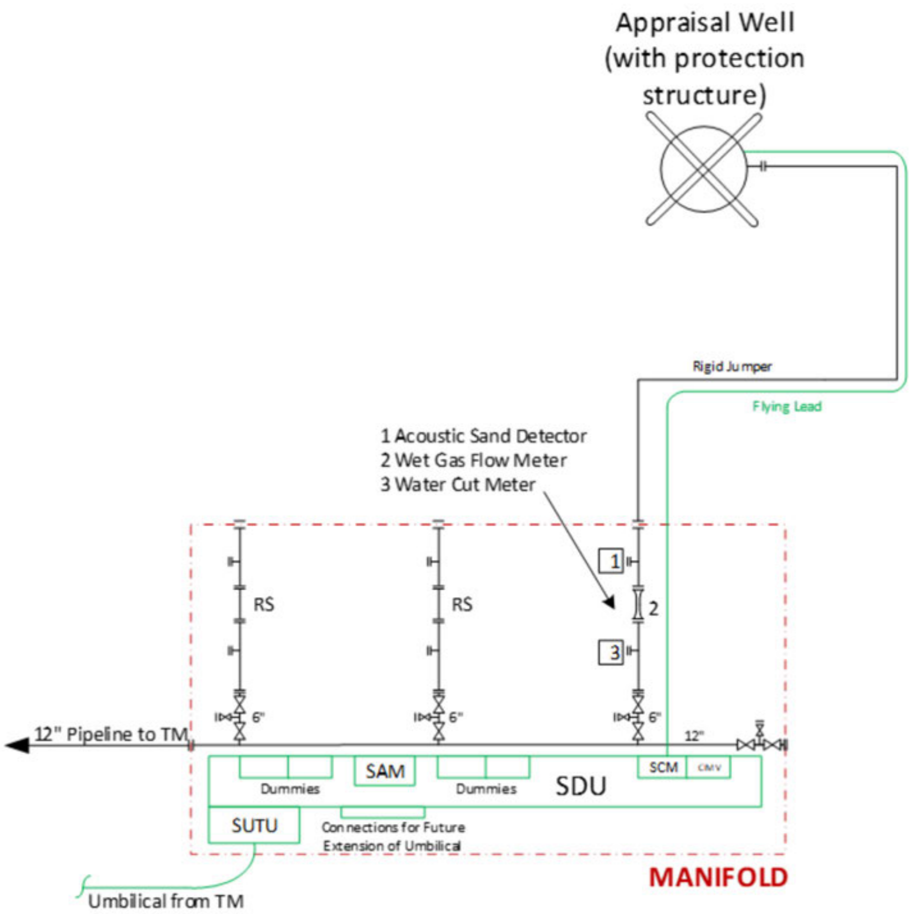


Figure 2-8 **Layout and Dimensions of Subsea Structures at Tolmount East**

2.6.3 Controls and communication

The subsea facilities will be remotely monitored and controlled from the onshore Easington Terminal. The controls system will be an open system, with hydraulic controls fluids vented to sea rather than returned via a dedicated core within the umbilical.

The subsea control system distribution follows a daisy chain approach, where hydraulic, electrical, methanol, chemical and optical services for future expansion will connect to the distribution unit at Tolmount East. A control umbilical will be installed from the Tolmount MFP to the Tolmount East manifold. This umbilical will provide the conduits for low- and high-pressure hydraulic lines, methanol, scale inhibitor, electrical cable and fibre optic bundles.

The subsea production control system will use an electro/hydraulic multiplexed system which can monitor and control the operations of the subsea well and manifold. This system will allow effective performance even in the event of a single line failure.

The manifold will also include individual Wet Gas Flow meter and water cut meters on each of the 6" branches.

Additional controls equipment to be added to Tolmount MFP include a Master Control System (MCS) which will allow control of all functions of the Tolmount East subsea equipment. The Hydraulic Power Unit (HPU) provides hydraulic fluid power to the subsea control system. The fluid filled HPU has an approximate weight of 5000 kg and a footprint of 10 m^2. The Topside Umbilical Termination Unit (TUTU) interfaces the subsea control fluid from the HPU and the Tolmount MFP chemical injection units to the subsea umbilical. It also includes the electrical interface from the topside control system to the subsea umbilical as well as being the point of termination for the fibre optic system. The TUTU will have an approximate weight of 1,500 kg and a footprint of 1 m^2.

2.6.4 Pipeline installation schedule

The pipeline pre-lay survey, construction and installation is currently scheduled to take place over the period between Q3 2022 to Q2 2023.

2.6.5 Tolmount East flowline

The specification for the Tolmount East flowline is likely to be as follows, although it is subject to confirmation during detailed design:

- Length from tie-in point at Tolmount MFP to tie-in point at the Tolmount East manifold is: 3.748 km;
- Outside diameter (OD)[4]: 12" (323.9 mm);
- The design pressure for the Tolmount East pipeline system is set to match that of the Tolmount topsides piping and the 20” Export pipeline’s fortified zone at 275 barg; and
- Nominal wall thickness of pipeline: 25.4 mm API 5L X65 complete with 3-layer polypropylene anti-corrosion coating.

[4] It has been assumed that standard 12-inch pipe OD of 323.9 mm will be used for all different wall thicknesses, meaning the system will not be constant internal diameter (ID). Modest changes in bore such as this can easily be accommodated by all types of pigs provided that suitable transition tapers are used.

2.6.6 Umbilical

The umbilical shall carry the main supplies of chemicals, hydraulics, electrical power and communications from the Tolmount MFP to Tolmount East subsea cluster. The umbilical shall be adjacent to the flowline for protection, and the umbilical design shall take account of these installation conditions. The base case umbilical specification is as follows. While it is expected to be amended during FEED, this specification is expected to be indicative of the final design:

- Length from tie-in point at Tolmount MFP to tie-in point at Tolmount East manifold: 4 km;
- OD of umbilical: 5.9" (150 mm);
- OD of J-tube within which umbilical is cased: 12" (323.9 mm); and
- Umbilical components:
    - 4 x MeOH (Methanol) cores (including 1 spare);
    - 1 x scale inhibitor core;
    - 2 x HP hydraulic cores;
    - 2 x LP hydraulic cores;
    - 1 x spare HP hydraulic/scale cores;
    - 3 x electrical power cables; and
    - 3 x fibre optic bundles.

2.6.7 Seabed sweeping

Seabed sweeping and/or dredging may be required prior to pipelay to flatten the mega ripples present across much of the route. Flattening of the crests of these features (which have wave heights between 0.1 m and 0.4 m) may be necessary in order to allow the pipeline and umbilical to be laid down. Pipeline detailed design will indicate which areas will require sweeping, which will be minimised as far as reasonably practicable.

It is expected that a Trailing Suction Hopper Dredger (TSHD), or similar vessel, will be used to flatten the mega ripple crests.

A TSHD (Figure 2-9) is used for dredging loose material such as sand, gravel, silt or soft clay. One or two suction tubes equipped with a drag head are lowered onto the seabed and trailed over the bottom. A pump system sucks up the mixture of seabed sediments and water. This slurry is discharged into the hopper or hold of the vessel where the majority of the seawater drains out. Once the hopper is full the vessel will halt operations and transit to an approved location to deposit the spoil, before returning to continue work.

Figure 2-9 Trailing suction hopper dredger

Since the mega ripples are likely to reform, either the sweeping operation will be carried out shortly before the pipelay operations or maintenance sweeping by the TSHD will be required to maintain a lay corridor.

The TSHD (or equivalent vessel) will be dynamically positioned (DP) and will not require anchoring during dredging.

2.6.8 Pipeline and umbilical lay

2.6.8.1 Tolmount East flowline

A dedicated dynamic position (DP) reel-lay vessel (Figure 2-10) will carry out the pipeline installation between the Tolmount East WHPS/manifold and the Tolmount MFP. The pipeline will be pre-fabricated onshore and then reeled onto the vessel reel at the loadout port. The directionality of the pipe lay will most likely be from Tolmount East to the

Tolmount MFP, while the umbilical lay direction will be from the Tolmount MFP to Tolmount East. The pipeline will be initiated either at the Tolmount MFP or the Tolmount East subsea cluster via a temporary anchor on the seabed, the pipeline vessel will then manoeuvre on DP along the pipeline route whilst simultaneously reeling off the pipe. The pipeline will be installed on to the seabed empty. The pipelay vessel will continue installing the pipeline until it reaches the tie-in point at either the Tolmount East subsea cluster or Tolmount MFP, (which is offset from Tolmount East and Tolmount MFP to allow the pipelay vessel to pass safely). When the pipelay vessel reaches the tie-in point it will lay down the pipeline on the seabed and leave the site to allow rock dump operations to commence should it be required. A survey support vessel will support the pipelay vessel throughout pipelay.

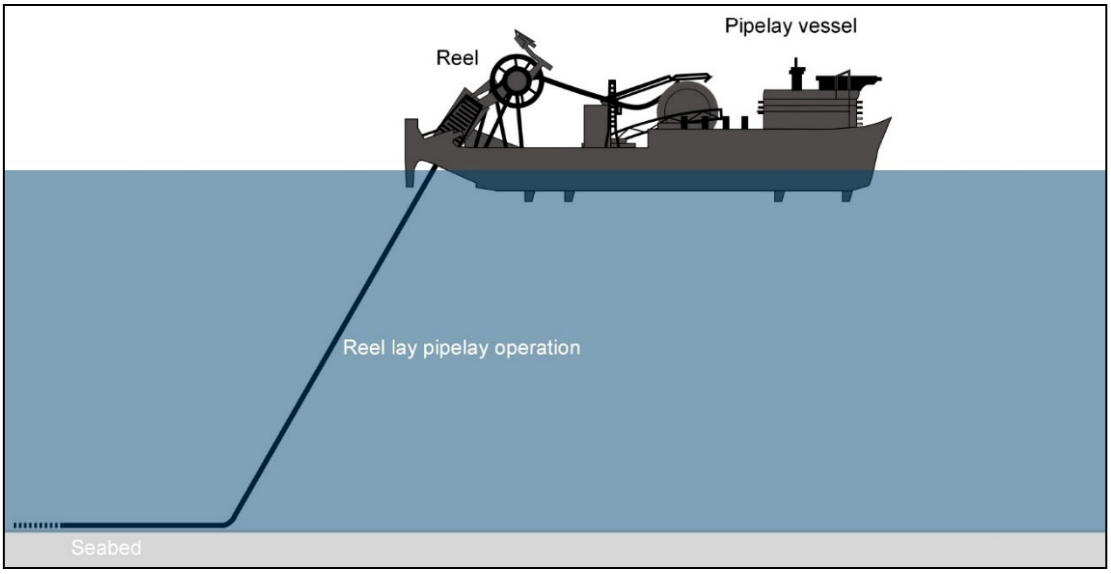


Figure 2-10 Typical reel lay operation

There is no planned laydown of the pipeline during operations, however the pipelay vessel will be prepared for a temporary laydown in the event of deteriorating weather conditions, equipment failure or other unforeseen events.

To perform the temporary laydown the pipeline catenary will be supported via the tensioner system while a temporary laydown head is attached to the end of the pipeline. After this the laydown head will be connected to the abandonment and recovery (A&R) winch, and the tensioner system opened. The vessel will then lay the pipeline on the seabed via the A&R winch, while an ROV monitors the pipeline and touchdown location. Once the laydown head arrives on the seabed, the ROV will disconnect the pipeline from the winch.

2.6.8.2 Umbilical

The umbilical will be surface laid parallel to the pipeline with minimal separation and will be installed by a construction vessel.

The first end of the umbilical will be pulled directly into the J-tube at the Tolmount platform. Once the umbilical is hung off on the Tolmount topside, the umbilical will be laid towards the Tolmount East manifold where it will terminate at the UTA. The umbilical UTA will be pulled into the Tolmount East manifold by divers, there is no J-tube on the subsea manifold. This will create overage length to allow the future pull-in into the Tolmount East manifold J-tube, which will likely be performed by divers and a dive support vessel (DSV).

2.6.8.3 Pipeline and Umbilical Protection

The base case is for trench and burial of the pipeline, without the use of significant quantities of rock armour protection. However, it is recognised that rock armour may be required for the following reasons:

- To ensure the structural integrity of the pipeline during operation and safety to the fishing trawls; and
- Following the recommendations of further studies to be performed during detailed engineering and post lay burial survey.

In the worst case scenario where burial is not achieved, rock armour may be required to be deposited along the 4 km route with the umbilical and pipeline being protected under separate berms. As described above, this option is included as the worst case assumption, whereas the base case option is to trench and bury the pipeline and umbilical along the entire length.

In the event that rock dumping the whole length of the pipeline and umbilical is chosen as a preferred protection method over trenching and backfilling, the requirement would be to maintain a minimum 0.6 m rock cover to top-of-pipe and umbilical throughout the length; this depth of cover being deemed sufficient for protecting the pipeline/umbilical from trawl activity and/or dragged anchors.

The quantities of rock required to provide additional ‘spot’ trawl protection, download weight to mitigate Upheaval Buckling (UHB), or rock protection (i.e. along the entire length of the pipeline and umbilical), will be minimised/targeted for both economic and environmental reasons.

In the worst case scenario, a rock cover of 1.07 m and 0.76 m to top of pipe and umbilical respectively has been assessed. The sourced material will be a standard rock/gravel mixture with a Dn_{50} of 30 mm for filter layer and 150 mm for the armour layer. The total area covered by this option equates to 61,200 m^2. For the pipeline, the approximate size of the berm is 1.4 m high x 9.4 m wide with a 1.07 m cover to the top of pipe, while for the umbilical, the approximate size is 0.9 m high x 5.9 m wide, with a 0.76 m cover (Figure 2-11).The worst case volume for both the pipeline and umbilical rock cover is estimated at 48,960 m^3 with a contingency volume of 20 % and a worst-case total weight 74,909 Te with the 20% contingency (see Table 2-5).

Pipeline and umbilical ends at both approaches will also be protected by concrete mattresses and grout bags at the riser spool swan necks and at the umbilical J-tube bellmouth.

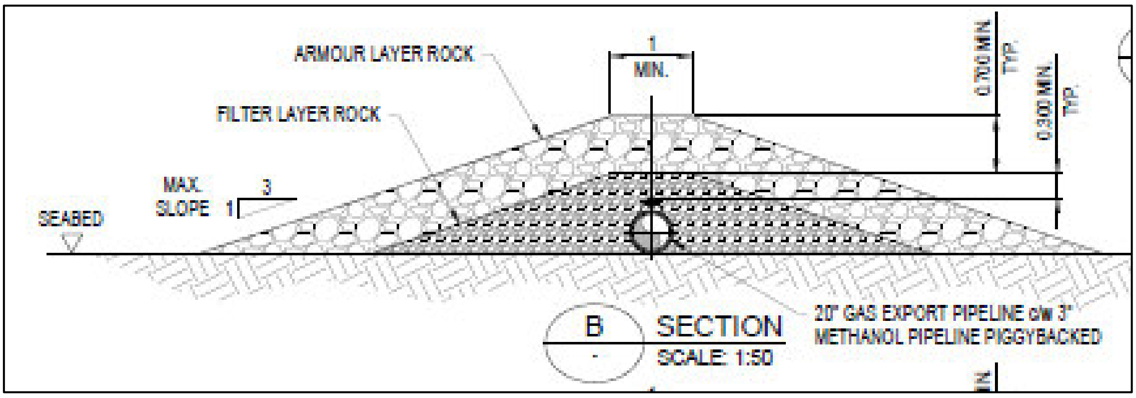


Figure 2-11 Illustration of rock dump with associated berm size

Table 2-5 Quantity of rock armour and concrete mattresses that may be required for pipeline & umbilical routes

	Rock Armour	
Option Description	Rock armour along entire route -two berms (one pipeline and one umbilical)	
Mattresses (6 m x 3 m)	N/A	
	Pipeline full	**Umbilical full**
Height (m) (Cover over pipe, m)	1.4 m high berm (1.07 m)	0.9 m high berm (0.76 m)
Width (m)	9.4	5.9
Length (m)	100% - 4000	
Area (m^2)	37,600	23,600
Pipeline & umbilical total area (m^2)	61,200	
Berm cross sectional area (m^3/m)	7.3	2.9
Berm volume (m^3)	4000 m x 7.3 m^3/m = 29,200 m^3	4000 m x 2.9 m^3/m = 11,600 m^3
Berm volume with contingency (20%) (m^3)	35,040	13,920
Pipeline & umbilical total volume (m^3)	48,960	
Weight (Te) – in air	44,676	17,748
Weight (Te) – in air with contingency (20%)	53,611	21,298
Pipeline & umbilical total weight (Te)	74,909	

2.6.9 Tie-in

Following laydown, and once flood, cleaning, gauging and hydrotesting of the pipeline has been completed (refer to Section 2.6.11), the pipeline will be connected to the tie-in flange on the Tolmount East subsea manifold and the riser base on the Tolmount MFP using pre-fabricated flanged rigid spool-pieces installed by divers from a DSV. At the Tolmount East end a Z shape spool (made up of two parts) will be installed to connect the manifold to the pipeline end. The dimensions will be approx. 10 m x 25 m x 20 m.

At the Tolmount MFP end a U shape spool (made up of two parts) will be installed to connect the pipeline end to the Tolmount MFP. The dimensions will be approx. 12 m x 34 m x 15 m. (Figure 2-12). Dye sticks will be inserted at the flange connections during spool tie-in to enable leak detection; dye will only be present where a leak is most likely to occur (i.e. at the flange connections), and the total quantity of dye used is minimal. There are also rigid spools between the manifold and WHPS, and jumpers between the manifold and trees.

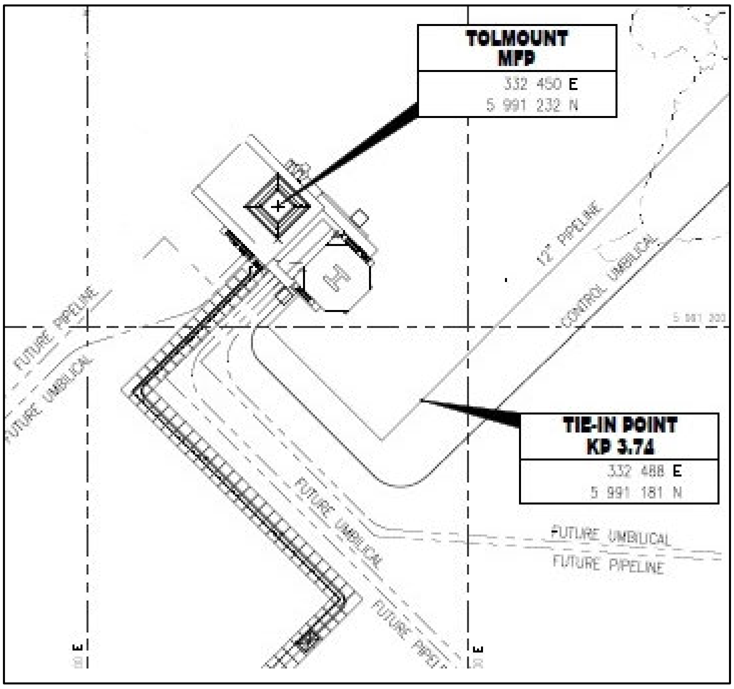


Figure 2-12 Tie-in spools on approach to Tolmount MFP

2.6.10 Survey support

Survey vessels will be active throughout the pipeline installation and remedial activities, carrying out a variety of tasks. These include the following:

- Seabed Preparation Survey – surveys carried out during the seabed preparation works;

- Pre-lay Survey – a survey will be carried out offshore prior to laying the pipeline onto the seabed;
- Pipelay Support – ROV surveys providing:
    - Initiation and laydown support
    - Touch down monitoring
    - Real time route plotting
    - As-laid survey;
- Umbilical Support – ROV surveys providing:
    - J-tube pull-in and laydown support
    - Touch down monitoring
    - Real time route plotting
    - As-laid survey
    - Umbilical laydown support;
- Rock placement survey – to be carried out by the rock placement vessel.

2.6.11 Pre-commissioning

Once the 12" Tolmount East flowline has been installed, it will be flooded with filtered seawater, and then cleaned and gauged between the temporary subsea laydown heads at either end of the flowline. This will be accomplished by propelling a flooding, cleaning and gauging pig[5] train down the flowline from one end to the other. The pig train will introduce the filtered seawater to the pipeline in readiness for hydro-test. Following the hydro-test (subsea end to subsea end of the pipeline), the Pig Launchers/Receivers (PLRs) at each end will be detached by divers, and the spools tied-in to connect the pipeline to the Tolmount East subsea manifold and the Tolmount MFP (riser). The pipeline system will then be dewatered by pushing pigs (driven by nitrogen) from the Tolmount East manifold to the Tolmount MFP. Water will be discharged at Tolmount MFP until these pigs arrive at the MFP leaving the pipeline filled with nitrogen.

[5] Pigs are mechanical devices which are pushed through a pipeline during commissioning and maintenance operations.

Premier's chemical selection process will ensure that the additives chosen will comply with OSPAR and UK Offshore Chemical Regulations in order to ensure minimal potential environmental impact.

On completion of cleaning and gauging, the flowline will be hydrotested (strength tested). Hydrotesting will be undertaken by pumping in additional inhibited seawater while the discharge points are closed, raising the pressure to ensure the system is structurally sound. At the end of the hydrotest, dewatering will be from the subsea manifold to the Tolmount MFP. Pipeline tie-in spools will be hydrotested in the fabrication yard prior to loadout and installation. Once the flowline has been hydrotested, the flanged spools will be installed and connected to the ends of the pipeline and the risers at the MFP and Tolmount East WHPS/manifold by divers. On completion of subsea tie-in operations, the entire flowline system will be leak tested to ensure the system is leak free and ready to be brought into service.

To dewater the TE flowline, a nitrogen dewatering spread will be located on a vessel, hoses will be passed over to a temporary test head connected to Tolmount East subsea manifold. The flowline will be dewatered by a pressure driven pig train from the Tolmount East manifold to the Tolmount MFP. Between the pig train will be methanol slugs used to condition the inner wall of the pipeline before service. Displaced inhibited water will be routed at the Tolmount MFP - either through an existing dump caisson, or over the side via temporary pipework. Following dewatering, the flowline will be left filled with nitrogen at low pressure. As the flowline will be in wet service during operations, no special drying techniques are required. Prior to removal of the temporary dewatering heads at the MFP and Tolmount East manifold for tie-in of the topside pipework, the flowline pressure will be vented off to ambient.

There will be no expected discharges associated with pre-commissioning of the umbilical, if there are, the volumes will be relatively small (a couple of cubic metres).

2.6.12 Flowline operation and maintenance

During its operational lifetime, the TE flowline will be subject to a number of inspections (called in-line inspections) to examine integrity as part of the pipeline integrity management strategy. The frequency of intelligent pigging operations (internal inspections) has not yet been determined. This will only be undertaken if unavoidable as it would require significant diving intervention. External inspection of the pipeline will take place through a combination of ROV/autonomous operated underwater vehicle and towed sonar. The frequency of such maintenance will be determined by ongoing risk assessment. It is currently expected that inspections will be carried out on an alternating cycle, with ROV used for one review and towed sonar the next.

A temporary launcher for flowline commissioning will be installed at the Tolmount East manifold by divers. Space and piping connections for a temporary receiver on the Tolmount MFP already exist. This receiver will be used during commissioning. This will enable inspection as required.

2.7 Tolmount MFP modifications

The following modifications are required on the Tolmount MFP as part of the Tolmount East project:

- Installation and hook-up of the topsides elements of the new subsea control system in predesignated locations (MCS, EPU, HPU and TUTU);
- Connection of the 12” riser to the export manifold;
- Installation of new sample system to allow sampling the Tolmount East fluids;
- Connections to the Tolmount MFP power distribution system;
- Connections to the Tolmount MFP Integrated Control and Safety System (ICSS);
- Connection to the methanol distribution system;
- Connection of spare Scale Inhibitor pump head; and
- Connection of the above topsides systems to the new TUTU.

2.8 Production

2.8.1 Production profiles

Based on the expected availability of the Tolmount system, the total annualised daily average gas production from the Tolmount East well (i.e. excluding future development) is expected to peak in 2024 at approximately 2,520 (1,000 m^3 per day) before steadily declining over expected field life (Table 2-6, Figure 2-13). The production profiles presented herein are an are the most optimistic prediction (called ‘P10’) with a 10% chance that cumulative production will be higher.

Total condensate production from the Tolmount East well will also peak in 2024 at an annualised daily average of approximately 68 Te per day before steadily declining over field life. This is described in Section 2.4 and is reflected in the P10 profile by way of a declining annual average CGR (Table 2-6, Figure 2-14). The actual volume of condensate processed on the MFP will vary and is dependent on the fluid phase at the operation conditions; hence P10 figures are presented as a standard basis.

Based on the P10 figures it is estimated that the annualised daily produced water production rate will be a maximum of 56.5 m^3 per day (Table 2-6, Figure 2-15), and will peak in 2043.

Table 2-6 Annual average Tolmount East well production figures (P10)

Year	Gas rate (1,000 m3/d)[6]	Condensate rate (Te/d)[7]	Produced water rate (m3/d)[8]
2022	-	-	-
2023	1,057	28.5	3.0
2024	2,520	68.0	7.1
2025	2,304	62.2	42.5
2026	1,937	52.3	52.8
2027	1,662	44.8	53.6
2028	1,438	38.8	54.1
2029	1,249	33.7	54.5
2030	1,089	29.4	54.8
2031	954	25.7	55.0
2032	834	22.5	55.2
2033	729	19.7	55.4
2034	637	17.2	55.5
2035	557	15.0	55.6
2036	488	13.2	55.7
2037	428	11.5	55.8
2038	375	10.1	55.8
2039	330	8.9	55.9
2040	291	7.8	56.1
2041	256	6.9	56.1
2042	226	6.1	56.3
2043	200	5.4	56.5
2044	178	4.8	56.5
Total	7,211 million Sm^3	194,540 Te	403,145 Sm^3

[6] Conversion from MMscf to 1,000 m^3 used the calculation: (MMscf x 0.028316579) x 1000.
[7] Conversion from bbl to tonnes used the calculation: (bbl x0.159) x 0.728 (Tolmount condensate sg).
[8] Conversion from bbl to m^3 used the calculation: bbl x 0.159.

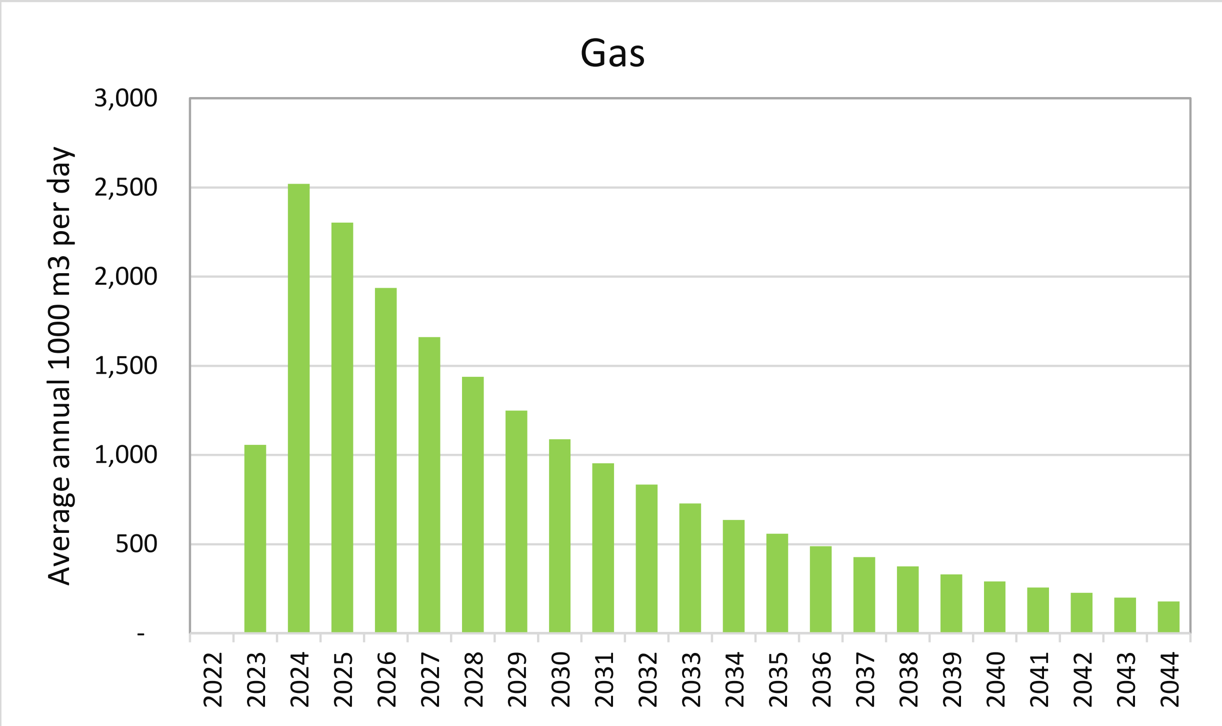


Figure 2-13 Tolmount East (excluding potential future wells gas production profile

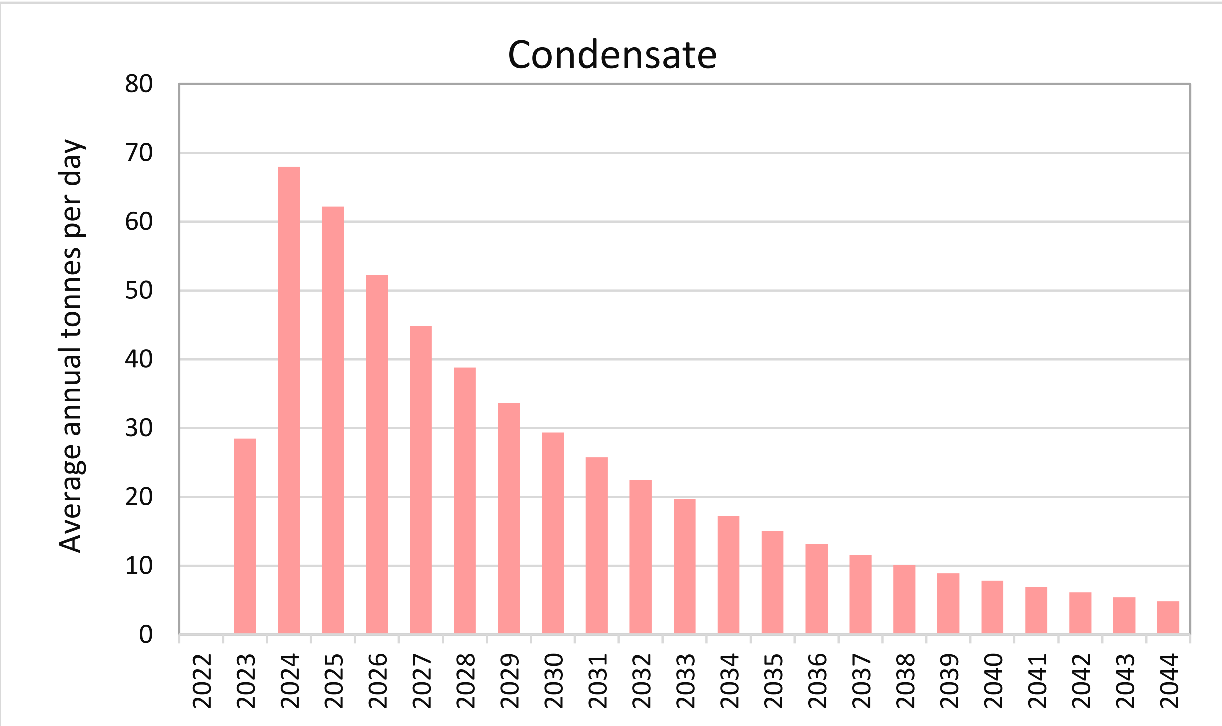


Figure 2-14 Tolmount East (excluding potential future wells) condensate production profile

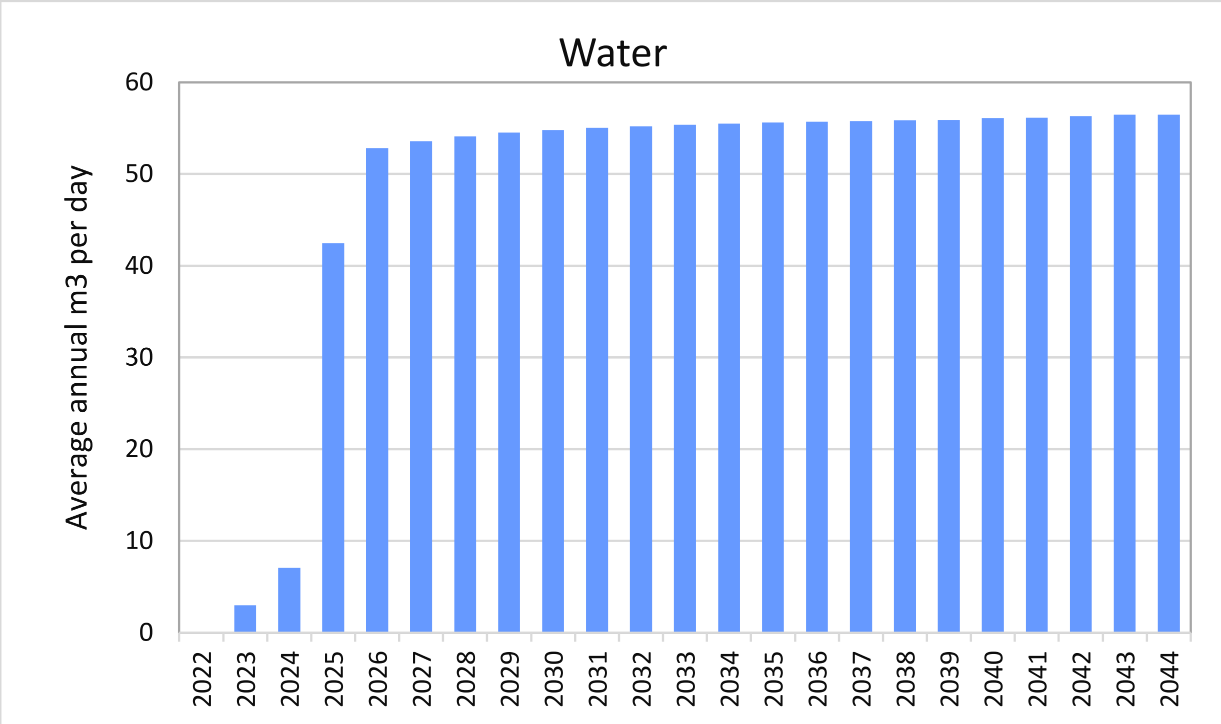


Figure 2-15 Tolmount East (excluding potential future wells) produced water production profile (annual average)

2.8.1.1 Produced water rates

The high case gas and condensate production profiles presented and assessed within this ES relate to the upper end (or P10) of the expected range of outcomes. However, it should be noted that in the case of water prediction in gas reservoirs:

- High case hydrocarbon profiles tend to occur when little or no water is produced from the reservoir. Conversely, low case hydrocarbon profiles tend to be associated with more water production from the reservoir; and
- Predicting the timing for the onset of water production rates is technically challenging.

For this reason, the S-shaped water profile illustrated in Figure 2-16 reflects the highest possible (P10) water production from as early as can be reasonably expected (black line in Figure 2-16), as well as the most likely profile (green bars). From Figure 2-16, under the worst case P10 scenario, water production starts in the Year 2023, and rapidly rises to a maximum of 56.4 m³ per day (355 bwpd). The corresponding total water production associated with this profile is 0.4 million m³ (2.54 million bbls).

In reality, it is very unlikely that this water profile would be realised during field life due to its negative impacts on field operational efficiency and economic performance. However, these worst-case values are included in this ES to provide additional context and to confirm that the Easington terminal waste-water treatment facilities have sufficient capacity (i.e. 63.6 m^3 per day, 400 bwpd) to treat the received water.

For additional context, the mid case (P50) development assumptions, which are anticipated to more accurately reflect reservoir conditions, predict water production starting at a later date of the Year 2030 with a maximum rate of 28.3 m^3 per day (178 bwpd). This produced water rate lasts for 2 years after which water production is predicted to fall to zero by 2034. The corresponding total water production associated with this profile is 0.23 mmstb.

Despite the challenges in predicting the timing of water production and rates, it is clear from Figure 2-16 that the available onshore processing capacity of 63.6 m^3 per day (400 bwpd) is sufficient to treat the worst case (P10) and more realistic P50 volumes of produced water that will be received onshore.

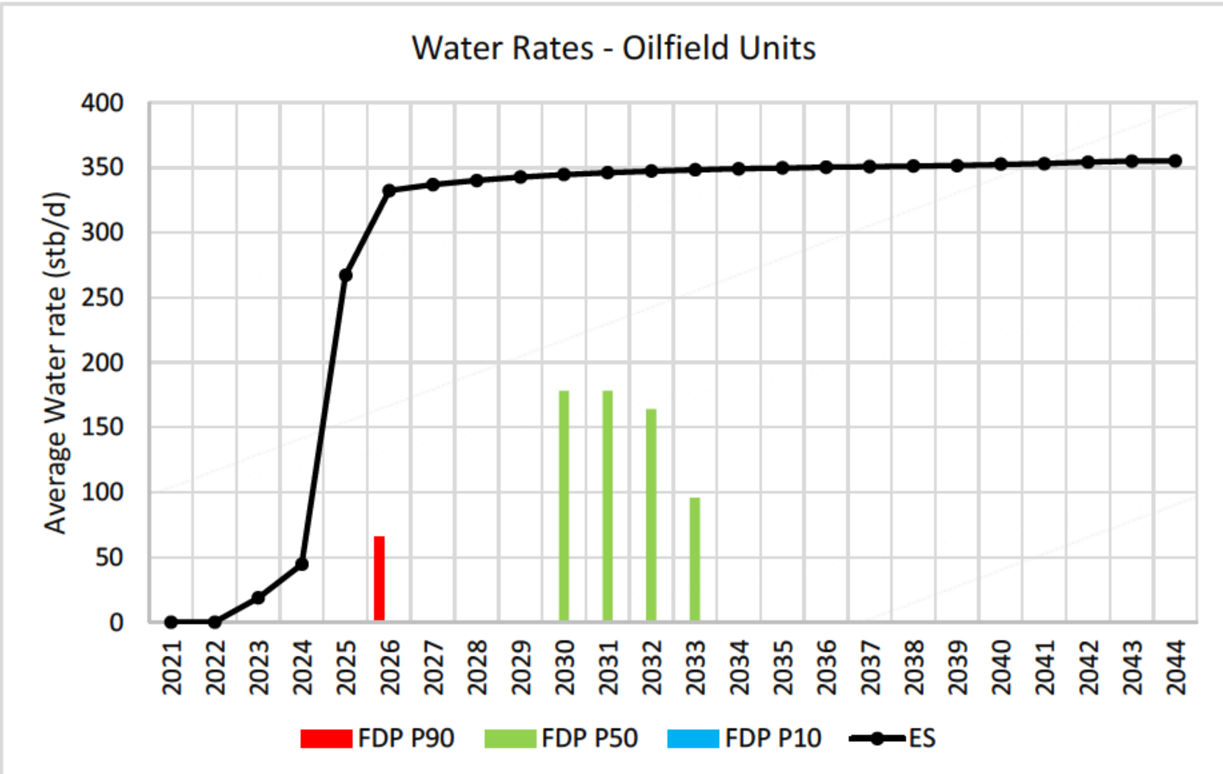


Figure 2-16 **Predicted highest possible (P10) water production rates from the one well**

2.8.2 Flow assurance and pipeline corrosion prevention

An overview of the chemical supply set up for the project is shown in Figure 2-17.

2.8.2.1 Corrosion inhibitor/methanol

Internal corrosion of the Tolmount East system shall be managed by continuous corrosion inhibitor injection (>95% availability). Corrosion inhibitor performance shall be qualified through the project with dosage requirements established accordingly. Corrosion inhibitor is required in order to control the rate of CO_2 corrosion to below 0.1 mm annually.

Corrosion inhibitor shall be comingled with methanol at the Easington Terminal and then batch delivered to the Tolmount MFP via a piggybacked 3" pipeline. Control of oxygen content in the methanol is required to prevent oxygen corrosion in the system, typically this shall by nitrogen gas blanketing of the methanol storage tanks onshore. The general principle to be adopted in the external corrosion protection design, for both carbon steel and corrosion resistant alloy (CRA) components, is that of high integrity external coatings with a dedicated cathodic protection (CP) system for the various subsea components. These systems shall be made mutually compatible by the use of electrical bonding, where necessary, to ensure continuity and provide system redundancy. Monitoring of external corrosion control measures is also required from installation through the design life to assess coating/insulation condition and CP potential.

A subsea methanol Chemical Injection Metering Valve (CIMV) will have the facility to bulk load individual wellheads for start-up activities where there is the potential to develop hydrates across the choke valve as well as continuously deliver methanol/corrosion inhibitor to the well.

The dosing of the corrosion inhibitor into the methanol is conducted onshore.

2.8.2.2 Scale inhibitor

Scale inhibitor will be supplied via the umbilical to the SDU which contains the flow meters and rate control devices allowing injection to multiple destinations at different flow rates and destination pressures. Scale inhibitor will be dosed at the well choke valve should water breakthrough occur.

Scale inhibitor will be allocated a dedicated core in the umbilical, with a generic spare tube which can be considered as redundant against the event of main core failure. The umbilical cores shall be sized to supply 10 wells down the Tolmount East cluster, which is designed to allow for the tie-in of future production from other fields in the area. The subsea control system and the umbilical are nominally sized to be able to service up to 10 wells. The piping within the subsea manifold allows for the tie-in of a future pipeline and the subsea umbilical termination unit design allows for the extension of the umbilical to a future development.

Scale Inhibitor is to be continuously injected at the wellhead upstream of the choke valve. The continuous injection rate is based on a 20-50 ppmv dosage for water in the production wellhead. The Tolmount East reservoir sands have good permeability and sand failure is expected. The completion design has yet to be finalised, though the design will aim to retain failed sand in place. Subsequently, no sand handling capability will be installed. Small quantities of very fine material (‘fines’) may be produced but will be carried through the production process and filtered out onshore.

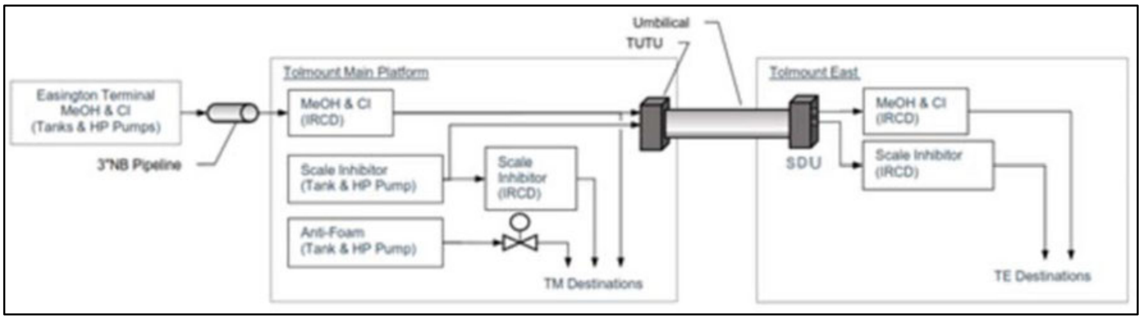


Figure 2-17 Chemical supply

2.8.2.3 Sand management

The Tolmount East reservoir sands have good permeability and sand failure is expected. The completion design has yet to be finalised, though the design will aim to retain failed sand in place. Subsequently, no sand handling capability will be installed on the Tolmount MFP. Small quantities of very fine material (‘fines’) may be produced but will be carried through the production process and filtered out onshore.

2.9 Vessel requirement

Table 2-7 outlines the anticipated vessel requirements for the installation and operation of the different aspects of the Tolmount East project. These durations do not include mobilisation, demobilisation or transit times, and also do not include allowance for weather delays.

Table 2-7 Vessel requirements

Activity	Vessel type (number of vessels)	Days	Timing
Pipeline and Subsea Installation Activities			
Pipeline pre-lay survey, boulder clearance and pre-sweep.	Survey vessel (1)	27	September 2022
Offshore pipelay	Reel lay (1)	4	March 2023
Umbilical installation	Construction vessel (umbilical lay) (1)	4	March 2023
Trench and backfill pipeline and umbilical	Trenching vessel	14	March 2023
Rock placement	Dynamically Positioned fall pipe vessel	8	March 2023
Offshore pipeline surveys, as-laid, OOS, as-built, metrology	ROV support vessel (1)	8	April 2023
Install of Wellhead Protection Structure (WHPS) / 'J' tube drift	Dive support vessel	3	September 2022
Installation of subsea manifold (including deployment of skid)	Construction support vessel (structures)	4	May 2023
Installation, hook-up and protection of tie-in spools between pipeline, Tolmount East (WHPS and manifold) and Tolmount MFP	Dive support vessel (1)	28	June 2023
Drilling and Hook- up Activities			
Debris site survey	Survey vessel (1)	3	July 2022
MODU move	Anchor handling vessels (2)	5	February 2023
	Tow vessel (1)	5	February 2023
Drilling	Safety standby vessel (1)	65	March – May 2023
Drilling	Supply vessel (1), either at the MODU location or transiting to port and back for the duration of drilling activities.	65	March – May 2023
	MODU drilling	65	March – May 2023

Activity	Vessel type (number of vessels)	Days	Timing
	MODU transit	5	May 2023
	Spot hire vessel (1), likely base case 20% of the duration	32	March – May 2023
Helicopter Flights	S-92 helicopter (flight route to be determined, but may be from Aberdeen or a more local helicopter base)	Approx. 47	March – May 2023
Modifications to Tolmount MFP			
Walk-to-Work Vessel	Supply vessels (including 2 days for transit)	64	September 2022 – June 2023
Helicopter Flights	S-76 helicopter (flight route to be determined, but may be from Norwich helicopter base)	5 return flights	2023
Operations			
Pipeline integrity and inspection surveys	ROV support vessel (1)	1 survey every 5 years	Field life
Decommissioning Activities			
Plug and Abandonment	Jack up MODU	34	Approx. 2048
Well Clean Up Activities			
Flaring for well clean-up	1,000 Te gas; 1,000 m3 condensate	2	2023

2.9.1 Ports

During construction, the different types of vessel are likely to come from different ports, and the final ports used will depend on the contractor selected. Current predicted ports will be as follows:

- Dredging vessels, DSVs, Walk-to-Work and survey vessels are likely to mobilise in Immingham, Grimsby or Teesport;
- Pipelay will mobilise in their home port, likely to be Scotland;
- Umbilical vessel will mobilise at the umbilical loadout port, likely be North East UK or Norway;

- For the vessels involved with transporting and installing the WHPS and subsea manifold, North-east Scotland, Dutch and/or Norwegian ports are most likely to be used, though there is also a potential for a tow of some structures from an Adriatic; and
- Once operational, supply and standby vessels are likely to come from Great Yarmouth.

2.10 Decommissioning

Premier are aware of the need to consider decommissioning during the engineering design and EIA process. As such the Tolmount East development represents a minimal subsea development to produce the hydrocarbons from the reservoir, and is expected to be relatively straight forward to decommission. Some considerations that have contributed to the engineering design are as follows:

- The WHPS is mechanically connected to the wellhead, so it can be disconnected and taken off upon decommissioning. The Tolmount East subsea manifold has been designed with a gravity base foundation, which negates the need for piling and also means the structure can be removed from the seabed on decommissioning, returning the seabed to its original state.
- The base case is for trench and burial of the pipeline, without the use of rock armour protection, although it is recognised that it may be required to ensure 1) the structural integrity of the pipeline during operation and safety to the fishing trawls and 2) following the recommendations of further studies to be performed during detailed engineering.

Once production from the Tolmount East Development becomes irrevocably uneconomic, permission will be sought for production to cease. Decommissioning of oil and gas facilities in the UK is regulated under the Petroleum Act 1998, as amended by the Energy Act 1998. The UK's international obligations on decommissioning are governed principally by the Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention).

The Department's "Guidance on the Content of Offshore Oil and Gas Field Development Plans" (DECC, 2011) states "in accordance with the UK's international obligations, all installations emplaced after 9th February 1999 must be completely removed to shore for reuse, recycling or final disposal on land". Business, Energy and Industrial Strategy

(BEIS) (2018) provides specific guidance on decommissioning activities; the approach outlined in that guidance (or new guidance at the time of decommissioning) will be adopted. This is summarised in Figure 2-18 and shows the process leading to approval of a decommissioning programme.

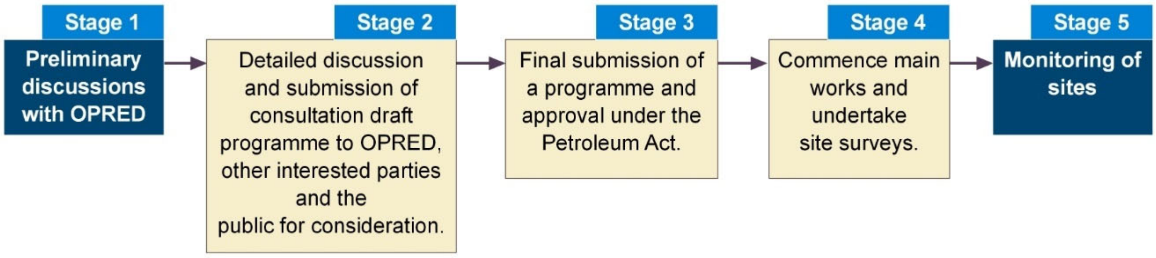


Figure 2-18 Decommissioning approach

The production well will be plugged and abandoned at the end of field life. It is likely that cement plugs will be set across the reservoir sections, across casing shoes and in the conductor casing, and that the conductor casing will be cut below the seabed. The well abandonment will follow legislation and guidelines applicable at the time and the decommissioning strategy will be reviewed as the Project makes its way through the operational phase.

The OSPAR provisions do not apply to pipelines; however, BEIS (2018) guidance sets out UK policy on pipeline decommissioning and shows the process leading to approval of a decommissioning programme supported by a focused environmental process that culminates in a streamlined Environmental Appraisal report. The ultimate intention is to leave the seabed of the development area in such a condition that it will pose no risk to the marine environment or to navigation and other sea users. The decommissioning strategy for production pipelines will depend on a number of factors including the availability of suitable technology and knowledge, and the potential environmental, safety and cost implications of decommissioning methods at the end of field life. However, the infrastructure will be adequately maintained over the operational life in order to maximise re-use or recycling options on decommissioning.

Prior to the end of field life, there may well be changes to the statutory decommissioning requirements as well as advances in technology and knowledge. Recognised industry standard environmental practice will be utilised during all decommissioning operations in line with the legislation and guidance in place at the time of decommissioning. Discussions on what may be required will be held with the Regulator as early as possible before decommissioning commences.

Prior to the decommissioning process, re-use and recycling alternatives will be considered where feasible to reduce the potential for materials having to go to landfill. It is expected that in advance of the decommissioning process an inventory of Project equipment will be made and the potential for further reuse will be investigated.

3 ENVIRONMENTAL BASELINE

3.1 Introduction

As part of the EIA process it is important that the main physical, biological and socio-economic sensitivities of the receiving environment are well understood. As such, this section describes the main characteristics of the environment in and around the Project and highlights the key sensitivities.

This section draws on a number of information sources including published papers, relevant strategic environmental assessments (SEAs) (primarily the UK Offshore Energy SEA 3, (DECC, 2016)) and site-specific investigations, as well as the East Offshore Marine Plan, the Marine Management Organisation's (MMO's) Marine Information System, and data sources such as the JNCC and Natural England.

3.1.1 Site-specific surveys

Site-specific surveys have been carried out since 2014 to inform the Project EIA. Further geophysical surveys were conducted in 2018, which included re-sampling of stations previously targeted in the 2014 survey.

A summary of the reports (and survey scopes) generated from the different surveys and used in this ES is provided below.

- Tolmount Field Development Project UKCS Block 42/28d, We2a Offshore Geophysical Survey Results Report (Fugro, 2015a);
- Tolmount Field Development Project UKCS Block 42/28d We2c Environmental Habitat Assessment Volume 1: Tolmount Infield Routes (Fugro, 2015b);
- Tolmount Field Development Project UKCS Block 42/28d E.ON E&P UK Limited We2 Environmental Baseline Survey Report Tolmount Site (Fugro, 2015c);
- Tolmount Field Development Block 42/28d. Volume 1, Geophysical and Geotechnical Survey Report (Horizon Geosciences, 2018);
- Tolmount Area Development – Tolmount to Easington Pipeline Route Environmental Baseline Survey and Habitat Assessment Report (Ocean Ecology, 2018); and
- Tolmount East Survey Gap Analysis (Xodus Group Limited, 2019).

The Tolmount East Development will be located approximately 4 km north-east of the Tolmount MFP. The location of previous environmental surveys, reviewed as part of the baseline study, are shown in Figure 1-1.

A geophysical, geotechnical and environmental survey was conducted across the Tolmount field, including the proposed Tolmount East location and associated pipeline/umbilical tie back route to the Tolmount MFP between 30th September and 19th October 2014. The environmental survey comprised drop down video (DDV) and camera transects, as well as sediment sampling using a dual van Veen grab, to ground-truth the wider scale interpretation of seabed types gained from the acoustic data. Following a review of the geophysical data collected, 23 environmental station locations were proposed within the Tolmount field, including 23 grab locations, 22 DDV locations and one camera transect. At all 23 stations, four 0.1 m^2 grab samples were acquired and subsampled for analysis of sediment particle size, organic matter, total organic carbon, hydrocarbon, metals and macrofauna content (Fugro, 2015a; 2015b; 2015c). Subsequently, a geotechnical and geophysical survey was undertaken between 27th June and 13th July 2018 which included six environmental ground-truthing stations located in the vicinity of the Tolmount MFP, of which four were deliberate re-samples of stations previously targeted in the 2014 survey (Horizon Geosciences, 2018; Ocean Ecology, 2018).

Overall, survey coverage is considered to be good across the proposed Tolmount East Development Area and is expected to adequately characterise the baseline conditions. On behalf of Premier, Xodus provided an environmental survey gap analysis of known baseline data for the area (Xodus, 2019). As a result of the gap analysis and in consultation with the regulator and JNCC, it was agreed that the survey analysis provided adequate coverage to refresh the 2014 Tolmount Development survey data that exceeded the five-year threshold recommended by OPRED. The refresh of the 2014 Tolmount Development survey following the 2018 survey as discussed in the survey gap analysis (Xodus, 2019) means the available information is still considered to be applicable to the Tolmount East Development. The existing availability of the baseline survey data collected from the wider Tolmount Area will further assist in the assessment of seabed conditions at the Tolmount East drill centre and pipeline route (Xodus Group Limited, 2019).

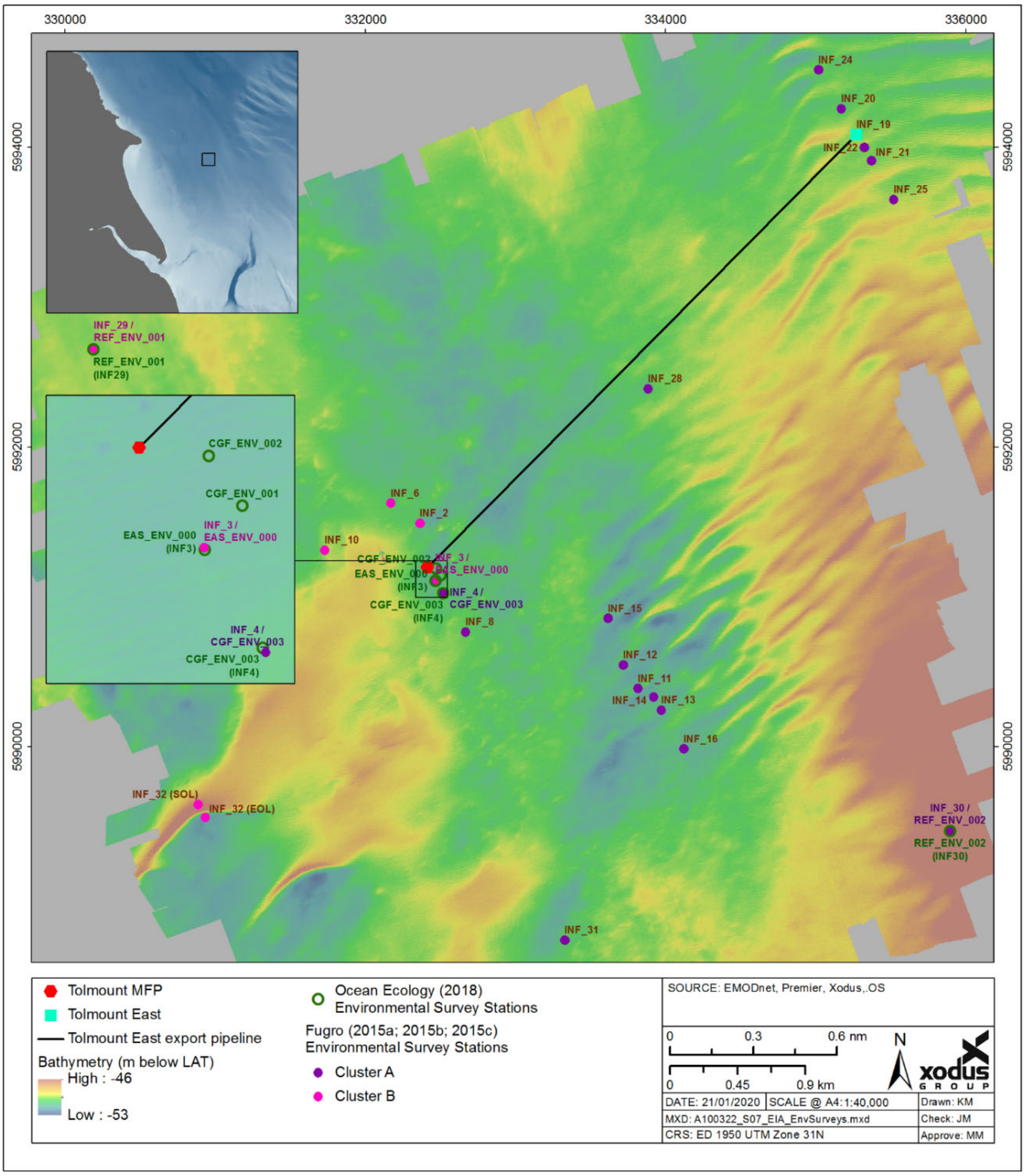


Figure 3-1 **Tolmount Project infield bathymetry and environmental survey locations (Fugro, 2015c)**

3.2 Physical environment

3.2.1 Weather and sea conditions

The east coast of the UK is relatively sheltered compared to the west. Mean wind speed at the coast is 5-8 m/s during winter and 4-5 m/s during summer (DECC, 2016).

Offshore in Regional Sea 2 where the Project is located, winds are predominantly from the south and north-west. Wind speed is most commonly between 1-11 m/s summer. In winter there is an increased probability of high winds. In January wind speed exceeds 14 m/s 20% of the time, whilst in July these speeds occur only 2-4% of the time (DECC, 2016).

Figure 3-2 shows the annual hourly mean wind direction and speed at a recording station close to the Project area. Winds occur from all directions but winds from the south-west and west predominate. The maximum hourly mean wind speed is 24.5 m/s (Fugro GEOS, 2001).

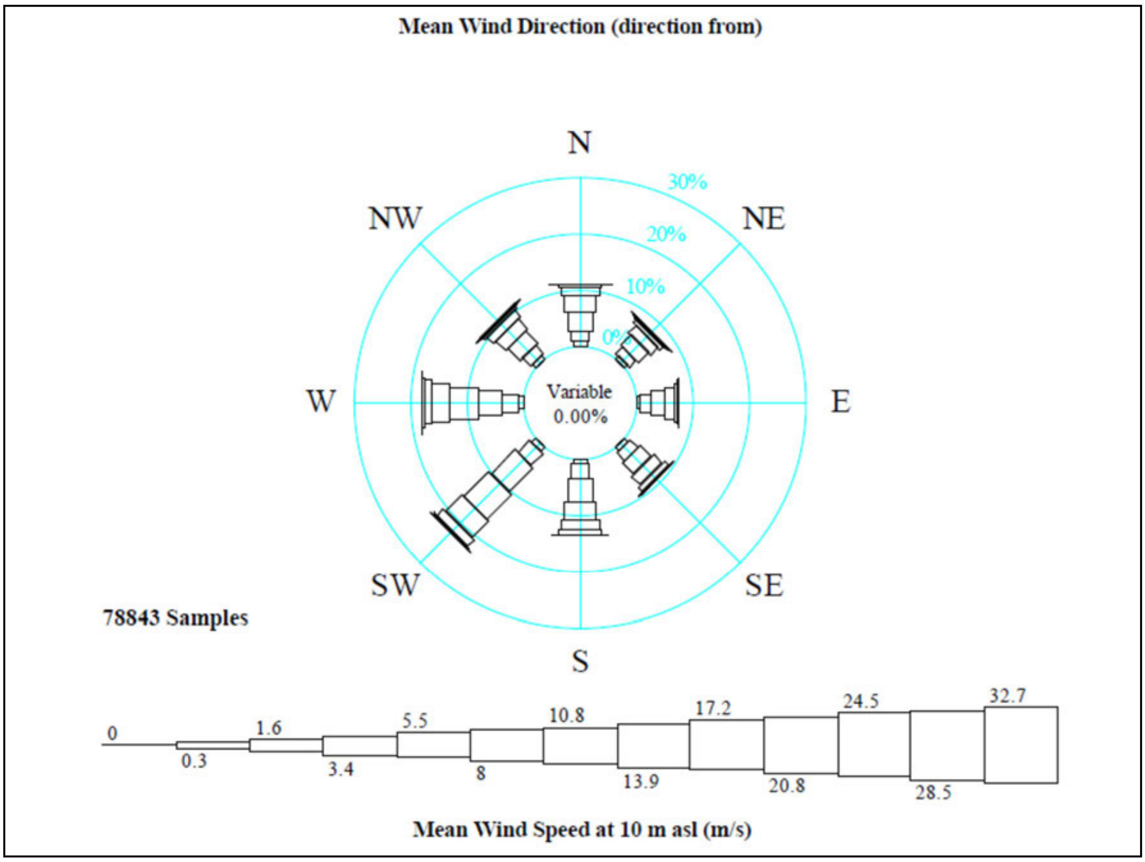


Figure 3-2 Mean wind direction and speed for the Tolmount East area (Fugro GEOS, 2001)

This region of the North Sea is dynamic, characterised by shallow, well-mixed waters, which undergo large seasonal temperature variations. The SNS receives significant freshwater input from the surrounding land masses, making it less saline than other parts of the North Sea and subject to nutrient-rich inputs (DECC, 2009; 2011).

Currents in the North Sea circulate in an anti-clockwise direction, driven by inflows from the Atlantic via the NNS down the UK east coast and through the English Channel, and outflow northwards along the Norwegian coast (Figure 3-3).

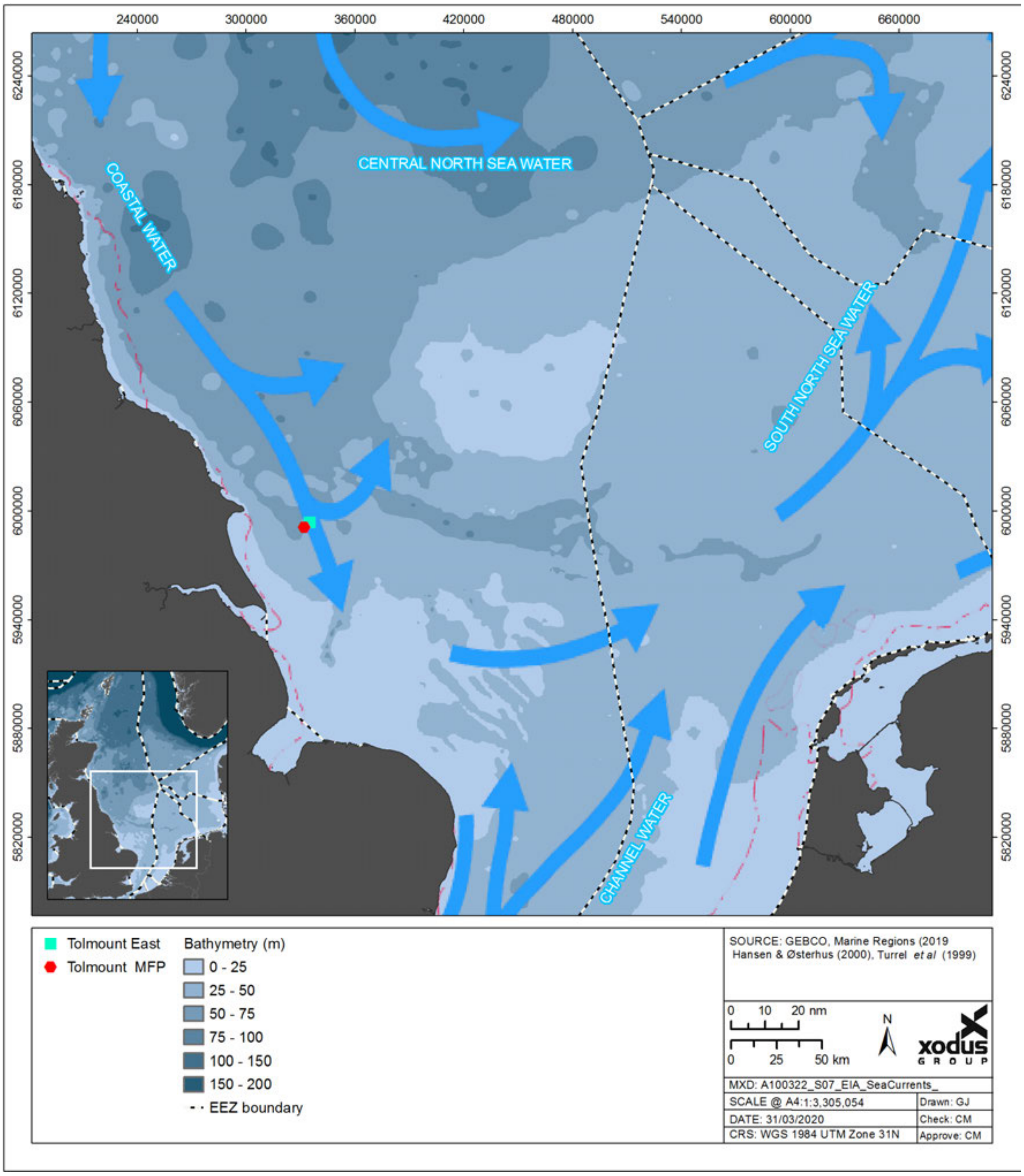


Figure 3-3 Tolmount East development and Tolmount MFP location in the context of North Sea circulation patterns

The dynamic nature of the marine environment in the Project area is indicated by a study of seabed habitats around the UK that assessed combined peak kinetic energy at the seabed due to both wave and current action (McBreen et al., 2011). This classified the peak seabed kinetic energy from waves and currents combined as moderate over most the SNS, increasing to high towards the Holderness coastline.

The mean wave field from 2008 to 2016, measured at the Hornsea wave buoy situated 5 km off Hornsea for the months of January, April, July and October is shown in Figure 3-4 (Channel Coastal Observatory (CCO), 2019). The most frequent wave direction in all months is north-north-east, followed by north-east then east-north-east in all months but July. The mean significant wave height in the vicinity of Tolmount is 1.49 m, ranging from an average of 1 m in the summer to over 1.9 m in the winter (ABPmer, 2016).

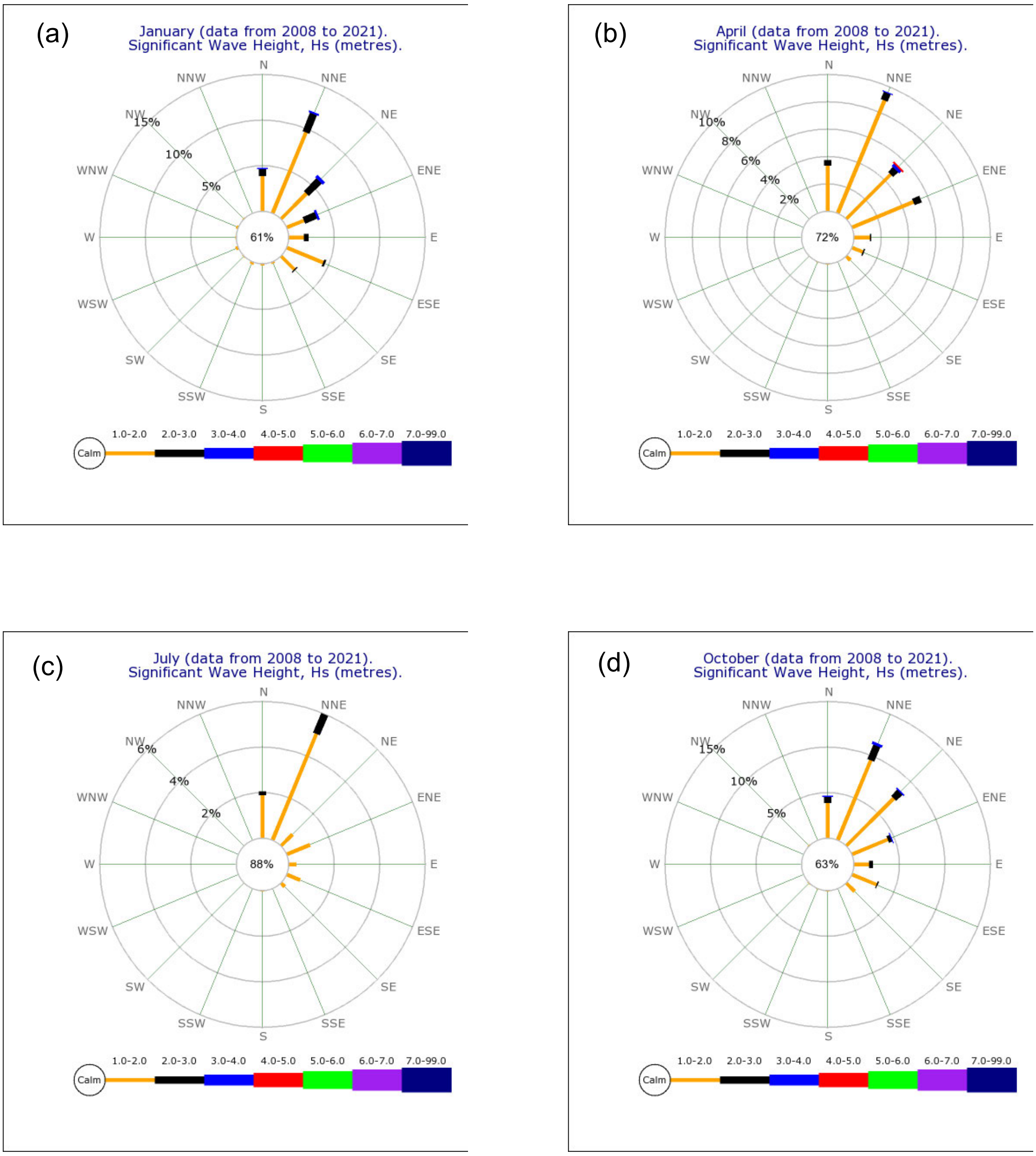


Figure 3-4 Wave roses from the Hornsea wave buoy (data record covering 2008 to 2021) (CCO, 2021)

3.2.2 Bathymetry

The North Sea is a large shallow water body with a surface area of around 750,000 km^2. The SNS is particularly shallow, with water depths that are predominantly less than 50 m (DECC, 2009). Bathymetry at the Tolmount East Project area is shown in Figure 1-1.

Water depth between the proposed Tolmount East WHPS and the Tolmount MFP ranges from 50.2 m to 51.8 m below lowest astronomical tide (LAT) (Fugro, 2015a; Horizon Geosciences, 2018). Water depth increased slightly from Tolmount East towards the Tolmount MFP location.

3.2.3 Sediment type and seabed features

DECC (2009) and mapped information (JNCC, 2010a) indicate benthic sediments in the SNS consist largely of sand or muddy sand, with significant areas of coarse sediment, the latter mostly closer to shore. Seabed features in the SNS include active sandbanks and sand waves which are maintained by the tidal and current regimes described above (DTI, 2001). Examples of such features include the North Norfolk sandbanks, active systems that are thought to be progressively migrating in a north-easterly direction and which are maintained by sediment transported offshore, and the less active Dogger Bank, a large sublittoral sandbank formed by glacial processes before being submerged through sea level rise (DECC, 2009).

The seabed sediments recorded between Tolmount East and the Tolmount MFP were generally fine to medium sand with shells, shell fragments, gravel and cobbles (Fugro, 2015b). However, there was a single station close to the Tolmount MFP location that exhibited coarse sand (INF_4). Sandwaves were observed near the proposed Tolmount East WHPS location, and megaripples were observed along the entire route with crests orientated east-northeast to west-southwest. Two small depressions were observed, which were deemed to be scour features associated with boulders. Seabed sediments at the south-east of the survey area were similar, comprising silty fine sand to coarse sand with occasional fine gravel and shell fragments (Fugro, 2015c). The proportion of mud (silt and clay) in the samples ranged from zero to 4.2% with a mean value of 1.86%.

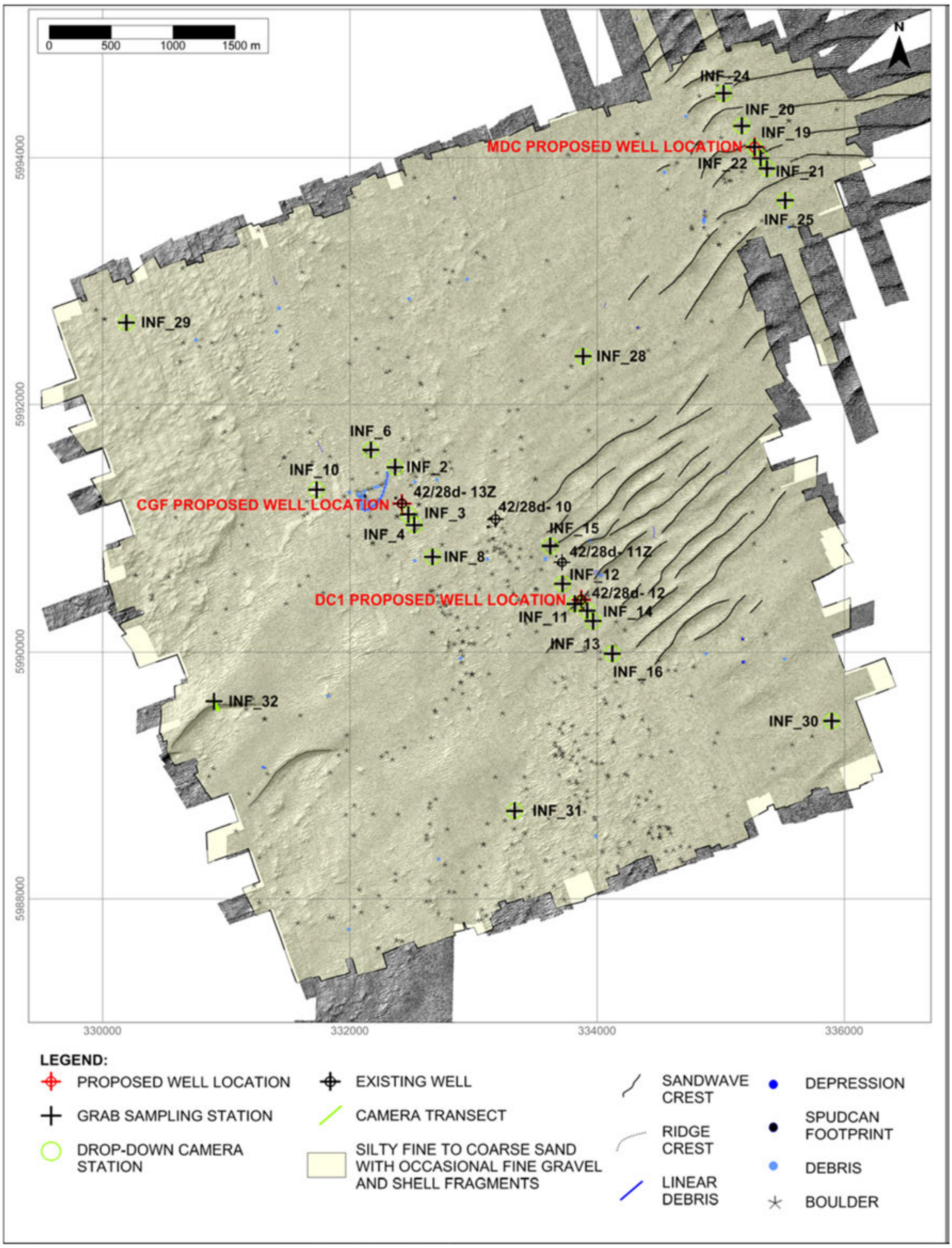
Particle size analysis indicated that sediments ranged from medium sand to coarse sand across the survey area (Fugro, 2015b; Ocean Ecology, 2018). The proportion of mud in the samples ranged from 2.5% to 9.1%. Whilst sand is the dominant fraction in all samples, it is clear that proportions of gravel and mud are variable. This is likely to be due to the small scale patchiness of sediment distribution due to the uneven nature of the seabed.

Sediment organic carbon content was generally low across the survey area, although slightly higher in the north-west of the site. The generally low concentration of organic material across the site indicates there is no particular reason for concern regarding this slight anomaly.

Fugro (2015c) reported the maximum total hydrocarbon (THC) concentration was 8.8 ugg^{-1} at Station 8 (INF_8), situated approximately 500 m south east of the Tolmount East WHPS. Sediment hydrocarbon content was slightly elevated above the mean background concentration for the SNS of 4.34 ugg^{-1}, but below the 95th percentile value of 11.39 ugg^{-1} (UKOOA, 2001). A slight increase in THC was associated with the central region of the site where the four existing wells are located, suggesting possible low-level inputs from drilling-related activities. Ocean Ecology (2018) reported THC ranging from 0.33 μgg^{-1} to 0.83 μgg^{-1}, which is an order of magnitude below the Fugro (2015c) results across the site.

Fugro (2015c) reported trace elements (heavy metals) to be generally low across the Tolmount area, with only barium (a common constituent of drilling fluid) exceeding the UKOOA 95th percentile value (302.95 μgg^{-1}) at more than half the stations (UKOOA, 2001). Barium concentrations ranged from 166 μgg^{-1} to 1,940 μgg^{-1} (Fugro, 2015c). All of the stations close to the existing wells near the Tolmount East development and DC1 drilling centre locations (see Figure 3-5 for location) had elevated barium, but three of the six stations at Tolmount East, where no drilling has yet occurred, also had barium concentrations above the 95th percentile concentration. Station 28 (INF_28) located halfway between the Tolmount MFP and Tolmount East had a barium concentration below the UKOOA mean background value (218.38 μgg^{-1}).

The Ocean Ecology (2018) trace element results were in line with the UKOOA mean background concentration for the SNS (218.38 μgg^{-1}). Two of the Fugro (2015c) stations that were re-sampled in Ocean Ecology (2018) exhibited much lower barium concentrations in the more recently acquired samples. These stations are located 100 m and 300 m downstream of an existing well, and it is therefore possible that sediments containing elevated barium from drilling activity were present during the 2014 survey, but had been transported away from the area by the time of the 2018 survey.



Note: The well locations shown on this figure were development options at the time of the survey in 2014. The CGF proposed well location is now the location of the Tolmount MFP and the MDC proposed well location is now the proposed location of the Tolmount East WHPS

Figure 3-5 Tolmount infield area seabed features (Fugro, 2015c)

3.3 Biological environment

3.3.1 Plankton

Plankton consists of the plants (phytoplankton) and animals (zooplankton) that drift in the surface waters with the tides and currents. Plankton forms the basis of marine ecosystem food webs and the composition of planktonic communities is variable temporally, depending upon the circulation patterns of water masses, the season and nutrient availability. The distribution and abundance of plankton is heavily influenced by water depth, tidal mixing and thermal stratification within the water column (Edwards *et al*., 2010). The majority of the phytoplankton occurs in the photic zone, i.e. the upper 20 m or so of the water column in temperate latitudes, which receives enough light for photosynthesis (Johns and Reid, 2001). However, zooplankton can extend to greater depths and many species undergo diurnal vertical migrations, rising to the surface to feed before returning to depth. Natural seasonality and high small-scale variability, both in species composition and abundance, is an important feature of planktonic communities. Plankton are crucial to the integrity of a health food chain upon which larger animals, such as fish, birds and cetaceans, are dependent for survival. The distribution of plankton therefore directly influences the movement and distribution of other marine species. As planktonic assemblages move with tides and currents; plankton is transient and unlikely to be in the vicinity of any one location for an extended period of time.

Densities of phytoplankton fluctuate during the year, with sunlight intensity and nutrient availability driving its abundance and productivity, which ultimately is affected by water column stratification (Johns and Reid, 2001). The characteristics of this annual cycle are determined by local weather and oceanographic conditions and are important in biological terms as they provide important feeding areas for most animal groups within the marine ecosystem, including zooplankton, cephalopods, pelagic fish, seabirds and cetaceans (Johns and Reid, 2001). Phytoplankton abundance within the SNS fluctuates less than in the central and northern North Sea, and winter levels also remain higher than further north. Monitoring between 1997 and 2007 has shown that whilst phytoplankton numbers increase in May, the spring peak in biomass is lower than that observed in central and northern areas of the North Sea (SAHFOS, 2015).

Analysis of data provided by the Continuous Plankton Recorder (CPR) surveys suggest that the most abundant zooplankton species in the North Sea are the calanoid copepods, in particular *Calanus* spp. and smaller copepod species such as *Para-Pseudocalanus* spp., *Acartia* spp. and the younger stages of *Calanus* (Johns and Reid, 2001). *Calanus finmarchicus* has historically dominated the zooplankton of the North Sea and is used as an indication of zooplankton abundance. Analysis of data provided by the CPR surveys in the 10-year period between 1997 and 2007 shows that the biomass of *C. finmarchicus* in the SNS attains lower levels than in the central and NNS. The data also showed that numbers of *C. finmarchicus* in the SNS remain relatively constant through the year with only a small increase in April (SAHFOS, 2015). This spring increase is likely to reflect the growth in the zooplankton as a result of the increased food (including phytoplankton) available (SAHFOS, 2015).

Overall abundance of *C. finmarchicus* has declined significantly over the last 60 years. This has mainly been attributed to changes in seawater temperature and salinity (Beare *et al*., 2002, FRS, 2004). *C. finmarchicus* has been replaced by boreal and temperate Atlantic and neritic species; in particular, a relative increase in the populations of *Calanus helgolandicus* has occurred (DECC, 2009, Baxter *et al*., 2011).

3.3.2 Benthos

The biota living near, on or in the seabed is collectively termed benthos. The diversity and biomass of the benthos is dependent on a number of factors including substrata type (e.g. sediment, rock), water depth, salinity, the local hydrodynamics and degree of organic enrichment. The species composition and diversity of the benthos or macrofauna found within sediments is commonly used as a biological indicator of sediment disturbance or contamination.

The environmental survey of the Tolmount area reported a generally low abundance and diversity of epifauna with occasional hermit crabs (*Pagurus bernhardus)* with commensal hydroids (*Hydractinia echinate)*, common sea star (*Asterias rubens)* and brittle stars (*Ophiura spp.*). Epifaunal diversity and abundance increased slightly wherever pebbles and cobbles were present, to include tube-dwelling serpulid polychaetes (especially the keel worm (*Spirobranchus triqueter)*), hydroids (*Tubularia indivisa*) and bryozoans (*Alcyonidium diaphanum)*. Occasional fish were observed, including skate (*Leucoraja naevus)*, red gurnard (*Chelidonichthys cuculus)* and unidentified flatfish (Fugro, 2015b).

Infauna within the survey area showed low to moderately high richness and diversity (Fugro, 2015c).

Annelids (mostly polychaete worms) were the most abundant type of invertebrate, both in terms of abundance and number of taxa present, with molluscs, crustaceans and echinoderms accounting for lower numbers of species and individuals (Fugro, 2015c; Ocean Ecology, 2018). While annelids were dominant overall, the single most abundant taxon present was the sea urchin (*Echinocyamus pusillus)*, followed by the bivalve *Kurtiella bidentata*. The next eight most abundant taxa (not in order) were species of nemertean worm, the four polychaetes (*Scoloplos armiger*, *Spiophanes bombyx*, *Aricidea minuta* and *Parexogone hebes)*, two amphipod crustaceans (*Bathyporeia elegans* and *Perioculodes longimanus*) and the brittle star (*Amphiura filiformis)*.

Multidimensional scaling indicated two communities were present across the site, with both generally composed of the same species, but one community (cluster B[9]) across the western half of the field, which accounted for the majority of the stations examined, exhibiting a dominance of the urchin *E. pusillus* and a commensurate reduction in other species present (Fugro, 2015c). Stations in cluster A[9] exhibited a more evenly distributed fauna, and were located in the eastern half of the site. These macrofauna community clusters appeared to be correlated with sediment type, with the macrofauna cluster A occurring in sediments with a higher proportion of fine sands, and the *E. pusillus* dominated cluster B stations occurring in sediments with a higher proportion of gravel.

The observed species assemblages correlated well with known species habitat preferences. Four of the ten most abundant species in cluster A were not in the top species in cluster B. These species (*Bathyporeia elegans*, *Perioculodes longimanus*, *Amphiura filiformis* and *Magelona filiformis*) are all known to show a preference for slightly muddy fine sands. Conversely, four of the top ten taxa in cluster B were not present within the top ten taxa in cluster A, although they were present at lower abundance. These taxa (*Parexogone hebes*, *Ophelia borealis*, *Pseudomystides limbata* and *Grania* sp.) are known to show a preference for coarser sands, shell and gravel sediments. The small pea urchin, *E. pusillus*, dominant in cluster B, is also known for its preference for coarse sand and gravel environments.

Biotope classification based on seabed photography indicated that all infield stations were most consistent with the EUNIS biotope complex A5.14 - 'Circalittoral coarse sediment', which is defined as 'coarse sands, gravel and shingle' (Fugro, 2015b; Ocean Ecology, 2018). Patches of sand with no associated coarse material were observed, but

[9] Cluster A and cluster B as defined in Fugro (2015c) are illustrated in Figure 1-1.

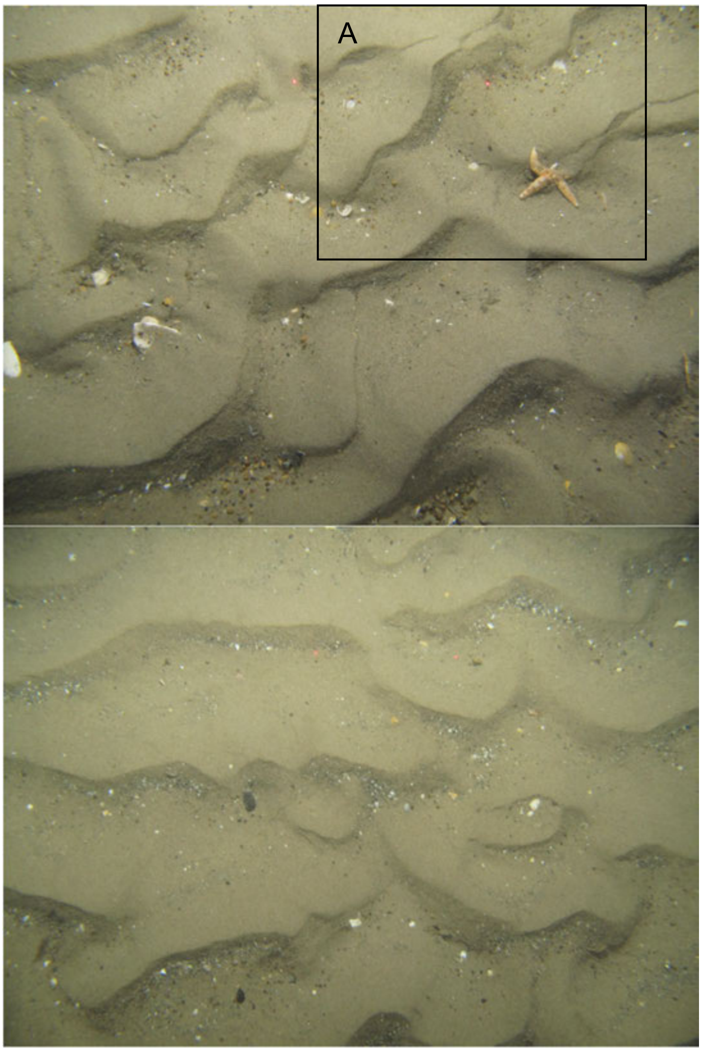
were too small in size to be considered as a separate biotope (Fugro, 2015b). Representative seabed photographs of the infield area are presented in Figure 3-6.

Data from EUSeaMap (2019) indicates that the likely broad scale habitat in the area is A5.27 – 'Deep circalittoral sand'. Fugro (2015b) deviated from the EUSeaMap description due to the presence of gravel-sized particles in the sediment, which ranged from zero to 20% (more commonly up to 10%) of total sediment weight across the survey area. Fugro (2015c) identified that the proportion of gravel in the sediment was variable across the survey area, with more gravel apparent in the troughs of sand ripples. Point data from EUSeaMap (2019) confirms that sediments in the wider area are patchily distributed between areas of sand and coarse sediment and as such, the Fugro (2015c) results are likely to be representative of the wider area.

Elements of the biotope A5.141- '*Pomatoceros triqueter* (now called *Spirobranchus triqueter*) with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles' may also be present within the infield site. This biotope is characterised by a few ubiquitous robust and/or fast growing ephemeral species, such as the calcareous tube worms *S. triqueter*, which are able to colonise pebbles and unstable cobbles. As outlined above, these tube worms were observed on some of the shells, pebbles and cobbles present. However, these patches of gravelly sediments were too small to be mapped or considered as a separate biotope.

Review of the dominant infaunal taxa supported a different interpretation of the biotopes in the infield area. The infaunal community was best represented by the EUNIS biotope A5.251 - '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sands', equivalent to the JNCC classification 'SS.SSaCfiSaEpusOborApri' (Connor *et al*., 2008). Although *A. prismatica* was present in fairly low numbers *E. pusillus* and *O. borealis*, were identified as dominant taxa.

No EC Habitats Directive Annex I habitats were identified in the infield survey area (Fugro, 2015c; Ocean Ecology, 2018). There was no evidence for the presence of Features of Conservation Importance (FOCI, as defined by JNCC and Natural England, 2016a) or OSPAR listed threatened / declining habitats or species.



Station: INF30 (Figure 1-1 and Figure 3-5)
Easting: 335 897 m
Northing: 5 989 444 m

Sediment: Rippled sand with shell fragments, shells and gravel

Faunal Description:

A: Common sea star (*Asterias rubens*)

Station: INF04 (Figure 1-1 and Figure 3-5)
Easting: 335 897 m
Northing: 5 989 444 m

Sediment: Rippled sand with shell fragments, shells and gravel

Faunal Description:

No visible fauna

Figure 3-6 Examples of seabed and benthos representative of EUNIS biotope complex A5.14 - 'circalittoral coarse sediment' found across the Tolmount field (Fugro, 2015c)

3.3.3 Fish and shellfish

A number of commercially important fish species occur in the vicinity of the Project, which is located within the nursery area of cod Gadus morhua (high intensity), herring (*Clupea harengus)*, lemon sole (*Microstomus kitt)*, whiting (*Merlangius merlangus)* (high intensity), blue whiting (*Micromesistius poutassou)*, mackerel (*Scomber scombrus)*, anglerfish (*Lophius piscatorius)*, sandeels (*Ammodytidae)*, spur dog (*Squalus acanthias)* and sprat (*Sprattus sprattus)* (Figure 3-7 and Figure 3-8)

Spawning activity is generally regarded as representing a higher sensitivity than nursery areas. The Project is located within spawning grounds of for cod, herring, lemon sole, plaice (*Pleuronectes platessa)* (high intensity), sandeels and sprat. The spatial distribution of spawning grounds is shown in Figure 3-9.

Herring, cod and plaice all contribute to commercial fisheries landings in the vicinity of the Project. In addition, sprat and herring play an important ecological role as principal prey items for several larger fish species, marine birds and mammals. Although there is fish spawning and nursery activity in the vicinity at certain times of the year, the spawning and nursery areas tend to be transient (Cefas, 2001), and are part of larger offshore areas in addition spawning may vary temporally and fish may spawn earlier or later from year to year (Coull *et al*., 1998, Ellis *et al*., 2012).

Other fish types known from the region include horse mackerel (*Trachurus trachurus)*, pollack (*Pollachius pollachius)*, saithe (*Pollachius virens)*, seabreams (species unknown), Atlantic salmon (*Salmo salar)*, sea trout (*Salmo trutta)*, bass (*Dicentrarchus labrax)*, pouting or bib (*Trisopterus luscus)*, shad (*Alosa spp*.), haddock (*Melanogrammus aeglefinus)*, hake (*Merluccius merluccius)*, ling (*Molva molva)*, red mullet (*Mullus surmuletus)*, gurnards (various species), John dory (*Zeus faber)*, greater weever (*Trachinus draco)*, turbot (*Scophthalmus maximus)*, halibut (*Hippoglossus hippoglossus)*, flounder (*Paralichthys dentatus)*, brill (*Scophthalmus rhombus)*, dab (*Limanda limanda)*, starry smooth hound (*Mustelus asterias)*, tope (*Galeorhinus galeus)*, thornback ray (*Raja clavate)*, spotted ray (*Aetobatus narinari)* and blonde ray (*Raja brachyura)*. Note that the shad species *Alosa* (allis shad) and *A. fallax* (twaite shad) are classified as rare and listed in Appendix III of the Bern Convention and Annexes II and V of the EC Habitats Directive; they are also highlighted in the Wildlife and Countryside Act (1981).

A review of the juvenile fish data was undertaken by Aires *et al.* (2014), taking into account the findings of Ellis *et al.* (2012) and Coull *et al.* (1998), together with findings from the National and International Bottom Trawl Surveys, the Beam Trawl Survey, International Herring Larval Surveys and other standalone surveys. The findings summarise the probability of aggregations of juvenile, group 0 fish, present around the UKCS. Within the Project and surrounding area, there is a low to moderate probability of juvenile sprat and herring being present and a low probability of plaice, sole, whiting, haddock, cod, hake, angler fish, mackerel, horse mackerel, Norway pout (*Trisopterus esmarkii)* and blue whiting (Aires *et al*., 2014).

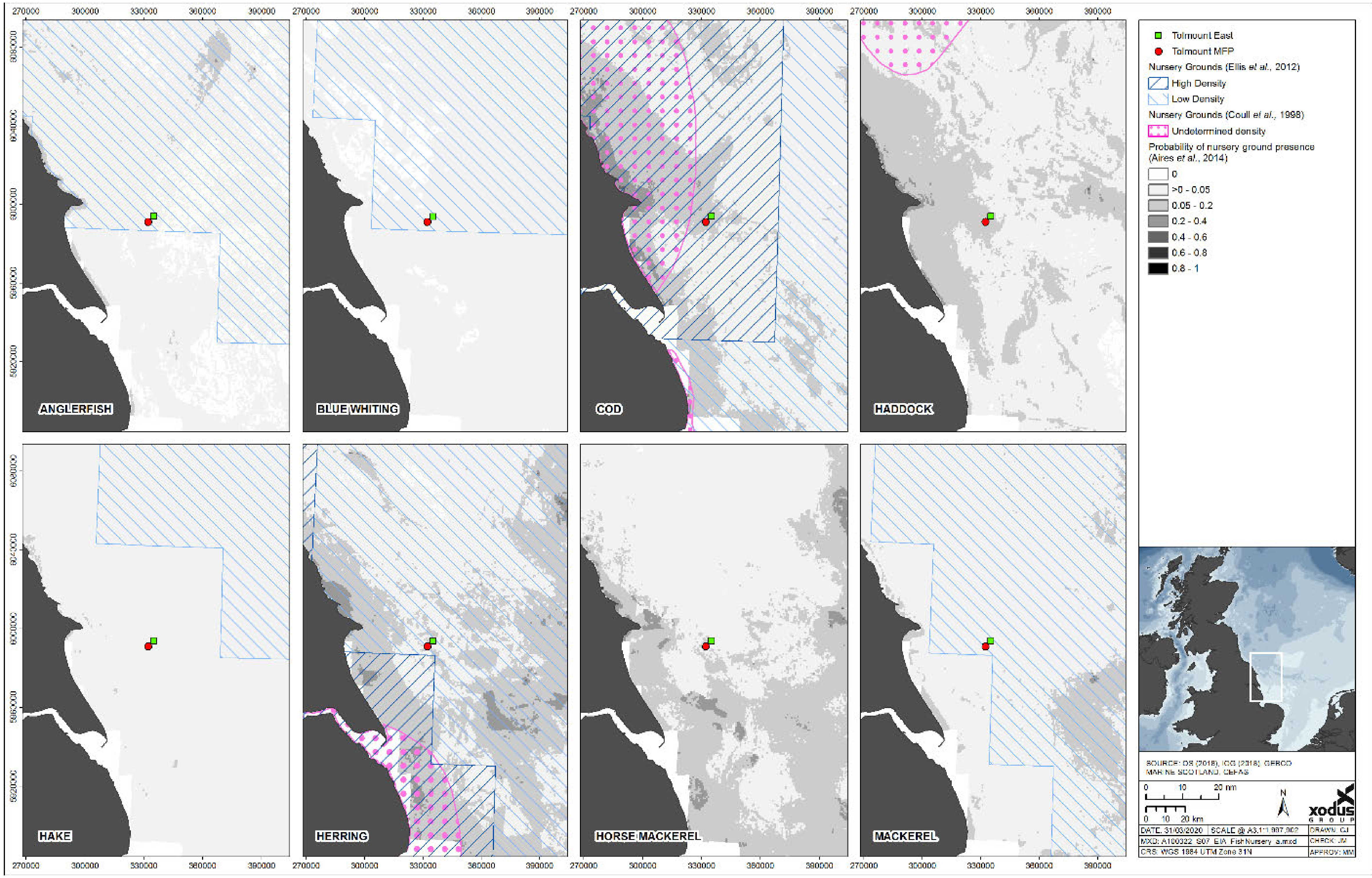


Figure 3-7 Location of nursery grounds in the vicinity of the Project

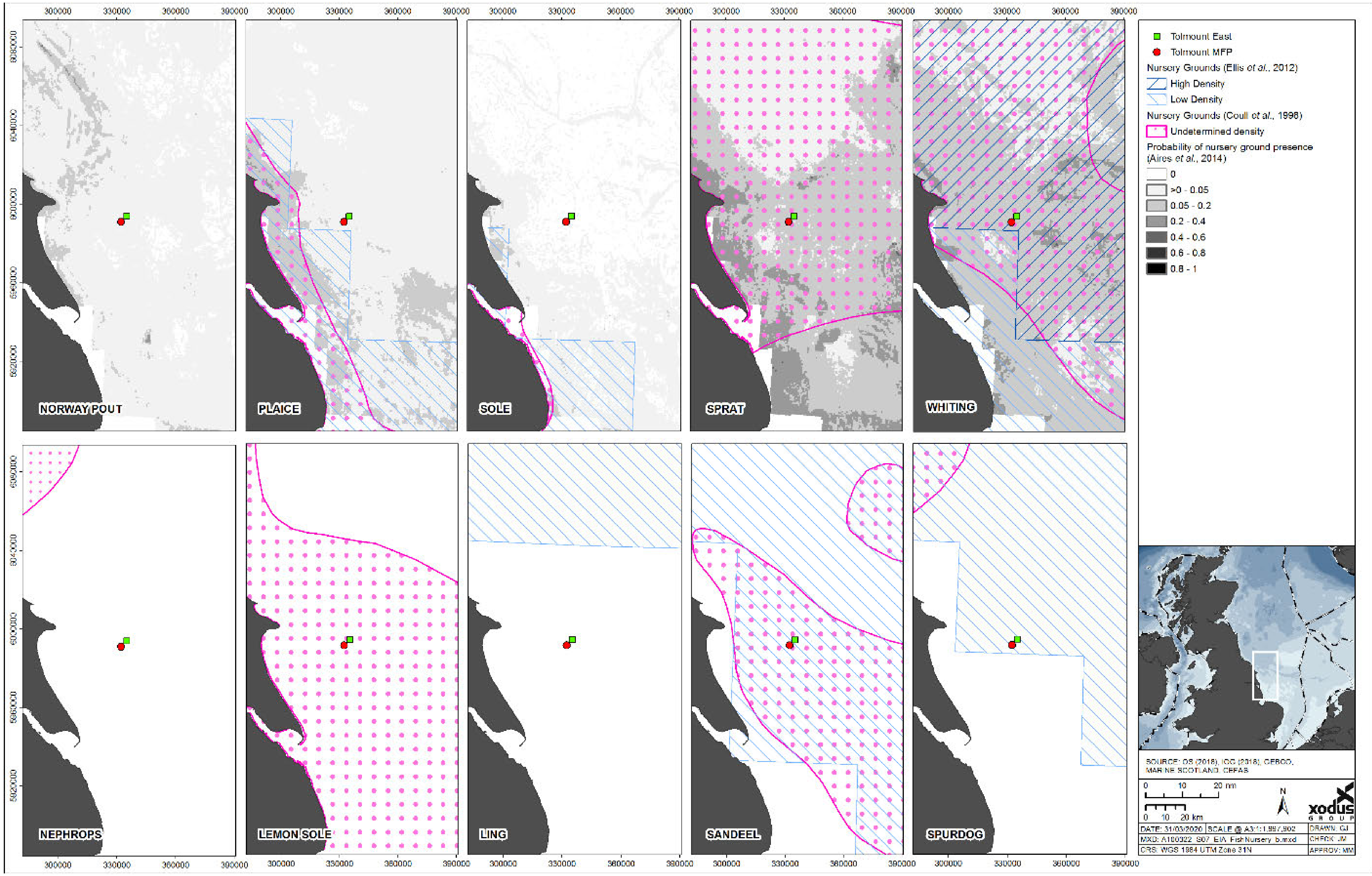


Figure 3-8 Location of nursery grounds in the vicinity of the Project (continued)

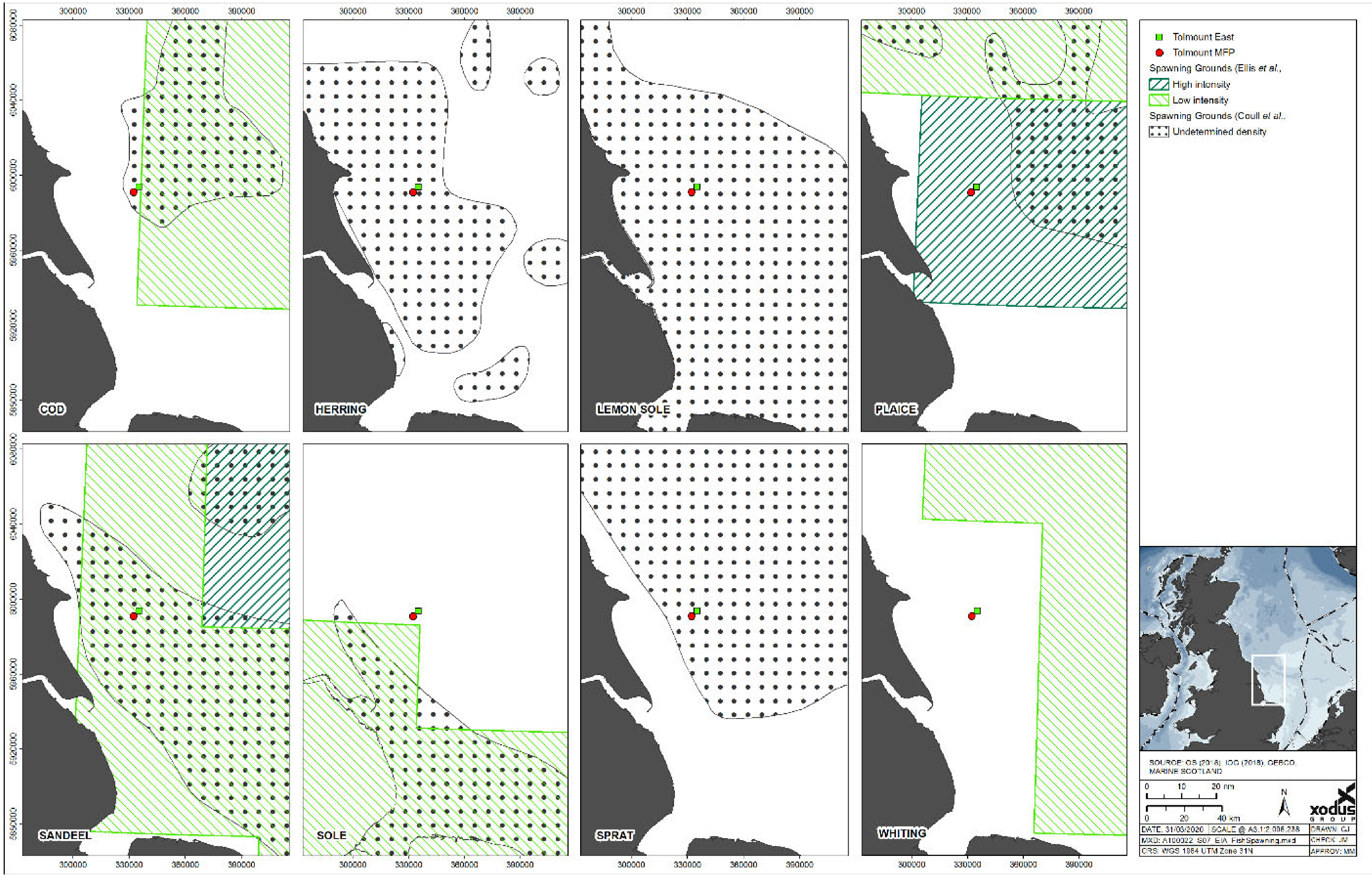


Figure 3-9 Location of spawning grounds in the vicinity of the Project

Environmental surveys carried out for the Project recorded occasional fish including skate, red gurnard, cuckoo ray, cod and flatfish (Fugro, 2015b).

The basking shark (*Cetorhinus maximus)* and spiny dogfish (*Squalus acanthias)* are classed as vulnerable under the International Union for Conservation of Nature (IUCN) Red list. In addition, basking sharks are protected under the Wildlife and Countryside Act 1981 (as amended). Basking shark is a seasonal visitor to British waters some marine areas are known to attract more sharks than others and are known as hotspots; these hotspots all occur on the western coast of the UK (Basking Shark Trust, 2017). A total of 55 basking shark sightings were reported to the Basking Shark Trust in 2018, one of these sightings was near Flamborough Head, which is approximately 29 km west of the Project (Basking Shark Trust, 2018). It is therefore considered unlikely that the species will be encountered with any frequency in the vicinity of the Project.

The Project is located 50 km northeast from the Humber Estuary SAC which is noted for the presence of river lamprey (*Lampetra fluviatilis)* and sea lamprey (*Petromyzon marinus)* which breed in the River Derwent, a tributary of the River Ouse.

Whilst most fish species spawn into the water column of moving water masses over extensive areas, benthic spawners such as herring have very specific habitat requirements, and as a consequence their spawning grounds are relatively limited and potentially vulnerable to seabed disturbance and change. Herring generally require clean gravelly sediment in waters of less than 40 m depth (ICES, 2014) with sediment containing less than 2% fine particles (Saetre, 1999). There are three identified sub-populations of herring in the North Sea and these sub-populations have different associated spawning grounds, spawning at different times of year (Keltz & Bailey, 2010). The herring populations with spawning grounds identified to include Block 42/28d are known as 'Banks' or 'Dogger' herring and spawn between August and October (Coull, *et al*., 1998).

No periods of concern relating to spawning activity (herring in particular) are flagged by the Department for Environment, Food & Rural Affairs (DEFRA) and Centre for

Environment, Fisheries and Aquaculture Science (Cefas) in relation to seabed disturbance from drilling activities[1] for Block 42/28d.

A herring spawning assessment survey was commissioned as part of the environmental survey work carried out over the Tolmount area (Fugro, 2015b). It concluded that the majority of sediments within the survey area were 'unsuitable' for herring spawning due to low proportions of gravel (<10%), indicating low spawning potential. Eight survey stations were deemed to have moderate spawning potential, but no areas of high or very high potential were recorded (Figure 3-10). Due to the patchy nature of gravel sediments in the infield area it was difficult to identify distinct areas of spawning potential. A slight increase in gravelly sediments was observed within the central region of the infield area, although the gravel was very patchily distributed and restricted to the troughs of the sand ripples (Fugro, 2015b).

[1] It is assumed that this concern relates to any activity, including drilling, that might cause disturbance to the seabed.

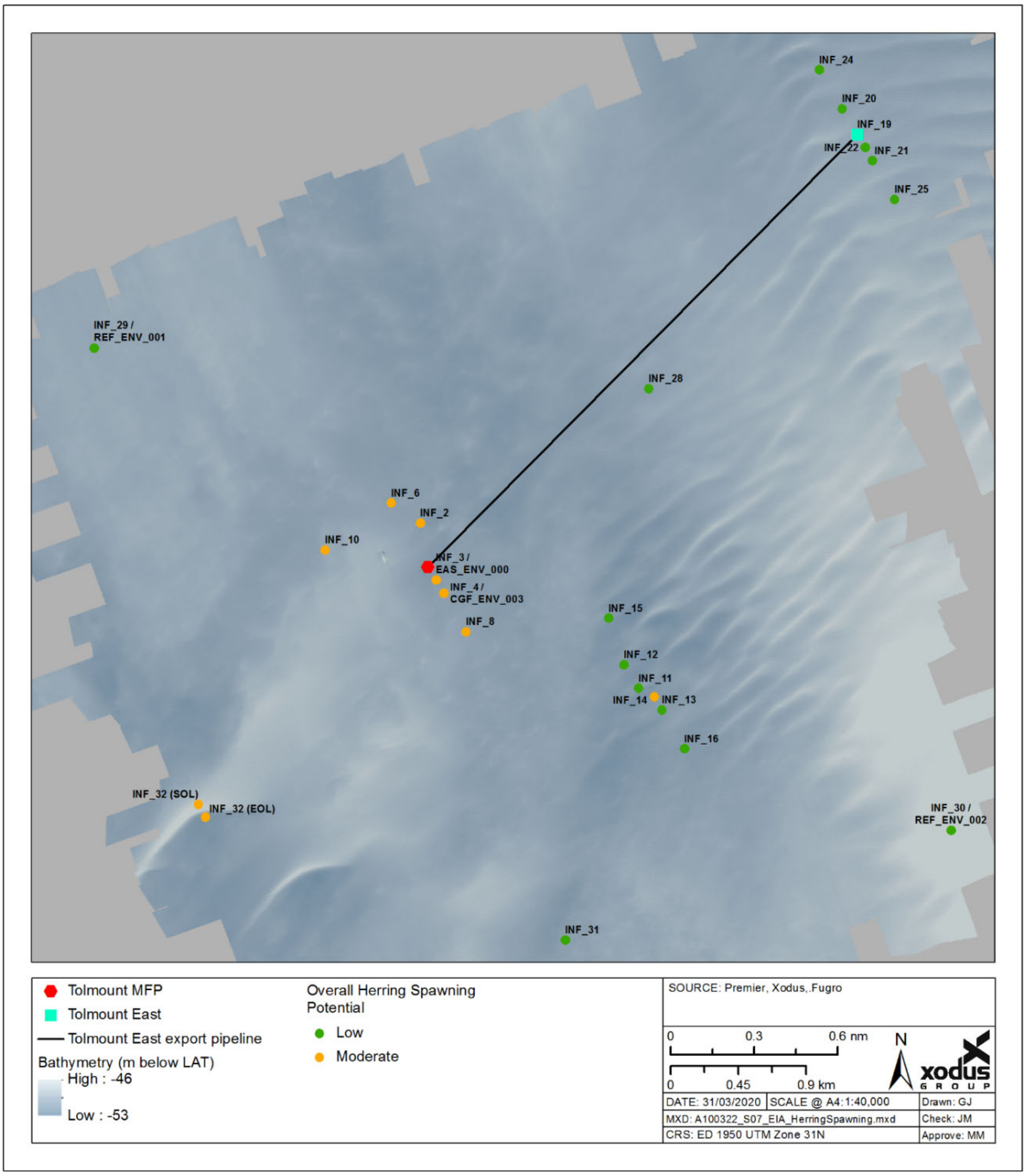


Figure 3-10 Herring spawning potential in the infield area of the Project (Fugro, 2015b)

With regard to shellfish, several types occur in the region and some are caught commercially (see section 3.5.1). These include cockle (*Cerastoderma edule)*, scallop (*Pecten maximus)*, cuttlefish (*Sepia officinalis)*, squid and octopus (species unknown), together with brown crab (*Cancer pagurus)*, lobster (*Homarus vulgaris)*, brown shrimp (*Crangon crangon)*, pink shrimp (*Pandalus borealis)*, Norway lobster (*Nephrops* *norvegicus)*, spider crab (*Macrocheira kaempferi)* and the velvet or swimming crab (*Necora puber)*.

3.3.4 Marine reptiles

Although not indigenous to the UK, sea turtles are the only marine reptiles to be found in UK waters. Of the seven species of marine turtle in the world, five have been recorded in UK waters: the leatherback turtle (*Dermochelys coriace)* and the hard-shelled species loggerhead turtle (*Caretta caretta)*, Kemp's ridley turtle (*Lepidochelys kempii)*, green turtle (*Chelonia mydas)* and hawksbill turtle (*Eretmochelys imbricate)*. Of these five species, the majority of records in UK waters are leatherback (DECC, 2016). Most sightings occur around the west and south coasts of Ireland, south west England, north-west Wales and the Irish Sea (Reeds, 2004). This is supported by the British Isles and Republic of Ireland Marine Turtle Strandings and Sightings Report (Penrose and Gander, 2013) which reports that there were no sightings or standings of turtles in the vicinity of the Project in the period from 2002 – 2012. It is therefore unlikely that turtle species or other marine reptiles will be recorded in the vicinity of the Project.

3.3.5 Birds

3.3.5.1 Seabirds

According to the density maps provided in Kober *et al.* (2010), the following species have been recorded within the Tolmount East Development area: northern fulmar (*Fulmarus glacialis)*, pomarine skua (*Stercorarius pomarinus)*, Artic skua (*Stercorarius parasiticus)*, great skua (*Stercorarius skua)*, black-legged kittiwake *(Rissa tridactyla)*, little gull (*Hydrocoloeus minutus)*, great black backed gull (*Larus marinus),* common gull (*Larus canus)*, lesser black backed gull (*Larus fuscus)*, herring gull (*Larus argentatus)*, glaucous gull *(glaucous gull)*, sandwich tern (*Thalasseus sandvicensis),* common tern (*Sterna hirundo)*, Arctic tern (*Sterna paradisaea)*, common guillemot (*Uria algaa*), razorbill (*Alca torda*)and Atlantic puffin (*Fratercula arctica)*.

Of the seabird species which breed regularly in Britain and Ireland, fulmar (*Fulmar glacialis)*, cormorant (*Phalacrocorax carbo)*, shag (*Phalacrocorax aristotelis)*, gannet (*Sula bassana)*, three species of auk, six species of gull and five species of tern breed around mainland North Sea coasts within the SEA2 area. Auk and kittiwake colonies at the Farne and Coquet Islands, Marsden Bay and at Bempton cliffs support internationally important populations (DTI, 2001).

An Ornithological Technical Report has been completed to provide a characterisation of ornithological conditions in the area of the Project (NIRAS Consulting, 2017). The report identified the key species thought to be important to the Project area indicating the higher relative cumulative densities of seabirds in summer (April to September) than in winter (October to March) (Bradbury, 2014 in NIRAS Consulting, 2017). In summer, Guillemot, black-legged kittiwake and unidentified auk species occurred in the highest densities. The presence of guillemot and kittiwake suggest the area is used by foraging breeding birds, most likely birds associated with colonies at Flamborough Head (Tasker & Pienkowski, 1987; Stone *et al*., 1995 in NIRAS Consulting, 2017). This report also highlighted four species of conservation concern that are afforded protection under Article 4 of the EU Birds Directive were observed in the area (albeit at very low densities). These included: Red-throated diver (*Gavia stellata*), Common scoter (*Melanitta nigra*), Sandwich tern (*Thalasseus sandvicensis*), Common tern (*Sterna hirundo*).

JNCC has developed The Seabird Oil Sensitivity Index (SOSI), as a tool which aids planning and emergency decision making with regards to oil pollution. It identifies areas at sea where seabirds are likely to be most sensitive to oil pollution. It is based on seabird survey data collected from 1995 to 2015, from a wide survey area extending beyond the UK Continental Shelf using boat-based, visual aerial, and digital video aerial survey techniques (Webb *et al*., 2016). The data was combined with individual species sensitivity index values based on a number of factors which include:

- Habitat flexibility (a species ability to locate to alternative feeding sites);
- Adult survival rate;
- Potential annual productivity; and
- The proportion of the biogeographical population in the UK.

The combined seabird data and species sensitivity index values are subsequently summed at each location to create a single measure of seabird sensitivity to oil pollution. The seasonal sensitivity of seabirds in the vicinity of the Project is detailed in Table 3-1, Figure 3-11 and Figure 3-12. Where no data coverage was available in a certain month, data from adjacent months have been used. In Block 42/28d, sensitivity is very high in February to April (using data from March to cover a data gap in April) and June, high in May and July to November (using data from September to cover a data gap in October), medium in December and low in January.

There are periods of concern relating to seabird vulnerability to surface pollution for the months of February, March, April and June, as highlighted by the JNCC. This is in relation to drilling activities for Block 42/28.

Table 3-1 Seabird Oil Sensitivity Index (SOSI) in the blocks surrounding 42/28 (Webb et al., 2016)

Block	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
42/24	5*	2*	2	2*	4	1	3	3	3	3*	5*	5
42/25	5*	1*	1	1*	5	1	3	3	1	1*	5*	5
42/26	3	1	2	2	2	2	4	2	3	3*	3	4
42/27	3	2	2	2	2	2	4	2	3	3*	3	4
42/28	**5**	**2**	**2**	**2***	**3**	**2**	**3**	**3**	**3**	**3***	**3**	**4**
42/29	5	2	1	1*	4	1	3	3	3	3*	5	4
42/30	2*	2	2	2*	5	1	3	3	2	2*	3*	3
47/1	3	1	2	5	2	3	5	2	3	3*	3	4
47/2	3	2	2	5	3	2	5	2	3	3*	3	4
Key	1 = Extremely high	2 = Very high	3 = High	4 = Medium	5 = Low	N = No data						
* in light of coverage gaps, an indirect assessment of SOSI has been made by using data from adjacent months												

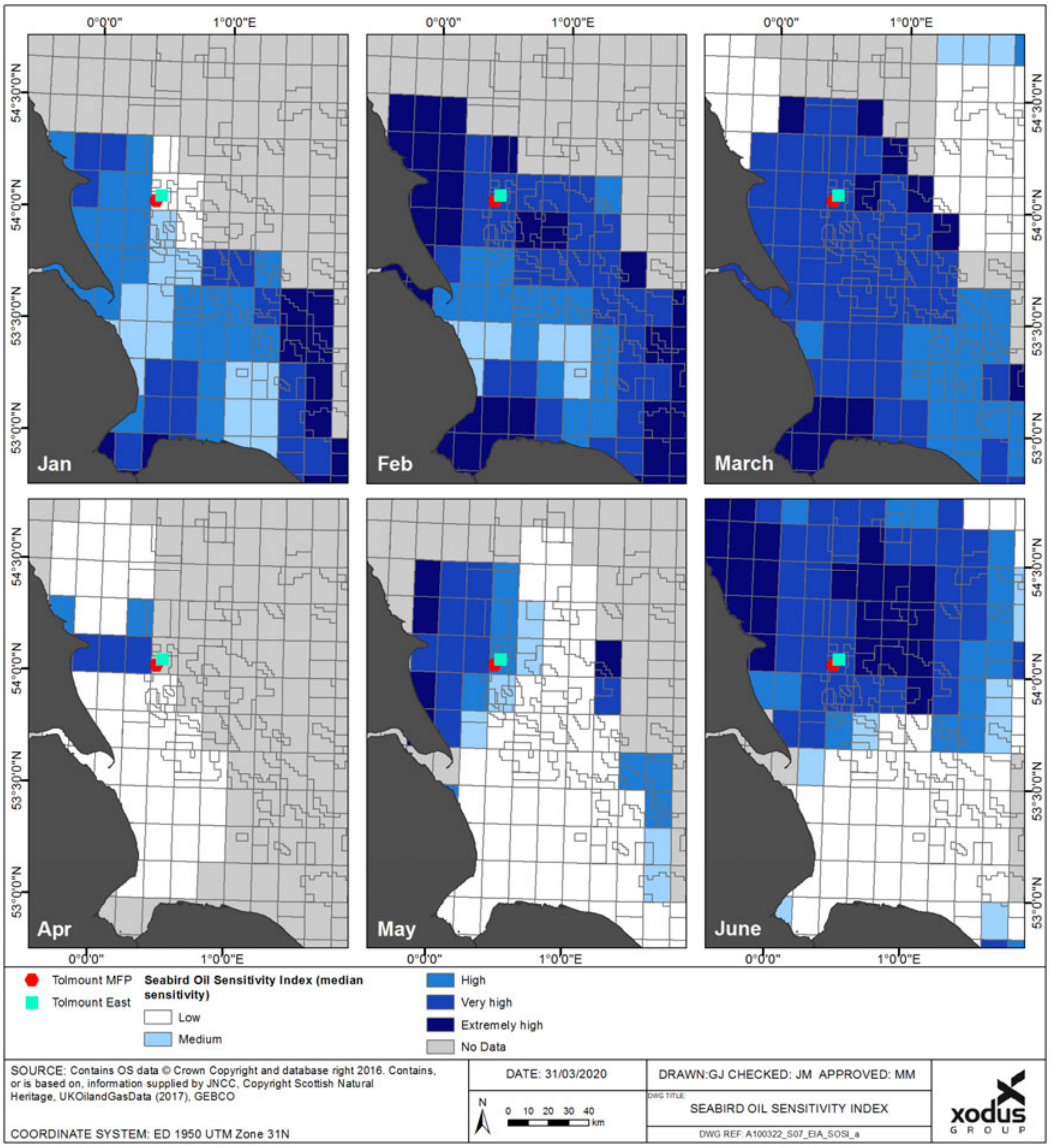


Figure 3-11 Vulnerability of seabirds in the vicinity of the Project

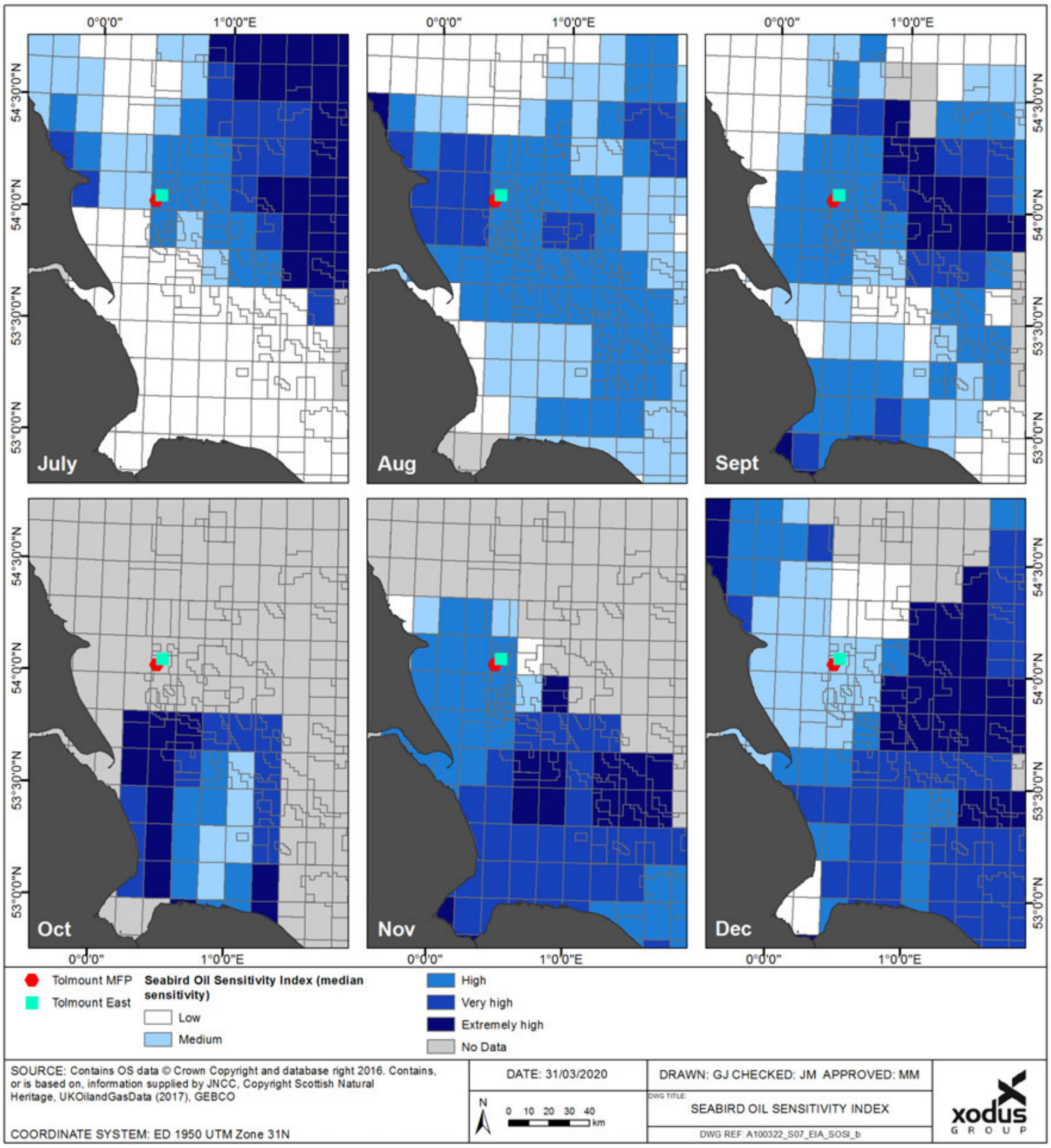


Figure 3-12 Vulnerability of seabirds in the vicinity of the Project (continued)

3.3.6 Marine mammals

3.3.6.1 Pinnipeds

Two species of seal live and breed in the UK, namely the grey seal (*Halichoerus grypus*), and the harbour seal (*Phoca vitulina*) (Jones *et al*., 2015; DECC, 2016). Both grey and harbour seals are protected under Annex II of the EU Habitats Directive and are listed as Priority Marine Features (PMFs). Approximately 38% of the world's grey seals breed in the UK, 88% of which breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney, while approximately 30% of harbour seals are found in the UK. However, this proportion has declined from approximately 40% in 2002. Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles (Special Committee on Seals, 2017).

Grey and harbour seals will feed both in inshore and offshore waters depending on the distribution of their prey, which changes both seasonally and yearly. Both species tend to be concentrated close to shore, particularly during the pupping and moulting season. Seal tracking studies from the Moray Firth have indicated that the foraging movements of harbour seals are generally restricted to within a 40–50 km range of their haul-out sites (Special Committee on Seals, 2017). The movements of grey seals can involve larger distances than those of the harbour seal, and trips of several hundred kilometres from one haul-out to another have been recorded (SMRU, 2011).

Both grey and harbour seals are present in the SNS, with 0.6% of the UK population of grey seals living and breeding along the English coast between Newcastle and Great Yarmouth. The main breeding site historically is at Donna Nook in Lincolnshire (approximately 17.4 km south of the Easington Terminal). Donna Nook is a National Nature Reserve (NNR) which spans approximately 10 km of the coastline. For the majority of the time the grey seals from the reserve are hauled out on sand banks or out at sea, but in November and December the seals come ashore to give birth to pups on coastal sand dunes (Lincolnshire Wildlife Trust, 2016). The seals at Donna Nook have reportedly become habituated to human disturbance, over 70,000 people visit the colony during the breeding season with no apparent impact on the breeding seals (SCOS, 2016). Along with Blakeney Point and Horsey, Donna Nook is one of three colonies which make up a group of breeding colonies for grey seals on the east coast of

England, out of the three Donna Nook is considered by the Special Committee on Seals (SCOS) to be the largest grey seal colony, although grey seal pup production has been highest in recent years at Blakeney Point (SCOS, 2016). Distribution data on grey seals suggest there is the possibility for grey seals to be present in the Project area, but they are not expected to spend a significant amount of time within this area (Figure 3-13).

There is a significant population of harbour seals in the area surrounding the Wash, although this represents less than 10% of the total UK population. Generally, harbour seals forage around their haul out sites throughout the year and are not normally recorded more than 60 km from shore, although more recent tagging studies have shown that they may occasionally forage at much greater distances.

Since the proposed Tolmount East development is located approximately 37 km offshore, it is likely that grey or harbour seals will use the area with any regularity or in great numbers. This is confirmed by the grey and harbour seal density maps published by the Sea Mammal Research Unit (SMRU). The maps report the presence of harbour seals at a very low density of between 0 and 1 animals per 25 km^2 but a moderate density of grey seals of between 5.1 to 10.0 animals per 25 km^2 (Russell *et al*., 2017) (Figure 1-13).

SCOS, (2017) reports the regional population of grey seals as 6,900 individuals and harbour seal as 5,200 individuals. Harbour seals are counted while they are on land during their August moult, giving a minimum estimate of population size whereas grey seal population trends are assessed from the counts of pups born during the autumn breeding season, when females congregate on land to give birth.

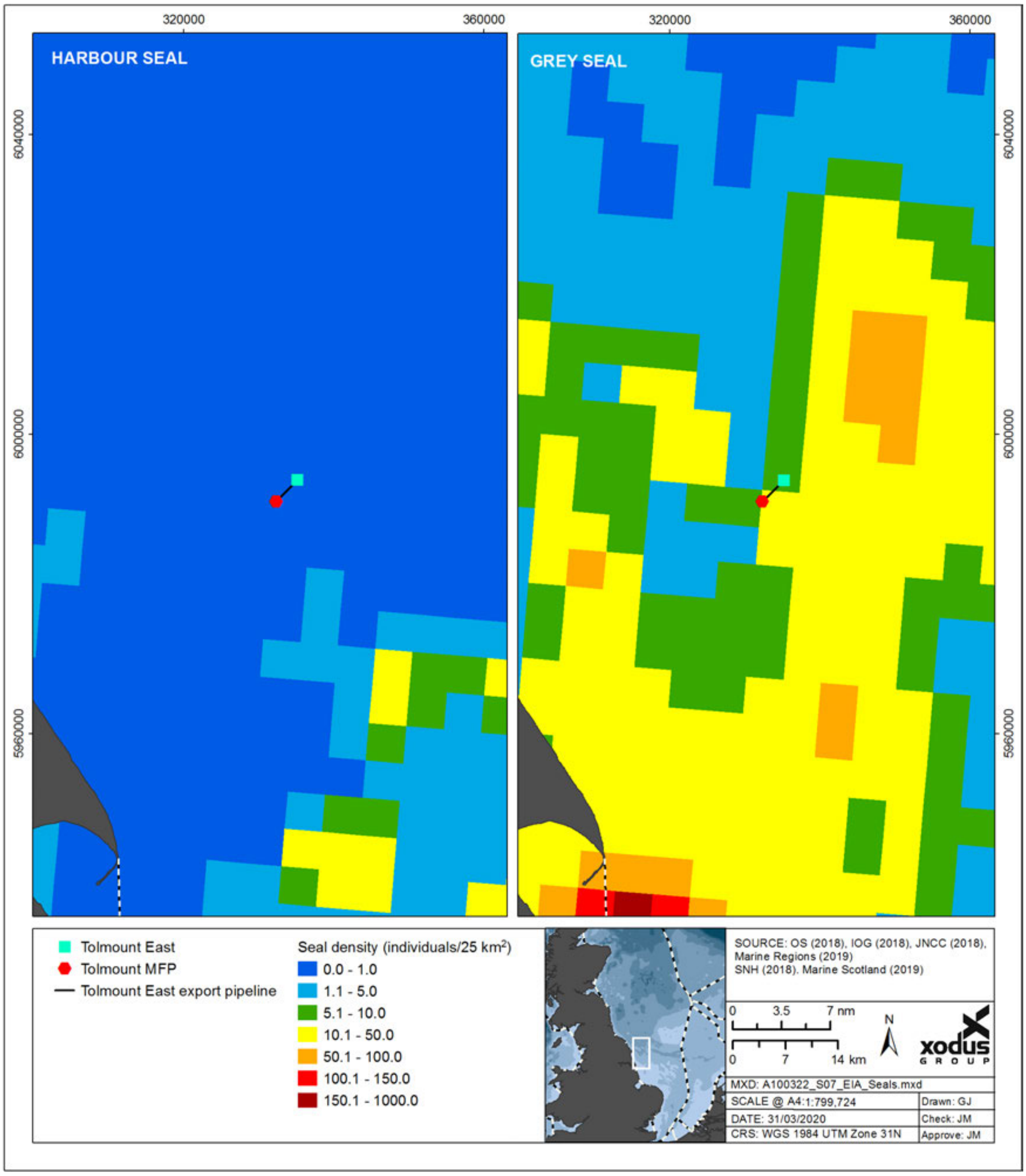


Figure 3-13 Harbour and grey seal density within the vicinity of the Tolmount East Development area

1.1.1.1 Cetaceans

Compared to the CNS and NNS, the SNS generally has a relatively low density of marine mammals, with the likely exception of harbour porpoise (*Phocoena phocoena).* While over ten species of cetacean have been recorded in the SNS, only harbour porpoise and white-beaked dolphin (*Lagenorhynchus albirostris)* can be considered as regularly occurring throughout most of the year, and minke whale (*Balaenoptera acutorostrata)* can be considered a frequent seasonal visitor (Table 1-2). Bottlenose dolphin (*Tursiops truncatus)* and Atlantic white-sided dolphin (*Lagenorhynchus acutus)* can be considered uncommon visitors (DECC, 2016).

Surveys undertaken for the “Small Cetaceans in the European Atlantic and North Sea” (SCANS-III) provide density estimates for commonly sighted cetacean species across different regions (survey blocks) in the UKCS (Hammond *et al*., 2017). The approximate density of a particular cetacean species in the vicinity of a development can be estimated using the densities for the survey block within which a development is located (Hammond *et al.,* 2017). The Tolmount East Development is located within Block O of the SCANS-III survey (Hammond *et al*., 2017). Within Block O, harbour porpoise as the most abundant cetacean species in the Project area (approximately 53,485 individuals), followed by minke whale (approximately 603 individuals) and white-beaked dolphin (approximately 143 individuals) (Hammond *et al*., 2017). The density (animals / km^2) of each cetacean is shown on Table 1-3.

Harbour porpoise and bottlenose dolphin are listed for protection under Annex II of the Habitats Directive which enables the designation of SACs for these species (Section 1.4)). The Tolmount East Development will be located 1.1 km west of the SAC boundary. As such, harbour porpoise present in the Project area are likely to include individuals from the Southern North Sea SAC.

Table 3-2 Cetacean occurrence in the Project area (Hammond et al., 2017; ASCOBANS, 2018)

Species	Description of occurrence
Harbour porpoise	Harbour porpoise are seen throughout the UKCS, though the greatest numbers are found in the SNS. They usually occur in shallow waters (less than 50 m) in groups of up to three individuals, although they have been sighted in larger groups and in deeper waters (up to 200 m). Harbour porpoise movements are variable, and they do not undertake seasonal migrations.
White-beaked dolphin	White-beaked dolphins are more prevalent in the northern part of the North Sea, and sightings have also been common as far south as the eastern English Channel. Strandings have occurred along the southern North Sea coasts for decades, indicating that this is also part of their distributional range. White-beaked dolphins can be found hugging the 50 to 100 m depth contour of the continental shelf year-round, though sightings peak in June and early autumn. This species is usually observed in small groups of less than 10 individuals.
Minke whale	Minke whales usually occur on the continental shelf in water depths up to 200 m. They are mostly seasonal visitors in the North Sea, and sightings generally do not occur South of the Dogger Bank. They are usually sighted alone or in pairs; however, groups of up to 15 individuals may aggregate during feeding events. Data suggest that animals return to the same seasonal feeding grounds each year. They are mostly found singly, or in small groups and are rarely sighted outside of the May – September months.

Table 3-3 Cetacean densities in the vicinity of the Project Hammond *et al.*, 2017)

Species	Density (animals / km^2)	Number of animals in regional population
Harbour porpoise	0.888	227,298
White-beaked dolphin	0.002	15,895
Minke whale	0.010	23,528

Based on the available information, the Project area is considered to support low numbers of individuals from a number of species which will belong to wider ranging populations. The Project area itself is not expected to be of particular importance for feeding, breeding or migrating cetaceans, although harbour porpoise sighted in the Project area are likely to be associated with the nearby Southern North Sea SAC.

3.4 Conservation

Figure 3-14 shows sites of conservation importance in the vicinity of the Project.

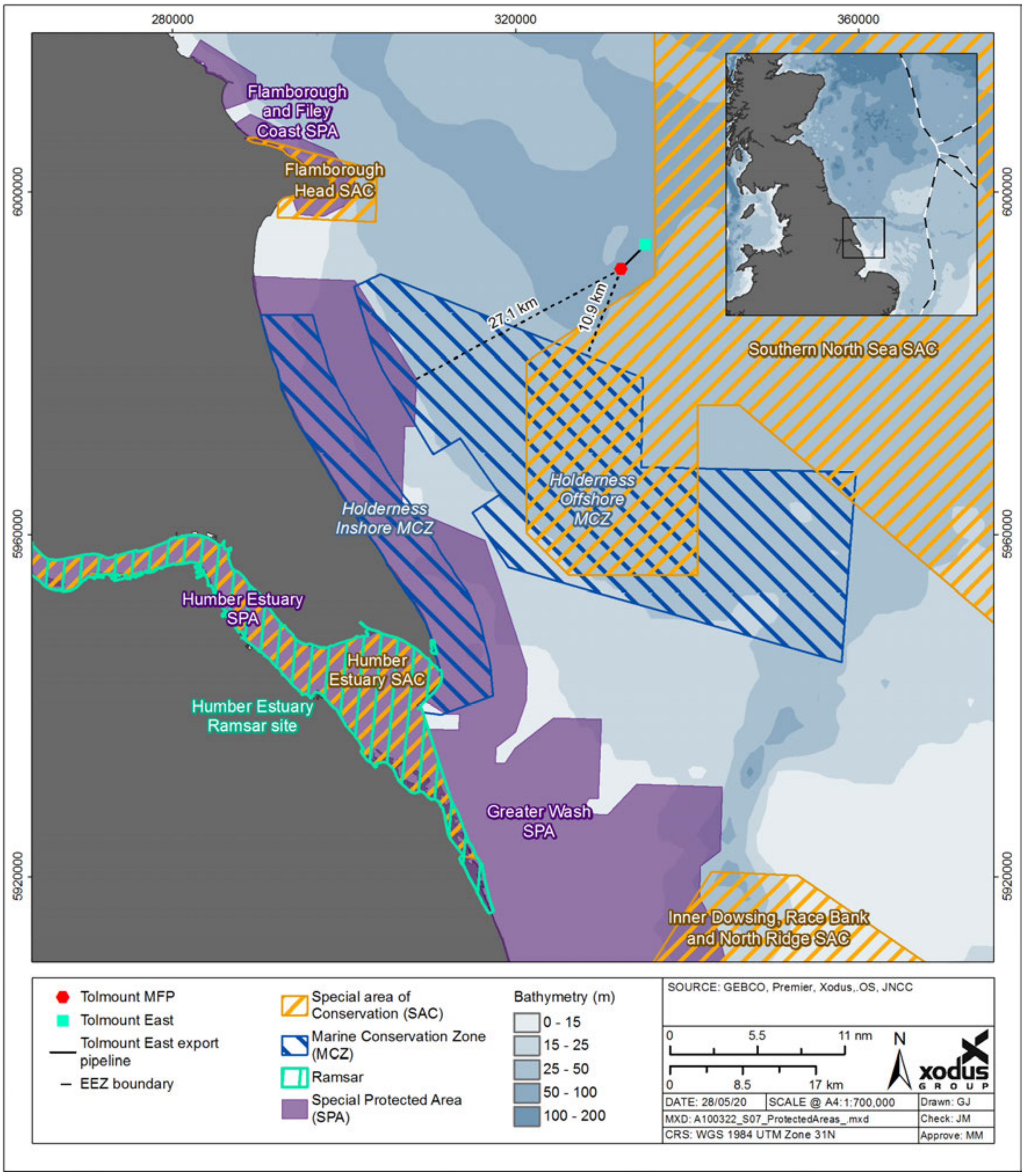


Figure 3-14 Sites of conservation importance in the vicinity of the Project

3.4.1 Offshore sites of conservation importance

As shown in Figure 3-14 the proposed Project is not situated in any sites of conservation importance. The closest site of conservation importance is the Southern North Sea SAC, located 1.1 km east of the Project. Other sites of conservation importance in the region include the Holderness Offshore Marine MCZ, Flamborough Head SAC and Greater Wash SPA.

The Southern North Sea SAC has been designated due to the presence of harbour porpoise (JNCC, 2019a). The harbour porpoise is the most common cetacean in UK waters. They are widely distributed and abundant throughout the majority of UK shelf seas, both coastally and offshore, with notably fewer sightings in the far southern and south-eastern North Sea and eastern Channel (Reid *et al*. 2003). The SAC ranges in depth from mean low water down to 75 m, with the majority of the site shallower than 40 m, and is characterised by its sandy, coarse sediments which cover much of the site. These physical characteristics are thought to be preferred by harbour porpoise, likely due to availability of prey.

The Holderness Offshore MCZ is located approximately 10.9 km south west of the Project (Figure 3-14). The designation of this site was recommended due to the presence of ocean quahog *(Arctica islandica*) and the EUNIS broad scale habitats 'Subtidal coarse sediment' (A5.1) and 'Subtidal mixed sediments' (A5.4). In addition, the presence of the FOCI habitat 'Subtidal Sands and Gravels' was confirmed for this site (DEFRA, 2019). The site is significant for crustaceans, including edible crabs and common lobster. Water depth across the site ranges from 10 - 50 m. The seafloor consists of mixed and coarse sediment interspersed with small cobbles and Ross worm (*Sabellaria spinulosa)* reef, creating a mosaic of habitats for attaching and burrowing creatures.

The Flamborough Head SAC is located 39 km west of the Project. The site is an area of partly vegetated high chalk cliffs, with over 200 caves and a chalk reef extending up to 6 km offshore. The qualifying features of the site are the following Annex I habitats: reefs, vegetated sea cliffs of the Atlantic and Baltic coast and submerged or partially submerged sea caves (JNCC, 2015a).

The Greater Wash SPA is located 27.1 km west of the Project. The Greater Wash area is known to provide areas of importance for over-wintering red-throated diver, little gull and common scoter during the winter period (October to April). The area is a designated SPA to protect these areas. In addition, the Greater Wash SPA provides protection to important foraging areas for common, Sandwich and little tern, which breed along the adjacent coastline (JNCC, 2019b).

Humber estuary SAC extends about 70 km from the mouth of the Humber, past the ports of Grimsby, Immingham, Hull and Goole and up to the limit of saline intrusion on the rivers Ouse and Trent. Annex I habitats that are a primary reason for selection of this site include estuaries and mudflats and sandflats not covered by seawater at low tide. There are Annex II species present as a qualifying feature including grey seal, sea lampray and river lampray (JNCC, 2015b).

A number of marine species in UK waters have been identified for protection under Annex II of the European Habitats Directive. Annex II species recorded in the offshore areas of the UK that qualify for protection include the grey seal, harbour seal, harbour porpoise and bottlenose dolphin. All these Annex II species are likely to occur in the Project area.

Harbour porpoise are also European Protected Species (EPS). EPS are protected by law throughout the EU listed in Annexes II and IV of the Habitats Directive 92/43/EEC. The European sturgeon (*Acipenser sturio)* and leatherback turtle are also classed as EPS and occur in UK waters, although they are not expected to be present in significant numbers in the vicinity of the Project.

The diadromous fish Atlantic salmon and sea lamprey are also listed on Annex II. These species migrate between fresh and sea water and it is possible that will be encountered to some extent in the vicinity of the Project.

Some species featuring on the OSPAR list of threatened and/or declining species (OSPAR, 2008), together are also likely to be present in the area including the black-legged kittiwake, cod and harbour porpoise (OSPAR, 2008).

The National Biodiversity Network (NBN) Gateway is a database for species records. A search of species records within the area of the Project returned 233 occurrences, none of which were for species of conservation concern (NBN Gateway, 2019).

The MMO has produced an interactive map which details species listed as FOCI. Whilst there are no records in the Project footprint, there are occurrences in the wider area (MMO, 2019a). For example, a number of instances of ocean quahog have been recorded in the region, although all are in excess of 40 km from the Project.

3.5 Other sea users

Other sea users in the vicinity of the Project are shown in Figure 3-15 and are described in the following sections.

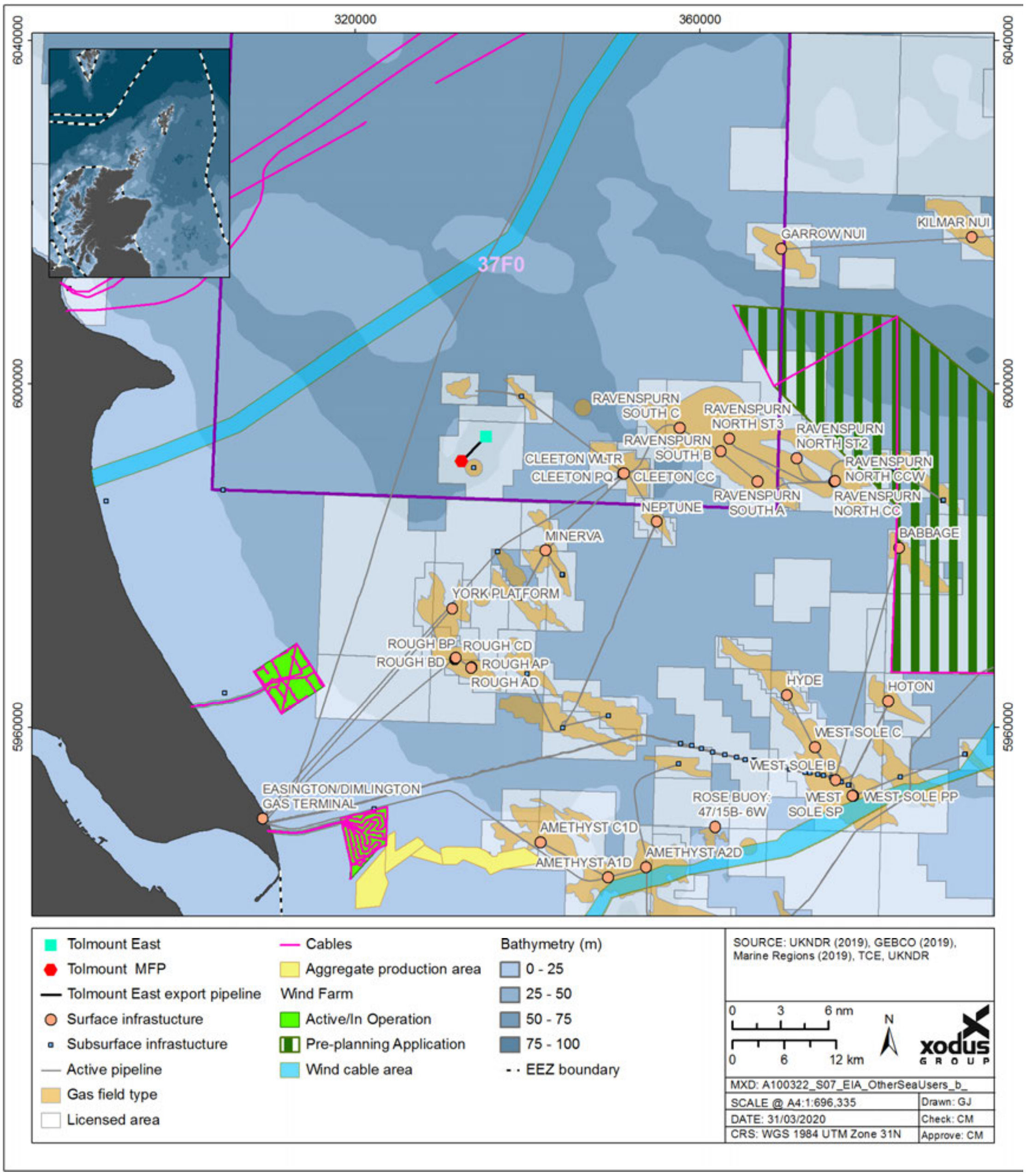


Figure 3-15 Other sea users in the vicinity of the Project

3.5.1 Commercial fisheries

In November 2015 Xodus Group Limited completed a Fishing Intensity Study with the purpose of characterising commercial fishing in the vicinity of the Project (Xodus Group Limited, 2015), this study has been used to inform this description. Statistics from The Scottish Government (2021) have been used for commercial fisheries statistical data.

The North Sea has important fishing grounds and is fished throughout by both UK and international fishing fleets, targeting both demersal, pelagic and shellfish fish stocks.

The seas in the north-east Atlantic region have been divided into a series of administrative rectangles by the International Council for the Exploration of the Seas (ICES). These are known as ICES statistical rectangles and measure 30 minutes latitude by 1 degree longitude in size, which covers approximately 30 nautical square miles and are used as a basis for carrying out statistical analysis of sea areas. The Tolmount MFP, Tolmount East subsea infrastructure and pipelines are located within ICES rectangle 37F0 (Figure 3-15).

Apart from 2013, from 2011 to 2019 shellfish dominated both the landings value and live-weight tonnage from ICES rectangles 37F0, accounting for approximately 88% of the landings value and 64% of the live-weight (Table 3-4). To put landings into context, a total of 493,075 tonnes with a value of £767,721,934 was landed in the UK in 2019 (Scottish Government, 2021). Therefore, contributions from ICES 37F0 was relatively low, comprising approximately 0.67% and 0.70% of the UK total landings and value in 2019.

Over the period 2011 to 2019 fluctuations can be seen in the landings for ICES rectangle 37F0 (Table 3-4). Shellfish species increased by around 39% in value from 2017 to 2018, with 2018 being the highest value during the evaluated period. Although the shellfish value decreased again in 2019, it was still higher than the observed up to 2017. Fluctuations are again observed for the other species. In terms of the demersal catch there was approximately a 88% reduction between 2017 and 2018, but increasing by a factor of 11 in 2019 (Table 3-4). For pelagic species, the highest value occurred in 2019, associated with over a 340% increase from the next highest occurrence in 2013 (Table 3-4).

Table 3-4 Live weight and value of fish and shellfish taken from ICES rectangles 37F0, 2011 to 2019 (Scottish Government, 2020)

ICES rectangle	Year	Demersal		Shellfish		Pelagic	
		Live-weight (tonnes)	Value (£)	Live-weight (tonnes)	Value (£)	Live-weight (tonnes)	Value (£)
37F0	2011	153	412,519	871	2,036,087	20	4,647
	2012	153	268,446	701	1,545,734	506	139,146
	2013	1,254	272,944	521	1,084,905	1,344	330,829
	2014	64	83,869	1,357	2,736,202	327	114,403
	2015	35	92,398	1,677	3,351,358	544	176,032
	2016	7	15,371	1,128	2,445,614	1	848
	2017	85	118,050	1,376	3,322,569	12	19,325
	2018	10	14,521	1,917	4,612,304	<1	164
	2019	203	158,601	1,568	4,057,854	1,550	1,134,168
Total		1,964	1,436,719	11,116	25,192,627	4,304	1,919,562

Key species landed from rectangle 37F0 in 2019 are shown in Table 3-5. Shellfish species account for the highest percentage value with brown crab accounting for 35%, followed by scallops accounting for 25% of the total value of landings. The top four species in terms of landing value account for 95% of the value for 2018.

Herring accounted for the majority of the liveweight tonnage for ICES rectangle 37F0 responsible for 46% of the total in 2019.

Table 3-5 Value and live weight tonnage for the species which contribute the over 10% of total landings from ICES rectangles 37F0 in 2019 (Scottish Government, 2020)

ICES rectangle	Species	Value (£)	Percentage total Value (%)	Liveweight (tonnes)	Percentage total liveweight (%)
37F0	Brown crab	1,851,799	35	875	26
	Scallops	1,334,288	25	609	18
	Herring	1,120,379	21	1,535	46
	Lobsters	737,959	14	48	1
Other species caught in 37F0: bass, brill, cod, crabs (velvet), cuttlefish, dabs, gurnards – grey, gurnards - red, haddock, hake, halibut, horse mackerel, John Dory, lemon sole, lesser spotted dog, ling, mackerel, monks or anglers, mullet, plaice, pouting, sand eels, sea trout, sole, squid, starry smooth hound, spotted ray, surmullet, thornback ray, tub gurnard, turbot, whelks, whiting.					

Fishing activity in ICES rectangle 37F0 occurs throughout the year as detailed in Table 3-6. The total days spent fishing ranged between 824 days in 2014 and 1,264 days in 2019.

Trapping accounted for the majority of fishing effort in 2019 (770 days), with dredging accounting for a further 480 days. The remaining 14 days of effort was accounted for by use of seine nets and trawls, data for these methods is disclosive.

Table 3-6 Days spent fishing in ICES rectangle 37F0 2011-2018 (Scottish Government, 2019)

ICES rectangle	Year	J	F	M	A	M	J	J	A	S	O	N	D	Total
37F0	2014	70	82	143	49	69	33	33	55	38	74	84	94	824
	2015	177	106	161	166	98	47	52	67	66	71	63	91	1,166
	2016	62	33	35	45	48	98	102	95	80	115	99	62	872
	2017	49	42	150	162	66	78	61	76	64	75	72	95	989
	2018	52	59	95	106	160	64	91	150	129	122	92	98	1,218
	2019	78	85	120	115	156	98	88	88	220	88	73	54	1,264

Note: Monthly fishing effort by UK vessels: green = 0 – 100 days fished, yellow = 101 – 200, orange =201-300, red = ≥301.D = Disclosive

Xodus Group Limited (2015) reported that the Project area is fished throughout the year and the presence of fishing vessels in the area is not determined by season; rather, tidal and weather conditions dictate utilisation. In times of bad weather, the area is generally avoided altogether. The average weekly density of all vessel types in ICES 37F0 is 50 – 150 transits, which is regarded as high shipping traffic (Scottish Government, 2016).

Crabs and whelks are targeted on a variety of substrates, whereas lobsters are targeted on rocky, uneven ground and around wreck sites. Crab, lobster and whelks are not currently quota restricted, although all vessels landing over a particular weight must be licensed. Crab and lobster are principally targeted by full time static gear vessels setting creels, and whelks are caught with pots. There are a number of locally based vessels that will spend the majority of time fishing here. As of March 2021, local ports were recorded as the “home port” for the following numbers of vessels with shellfish licenses and lengths up to 10 m(MMO, 2021):

- Withernsea – 6 vessels;
- Bridlington – 18 vessels; and
- Grimsby – 5 vessels.

Scallop fishing activity is undertaken year-round, but activity peaks in the summer months. Scallop fisheries are targeted by two distinct categories of vessel: smaller vessels with limited operational range and home ports close to scallop grounds, and larger category “nomadic” boats which target grounds around the UK. There are fluctuations in annual landing values and effort (within the timescale studied), suggesting the number of vessels fishing the Project area varies (therefore it is assumed landings are made predominantly by these “nomadic” boats). As of March 2021, there were no vessels under 10 m in length with a scallop licence. However, in 2019, there were five vessels with a scallop license using Grimsby as their “home port” (MMO 2019), where it is expected that these locally-based vessels would spend the majority of their fishing effort in the local area.

3.5.2 Oil and gas activity

The Project is in an area of historic and current oil and gas exploration and production. Accordingly, there are numerous wells, pipelines and platforms in the region. However, oil and gas activity in the area immediately around the Project is moderate. Oil and gas installations within a 40 km radius are detailed in Table 3-7.

Table 3-7 Oil and gas installations within 40 km of the Project

Name	Installation	Operator	Distance (km)
Tolmount	MFP and pipeline to Easington (to be installed)	Premier	4
Minerva	Platform	Perenco	14.3
York	Platform	Centrica	17.1
Cleeton WLTR/PQ/CC	Platform(s)	Perenco	18.8
Rough CD	Platform	Centrica	22.9
Rough BP	Platform	Centrica	22.9
Rough BD	Platform	Centrica	23.0
Neptune	Platform	Perenco	23.8
Rough AD/AP	Platform(s)	Centrica	24.0
Ravenspurn South C	Platform	Perenco	25.6
Ravenspurn South B	Platform	Perenco	30.2
Ravenspurn North ST3	Platform	Perenco	31.3
Ravenspurn South A	Platform	Perenco	34.5
Ravenspurn North ST2	Platform	Perenco	38.9

3.5.4 Military Activity

No Military Practice Areas occur in the immediate vicinity of the Project. A Small Arms Firing Range Practice Area exists approximately 39.7 km west of the Project (X5309) at Rowlston and another larger Military Practice Area (D307) is located approximately 55.4 km south west of the Project (MMO, 2017). Special consultation conditions are not required by Ministry of Defence (MoD) in relation to Block 42/28d.

3.5.5 Shipping Activity

Anatec prepared a traffic survey, collision frequency assessment and review of effect on navigation for the Tolmount East operation (Anatec, 2019). A shipping intensity study indicated that there are 46 routes within a 10 nm radius of the Tolmount East location, trafficked by an estimated 7,837 vessels per year (Figure 3-16). This represents an average of 21 vessels per day (Anatec, 2019). The majority (37%) of vessels trafficking these routes were cargo ships. Tankers accounted for 26% of the vessel distribution with fishing vessels accounting for 10% (Anatek, 2019). The Automatic Identification System (AIS) data for the vessels transiting in the area surrounding Tolmount East is consistent with the comparatively high density of cargo and tanker vessels, relative to other vessel types (Figure 3-17).

The vessel route which passes closest to the Tolmount location is indicated by Route 1 in Figure 3-16; this route represents a crossing from Immingham-N to Norway/Russia, which currently passes through the proposed location of Tolmount East. This route averages 48 vessels per year. The most frequented route is indicated by Route 13 in Figure 3-16; this route is used by an estimated 2,417 vessels per year and passes south-west Tolmount East at a mean distance of 7.2 nautical miles (Anatec, 2019).

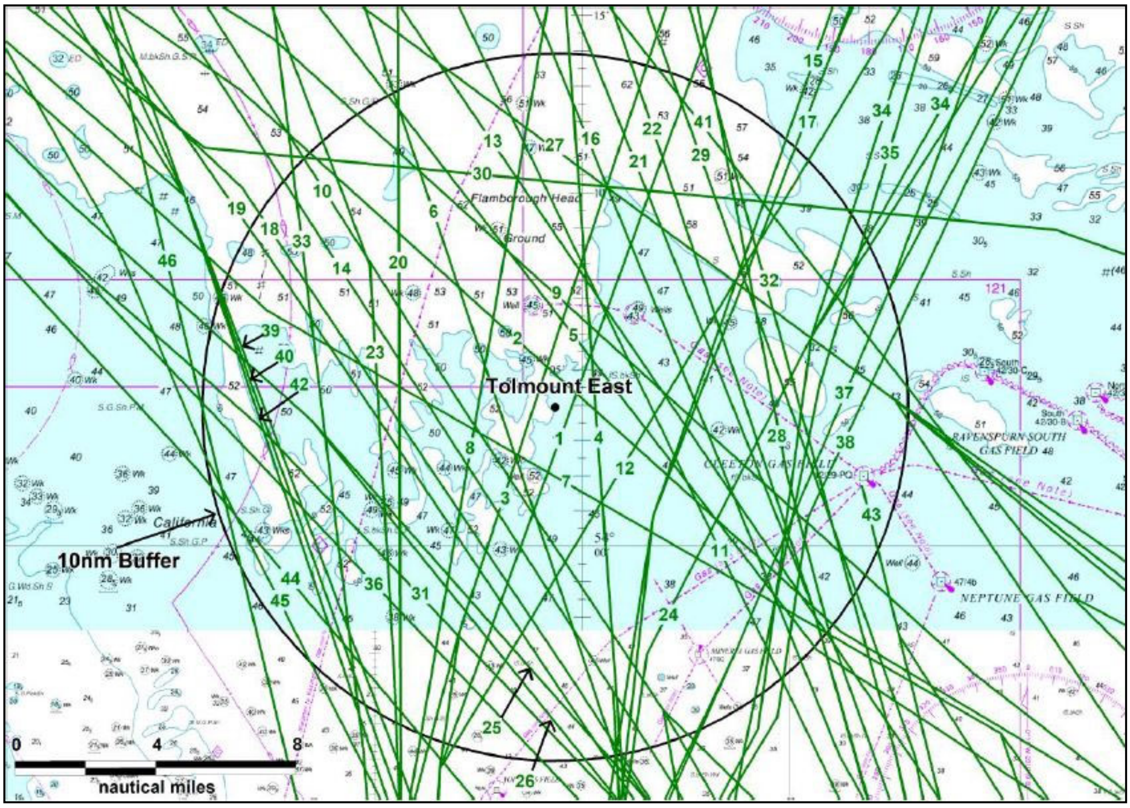


Figure 3-16 Shipping routes in the vicinity of the Tolmount East location (Anatec, 2019)

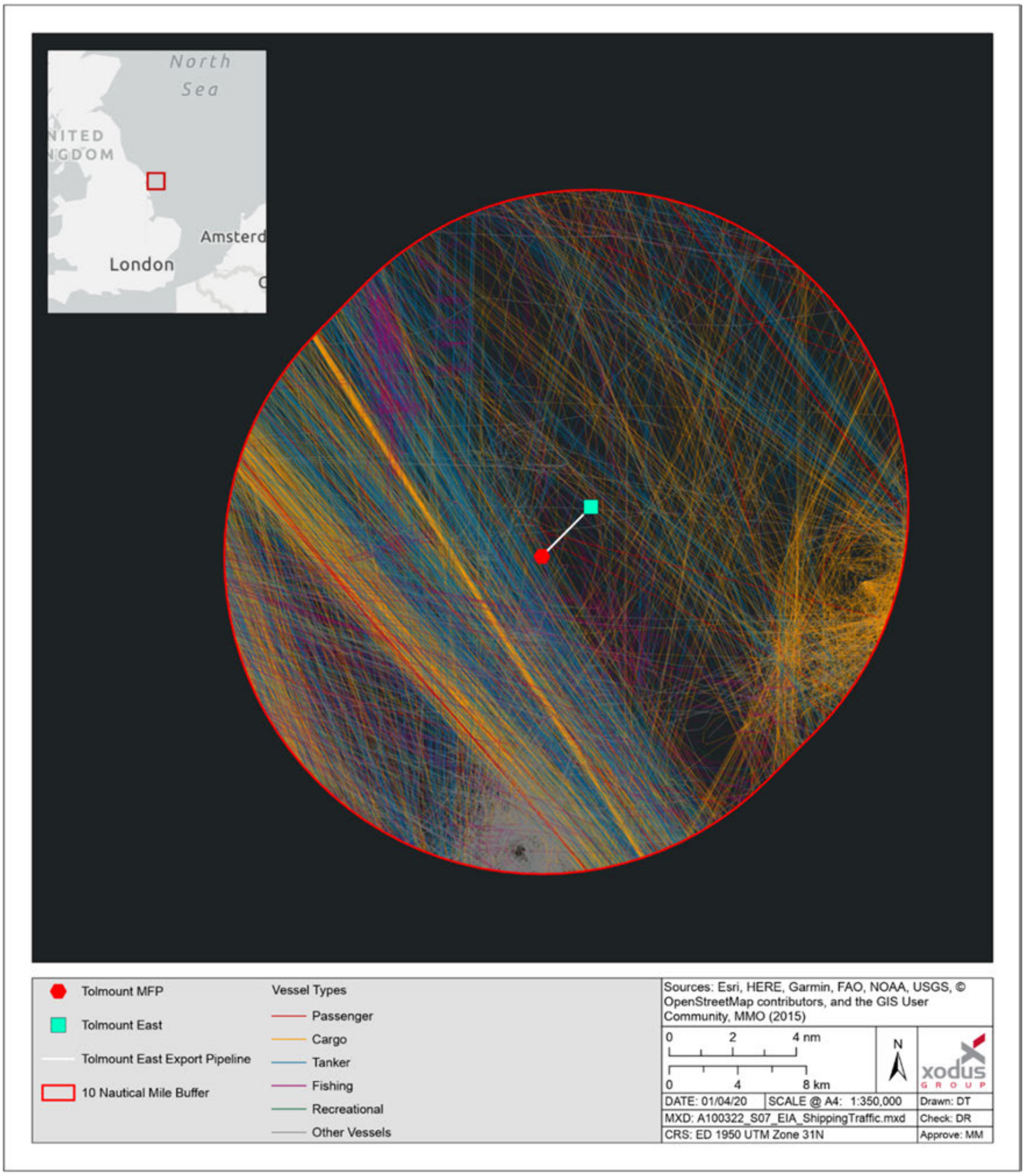


Figure 3-17 Vessel tracks within the Tolmount East development area

3.5.6 Renewables

3.5.6.1 Offshore wind

There are a number of wind farm licensed areas and wind farm projects under development in the vicinity of the Project (Figure 3-15).

The Westermost Rough Offshore Wind Farm is situated 8 km off the Yorkshire Coast, north of Hull and contains 35 turbines of 6 MW capacity, covering a total area of 35 km^2 and providing enough electricity to power around 150,000 UK homes. The farm is located approximately 29 km from the Project (Ørsted, 2019a). The Humber Gateway wind farm is located approximately 41 km from the Project. The farm became fully operational in 2015. The farm is operated by E.ON Energy and consists of 73 turbines producing 219 MW of energy which is enough to power 170,000 homes (E.ON, 2019).

Hornsea Project Two, is being developed by SMart Wind and will consist of 165 turbines. It is located approximately 63 km from the Project and will deliver up to 1,400 MW of electricity (Ørsted, 2019b).

Tolmount East is also located in close proximity to several offshore wind farms which are in the planning or pre-planning stage (Figure 3-15). This includes the Hornsea Project four which is approximately 33 km ENE of Tolmount East. In addition to this, the Doggerbank Creycke Beck A export cable leasing area is approximately 15 km NNW (Figure 3-15).

3.5.7 Cables and pipelines

There are several pipelines in the vicinity of the Project, the nearest being PL1929 which runs between Wollaston and Whittle installations situated approximately 5 km away. The Project does not cross any pipeline.

The Project does not cross any cables. The nearest cable to the proposed project is associated with the Westernmost Rough Wind farm, situated >28 km in a southerly direction (KIS ORCA, 2019).

3.5.8 Archaeology

Geophysical survey effort (Fugro, 2015a) identified one wreck located approximately 280 m west-northwest of the Tolmount MFP, which corresponds to UK Hydrographic

Office (UKHO) Wreck ID 6685. This wreck was also identified in the Tolmount MFP to Easington pipeline route archaeological assessment (Wessex Archaeology, 2018). There were no other wrecks identified during geophysical survey of the proposed Tolmount East subsea development or pipeline route, and UKHO data does not indicate any other wrecks in the near vicinity (UKHO, 2019; Fugro, 2015a).

3.5.9 Aggregate extraction

Over 20 million tonnes of marine sand and gravel is extracted from over 65 licensed areas around the coast of England and Wales each year (Marine Aggregates Information Centre, 2019). The nearest licenced aggregate extraction site occurs approximately 44 km south of the Project (Figure 3-15). The 20th Annual report of marine aggregate extraction published by The Crown Estate and the British Marine Aggregate Producers Association (BMAPA) reports that the Humber region has nine licenced marine aggregation extraction sites. The licences are for the removal of both sand and gravel, principally for use in the construction industry. During 2017, 1.88 million tonnes of construction aggregate were dredged from a permitted licensed tonnage of 4.4 million. In addition, 0.5 million tonnes were specifically dredged for beach nourishment (The Crown Estate and BMAPA, 2018).

4 EIA METHODOLOGY

4.1 EIA overview

This section provides detail on how the EIA process has been applied to the Tolmount East Project and describes the key components that have fed into it. Figure 4-1 presents an overview of the EIA process.

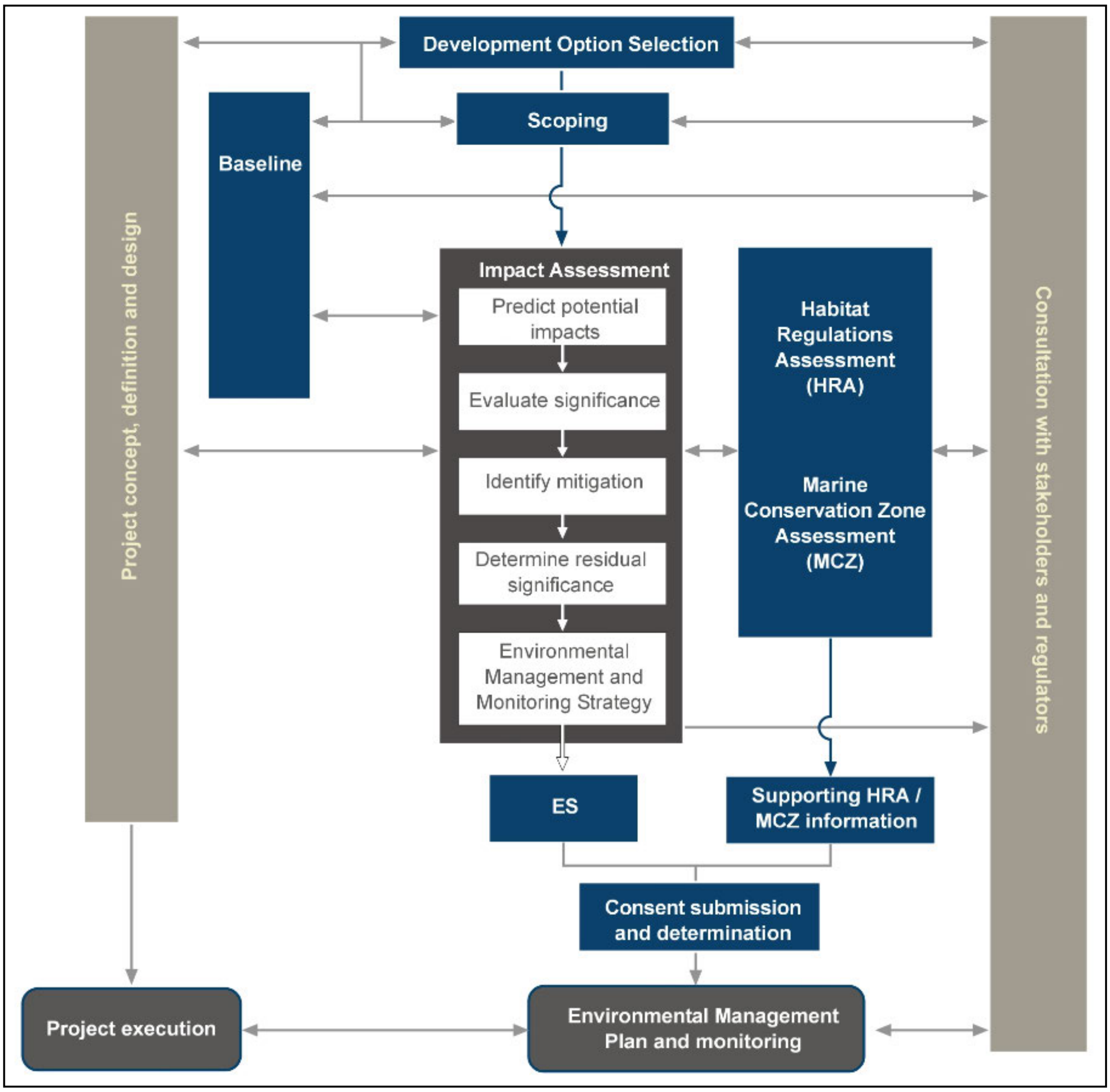


Figure 4-1 The EIA process

4.2 Environmental issues identification

The main objective of the environmental issues identification process is to identify the key potential environmental issues, and to agree practicable measures (mitigation) to eliminate or minimise harm to the environment.

Environmental issues identification was based on:

- Known potential environmental issues specifically related to the Project. These are well understood given the environmental work conducted during the Project's lifetime and accumulated experience with other oil and gas development projects;
- ENVID which was conducted by environmental consultants at Xodus Group and the Premier project team based on previous work on the Tolmount Area Development Offshore ES (with results presented in Appendix A);
- Stakeholder engagement through a scoping letter and consultation meetings;
- Comments from OPRED and consultees on the original Tolmount Area Development Offshore ES; and
- Comments from OPRED on Tolmount East Development previously submitted in June 2020.

The environmental issues identification process was kept under review through the EIA, with mitigation revised as understanding of the Project increased and as consultation continued. The key issues that were assessed in this ES are therefore a combination of issues identified as significant during the early Project stages, issues of importance raised by consultees (the output of which is detailed in Section 0), and issues that have become clearer with enhanced Project definition. The key issues identified are summarised below and described in more detail in Section 4.7:

- Discharges to sea;
- Seabed impacts;
- Other sea users;
- Atmospheric emissions; and

- Accidental events.

Following consultation with consultees and OPRED, changes have been applied to the engineering design, which means some of the concerns raised during consultation have been resolved. The engineering design elements contribution to the reduced scoping concerns are addressed further in the introduction of the assessed issues in Section 4.7.

4.3 Scoping and consultation

The EIA Regulations require that the EIA consider the likely significant effects of a project on the environment. To achieve this, Premier has maintained full and open communication with OPRED and its statutory advisors since the start of the Tolmount East Development. This has provided an opportunity for stakeholders to highlight their initial views and environmental concerns at an early stage of the EIA process.

Scoping activities involved the review of all potential Project options and a high level screening of these with the regulator and key stakeholders. Scoping letters were sent to OPRED, JNCC and the Maritime and Coastguard Agency (MCA) which detailed the initial MFP concept for Tolmount East. It was not considered necessary to send additional scoping letters reflecting the revised subsea development concept as the impacts resulting from the installation of a subsea manifold and WHPS are considered to be reduced when compared to the installation of a MFP.

Written feedback was provided by the consultees. Overall, the consultees were satisfied with the proposed approach to the EIA, the key environmental issues and potential significant effects identified for assessment, and the supporting studies proposed to facilitate assessment. The key concerns as identified through the ENVID are summarised below and details of how each issue has been addressed are provided in Appendix B. It is however noted that following further optimisation of the project design, some concerns are no longer applicable and are removed from this ES, although they are discussed within Appendix B.

- Potential impacts arising from the introduction of hard substrate on the seabed;
- Potential seabed disturbance arising from anchoring of vessels and the MODU jack-up rig. Impacts should assess a worst case scenario;

- The potential disturbance of historical drills cuttings;
- Impacts from potential releases should also be assessed in their potential to result in a Major Environmental Incidents (MEI) as defined under the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015 (SCR 2015);
- The project activities should be placed in context of the East Shore Marine Plans; and
- The impacts on Shipping and Navigation should be assessed.

Further optimisation of the engineering design following the ENVID process has removed the need for piling, which means the potential for injury / disturbance of harbour porpoise within the SNS SAC from piling noise is no longer considered an issue within the EIA.

4.4 Environmental significance

The updated 2020 EIA Regulations provide more detailed guidance on the requirements of impact assessments, including a list of necessary consideration of effects on the Project on the environment. The Regulations do not provide a specific definition of significance, but indicate that the methods used for identifying and assessing potentially significant effects should be transparent and verifiable. Despite being an inherently subjective process, use of a defined methodology makes the assessment as objective as possible.

The methodology presented here has been developed by reference to the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for ecological impact assessment in the UK and Ireland (CIEEM, 2018), the Marine Life Information Network (MarLIN) species and ecosystem sensitivities guidelines (Tyler-Walters *et al*., 2001) and guidance provided by the MMO (MMO, 2014) and by The Institute of Environmental Management and Assessment (IEMA, 2004).

EIA provides an assessment of the environmental effects that may result from project-generated impacts on the receiving environment. The terms impact and effect have different definitions in EIA, and one drives the other.

Impacts are defined as the changes resulting from an action. In general, impacts are specific, measurable changes in the receiving environment (volume, time and/or area). Effects (the results of the impact on receptors) consider the response of receptors to an impact. Within the 2020 EIA Regulations, the different types of effects that require consideration have been increased to cover direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive, negative and transboundary effects.

The relationship between impacts and effects is not always straightforward; for example, a direct impact may give rise to a secondary impact (such as direct seabed disturbance leading to an increase in re-settlement of suspended sediment at a location remote from the initial impact area), which could have an additional effect on receptors. There may also be circumstances where a receptor is not sensitive to a particular impact and thus there will be no significant effects.

For each impact, the assessment identifies a receptor's sensitivity and vulnerability to the impact, and implements a systematic approach to understand the likely effects. The process considers the following:

- Identification of impacts that will arise from the Project (including nature, magnitude, duration and (for non-planned events) likelihood of impact);
- Identification of receptors that may be affected by the impacts, and assessment of receptor value and vulnerability to the impacts in question;
- Assessment of the likely effect of each impact on the relevant receptors, (considering the pathway, duration and permanence), based on the impact magnitude and receptor vulnerability; and
- Assessment of the consequence associated with each impact, based on the expected effects on receptors. If the consequence of an impact is predicted to be moderate or higher, the impact is considered "significant".

Mitigation measures will be identified to avoid, prevent, reduce or offset potentially significant adverse effects. Mitigation measures may also be recommended to ensure non-significant effects remain so. Monitoring measures will be developed to ensure that specific mitigation measures are adhered to, and that environmental effects are minimised across the Project.

For some types of impacts, significance criteria are standard or numerically based. For others, where no applicable limits, standards or guideline values exist, a more qualitative approach is required. This involves assessing significance using professional judgement.

Whilst the assessment of impact significance is a subjective process, a defined methodology makes the assessment as objective and transparent as possible, and increases consistency across different topics. The assessment process used in this ES is described below. The terms and criteria associated with the impact assessment process are described and defined. Details on how these are combined to assess consequence and impact significance are then provided.

4.5 Environmental characterisation and impact assessment

In order to assess the potential for significant effects on environmental receptors, the environmental baseline conditions must be understood. The environmental baseline in and around the Development area is described in Chapter 3. The baseline characterisation was completed as a desk study using existing regional-level data, supplemented with site-specific surveys and modelling as required. Consultation feedback from key stakeholders was also incorporated. The environmental baseline was used to identify key receptors that could be exposed to significant effects (e.g., seabirds, marine mammals, seabed species and habitats), which are assessed in Chapters 5 to 10.

Where data gaps and uncertainties remain (e.g. where there are no suitable options for filling data gaps), these are highlighted in each impact assessment section, and are taken into account during the assessment of impact significance.

4.5.1 Impact definition

4.5.1.1 Impact magnitude

Determination of impact magnitude requires consideration of a range of key impact criteria including:

- Nature of impact, whether it be beneficial or adverse;
- Type of impact, be it direct or indirect etc.;
- Size and scale of impact, e.g. the geographical area;
- Phase of development when impact likely to occur (e.g. pre-construction, installation/construction, commissioning);
- Duration over which the impact is likely to occur, e.g. days, weeks;
- Seasonality of impact, i.e. is the impact expected to occur all year or during specific times of the year e.g. summer; and
- Frequency of impact, i.e. how often the impact is expected to occur.

These variables are expanded in the tables below to provide consistent definitions across all EIA topics. In each impact assessment section, these terms are used in the assessment summary table and are described as necessary in any supporting text. With respect to the nature of the impact (Table 4-1), it should be noted that all impacts discussed in this ES are adverse unless explicitly stated otherwise.

Table 4-1 Nature of impact

Nature of impact	Definition
Beneficial	Advantageous or positive effect to a receptor (i.e. an improvement).
Adverse	Detrimental or negative effect to a receptor.

Table 4-2 Type of impact

Type of impact	Definition
Direct	Impacts that result from a direct interaction between the Project and the environment. E.g. Disturbance of a specific area of seabed due to trenching and laydown activities.

Type of impact	Definition
Indirect	Reasonably foreseeable impacts that are caused by the Project, but which occur later in time than the original, or at a further distance from the proposed Project area. Indirect impacts include impacts that may be referred to as 'secondary', 'related' or 'induced'. E.g. change in seabed currents due to the presence of a rock armour berm over a buried pipeline
Cumulative	Impacts that act together with other impacts (including those from any concurrent or planned future third party activities) to affect the same receptors as the proposed Project. Definition encompasses "in-combination" impacts. E.g. disturbance of a specific area of seabed from one project could act cumulatively with disturbance of an area of seabed at a nearby third-party project.

Table 4-3 Duration of impact

Duration	Definition
Temporary	Impacts that are predicted to be of short duration (e.g. less than one year) and are temporary or intermittent in nature.
Short term	Impacts that are predicted to last for a limited period of time (e.g. between 1 and 5 years) and will cease on completion of the development activities (e.g. installation / construction) or as a result of planned mitigation, reinstatement or natural recovery.
Medium term	Impacts that are predicted to last more than a few years (e.g. between 5 and 10 years - depending on overall project lifetime). For example, impacts that might occur during construction and installation (e.g. over a couple of years) but may last longer than this until mitigation, reinstatement or natural recovery has taken effect.
Long term	Impacts that may, but not necessarily, commence during construction/installation and are expected to continue for the duration of the project, or in some cases beyond the lifetime of the project, before eventually ceasing. These include ongoing intermittent or repeated activities e.g. maintenance or seasonal events that are required to take place for the lifetime of the project.
Permanent	Impacts that are predicted to cause a permanent irreversible change and to continue well beyond the planned lifetime of the project / development.

Table 4-4 Geographical extent of impact

Duration	Definition
Temporary	Impacts that are predicted to be of short duration (e.g. less than one year) and are temporary or intermittent in nature.
Short term	Impacts that are predicted to last for a limited period of time (e.g. between 1 and 5 years) and will cease on completion of the development activities (e.g. installation / construction) or as a result of planned mitigation, reinstatement or natural recovery.
Medium term	Impacts that are predicted to last more than a few years (e.g. between 5 and 10 years - depending on overall project lifetime). For example, impacts that might occur during construction and installation (e.g. over a couple of years) but may last longer than this until mitigation, reinstatement or natural recovery has taken effect.
Long term	Impacts that may, but not necessarily, commence during construction/installation and are expected to continue for the duration of the project, or in some cases beyond the lifetime of the project, before eventually ceasing. These include ongoing intermittent or repeated activities e.g. maintenance or seasonal events that are required to take place for the lifetime of the project.
Permanent	Impacts that are predicted to cause a permanent irreversible change and to continue well beyond the planned lifetime of the project / development.

Table 4-5 Frequency extent of impact

Frequency	Description
Continuous	Impacts that occur continuously or frequently.
Intermittent	Impacts that are occasional or occur only under a specific set of circumstances that occurs several times during the course of the Project. This definition also covers such impacts that occur on a planned or unplanned basis and those that may be described as 'periodic' impacts.

4.5.1.2 Impact magnitude criteria

Overall impact magnitude requires consideration of all the impact parameters described above. Based on these parameters, magnitude can be assigned following the criteria outlined in Table 4.6. The resulting effect on the receptor is considered under vulnerability and is an evaluation based on scientific judgement.

Table 4-6 Impact magnitude criteria

Magnitude	Criteria
Major	Extent of change: Impact occurs over a large scale or spatial geographical extent and /or is long term or permanent in nature. Frequency / intensity of impact: high frequency (occurring repeatedly or continuously for a long period of time) and / or at high intensity.
Moderate	Extent of change: Impact occurs over a local to medium scale / spatial extent and / or has a short to medium term duration. Frequency / intensity of impact: medium to high frequency (occurring repeatedly or continuously for a moderate length of time) and / or at moderate intensity or occurring occasionally / intermittently for short periods of time but at a moderate to high intensity.
Minor	Extent of change: Impact occurs on-site or is localised in scale / spatial extent and is of a temporary or short term duration. Frequency / intensity of impact: low frequency (occurring occasionally / intermittently for short periods of time) and / or at low intensity.
Negligible	Extent of change: Impact is highly localised and very short term in nature (e.g. days / few weeks only).
Positive	An enhancement of some ecosystem or population parameter.
Notes: Magnitude of an impact is based on a variety of parameters. Definitions provided above are for guidance only and may not be appropriate for all impacts. For example, an impact may occur in a very localised area (minor to moderate) but at very high frequency / intensity for a long period of time (major). In such cases expert judgement is used to determine the most appropriate magnitude ranking and this is explained through the narrative of the assessment.	

4.5.1.3 Impact likelihood for unplanned and accidental events

The likelihood of an impact occurring for unplanned / accidental events is another factor that is considered in this impact assessment. This captures the probability that the impact will occur and also the probability that the receptor will be present and follows the criteria set out in Table 4-7.

Table 4-7 Likelihood for Unplanned and Accidental Events

Likelihood	Quantitative definition	Qualitative definition
Likely	More than once per year	Event likely to occur more than once on the facility
Possible	Once in 10 years	Could occur within the lifetime of the development
Unlikely	Once in 100 years	Event could occur within lifetime of 10 similar developments. Has occurred at similar facilities.
Remote	Once in 1,000 years	Similar event has occurred somewhere in industry or similar industry but not likely to occur with current practices and procedures.
Extremely remote	Once in 10,000 years	Has never occurred within industry or similar industry but theoretically possible.

4.5.2 Receptor definition

4.5.2.1 Overview

As part of the assessment of impact significance it is necessary to assess receptor sensitivity, vulnerability and value. The sensitivity of a receptor is defined as 'the degree to which a receptor is affected by an impact' and is a generic assessment based on factual information whereas an assessment of vulnerability, which is defined as 'the degree to which a receptor can or cannot cope with an adverse impact' is based on professional judgement taking into account a number of factors, including the previously assigned receptor sensitivity and impact magnitude, as well as other factors such as known population status or condition, distribution and abundance.

4.5.2.2 Receptor sensitivity

Example definitions for assessing the sensitivity of a receptor are provided in Table 4-8.

Table 4-8 Sensitivity of receptor

Receptor sensitivity	Definition
Very high	Receptor with no capacity to accommodate a particular impact and no ability to recover or adapt.
High	Receptor with very low capacity to accommodate a particular impact with low ability to recover or adapt.
Medium	Receptor with low capacity to accommodate a particular impact with low ability to recover or adapt.
Low	Receptor has some tolerance to accommodate a particular impact or will be able to recover or adapt.
Negligible	Receptor is generally tolerant and can accommodate a particular impact without the need to recover or adapt.

4.5.2.3 Receptor vulnerability

Information on both receptor sensitivity and impact magnitude is required to be able to determine receptor vulnerability. These criteria, described in Table 4-6 and Table 4-8, are used to define receptor vulnerability as per Table 4-9.

Table 4-9 Vulnerability of receptor

Receptor vulnerability	Definition
Very high	The impact will have a permanent effect on the behaviour or condition of a receptor such that the character, composition or attributes of the baseline, receptor population or functioning of a system will be permanently changed.
High	The impact will have a prolonged or extensive temporary effect on the behaviour or condition of a receptor resulting in long term or prolonged alteration in the character, composition or attributes of the baseline, receptor population or functioning of a system.
Medium	The impact will have a temporary effect on the behaviour or condition of a receptor such that the character, composition, or attributes of the baseline, receptor population or functioning of a system will either be partially changed post development or experience extensive temporary change.

Receptor vulnerability	Definition
Low	Impact is not likely to affect long term function of system or status of population. There will be no noticeable long term effects above the level of natural variation experience in the area.
Negligible	Changes to baseline conditions, receptor population of functioning of a system will be imperceptible.

It is important to note that the above approach to assessing sensitivity / vulnerability is not appropriate in all circumstances and in some instances professional judgement has been used in determining sensitivity. In some instances, it has also been necessary to take a precautionary approach where stakeholder concern exists with regard to a particular receptor. Where this is the case, this is detailed in the relevant impact assessment Section.

4.5.2.4 Receptor value

The value or importance of a receptor depends on a pre-defined judgement based on legislative requirements, guidance or policy. Where these may be absent, it is necessary to make an expert judgement on receptor value based on the perceived views of key stakeholders, experts and specialists. Examples of receptor value definitions are provided in Table 4-10

Table 4-10 Value of receptor

Value of receptor	Receptor type	Definition (example only – does not cover all receptors)
Very high	Environmental receptors	Receptor of very high importance or rarity, e.g. species that are globally threatened e.g. IUCN Red List of Threatened Species ('Red List') including those listed as endangered or critically endangered and / or a significant proportion of the international population (> 1%) is found within the Project site.
	Cultural and socio-economic receptors	Receptor has no alternative to utilise an alternative area. Receptor is entirely dependent on the Project area for all income / activities. Receptor is the best known / only example to contribute to knowledge and understanding and / or outreach.
High	Environmental receptors	Receptor of high importance or rarity, such as species listed as near-threatened or vulnerable on the IUCN Red List. Habitats and species protected under the EU Habitats Directive. Bird species protected under the EU Birds Directive. Habitats and species (including birds) that are a qualifying interest of a SAC, SPA or Ramsar site and a significant proportion of the national population (>1%) is found within the Project site. Conservation interests (habitats and species) of Marine Protected Areas (MPAs), Heritage MPAs and MCZs.
High	Cultural and socio-economic receptors	Receptors and sites of international cultural importance (e.g. United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Sites (WHSs). Receptor has little flexibility to utilise an alternative area. Receptor generates the majority of income from the Project area. Receptor is above average example and / or has high potential to contribute to knowledge and understanding and / or outreach.
Medium	Environmental receptors	Receptor of least concern on the IUCN Red List, listed as a breeding species on Schedule 1 of the Wildlife and Countryside Act 1981, form a cited interest of a SSSI, are listed in the UK Biodiversity Action Plan or on the Birds of Conservation Concern (BOCC) 'Red list' and a significant proportion of the regional population (>1%) is found within the Project site.
	Cultural and socio-economic receptors	Receptor has some flexibility to utilise an alternative area. Receptor is active in the project area and utilises it for up to half of its annual income / activities.

Value of receptor	Receptor type	Definition (example only – does not cover all receptors)
		Receptor is average example and / or has moderate potential to contribute to knowledge and understanding and / or outreach.
Low	Environmental receptors	Any other species of conservation interest (e.g. BOCC Amber listed species).
	Cultural and socio-economic receptors	Receptor has high flexibility to utilise an alternative area. Receptor is active in the project area and other areas and is reliant on project area for some income / activities. Receptor is below average example and / or has low potential to contribute to knowledge and understanding and / or outreach.
Negligible	Environmental receptors	Receptor of very low importance, such as those which are generally abundant around the UK and Ireland with no specific value or conservation concern.
	Cultural and socio-economic receptors	Receptor is very active in other areas and not typically present in the project area. Receptor does not generate any income / activities from the project area. Receptor is poor example and / or has no potential to contribute to knowledge and understanding and / or outreach.

4.5.3 Consequence and significance of potential impact

4.5.3.1 Overview

Having determined impact magnitude and the sensitivity, vulnerability and value of the receptor, it is then necessary to evaluate impact significance. This involves:

- Determination of the consequence of impacts based on a consideration of sensitivity, vulnerability and value of the receptor and impact magnitude;
- Assessment of impact significance (in accordance with EIA regulations) based on the predicted consequence of the effect;
- Mitigation; and
- Residual impacts.

4.5.3.2 Assessment of consequence and impact significance

The effects associated with each impact are assigned a consequence ranking using expert judgement as shown in

Table 4-11. The significance of impact is derived directly from the consequence ranking.

Table 4-11 Assessment of consequence

Assessment consequence	Description (consideration of receptor sensitivity and value and impact magnitude)	Impact significance (EIA regulations)
Major consequence	Impacts are likely to be highly noticeable and have long term effects, or permanently alter the character of the baseline and are likely to disrupt the function and status/value of the receptor population. They may have broader systemic consequences (e.g. to the wider ecosystem or industry). These impacts are a priority for mitigation in order to avoid or reduce the anticipated effects of the impact.	Significant
Moderate consequence	Impacts are likely to be noticeable and result in lasting changes to the character of the baseline and may cause hardship to, or degradation of, the receptor population, although the overall function and value of the baseline / receptor population is not disrupted. Such impacts are a priority for mitigation in order to avoid or reduce the anticipated effects of the impact.	Significant
Low consequence	Impacts are expected to comprise noticeable changes to baseline conditions, beyond natural variation, but are not expected to cause long term degradation, hardship, or impair the function and value of the receptor. However, such impacts may be of interest to stakeholders and/or represent a contentious issue during the decision-making process, and should therefore be avoided or mitigated as far as reasonably practicable.	Not significant
Negligible	Impacts are expected to be either indistinguishable from the baseline or within the natural level of variation. These impacts do not require mitigation and are not anticipated to be a stakeholder concern and/or a potentially contentious issue in the decision-making process.	Not significant
Positive	Impacts are expected to have a positive benefit or enhancement. These impacts do not require mitigation and are not anticipated to be a stakeholder concern and/or a potentially contentious issue in the decision-making process.	Not significant

4.5.3.3 Mitigation

Where potentially significant impacts (i.e. those ranked as being of moderate impact level or higher in

Table 4-11 are identified, mitigation measures must be considered. The intention is that such measures should remove, reduce or manage the impacts to a point where the resulting residual significance is at a not-significant level. Mitigation is also proposed in some instances to ensure impacts that are predicted to be not significant remain so. Chapter 11 provides detail on these commitments and how any mitigation measures identified during the impact assessment will be managed.

4.6 Residual impacts

Residual impacts are those that remain once all options for removing, reducing or managing potentially significant impacts (i.e. all mitigation) have been taken into account.

4.7 Issues assessed

As detailed in Section 4.2, the scope of this EIA covers the installation, operation and decommissioning of the Tolmount East Development. The ENVID process, stakeholder consultation and the technical review phases, have highlighted the following issues being considered and agreed for assessment:

- Discharges to sea (see Chapter 5)
    - Discharges associated with the Project relate only to low volumes of cementing and fluids used in pipeline pre-commissioning operations, resulting in changes in water quality, localised and temporarily increased suspended solid concentrations, and possible impacts to organisms in the water column and on the seabed.
- Seabed disturbance (see Chapter 6)
    - Direct loss of benthic species;
    - Direct loss of existing seabed habitat;
    - Introduction of new habitat;
    - Direct loss of marine archaeological remains;

- Wider indirect disturbance to the benthic environment through the suspension and re-settlement of sediments disturbed by pipeline installation, anchoring, drilling and cuttings discharge, mud and cement discharges;

- Other Sea Users (see Chapter 7)
    - Interference with shipping and fishing activities that may occur in the area;
    - Loss of access to the area for other vessels on a temporary basis;
    - Increased risk of vessel collisions through the presence of the MODU and other vessels during drilling and installation activities; and
    - Increased risk of damage to vessels as a result of dropped objects.
- Atmospheric emissions (see Chapter 8)
    - Climate change due to greenhouse gases including carbon dioxide (CO_2);
    - Generation of acid rain from oxides of nitrogen (NOx) and sulphur (SOx); and
    - Human health impacts of ground level nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and ozone generated by the action of sunlight on NOx and volatile organic compounds (VOCs).
- Accidental events (see Chapter 9)
    - Possible toxicity and smothering impacts to birds, other marine species (e.g. marine mammals) and habitats through the release of hydrocarbons and chemicals from a well blowout, pipeline inventory loss offshore or the loss of the diesel or chemical inventory from the MODU.

4.7.1 Issues scoped out

During the ENVID workshop and as the EIA developed the following issues were reviewed, but it was considered that the potential impacts were too small and likely to be insignificant; it was therefore agreed they would be scoped out of further assessment in the EIA:

- Discharges to sea
    - There are to be no discharge of drilling mud (LTOBM) and cuttings, as these are to be skipped and shipped onshore for processing and disposal and are therefore scoped out;
    - Routine blackwater production (i.e. sewage), grey water (i.e. from showers, laundry, hand and eye wash basins and drinking fountains) and food waste (macerated) disposal (from MODU) – scoped out due to existing, effective management controls in place for such discharges;
    - Routine seawater usage for cooling (e.g. engine cooling) – scoped out due to the highly limited temporal and spatial extent of such discharges; and
    - Produced sand from the Tolmount East reservoir – scoped out as the material will be returned to shore, so there is no route for impact offshore.
- Physical presence
    - Conductors and pipeline producing heat within the marine environment – scoped out as the additional heat will be so limited as to pose no risk to the marine environment.
- Atmospheric emissions
    - Fugitive emissions (e.g. from seals, welds, valves, pipes, pumps, flanges etc. (MODU vessels) – scoped out as these emissions are expected to be at extremely low levels that, even cumulatively, would not contribute to any potential impact.
- Waste

  - Routine generation and disposal of non-hazardous waste streams – scoped out due to existing, effective management controls in place for waste;
  - Routine generation and disposal of special/ hazardous wastes, e.g. oily rags, medical waste, solvents, batteries, computers, fluorescent tubes, oil/grease/chemical cans/drums/sacks, contaminated produced sand, contaminated cuttings, pigging waste – scoped out due to existing, effective management controls in place for waste; and
  - Routine generation and disposal of radioactive wastes (disposal onshore) (e.g. NORM, contaminated cuttings, radiation sources in safety/ detection equipment etc.) – scoped out due to existing, effective management controls in place for waste.

- Accidental events
  - Accidental deposit of materials on the seabed (e.g. dropped objects, pipelines, ROV etc.) – scoped out due to existing, effective management controls in place for dropped objects;
- Underwater noise
  - Disturbance to marine mammals and fish from underwater noise emissions during drilling and vessel operations across the project area. The potential for injury from the introduction of underwater noise has been scoped out due to optimisation in the engineering design precluding the need for any piling activities within the Tolmount East Development. The noise emissions associated with construction activities (from drilling and vessels) are not able to generate enough pressure to cause injury. Although drilling is to occur, this activity will be at depth and the majority of noise generated by drilling will be directed into the seabed. For this reason, it is likely that continuous noise from the MODU and other project vessels, particularly those utilising DP to remain on station, will mask the noise emissions from drilling. Therefore, the dominant source of underwater noise across the project

area is associated with vessel activities. The baseline cumulative ambient noise levels from both normal vessel movement and natural sounds (e.g. associated with biological, hydrographic and climactic inputs) in the region of the Southern North Sea encompassing the project area is on the order of 110 – 115 dB, with an excess of 15 – 20 dB associated with shipping (JOMOPANS, 2021). Vessels associated with the Tolmount East Development are anticipated to generate a marginal increase to localised vessel activity during the construction period between March and May 2023 (Section 2.3), with a total of seven supporting vessels being deployed over this period. Changes to the ambient noise levels will be temporary and spatially constrained, and will not cause adverse impacts to individual receptors or significant disturbance to marine mammal populations across the project area or the wider region. For the above reasons it is considered that potential issues associated with underwater noise from drilling at the seabed, noise from the MODU and vessels can all be scoped out. As there is no piling associated with the Tolmount East development, there is no cumulative impact associated with piling construction works of nearby offshore windfarms (OWF) including Hornsea Two OWF, which is currently under construction.

4.8 Cumulative impact assessment

As per European Commission (1999 and 2017) guidance, the consideration of potential cumulative impacts is an important stage in the EIA process as combined incremental impacts pose a threat to sensitive receptors. The MMO considers that in order to fully discharge its duties under Section 69 (1) of the Marine and Coastal Access Act, cumulative and in-combination impacts must be considered (Kershaw *et al*., 2013).

When considering cumulative and in-combination impacts it is necessary to consider the following:

- Additive or incremental impacts: impacts that result from incremental changes caused by past, present and reasonably foreseeable actions together with the project; and

- Impact interactions: reactions between impacts of one project or between impacts of other projects in the area.

To assist the assessment of cumulative impacts, a review of existing developments (including oil and gas, cables and renewables) that could have the potential to interact with the Tolmount East Development was undertaken. The output of this review is reported in Section 3, and is considered when assessing the potential for cumulative impacts in Sections 5 to 10.

4.9 Transboundary impact assessment

The EIA Directive requires special procedures in the case that a project may have potentially significant impacts on the environment of other countries. For the purposes of providing adequate and effective consultation, any country which may be an affected party should be consulted. The Espoo Convention[2] requires notification and consultation only for projects likely to have a significant adverse environmental impact across boundaries. Each impact assessment Section contain sections which identify the potential for, and where appropriate, assessment of transboundary impacts.

4.10 HRA/MCZ Assessment

Under Article 6.3 of the Habitats Directive, it is the responsibility of the Competent Authority to make an Appropriate Assessment of the implications of a plan, programme or in this case project, alone or in combination, on a Natura site (SAC or SPA) in view of the site's conservation objectives and the overall integrity of the site.

As part of the assessment of impacts on key receptors, for those receptors that are a qualifying feature of a Natura site, relevant information on SACs or SPAs has also been provided as part of the impact assessment process. This information will then be used by the Competent Authority to determine the need for, and subsequently carry out (if required), an appropriate assessment of the Tolmount East Development Project.

For offshore areas (12 – 200 NM) the requirements of the Habitats Directive are transposed through the Conservation of Offshore Marine Habitats and Species

[2] The Convention on Environmental Impact Assessment in a Transboundary Context (informally called the Espoo Convention) is a United Nations Economic Commission for Europe (UNECE) convention signed in Espoo, Finland, in 1991 that entered into force in 1997.

Regulations 2017. In accordance with these Regulations, the impacts of a project on the integrity of a European site are assessed and evaluated as part of the HRA process.

In an analogous process, the Marine and Coastal Access Act 2009 requires the potential for significant risk to the conservation objectives of MCZs being achieved to be assessed. As with information for HRA, information in relation to potential impacts to MCZs in the area is provided in the 'Protected Sites' section of each impact assessment section where relevant.

4.11 Data gaps and uncertainties

The North Sea has been extensively studied, meaning that this EIA has been able to draw on a significant volume of published data. This bank of published data has been supplemented by a site survey programme and studies undertaken on behalf of Premier to collect environmental data, ensuring a robust baseline is available against which to assess impacts. These studies were completed in support of the recently approved Tolmount Development Project. The Tolmount Development is both larger in scale and closer to shore than the Tolmount East Development, and as such the modelling conducted for the Tolmount Development is expected to represent a worse case than is expected for the proposed Tolmount East Development Project. These studies include:

- Pipeline dewatering study to gain an understanding of chemical concentrations being discharged into the environment and to understand what areas of the marine environment the discharge could interact with;
- Accidental hydrocarbon release modelling to facilitate assessment of the impacts from worst case accidental event;
- Offshore cultural heritage assessment to highlight any areas of cultural significance;
- Fisheries intensity study to gain an understanding of fishing activity in the Project area and undertake a high-level assessment of potential socio-economic impacts to the fishing industry of development activities; and

)When evaluating and characterising potential impacts that could be associated with the Project, a variety of inputs are used, including baseline environmental data, modelling results, estimation of emissions and the Project footprint. These inputs carry varying levels of uncertainty and conservatism and although potential impacts may occur, they are not certain to occur (for example, there is some uncertainty in marine mammal response to certain noise emissions). To account for this uncertainty, worst case assumptions have been made, and where key uncertainties exist, they have been outlined within the impact assessment sections.

5 DISCHARGES TO SEA

5.1 Introduction

This chapter identifies and quantifies the discharges to sea associated with the Tolmount East Development (excluding the potential future development). It describes the management and mitigation measures employed to adhere to legislation and achieve Premier's environmental standards.

The Tolmount East appraisal well has already been drilled and the well sidetrack drilling mud is to be contained with cuttings skipped and shipped to shore for processing and disposal. There will be no further direct discharges to sea of drilling muds and cuttings associated with the Project. The only discharges to sea associated with the Project includes:

- Release of cement and clean-up chemicals during the drilling phase as considered in Section 5.4.1;
- Aqueous discharges due to the installation and commissioning of subsea infrastructure include chemicals used in pipeline flooding, cleaning, gauging, hydrotesting, leak-test and dewatering as discussed in Section 5.4.2; and
- Minimal and intermittent release of hydraulic fluid contained within an open system to support subsea valve actuation.

All produced water from Tolmount East will be treated onshore at Easington Terminal and there will be no discharges of Tolmount East produced water to sea (Chapter 2). Consequently, there will be no significant discharges to sea during the remaining construction and operational phases of the Project. Decommissioning is covered in Section 5.7, while discharges associated with vessel operations (sewage, drainage, etc.) are considered to have a minor environmental impact and are therefore not considered further in this section.

5.2 Regulatory controls

The key regulatory drivers that relate to the activities described in this section and which will assist in reducing potential impacts, are summarised below:

- Offshore Chemicals Regulations 2002 (as amended) (OCR): The OSPAR Decision relating to the Harmonised Mandatory Control System for the use and discharge of offshore chemicals is implemented on the UKCS by BEIS under the OCR. Under these Regulations, operators require permits to use and discharge chemicals;

- Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended) (OPPC): The OPPC Regulations were introduced to meet the OSPAR goal of reducing discharges of oil to the marine environment from the offshore oil and gas industry. The Regulations require a permit to be in place prior to the discharge of any oil to sea. During drilling operations and production, the Regulations will apply where any drill cuttings contain reservoir hydrocarbons, or during well clean-up if there are discharges of oil in water. Any discharges of oil to sea done by any kind of activity in the Project Area will require the relevant Oil Discharge Permit application to be submitted by Premier to BEIS at the appropriate time;

- Merchant Shipping (Prevention of Oil Pollution) Regulations 1996 (as amended): The Regulations implement MARPOL Annex 1 in the UK and control oily discharges from any vessel activity including machinery space drainage. The Regulations require all vessels to have in place a UK or International Oil Pollution Prevention Certificate to demonstrate compliance; and

- The Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008: The Regulations control sewage treatment and discharge and may apply to some offshore installations and vessels.

5.3 Assumptions and data gaps

Although there will be drilling of a sidetrack associated with the completion of the Tolmount East appraisal well, all mud and cuttings related to the drilling are to be skipped and taken to onshore for processing and disposal. As a result, there is not expected to be any further drilling discharges to sea, negating the need for dispersion modelling of drill and cutting cuttings. The assessment therefore focusses only on cementing and aqueous discharges and there are not considered to be any major data gaps in the assessment of discharges to sea.

5.4 Description and quantification of potential impacts

There will be limited discharges to sea associated with the Tolmount East Development due to the optimised engineering design and the planned construction activities. Drilling mud and cuttings associated with the well completion will be skipped and taken to shore along with fluids used in the well clean-up and testing. Cement will be mixed as required, so discharges would primarily occur during the cementing of the sidetrack. The only additional discharge during construction relates to the release of water at the Tolmount MFP associated with the pipeline pre-commissioning. There will be no discharges to sea during the operation of the Tolmount East development as any produced water will be piped to the Tolmount MFP and onshore to the Easington terminal for processing and disposal. The potential impacts to the seabed or water column associated with the limited discharge during construction activities are through the following mechanisms:

- Increased dissolved chemicals in the water column; and
- Increased suspended solids in the water column.

5.4.1 Drilling discharges

5.4.1.1 Drilling programme overview

As outlined in Chapter 2, the Project will be developed by re-entering, sidetracking and completing the existing appraisal well at Tolmount East. Drilling the 6” sidetrack on the existing appraisal well will entail using LTOBM. No discharge is to occur with this activity as the drill mud and cuttings is to be shipped to shore for treatment and disposal. A summary of proposed drilling programme for completing and sidetracking the existing appraisal well and the expected quantities of drill cuttings are summarised in

Table 5-1, noting again that it will not be discharged at sea.

Table 5-1 Drilling programme and mass of drill cuttings

Component	Sidetrack
Diameter (in)	6”
Length (m)	280
Mud type	LTOBM
Discharge type	No discharge to sea, skipped and shipped to shore
Estimated weight of cuttings (tonnes)	15

Drilling chemicals are used to maintain the desired technical composition of the mud to facilitate the drilling of the well. Chemicals for offshore use are approved by Cefas and categorised by applying the Offshore Chemical Notification Scheme (OCNS) ranking scheme based on aquatic and sediment toxicity, biodegradability and bioaccumulation potential. This scheme is the implementation made by the UK of the OSPAR Harmonised Mandatory Control Scheme (HMCS). Depending on which method of categorisation has been used, chemicals are assigned a letter (potential for environmental impact ranging from A (highest) to E (lowest) or a colour code (purple representing the highest threat to the environment and gold the lowest threat). The majority of the drilling chemicals likely to be used are categorised as PLONOR. The detail of the actual chemicals to be used or discharged and their quantities will be the subject of permit applications.

5.4.1.2 Cementing

Cementing associated with completion of the existing appraisal well will be treated in the same way as WBM and discharged to sea. To limit discharge, cement will be mixed as required. Therefore, the only instances that a discharge may occur would be in relation to an aborted cementing activity and during the washing down of equipment Table 5-2 provides reasonable worst case volumes of mixed cement that may be discharged during the cementing operations.

Table 5-2 Estimated mixed cement discharges per well section

Cement discharged per section	6"
Barrels	20
m^3	3.2

All chemicals to be used within the cement will be selected based on their technical specifications and environmental performance. Chemicals with substitution warnings (those chemicals that contain hazardous substances to the marine environment and their use and/or discharge selected for phase-out) will be avoided where technically possible.

5.4.1.3 Well clean-up and testing

As detailed in Section 2.5.6, during well clean-up and completion operations, the proposed well will be cleaned up to remove any drilling fluids waste and debris and prevent damage to the pipeline or topsides production facilities. Debris will be retained in skips and shipped to shore for treatment and disposal.

5.4.2 Aqueous discharges

5.4.2.1 Installation and commissioning overview

After the TE flowline has been installed, a series of pre-commissioning operations will be conducted as described in the Project Description (Section 2.6). The flowline will be flooded with seawater and then hydrotested (pressurised with seawater beyond the operating pressure for a short period) to check its integrity. The seawater used will be dosed with chemicals including biocides and oxygen scavengers (to prevent corrosion and bacterial formation), and small quantities of dye may be used to assist in leak detection. Typical dosages for these chemicals, based on industry experience of the product type and application, include 25 parts per million (ppm) for dyes and 475 ppm for biocides, corrosion inhibitors and oxygen scavengers. Prior to commissioning, the flowline will be dewatered from the subsea manifold to the Tolmount MFP. Water discharged will be at Tolmount MFP - either through an existing dump caisson, or over the side via temporary pipework.

5.4.2.2 Controls and Communications

Hydraulic fluid that will be used for subsea control of the valves will be a PLONOR chemical. As this is to be used in an open system, there will be a small discharge to sea when the valves actuate, at less than 1 kg. The detail of the chemical name, use and discharge pattern and quantities will be the subject of permit applications.

5.4.2.3 Potential Water Column Impacts

The flowline dewatering discharge, together with any smaller minor discharges associated with pressure testing of subsea equipment and the flowline, have the potential to affect water quality in the immediate vicinity of the discharge, with the potential for impacts on marine biota.

5.5 Management and mitigation

Premier procedures for chemical management, as well as specific regulatory controls, will be in place to prevent or reduce potential environmental impacts. These are in accordance with Premier's overall HSES management, with the overall aim of minimising environmental impact during all operations (Section 10.1). As such, a number of mitigation measures will be applied to the proposed project to limit, where practicable, the potential environmental impacts of discharges to sea, including:

- A rig audit will be conducted to the ensure drilling rig is in compliance with all relevant guidelines and legislation;
- Drilling mud and cuttings from the 6" sidetrack hole are to be skipped and shipped to shore for processing and disposal;
- No discharge of LTOBM or LTOBM contaminated cuttings to sea;
- Cementing procedures will be implemented to reduce unused cement;
- The Department sampling requirements will be followed when drilling through the reservoir section; and
- Alternatives to chemicals carrying substitution notifications will be sought;

- Chemicals with no or low potential for environmental impact (e.g. PLONOR) will be selected wherever practicable;
- Environmental risk assessment as part of OCR approval process, and identification of measures to reduce risk including chemical selection procedures, will be carried out to obtain approval for chemical use prior to operations commencing;
- Premier, in conjunction with its chemical suppliers, regularly investigates alternative technologies which may reduce the requirement for production chemical use. In addition, Premier is committed to trialling chemicals which have more environmentally acceptable components and which are not listed for substitution. An annual chemical substitution plan for sourcing, developing and trialling alternative non-sub chemicals across Premier's operations is maintained and submitted to OPRED;
- The actual concentrations of chemicals discharged during dewatering will be significantly lower than those applied to the flowline, as the chemicals will be used up whilst protecting the pipeline before it is dewatered.
- All produced water from Tolmount East will be treated onshore at Easington Terminal.

5.6 Cumulative and transboundary impacts

There are several other oil and gas projects within a 40 km radius of the Project, notably the Tolmount MFP Development which will have been recently completed by the time activities begin at Tolmount East.

Impacts to the water column include effects from discharges from flowline commissioning.

Dewatering operations are expected to cause a small and short-lived plume which potentially could contain toxic levels of some of the chemical(s) used during the installation of the pipeline. However, exposure of organisms in the water column to toxicity will be short-term and spatially limited and no cumulative impact to the marine environment is expected.

The limited quantity of chemicals discharged during the life of the Project and the use of appropriate management and mitigation measures reduces the likelihood of any measurable cumulative impacts to the benthic environment. Additionally, dilution of releases during the life of field will likely be rapid and potential impacts transient in nature. Considering this, no significant cumulative impacts are expected with regard to the water column.

Considering that the dewatering discharge point is 152 km from the UK/Netherlands median line, no transboundary impacts are expected.

5.7 Decommissioning

Decommissioning activities will be subjected to a Decommissioning Environmental Appraisal at the end of the field life and prior to decommissioning commencing. The requirement for any discharges to sea will depend on the Decommissioning Environmental Appraisal and the decommissioning strategy selected, which will be fully compliant with the regulations in place at the time.

5.8 Protected sites

The key drilling and commissioning discharges described above will not occur within any protected sites. As detailed in Section 3.4, there are no records of FOCI in the direct footprint of the Project, and those that occur in the vicinity are too far away (>40 km) to be affected (MMO, 2019a).

Cement and water discharges are only expected to result in short-term and small scale increases in water toxicity or suspended sediment loads, where the designated features within the sites not expected to be vulnerable to these changes. As such, there is considered to be no Likely Significant Effect (LSE) on SACs or SPAs and no significant effects on the conservation objectives of any MCZs, or on any protected species.

5.9 Residual impacts

5.9.1 Residual seabed impacts

Considering there will be no additional cuttings deposited due to the use of LTOBM and contaminated cuttings being shipped to shore for disposal, the proposed drilling operations is not considered to represent a significant residual impact to benthic species.

Furthermore, as related in Chapter 3 site-specific survey work around the infield area has identified no features (habitats or species) of conservation concern in the vicinity of the platform.

Receptor	Sensitivity	Vulnerability	Value	Magnitude
Seabed	Low	Negligible	Low	Negligible
Rationale				
The seabed surrounding the Project is typical of the central North Sea and predominantly gravel sand. As such, the value of the seabed receptor is considered to be **low**. The sensitivity of the seabed receptor is considered to be **low** as it has the ability to recover/adapt to short-term and reversible impacts. As the cuttings will be shipped to shore for treatment and disposal, with little to no discharge in relation to the Project, vulnerability is considered to be **negligible** and the magnitude is considered to be **negligible**.				
Consequence		**Impact Significance**		
Negligible		Not significant		

5.9.2 Residual water column impacts

Water column residual impacts relate to both the physical and chemical affects experienced predominantly by biota within the water column, including marine mammals, fish and planktonic species. Plankton are particularly susceptible to impacts from drill cuttings because they are generally non-motile, depending upon currents within the water column to travel, and cannot move away from an affected area.

A single discharge of inhibited seawater from the Tolmount East flowline will take place at the Tolmount MFP during pre-commissioning operations. The discharge will be temporary and is likely to be rapidly dispersed in the turbulent offshore environment meaning that there is no possibility of minor impact to species in the water column.

Receptor	Sensitivity	Vulnerability	Value	Magnitude
Water Column	Low	Low	Negligible	Negligible
Rationale				
Due to the regulated conditions of chemical use, the small discharge volumes in relation to the receiving environment, and the large dilution and dispersion available, impacts are expected to be largely non-measurable. So, sensitivity is therefore considered to be **low**. As discharge from the Project will either be skipped and taken to shore or as a single discharge at the Tolmount MFP, the vulnerability is considered to be **low**.				

No water column species of conservation concern are expected to occur in the proximity of the Project during construction operations, therefore the value of the water column receptor is therefore considered to be **negligible**. The predicted discharges will be rapidly dissipated within the water column due to rapid dispersion in the turbulent offshore environment, the extent of any change is expected to be small and transient and therefore the magnitude is considered to be **negligible**.	
Consequence	**Impact Significance**
Negligible	Not significant

6 SEABED IMPACTS

6.1 Introduction

The key activities that may impact the seabed are:

- Drill rig spud cans and anchoring;
- Installation of the WHPS and subsea manifold gravity base foundations;
- Seabed sweeping activities; and
- Rock armour along the entire pipeline and umbilical routes, forming two separate rock berms as the worst-case scenario, where the base case is to bury and trench the pipeline and umbilical.

The impacts associated with these activities have the potential to affect seabed receptors through the following mechanisms:

- Direct and indirect damage to biota (including benthos, fish and birds) and habitats, with short and long-term effects; and
- Direct and indirect damage to cultural heritage (marine archaeology).

The potential impact of discharges from construction and installation activities at Tolmount East is discussed in Chapter 5. However, there will not be any discharge (and therefore no deposition) of drill mud or cuttings from the sidetrack of the existing appraisal well to result in seabed impacts.

Specialist reports used to support this assessment are listed in Table 6-1.

Table 6-1 Supporting studies

Specialist	Details of study
Fugro	Tolmount Field Development geophysical, habitat assessment and environmental baseline survey (Fugro, 2015a, 2015b; Fugro, 2015c)
Ocean Ecology	Tolmount to Easington pipeline route environmental baseline survey and habitat assessment report (Ocean Ecology, 2018)
Wessex Archaeology	Cultural heritage technical report (Wessex Archaeology, 2018)

Xodus Group	Tolmount East Survey Gap Analysis (Xodus Group Limited, 2019)

6.2 Regulatory controls

The following legislation is key in relation to seabed disturbance from the Tolmount East Development in terms of the potential impacts to the seabed and benthic habitats offshore:

- The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020;
- The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999 (as amended);
- Marine (Scotland) Act 2010;
- Marine and Coastal Access Act (2009);
- Petroleum Act 1998;
- The EU Habitats Directive;
    - Conservation of Offshore Marine Habitats and Species Regulations SI 2017
    - Offshore Petroleum Activities (Conservation Habitats) Regulations 2001 (as amended);
- The Convention for the Protection of the Marine Environment of the North-East Atlantic (The OSPAR Convention);
- Convention on Biological Diversity; and
- The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention).

On behalf of the Scottish Government, JNCC, Scottish Natural Heritage (SNH) and Marine Scotland have together developed recommended lists of PMFs in Scotland's seas (Tyler-Walters *et al*., 2016). The list of PMFs has not been developed in accordance with any specific legislation, agreement or convention; it was developed to guide policy decisions regarding the conservation of Scotland's seas, through the identification of priority species and habitats. The list of recommended PMFs in Scotland's offshore waters was adopted in 2014 and contains 81 habitats and species considered to be of conservation importance (Tyler-Walters *et al*., 2016).

6.3 Assumptions

In order to ensure that the assessment of seabed impacts reflects the worst case scenario, key assumptions have been made regarding the following:

- The same series (Ensco 120 series) used for the drilling of the Tolmount MFP wells in 2020 will be used to sidetrack the Tolmount East appraisal well. Several worst case assumptions regarding the number of anchors and spud cans and the movements of anchor lines have been made;
- It is assumed that the export pipeline and umbilical will be surface laid and protected by a rock berm along their entire length; and
- It is assumed that any anodes or flanges located on the pipeline will result in a trivial increase in seabed disturbance and has thus been excluded from this assessment; and
- Although the base case is to trench and bury the pipeline and umbilical, the maximum likely rock berm heights and widths have been assumed for this assessment. Future design work is expected to reduce this where possible.

6.4 Data gaps

There are considered to be no major data gaps in the baseline information which would affect the assessment of impact on benthic biological features.

6.5 Description and quantification of potential impacts

The magnitude of the direct impact is the area of seabed that is expected to be directly disturbed or manipulated in some way due to the project.

Temporary direct impacts will result from the disturbance of seabed where sediment will be free to recover following the completion of installation operations.

Long-term direct impacts will result where the sediment is covered with subsea structures or stabilisation materials, which will be in place for the life of the Project, preventing recovery until they are removed. Permanent direct impacts will result where stabilisation materials are deposited that will not be removed (e.g. rock armour).

The direct impact area has been calculated by summing the expected disturbance footprints of all the relevant activities. Where activities overlap (for example seabed sweeping and/or dredging and pipeline laydown and rock dump), the activity covering the bigger footprint has been used to calculate the area affected in order to avoid double-counting.

The magnitude of the indirect area is the area of seabed that is expected to be affected by sediment re-settling following re-suspension due to direct disturbance. The indirect area is assumed to be twice the calculated direct impact area. This assumption is informed by the review of BERR (2008) which summarises modelled and observed indirect impact extents from sediment re-settlement in the SNS. BERR (2008) suggests a possible indirect impact range of 20 m to 200 m, assuming conservatively that all excavated material becomes suspended (which is not expected to happen). All indirect disturbance is expected to be temporary.

The area of direct and indirect seabed disturbance associated with each activity is presented in Table 6-2.

Table 6-2 Short and long-term, direct and indirect seabed impact areas

Parameter	Direct area (km^2)	Indirect area (km^2)
Short-term disturbance of the seabed		
4 x MODU anchors (5 m x 4.5 m) at Tolmount East appraisal well	0.00009	0.00018
4 x 500 m MODU anchor chains (each abrading a triangular area of seabed measuring 100 m in length and 20 m at the widest point)	0.008	0.016
3 x MODU spud cans (18 m diameter)	0.0076	0.0152
Temporary laydown of export pipeline (in event of bad weather) (4,000 m x 0.3048 m)	0.0012	0.0024

Parameter	Direct area (km^2)	Indirect area (km^2)
Pre-route surveys will identify if there is a requirement for boulder removal or pre-sweeping. If pre-sweeping is required it is likely to occur along up to 300 m of the pipeline or umbilical, impacting a 40 m wide corridor.	0.012	0.024
Pig launchers / receivers (5 m x 1 m)	0.000005	0.00001
Dead man anchors (DMA) x5 (1 m x 1 m)	0.000005	0.00001
Diver work baskets (2 m x 2 m)	0.000004	0.000008
ROV work baskets (4 m x 4 m)	0.000016	0.000032
Jumper deployment frames (10 m x 2 m)	0.00002	0.00004
Pressure gauges/skids (1 m x 1 m)	0.000001	0.000002
Survey tripods (2 m x 2 m)	0.000004	0.000008
Total short-term	**0.022**	**0.044**
Long-term disturbance of the seabed (indirect area will be short-term)		
Pre-route surveys will identify if there is a requirement for boulder removal or pre-sweeping. If pre-sweeping is required it is likely to occur along up to 300 m of the pipeline or umbilical, impacting a 40 m wide corridor.	0.012	0.024
Subsea manifold and gravity base foundation (20 m x 20 m)	0.0004	0.0008
WHPS and gravity base foundation (9 m x 9 m)	0.000081	0.00016
Surface laying of pipeline and rock dumping along its entire length (4,000 m) within a 9.4 m wide corridor.	0.03760	0.07520
Surface laying of umbilical and rock dumping along its entire length (4,000 m) within a 5.9 m wide corridor.	0.0236	0.0472
270 (6 m x 3 m) concrete mattresses protecting surface laid 12", 6" spool-pieces and flying leads	0.0049	0.0098
Grout bags (0.4 m x 0.25 m) for spool protection immediately adjacent to Tolmount East subsea structures and Tolmount MFP.	0.00006	0.00012
Rock filter bags (1.9 m x 0.4 m) adjacent to Tolmount East and Tolmount MFP (50 bags at each location)	0.000076	0.000152
Total long-term	**0.079**	**0.157**
Overall total	**0.101**	**0.201**

* Due to rounding of individual line item areas, the totals presented do not exactly match the sums of the line items; the totals are however accurate sums of the line item values when the missing decimal places are accounted for.

6.5.1 Direct impact

6.5.1.1 Effects on the benthos

Physical disturbance caused during the installation of the pipelines, umbilicals, and subsea facilities along with placement of rock and mattresses, may cause mortality or displacement of benthic species within the direct impact footprint. The significance of habitat loss or mortality of seabed organisms depends on the area of disturbance, the level of tolerance of the affected habitat and species to direct disturbance, the conservation value of the affected habitat or species and uniqueness of the affected habitats or species assemblages to the area.

The placement of the jack-up MODU spud cans and anchors, seabed sweeping/dredging and the rock placement activities will result disturbance of the sediment surface, penetration of the substrate, sediment supply disturbance, increase in scour, and changes in biodiversity from sediment composition.

Infaunal analysis indicates the dominant EUNIS biotope across the Project area is A5.251 (‘*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sands). Biotope A5.251 is expected to exhibit medium resistance[3] to these types of disturbance (Tyler-Walters *et al*., 2018), meaning some mortality can be expected (Tillin, 2016). This disturbance will be temporary and will cease once the seabed sweeping has taken place, the subsea infrastructure has been installed and the MODU is no longer in contact with the seabed. Recovery is expected to begin immediately after disturbance ceases. Biotope A5.251 is expected to exhibit high resilience, meaning that full recovery is expected within two years (Tyler-Walters *et al*., 2018). However, rock placement is expected to result in long-term impact as it will change the character of the seabed. Although the use of rock is the assumed worst case, with the base case for the pipeline to be trenched and buried along its entire length.

All biotopes, including A5.251 are by definition sensitive to impacts that result in change to another physical sediment type because this fundamentally changes the nature of the habitat in an area (Tillin, 2016). It can be expected that the areas covered with any

[3] Resistance refers to the ability of a receptor to absorb disturbance or stress without changing character.

infrastructure which lies on the seabed, including concrete mattresses, the WHPS and subsea manifold, will experience long-term change to another habitat type, with the loss of the existing biotope complex. Areas covered with rock armour (in the worst-case) will experience permanent change, since rock armour will remain *in situ* permanently and will not be recovered at the end of field life. The placement of concrete mattresses over the surface-laid spool pieces is likely to cause sediment supply disturbance due to the habitat being dominated by fine sands. However, in soft sediment environments concrete mattresses are likely to be naturally buried by sediment. This suggests the disturbance will be temporary and result in little or no impacts to sediment dispersion and deposition (Pidduck *et al*., 2017). Additionally, the new infrastructure and deposits are likely to develop a different faunal community from the surrounding soft sediment, similar to that found on examples of natural hard substrate in the area. The area affected by long-term and permanent disturbance will be extremely small (Table 6-2). Upon removal of the seabed infrastructure and concrete mattresses at the end of field life, recovery would be expected within two years as per the temporary disturbance. The base case is for the trench and burial of the pipeline and umbilical along the full length. However, in the worst case assumption where rock protection is required, the areas covered with rock armour will not recover to their previous condition. However, within soft bottom communities rock armour can act as an artificial reef and has the potential support growth of the associated species (Pidduck *et al*., 2017).

As described in Chapter 3, no EC Habitats Directive Annex I habitats were identified in the infield survey area which may be particularly sensitive to seabed disturbance (Fugro, 2015c; Ocean Ecology, 2018). Furthermore, there was no evidence for the presence of FOCI (as defined by JNCC and Natural England, 2016a) or OSPAR listed threatened / declining habitats or species. As such, there are not anticipated to be any seabed impacts to any species of conservation importance that would have any wide-scale effects on their conservation status.

6.5.1.2 **Effects on fish**

Fish are generally highly mobile and sensitive to pressure changes and visual stimuli. It is therefore expected that the majority of adult and sub-adult fish in the disturbance area will actively avoid physical damage. Given the wide area of similar habitat available and the temporary nature of the operations it is expected that fish will move outside the area of disturbance while installation activities are ongoing, and the Project area will be rapidly re-colonised following the cessation of installation activities.

Offshore installation is expected to take place as follows:

- September 2022 for the WHPS;
- Between February and May 2023 for the rig and manifold installation; and
- March 2023 for pipeline and umbilical installation.

The works coincide with known spawning and or nursery periods for cod (high nursery intensity), herring, lemon sole, plaice (high intensity spawning), sandeel and sprat (Coull *et al*., 1998), while delays in the Project schedule would extend the period of overlap with the above species. The majority of these species spawn over large areas and have planktonic eggs and larvae that become widely dispersed, therefore the proposed Project operations will only affect a small proportion of the spawn and juveniles of each affected species. Spawning and recruitment for these species is not expected to be affected beyond one year after cessation of the Project installation activities, and recovery is therefore expected to be rapid.

Herring spawning is considered vulnerable to disturbance because of the very specific and limiting benthic habitat requirements. Herring lay sticky eggs directly onto a seabed of coarse sand, gravel, shells and small stones (Saetre, 1999), meaning their available spawning habitat is limited (compared to species that are less selective). The majority of the Project area was found to be of low suitability for herring spawning (Figure 3-10), while the area around the Tolmount MFP was found to have moderate suitability (Fugro, 2015b).

Installation of the WHPS is expected in September 2022, the MODU in February 2023, and the pipeline and umbilical in March 2023. The installation timeframe for the WHPS in September overlaps with the expected herring spawning period of August to October. However, the WHPS is located in an area considered to have low suitability for herring spawning, thereby limiting the potential for direct effects.

The seabed area that has moderate suitability for herring spawning is in proximity to the Tolmount MFP in relation to the pipeline and umbilical, where the installation of the export pipeline and umbilical and rock placement will cause a direct permanent habitat loss of 0.059 km^2. However, the installation of these assets are scheduled to occur outside of the herring spawning period and are not considered to have any effects on the species.

Should delays occur in the installation programme of the subsea infrastructure, there is the potential for direct effects. The area of moderate suitability spawning ground potentially affected by direct disturbance, is expected to be very small compared to the area available. Furthermore, recovery associated with any disturbance is expected to be rapid, as it is likely to take one winter season for the sediment particle size distribution of the newly disturbed sediment to be re-sorted in line with the undisturbed sediment in the area. Nonetheless, Premier will be incorporating this consideration into the management of the construction works to limit the likelihood of a delays actually occurring to the activity.

6.5.1.3 Effects on marine archaeology

The wreck located approximately 280 m to the west-northwest of the Tolmount MFP (Fugro, 2015a) will be avoided by anchoring vessels for safety reasons. As such, no effects on the integrity of the wreck are expected. No other wrecks were identified as being within the proposed Tolmount East Development area (UKHO, 2019; Wessex Archaeology, 2018).

6.5.2 Indirect impact

6.5.2.1 Effects on the benthos

In addition to the direct loss and / or disturbance of benthic habitats, seabed disturbance will also potentially lead to the smothering of benthic species and habitats due to sediment suspension and re-settlement. Rock placed on the seabed, installation of subsea infrastructure and the installation and retrieval of spud cans associated with the MODU jack-up rig is likely to result in some sediment suspension. The sediment will be suspended in the water column and resettle in the immediate vicinity of the area of disturbance.

Exposure to higher than normal loads of suspended sediment has the potential to negatively affect adjacent habitats and species. The re-settlement of sediments can result in smothering (Gubbay, 2003), with the degree of impact related to the ability of buried species to regain the sediment surface or to clear particles from their feeding and respiratory surfaces.

The installation of the subsea infrastructure and the pipelaying activities may result in increased concentrations of suspended particles in the water near the seabed which may impair the respiration and feeding of benthic organisms, inducing metabolic stress and reducing growth and survival rates. Larger animals are generally more resistant to elevated levels of suspended solids in the water column, but some species are likely to be more sensitive than others. The re-settlement of sediments may result in the smothering of epifaunal species (see Gubbay, 2003 for a review), with the degree of severity related to the ability of receptors to clear particles from their feeding and respiratory surfaces (e.g. Rogers, 1990). Depending on the sedimentation rates, infaunal species and communities can work their way back to the seabed surface through blanket smothering (Neal and Avant, 2008).

DEFRA (2010) states that impacts arising from sediment re-suspension are short-term (generally over a period of a few days to a few weeks); in addition, infaunal communities are naturally habituated to sediment transport processes and are therefore less susceptible to the direct impacts of increased sedimentation rates and will work their way back to the seabed surface through blanket smothering. Sediment re-suspension and prolonged turbidity is only likely to persist in low energy areas with a high percentage of fine sediments (e.g. Hitchcock *et al*., 1996, in Gubbay, 2003). As outlined in Chapter 3, peak kinetic energy is moderate at Tolmount East. The shallow water depth and high current speeds suggest that the water column would frequently become turbid naturally, especially during storm events, which would create disturbance on a much larger scale than the proposed Project activities. Sediments across the Project area comprise fine to medium sand with a low mud content, and therefore disturbed sediments are expected to resettle quickly. In addition, as discussed in Section 6.5.1.1, Biotope A5.251 is expected to exhibit medium resistance and high resilience to changes in suspended solids and light smothering (Tyler-Walters *et al*., 2018).

The Tolmount East area is not considered to be an area of conservation importance for benthic species sensitive to smothering (e.g. ocean quahog) and does not lie in any protected site or Annex I habitat which could be impacted by large settlements of suspended sediment (Chapter 3).

6.5.2.2 Effects on fish

Fish eggs laid eggs on the seabed, are expected to be vulnerable to smothering. This is because smothering may decrease the oxygen supply. Herring eggs are of particular concern because herring is a UK BAP species. As noted in Section 3.3.3, the potential for herring spawning is low at Tolmount East and along the proposed pipeline route. One station at the Tolmount MFP was identified as moderate. Seabed disturbance is expected to occur in September and between March and May associated with the installation of the WHPS and subsea infrastructure respectively. Disturbance associated with the WHPS installation works coincides with the expected herring spawning period of August to October, there is therefore the potential for effects on herring spawning and laid fish eggs. However, as stated with respect to the direct impact (Section 6.5.1.2), the installation of the WHPS is in proximity to seabed areas considered to have low suitability for herring spawning.

The extent of indirect impacts are considered to be approximately twice the extent of the direct impact (BERR, 2008). The area of indirect impact associated with the of the WHPS and manifold and is small at approximately 0.001 km^2. The area of indirect impact is expected to be very small compared to the area available for herring spawning and is also unlikely to extend to the Tolmount MFP where the seabed of moderate suitability is located.

As the export pipeline and umbilical are to be installed outside of the herring spawning period, there is not considered to be any potential for effects on herring spawning. However, should any delay occur in the installation programme for the subsea structures, there is the potential for indirect impacts due to the likely proximity of the pipeline to the moderate suitability seabed. The area of indirect impact is still considered to be very small compared to the total area available for herring spawning across the SNS. Nonetheless, Premier will again incorporate this consideration into the management of the construction works to limit the likelihood of a delay actually occurring.

6.6 Management and mitigation

The following measures have been or will be taken in order to reduce seabed impacts as far as possible:

- Seabed surveys have been undertaken to identify the habitats and species present, and to assess the potential for herring spawning;
- Stakeholder consultation has been conducted to identify areas of stakeholder concern and draw on a wide expertise with regard to potential sensitivities;
- A detailed anchor pattern for the MODU will be developed prior to mobilisation; this will take account of any environmental sensitivities;
- Pipeline route optimisation has been conducted to minimise impacts on potential features of conservation interest;
- The spread of rock armour during placement will be reduced through use of a fall-pipe system held a few metres above the seabed to accurately place rock material;
- The volumes and locations of rock and concrete mattresses used will be refined during Detailed Design to reduce the footprint on the seabed to the minimum extent practicable. Noting that the base case is for the pipeline to be fully trenched and buried thereby limiting the requirement for rock armour protection;
- Monitoring of placement/laying operations using ROV will allow controlled placement of the spool pieces, concrete mattresses and rock armour by minimising the impact to the seabed; and
- The decommissioning philosophy has been included in the design phase of the Project. Project infrastructure has been designed to enable safe removal at the end of field life. Decommissioning will be performed in line with regulatory requirements at the time, which is likely to entail public consultation and a decommissioning EIA to minimise environmental impacts.

6.7 Cumulative and transboundary impacts

There are several other oil and gas projects within a 40 km radius of the Project, notably the Tolmount MFP Development which will have been recently completed by the time installation of Tolmount East begins. In addition, the seabed across the area is subject to fishing pressure as detailed in Section 3.5.

Whilst the Project will result in a predicted direct total disturbance of approximately 0.098 km^2 and an indirect impact of approximately 0.197 km^2 of seabed, the majority of this area will only be temporarily disturbed, and the area affected is small relative to the available similar habitat in the vicinity of the Project and in the wider SNS. The majority of the seabed disturbance associated with Tolmount East is expected to be short-term, with recovery occurring within two years. The total area disturbed is expected to be very small compared with disturbance caused by fishing activity, and disturbance associated with Tolmount East is expected to be indistinguishable from the normal annual variation in disturbance caused by fishing. As such, the Project is not expected to make a significant contribution to cumulative seabed impact.

The majority of the seabed disturbance is associated with the worst case rock armour covering the 3.74 km pipeline and umbilical. However, it is again noted that the use of rock armour is the assumed worst case, with the base case being the trench and burial along their entire length. Should the worst case rock armour be used, it will stay *in situ* post decommissioning the area will be permanently altered over a large surface area coverage.

The Project is located approximately 152 km from the UK / Netherlands median line, as such transboundary seabed impacts are not expected.

6.8 Decommissioning

Decommissioning activities will be subjected to a Decommissioning Environmental Appraisal at the end of the field life and prior to decommissioning commencing. The significance of any impact will depend on the baseline conditions at the time of the Decommissioning Environmental Appraisal and the decommissioning strategy selected, which will be fully compliant with the regulations in place at the time. As a worst case, impacts during decommissioning operations are expected to be on a similar scale to those occurring during installation. The engineering design for the Tolmount East development is such that the WHPS and manifold can be removed from the seabed as these are not piled. The base case for the development is also the trench and burial of the pipeline without the use of rock armour protection, although it is recognised that it may be necessary to maintain the pipeline integrity and safety for fishing trawls.

6.9 Protected sites

The Project is not located within any protected sites, and there are no known FOCI in the vicinity. As such, there will be no effects on protected benthic features from direct impacts. The only site close enough to potentially be affected by indirect impacts is the SNS SAC (Figure 3-14). Harbour porpoise are not expected to be sensitive to the temporary increases in sediment re-suspension and re-settlement associated with the installation operations associated with Tolmount East. Although this may impact prey availability, this is expected to be only temporary with minimal long-term impact.

As such, there is considered to be no LSE on SACs, SPAs and MCZs and hence no impact on conservation objectives or site integrity.

6.10 Residual impacts

Receptor	Sensitivity	Vulnerability	Value	Magnitude
Benthos	Low	Low	Low	Minor
Fish	Medium	Low	Medium	Minor
Rationale				
Indirect impacts are expected to be temporary and local in scale, and when set against the low sensitivity of the biotopes present, are expected to be of negligible significance. As the worst case, the direct impact magnitude has been presented here. No EC Habitats Directive Annex I habitats were identified in the infield survey area, and there was no evidence for the presence of FOCI, as defined by JNCC and Natural England, or OSPAR listed threatened / declining habitats or species. The benthic biotopes present along the proposed pipeline route are expected to have some tolerance to the predicted impact, with some ability to recover, therefore receptor sensitivity is **low**. Whilst full recovery of the benthic fauna is expected across the majority of the affected area, there will be a permanent impact over a very small area due to the worst case rock armour placement, therefore vulnerability is **low**. The benthos in the area is present across a wide area of the SNS and there are no known protected species or habitats in the impact area, therefore receptor value is considered **low**. While there will be a very small area of seabed that is permanently affected, this is not expected to degrade the function or				

value of the existing habitat and benthos, therefore the consequence is considered **low**. The magnitude of direct impacts will be local in scale (0.101 km^2) and the majority of the impact will be short-term, with a very small proportion of long-term or permanent direct impact. As such the direct impact magnitude is considered **minor**. Adult and sub-adult fish found in the affected area are expected to be tolerant to the expected scale and duration of direct impact and show rapid recovery following cessation of activities. Eggs and young juveniles, including of benthic spawners such as herring are expected to show low capacity to tolerate disturbance and therefore sensitivity is considered to be **medium**. Effects are expected to be short-term, with recovery in the season following cessation of disturbance. It is considered unlikely that there will be long-term effects above the level of natural variation, therefore vulnerability is expected to be **low**. Herring appears on the UK BAP list; therefore, receptor value is deemed to be **medium**. The long-term function and value of the fish population is not expected to be affected and therefore the consequence is considered to be **low**. Even with the occurrence of delays in the installation programme, the completed impact assessment is still considered to be applicable due to the short duration of works and associated short-term effects. As the consequences of the expected impact are low for all receptors, the impact is considered **not significant**.

Consequence	Impact Significance
Low	Not significant

7 OTHER SEA USERS

7.1 Introduction

The various stages of the Project have the potential to interfere with other shipping, navigation and fishing activities that may occur in the area. This could result in loss of access to the area for other vessels and increase the risk of vessel collisions. A Consent to Locate report produced by Anatec (2019) for Tolmount East has provided an assessment of the impact of the development on other sea users, and will be referred to throughout.

7.2 Regulatory controls

The regulatory framework which guides the management of impacts to other sea users from the proposed activities at the Tolmount East Project consists of the following legislation:

- Marine and Coastal Access Act (MCAA) 2009[4];
- Energy Act 2008;

Premier are aware of the relevant legislation, understand their responsibilities under this, and will adhere to all regulatory requirements.

7.3 Assumptions and data gaps

To ensure that the assessment of physical presence reflects the worst case scenario, a number of assumptions are made regarding Project activities. Primarily, these relate to vessel use and anchor systems.

It is considered that the information available to inform this assessment has been sufficient to undertake a thorough and accurate assessment of the potential impacts as a result of the physical presence of the Project.

[4] The MCAA includes provisions for the safety of navigation in UK waters, replacing the Coast Protection Act 1949. The Act includes navigational provisions, but virtually all activities associated with oil and gas exploration or production/storage operations do not require licences. Following the enactment of MCAA the Consent to Locate provisions of Section 34 of The Coast Protection Act 1949 were transferred to the Energy Act 2008 Part 4A to cover navigation considerations relating to exempted exploration or production/storage operations. The Consent to Locate provisions of the Energy Act Part 4A came into force in April 2011.

7.4 Description and quantification of potential impacts

The key impacts associated with Project activities which are likely to affect other sea users are:

- Increased vessel traffic
- Increased collision risk
- Temporary exclusion
- Snagging risk
- Dropped objects

These impacts will be described and assessed in the following Sections.

7.4.1 Increased vessel traffic and collision risk

The presence of Project vessels has the potential to interfere with other sea users (fishing and shipping), increasing the risk of vessel collision. A range of vessels will be utilised during installation and operation phases. A detailed breakdown of the types and duration of vessels required for the Project is presented in Section 2.9. Vessel movements associated with installation activities are due to commence in September 2022 and are anticipated to end in June 2023. Operations associated with the potential future development well are excluded from this assessment. There will be vessel continuously in the area approximately between March and May 2023, associated with the construction and installation. Following installation, other vessels will be required as part of routine maintenance and operation of the Project. Vessel presence will only be a few hours at a time throughout the planned operational life of the Project (20 years).

Based on installing the *Ensco 120* Jack-up drilling rig at the Tolmount East location, the annual collision frequency is estimated to be 1.9×10^{-3}, which corresponds to a collision return period of 520 years. This is above the historical average vessel collision frequency for offshore installations within the UKCS. The area is considered one of high-density shipping (7,837 ships per year passing within 10 nm of the Project; Anatec 2019). The high collision rate corresponds to the relatively high level of traffic in close proximity to the proposed Project (Anatec, 2019).

The Anatec 2019 Consent to Locate assessment also considered potential impacts on navigation. AIS data determined there are 46 shipping routes within 10 nm of the Project, amounting to an average of 21 vessels per day passing the Project area. Approximately 90% of traffic in the area can be attributed to tankers and cargo vessels (Anatec, 2019).

7.4.1.1 Assessment of impacts associated with increased vessel traffic and collision risk

A 500 m safety zone will be in place around the pipelay vessels during flowline installation works. Once installed and operational, there will be no permanent safety exclusion zone associated with the Project. However, Premier will apply for a safety zone for subsea infrastructure at Tolmount East. The intention of the exclusion zone is to reduce the potential for collision risk, though the closure of the area may impact other sea users.

The proposed Tolmount East Development will be located in relatively open waters and within a well-developed region of the SNS. Thus, mariners should already have an awareness that there may be offshore operations in the vicinity. Although many shipping routes transect the Project area, there is sufficient sea space in the wider region for all vessels to avoid the Project without significant route alteration (Anatec, 2019).

There are existing well established notification procedures required in advance of offshore installation activities (e.g. the requirements of Part 4a of the Energy Act and HSE Operations Notice 6 guidance). These, together with the use of AIS as an Aid to Navigation on all project vessels, will ensure awareness of the Project and associated offshore operations within the marine offshore and fishing industries and other sea users in the vicinity.

7.4.2 Temporary exclusion

As outlined above, the establishment of a temporary safety zone around dredging and pipelay vessels, and around the MODU when on location, will mean exclusion of other sea users, particularly shipping and fishing, from an area of approximately 0.8 km^2 (per safety zone) for the length of time that the activities occur. Pipeline installation works will lead to temporary and very short-term exclusion to other sea users from the immediate vicinity of the installation and pipelay vessels. The receptors for this temporary exclusion are not likely to change with distance along the pipeline route given its relatively short length (3.74 km).

In terms of fisheries, fishing effort in the vicinity of the Project occurs throughout the year; total days spent fishing annually has shown a slight increase from 2018 to 2019. The gear type dominating effort in the region is static gear (traps) although dredging also occurs. Some 1,264 days were spent fishing in the vicinity of the Project location in 2019. Shellfish species dominated the landings value and live weight in 2019 (see Section 3.5.1). The area of ICES rectangle 37F0 is approximately 3,549 km^2; the 0.8 km^2 area of a single temporary 500 m safety exclusion zone represents a very small proportion of the total area available to fisheries (0.02%). Furthermore, these exclusion zones will only be in place short-term. The length of time of the temporary exclusion zone will be reduced due to the shortened drilling programme as it is only the sidetrack of the existing appraisal well that is to be drilled.

7.4.3 Snagging risk

During drilling operations, there is the potential for the formation of mounds due to the deployment and recovery of the drill rig anchors. Over-trawling such anchor mounds with fishing gear could result in sediment being retained in fishing nets with potential damage of nets and equipment, affecting catches, and posing a threat to the safety of the vessel. These mounds are most likely to form in areas where sediments at or near the surface contain heavy clay. As discussed in Section 3.2.3, the seabed sediments in the Project area mostly comprise sand and gravel and the Project location is within a high energy environment. Consequently, it is considered anchor mounds have the potential to persist only in the short-term. If an anchor is laid in an area of exposed clay this has the potential to release clay into the water column. Clay could persist for longer in comparison to sand and gravel but is still anticipated to disperse relatively quickly and any holes in the seabed will refill rapidly with mobile sediment. So as a worst case it is anticipated that mounds have the potential to remain in the medium term.

A four-point anchoring system will be installed by the anchor handling vessels, the rig will then be unpinned, jacked down into the water and winched into its final position. On completion of drilling the anchor handling vessels will remove the anchors, take the MODU in tow, and leave the Tolmount East field. Given the water depth at Tolmount

East (approximately 50 m), the maximum anchor spread radius will extend to approximately 500 m, of which approximately 100 m of each anchor line will lie on the seabed.

The vessel used to lay the pipeline will use DP therefore there will be no snagging risk from anchor mounds relating to this process. No safety zone will be in place along the pipeline and, as such, once the installation and support vessels have moved out of the area, there will be no statutory restrictions on fishing in the vicinity. In the worst case assumption, the pipeline will be rock dumped along its length and there will be no physical restriction on ability to fish in the Project area in that respect. However, the physical presence of any rock placement and the presence of subsea facilities on the seabed have the potential to interact with fishing gear through the introduction of potential snagging hazards.

7.4.4 Dropped objects

There is the possibility for objects to be accidentally lost overboard during construction and installation activities and as part of normal operation and maintenance. If large enough, such objects can provide an uncharted obstacle that has the potential to damage fishing nets or fishing catch.

7.5 Management and mitigation

7.5.1 Increased vessel traffic and collision risk

A number of mitigation measures will be employed to minimise the impact of increased vessel traffic and collision risk resulting from the Project:

- A Consent to Locate is in place for the MODU and Premier will consult with relevant authorities and organisations to minimise interference impacts resulting from the proposed drilling activities;
- A standby safety vessel will operate on site for the duration of drilling operations;
- For the duration of the MODU being on site for drilling operations, navigation aids will be present on the vessel;

- When the MODU comes on site, it will have a 500 m safety zone around it. Once the MODU departs at the end of drilling, the 500 m safety zone will cease to exist;
- The main operators of ships passing in proximity to the Project activities will be provided with advanced notice of the drilling and installation operations. This will allow these vessels to revise their passage to take account of the operations at the site, should they consider it necessary;
- Reporting of the MODU move will take place in line with the requirements of Part 4a of the Energy Act and HSE Operations Notice 6 guidance. This includes informing the MOD Hydrographer and Maritime and Coastguard Agency (MCA). This will ensure details of the MODU locations are distributed via Notices to Mariners, Navtex and NAVAREA warnings, as well as to the appropriate Maritime Rescue Co-ordination Centre (MRCC);
- As part of the licence conditions for the Tolmount field, notification of the Project will be made to the MoD at least 12 months prior to operations commencing;
- The crew of the standby vessel attending the MODU will be experienced in traffic monitoring duties and should be briefed on the main routes of concern in the area;
- An automated AIS-based maritime traffic survey will be performed during the drilling operation to record the positions and characteristics of ships passing in the vicinity of the MODU;
- The MODU will be marked with AIS transceivers in order for vessels to observe the MODU on their AIS; and
- A collision risk management plan will be developed for the drilling operation to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the safety standby vessel whilst on location.

7.5.2 Temporary exclusion

Premier has reduced the vessel requirements and the number of vessels days as far as practicable whilst adhering to all safety and emergency response requirements.

7.5.3 Snagging risk

Mitigation measures will be employed to minimise the impact of snagging risk resulting from the Project including:

- The location of any anchors and associated anchor lines will be communicated to other sea users through standard communication channels, including Notices to Mariners and Kingfisher bulletins. This will be in the form of general communication that pipelay operations are being conducted and that there is an anchor spread, but precise anchor/wire positions will not be given as this will be a 24/7 activity;
- Premier has a Fisheries Liaison Officer (FLO), who will act as the Premier contact with fisheries organisations. Stakeholder engagement with local fishermen (the National Federation of Fishermen's Organisations (NFFO) has already commenced for Tolmount East and existing relationships will be maintained;
- Regular maintenance and pipeline route survey inspections will be carried out during the Project lifetime to ensure the pipeline remains in a favourable condition with minimal snagging risks;
- The subsea infrastructure and rock berms utilised are designed to be overtrawlable.

7.5.4 Dropped objects

The potential for dropped objects will be minimised during drilling, installation and operation through the following measures:

- Personnel will be suitably trained as to minimise the potential for dropped objects:
    - Lift planning will be undertaken to manage risk during lifting activities, and all lifting equipment will be tested and certified;
    - All deck items will be securely stowed;
    - All equipment and material on pipeline installation vessels will be adequately stowed or sea fastened;

  - Transfers of objects will use specialist equipment and consider environmental conditions; and
  - Procedures will be put in place to ensure that the location of any lost material is recorded and that significant objects are recovered where practicable and reported using PON 2 notification.
- The drilling contractor will have a dropped objects procedure which will be used for the proposed drilling operations to minimise any issues with dropped objects;
- Compliance to Lifting Operations and Lifting Equipment Regulations (LOLER) including inspection/testing; and
- Surveys will be undertaken to identify any debris within the Project location and along the pipeline route centreline prior to installation operations commencing. A post-installation debris survey will be performed once activities are completed. Specific debris surveys will not be undertaken along the pipeline route post installation, however 'as-built' surveys will be performed, which are likely to identify any significant dropped objects along the route.

7.6 Cumulative, in-combination and transboundary impacts

7.6.1 Increased risk of vessel collision

A number of developments in the vicinity of the Project (Section 3.5; Table 3-7; and Figure 3-15) will utilise vessels which have the potential to act cumulatively in increasing vessel collision risk posed by the Project. As mentioned in Section 7.1, shipping intensity and collision risk were assessed within the Consent to Locate prepared by Anatec (2019). It is considered that operationally active projects pose a significantly reduced collision risk, as operational phase vessel numbers are generally fewer in comparison to those needed for installation and construction. Furthermore, the Project is entirely subsurface therefore its long-term presence should not act in combination with any already active projects in terms of increasing collision risk.

With respect to projects which are under construction or have recently received consent, there is the likelihood of increased vessel activity which may act cumulatively with vessel activity relating to the Project. This is particularly true for those projects located closest (the Hornsea Project Four and Triton Knoll offshore wind projects which are 33 km and 60 km from the Project respectively). However, since it is unlikely that neither peak vessel activity nor vessel routes for these other projects will overlap with those for Tolmount East and considering the ample sea space available and the notifications to be provided, it is considered that such cumulative impacts will not be significant. With the reduction in drilling time due only sidetracking on the existing appraisal well, the potential for cumulative impacts will be reduced as the rid and associated vessel time in field would be considerably shorter.

7.6.2 Exclusion

The presence of Project vessels will result in temporary exclusion of other vessels from the area. Exclusion zones will apply during the installation and construction period of the Project, for example around the MODU. If these zones overlapped with other exclusion zones enforced by other projects, there would be a cumulative effect on the amount of area which is excluded to other sea users. DECC (2009) reports that exclusions and snagging risks to the fishing industry are cumulative to those resulting from natural obstructions, shipwrecks and other debris.

Exclusion zones for installation and construction activities will be temporary and short-term for the Project and for other projects. Furthermore, they represent a small fraction of the total sea area available for shipping and fishing activities (0.8 km^2). On this basis it is considered that the potential for cumulative impacts related to exclusion of other sea users is negligible. The length of exclusion will also be reduced due to the shortened drilling programme planned.

7.6.3 Snagging risk and dropped objects

Given the small potential for snagging risk and dropped objects as a result of the Project, it is considered that the chance for cumulative impact is negligible.

7.7 Decommissioning

It is anticipated that the decommissioning activities associated with the Project will in the main be a reversal of the installation activities and the majority of the potential impacts and the suggested mitigation and management relating to physical presence of the Project will be the same as has been described for installation. Any potential impacts that decommissioning operations may have on other sea users and wildlife interactions will occur in an area that experienced an impact during the installation operations. If not all the Project infrastructure is removed at decommissioning, then there are likely to be fewer activities/vessels present to cause physical presence impacts compared to the drilling and installation phases of the Project. In addition, the reduction in the drilling programme will result in less infrastructure to be removed at decommissioning, resulting in less impact on other sea users due to presence of rig/vessels to decommission. The majority of potential impacts will be of a similar or lesser magnitude than the impacts already described in this chapter.

During decommissioning, the WHPS and manifold are designed such that these can be removed, the well will then be abandoned and cut to below the level of the seabed. There is the potential that all or part of the pipeline and associated infrastructure including rock protection will be left *in situ*. In the worst case assumption that the pipeline is rock dumped and for the most part or overtrawlable, this would have no further impacts in terms of exclusion or snagging risk. However, if all or part of the pipeline is removed then there will be potential impacts similar to those described above for installation.

Prior to the end of field life, there may be changes to the statutory decommissioning requirements as well as advances in technology and knowledge. Premier will aim to utilise recognised industry standard environmental practice during all decommissioning operations in line with the legislation and guidance in place at the time of decommissioning. As an integral component of the decommissioning process, Premier will undertake a study to comparatively assess the technical, financial, health, safety and environmental aspects of decommissioning options, for which a further EIA may be required at that time.

7.8 Residual impacts

The information below presents the anticipated residual impacts as a result of the physical presence of the Project following from the mitigation measures outlined in Section 7.5.

Receptor	Sensitivity	Vulnerability	Value	Magnitude
Oil and Gas activities	Medium	Low	Low	Minor
Shipping	Low	Low	Medium	Minor
Fisheries	Low	Low	Low	Minor

Rationale

Oil and Gas activities

Although the Project will be located within relatively close proximity to a number of oil and gas developments, these should be able to tolerate the short-term exclusion and increased vessel activity. However, the nature of oil and gas developments is considered relatively sensitive thus the overall sensitivity is considered **medium**. There are not thought to be any long-term impacts on oil and gas developments in the area, and therefore, the vulnerability is considered **low**. The value of the receptor is considered **low** given the distance between the existing oil and gas activities and the Project. The magnitude of the impact to oil and gas developments from the Development is **minor** given the temporary and short-term nature of the disruption. Consequence is therefore **low**.

Shipping

The area is considered to have relatively high-density shipping (7,837 ships per year passing within 10 nm of the Project) and the collision risk has been reported as greater than average for the UKCS. Despite this, the sensitivity is considered **low** as the activity is capable of accommodating short-term interference. Vulnerability is also considered **low** as even though behaviour may have to change short-term, it is considered no long-term changes will be needed. The value of shipping is considered **medium** given the level of activity and number of routes in the area, though there is still some flexibility and adaptation possible. The magnitude is considered to be **minor** as the extent will be limited to the vicinity of the Project and the timescale is considered small as the main exclusion will occur throughout the installation operations. Consequence is therefore **low**.

Fisheries

Fishing effort within the Project area is considered to be low with the majority of vessels targeting shellfish. The sensitivity of fisheries to potential impacts as a result of the physical presence of the Project is considered to be **low** as the fishing industry has the ability to tolerate the impact and is also capable of adapting to any short-term exclusion. The vulnerability is also considered to be **low** as there are not expected to be any long-term effects to commercial fishing in the area. The value of the receptor is considered to be **low** as the effort in the area is considered to be low and forms a small part of a much larger area available for fishermen i.e. there is flexibility to utilise other areas. The magnitude of the impact is considered to be **minor** as any impact will be localised and largely of a short-term nature. Consequence is therefore **low**.

Consequence	Impact Significance
Low consequence	Not significant

8 ATMOSPHERIC EMISSIONS

8.1 Introduction

This section assesses the energy use that will occur as a result of the drilling, commissioning and operation of the Tolmount East Development (excluding potential future development) and presents an analysis of the atmospheric emissions associated with this energy use.

8.2 Regulatory controls

In the UK, there are a number of atmospheric regulatory controls which apply to offshore developments and require the provision of atmospheric emissions inventories, which are derived from:

- International Conventions;
- EU Directives; and
- National Regulations.

On a global scale, concern with regard to atmospheric emissions is increasingly focused on global climate change. The Intergovernmental Panel on Climate Change (IPCC) in its fifth assessment report (IPCC, 2014) states that 'Anthropogenic Greenhouse Gas (GHG) emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever.' This has led to atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century. IPCC (2014) states that the increased in GHGs emissions since the pre-industrial era have driven large increases in the atmospheric concentrations of CO_2, CH_4 and N_2O and that CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period. Between 2002 and 2011 CO_2 concentrations increased at the fastest ever decadal rate of change (IPCC, 2014).

The Kyoto Protocol is an international agreement, which the UK is party to and is linked to the United Nations Framework Convention on Climate Change with a principal aim of reducing GHG emissions. As part of the European Union's commitment to this protocol, it responded with the EU Emissions Trading Scheme (EU ETS) Directive. The Directive, currently in its 3rd Phase, has the main aim of reducing GHG and applies to installations with combustion facilities with a combined thermal input of >20 MW (th). The EU ETS covers the six greenhouse gases (CO_2, CH_4, N_2O, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons) that are included in Kyoto Protocol, although to date only CO_2 emissions have been quantified under the scheme.

Following the UK's departure from the EU, the atmospherics legislation that is derived from EU regulations has, as detailed above, effectively been transcribed into UK law so there is little variation in the regulations as a result of this. The most notable change is the withdrawal from the EU Emissions Trading Scheme (EU ETS). The Greenhouse Gas Emissions Trading Scheme Order 2020, which applies to atmospheric emissions of specific greenhouses gases from combustion equipment on offshore installations, came into effect on the 1st of January 2021 and sets out the UK Emissions Trading Scheme (UK – ETS) which largely mirror the previous EU ETS requirements, covering the same greenhouse gases as the EU system. It is noted that the emissions estimated for the Tolmount East Development are below the ETS threshold for participation in the scheme. However, Harbour Energy's Climate Change Policy and Net Zero commitment (Section 1.7) is for the reduction of Scope 1 and 2 emissions no later than 2035.

The Climate Change Act (2008) makes it the duty of the Secretary of State for Energy and Climate Change to ensure that the six 'Kyoto' climate gases are reduced to at least 80% of the 1990 baseline by the year 2050, by implementing a series of phased budgets. In June 2019 the UK committed to bringing greenhouse gas emissions down to reach the Net Zero target by 2050.

Atmospheric emissions regulatory control measures have been implemented under UK legislation include the National Emissions Ceiling Regulations 2018, which outlines a requirement for the Secretary of State to ensure that SOx, NOx, VOCs and ammonia in the UK do not exceed national emission reduction commitments. The Regulations also require a national air pollution programme to ensure that reduction targets are met.

The Merchant Shipping (Prevention of Air Pollution from Ships) (Miscellaneous Amendments) Regulations 2019, implement MARPOL Annex VI in the UK and establish controls on marine engines and marine fuel in order to limit emissions, in particular NOx and SOx. All vessels used during the proposed drilling project will have the appropriate UK Air Pollution Prevention Certificate (UKAPP) or International Air Pollution Prevention Certificate (IAPP) in place, as required.

In the UK, the Environmental and Emissions Monitoring System (EEMS) database has been designed to enable the analysis of offshore oil and gas environmental data. The database is operated by the OPRED and acts as the primary data storage and reporting resource for both the UK Government and offshore industry. EEMS provides the vehicle for offshore oil and gas industry emissions to be incorporated into annual UK inventories of atmospheric emissions.

The UK target to be net-zero GHG by 2050 is complementary to these regulatory requirements. The UK's commitment to Net Zero 2050 was made in 2019 and is aligned with Paris Agreement to which the UK is a signatory. There is also an initiative introduced by the World Bank to have Zero Routine Flaring by 2030 which is aligned with OGA's objective "*To ensure consistency of the OGA's offshore flaring and venting regime with MER UK and wider government policy, including emissions targets, by eliminating any unnecessary or wasteful flaring and venting of gas throughout the lifecycle of a petroleum installation and relevant facilities such as terminals*"[5]. This initiative is focused in eliminating routine flaring with the aim to minimise flaring for safety reasons or non-routine flaring. Premier's Net Zero commitment as detailed in Section 1.7 and its HSES management are also in accordance with these goals to limit and reduce environmental impacts.

8.3 Assumptions and data gaps

The following assumptions have been made when calculating the atmospheric emissions for the Tolmount East Development:

[5] https://www.ogauthority.co.uk/media/5014/flaring-and-venting-policy-position-website.pdf

- Vessels and helicopters included in the energy and gaseous emissions calculations are those presented in Table 2.8.
- There will be a 5-yearly survey of subsea structures during the life of the field lasting five days.
- Any well testing will be performed online for the Tolmount East Development. Therefore, there will be no emission to atmosphere.
- The Tolmount East development is a subsea development and will therefore not involve routine flaring to the atmosphere;
- Additional fuel use at the Tolmount MFP due to the Tolmount East Development will be negligible and as a result there will be no modifications to Tolmount MFP generator system.
- The Tolmount East Development will not alter the flow of degassed hydrocarbons to atmosphere currently occurring on the Tolmount MFP.
- There will be no additional venting at the Tolmount MFP.

8.4 Description and quantification of potential emissions

The emission of gases to the atmosphere from the Tolmount East Development could potentially result in impacts at a local, regional, transboundary and global scale. Local, regional and transboundary issues include the potential generation of acid rain from NO_X and SO_X released from combustion, and the human health impacts of ground level NO_2, SO_2 (both of which will be released from combustion) and ozone (O_3), generated via the action of sunlight on NO_X and VOCs. On a global scale, concern with regard to atmospheric emissions is increasingly focused on global climate change. The Intergovernmental Panel on Climate Change (IPCC) in its fifth assessment report (IPCC, 2014) summarises that 'Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases (GHGs) are the highest in history. Recent climate changes have widespread impacts on human and natural systems.' The IPCC report forecasts that global mean surface temperature change for the period 2016–2035 (relative to 1986–2005) will likely be in the range 0.3°C to 0.7°C (medium confidence). GHGs include water vapour, CO_2, methane (CH_4), nitrous oxides (N_2O), O_3 and chlorofluorocarbons. The most abundant GHG is water vapour, followed by CO_2. IPCC (2013) reports an approximately 40% increase in CO_2 concentrations compared to pre-industrial concentrations, to which the combustion of fossil fuels is the primary contributor.

Atmospheric emissions from the Tolmount East Development activities during the drilling, installation, and commissioning phases will include fuel consumption by the flowline and umbilical installation vessels, MODU, WHPS and manifold installation vessels, survey vessels, helicopters and flaring during well clean-up operations.

During the operational phase, there will be no increase in fuel consumption at the Tolmount MFP as a result of the Tolmount East well coming on line, as described further in Section 8.5.2.1. A summary of predicted atmospheric emissions for the Tolmount East Development is provided in Table 8-1.

Table 8-1 Atmospheric emissions from the Tolmount East Project (fuel use and emissions factors derived from Institute of Petroleum (2000) and Environmental and Emissions Monitoring System (2008))

Activity	Emission Source Details	Duration	Emissions (tonnes)							
			CO_2	CO	NOx	N_2O	SO_2	CH_4	VOC	CO_2e[1]
Pipeline and Subsea Installation Activities										
Pipeline pre-lay survey, boulder clearance and pre-sweep	Survey vessel (1)	27 days (September 2022)	1900.80	4.93	8.02	0.13	0.01	0.07	0.71	1949.14
Offshore pipelay	Reel lay (1)	4 days (March 2023)	190.20	0.94	3.54	0.01	0.72	0.01	0.14	196.31
Umbilical installation	Construction vessel (umbilical lay) (1)	4 days (March 2023)	190.20	0.94	3.54	0.01	0.72	0.01	0.14	196.31
Trench and backfill pipeline and umbilical	Trenching Vessel	14 days (March 2023)	665.70	3.30	12.39	0.05	2.52	0.04	0.50	687.10
Rock placement	Dynamically Positioned	8 days (March 2023)	456.48	2.26	8.50	0.03	1.73	0.03	0.35	471.15

[1] Carbon dioxide equivalent (CO_2e) is a term for descr bing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO_2e signifies the amount of CO_2 which would have the equivalent global warming impact.

	fall pipe vessel									
Offshore pipeline surveys, as-laid, OOS, as-built, metrology	ROV support vessel (1)	8 days (April 2023)	456.48	2.26	8.50	0.03	1.73	0.03	0.35	471.15
Install of Wellhead Protection Structure (WHPS) / 'J' tube drift	Dive support vessel	3 days (September 2022)	171.18	0.85	3.19	0.01	0.65	0.01	0.13	176.68
Installation of subsea manifold (including deployment of skid)	Construction support vessel (structures)	4 days (May 2023)	228.24	1.13	4.25	0.02	0.86	0.01	0.17	235.58
Installation and protection of tie-in spools between pipeline, Tolmount East (WHPS and	Dive support vessel (1)	28 days (June 2023)	1,597.68	7.91	29.74	0.11	6.05	0.09	1.21	1,649.04

manifold) and Tolmount MFP										
Drilling Activities										
Debris site survey	Survey vessel (1)	3 days (July 2022)	209.22	1.04	3.89	0.01	0.79	0.01	0.16	215.95
MODU move	Anchor handling vessels (2)	5 days (February 2023)	158.50	0.79	2.95	0.01	0.60	0.01	0.12	163.60
	Tow vessel (1)	5 days (February 2023)	79.25	0.39	1.48	0.01	0.30	0.00	0.06	81.80
Drilling	Safety standby vessel (1)	65 days (March-May 2023)	144.24	0.71	2.68	0.01	0.55	0.01	0.11	148.87
Drilling	Supply vessel (1), either at the MODU location or transiting to port and back for the duration of drilling activities.	65 days (March-May 2023)	2,060.50	10.21	38.35	0.14	7.80	0.12	1.56	2,126.74

	MODU 5 days in transit, and 65 days working	5 days (May 2023)	791.23	3.92	14.73	0.05	3.00	0.04	0.60	816.67
		65 days (March-May 2023)	10,286.02	50.94	191.44	0.71	38.94	0.58	7.79	10,616.66
	Spot hire vessel (1), likely base case 20% of the duration	32 days (March-May 2023)	507.20	2.51	9.44	0.04	1.92	0.03	0.38	523.50
Helicopter Flights	S-92 helicopter (flight route to be determined, but may be from Aberdeen)	5 return flights per week (March-May 2023) over 65 days or 9.3 weeks	235.95	0.62	0.01	0.02	0.03	0.01	0.18	242.51
Modifications to Tolmount MFP										
Walk-to-Work Vessel	Supply vessel (including 2 days for transit)	64 days (September 2022 - June 2023)	1,046.10	5.18	19.47	0.07	3.96	0.06	0.79	1,079.73

Helicopter Flights	S-76 helicopter (flight route to be determined, but may be from Norwich helicopter base)	5 return flights (2023)	5.59	0.01	0.00	0.00	0.00	0.00	0.00	5.74
Operations										
Pipeline integrity and inspection surveys	ROV support vessel (1)	1 survey every 5 years (for the duration of the fields life)	171.18	0.85	3.19	0.01	0.65	0.01	0.13	1 76.68
Decommissioning Activities										
Plug and Abandonment	Jack up MODU	34 days per well (~2048)	3,264.00	8.47	13.77	0.22	0.01	0.11	1.22	3,347.01
Well Clean Up Activities										
Flaring for well clean-up	1,000 te gas; 1,000 m3 condensate	2 days (2023)	6,000.00	24.70	4.90	0.16	0.03	70.00	30.00	8,215.38
Total Emissions for Tolmount East Development (Tonnes)			**30,815.94**	**134.86**	**387.95**	**1.88**	**73.56**	**71.29**	**46.82**	**33,793.29**

8.4.1 Well clean–up and testing

As previously discussed in Section 2.5.6, it is expected that flaring of gas and condensate will be required during the well clean-up period. This is not expected to last more than two days for the single well (i.e. <48 hours), during which time up to 2,000 Te of combined hydrocarbons (gas and condensate) will be flared. Flaring will be required until the well is producing within pipeline specification. The exact operational requirements will be confirmed prior to the sidetracking of the well. Emissions as a result of well clean-up flaring have been assessed and are presented within Table 8-1.

Any well tests undertaken for the Tolmount East Development well will be performed with the well online. Therefore, there will be no incremental emissions to atmosphere from online well tests.

8.4.2 Tolmount MFP fuel use

Power demand for Tolmount East Development is estimated to be 6 kW during normal operations and 39 kW during peak operations. There will be no required modifications to the Tolmount MFP generator system in order to meet the additional load. Incrementally, the emissions from Tolmount MFP generation may increase; however, this increase is likely to be a nominal with respect to typical fuel consumption on the Tolmount MFP.

8.5 Achieving Net Zero target for Scope 1 and Scope 2 GHG emissions

8.5.1 Background

It is intended that the Tolmount East project will be carbon neutral and it is clear that hydrocarbons have an important and long-term role to play in meeting the world's requirement for a reliable and affordable energy source. However, the period of transitioning to a lower-carbon future will mean that we need to improve our GHG performance. This will be achieved through two parallel work-streams:

- Minimising emissions, including through improved engineering and plant operational efficiency, and via investments in Best Available Technology (BAT) during the design phases of brown-field modifications and green-field projects; and
- To the extent that there remain irreducible emissions, from whatever source, Harbour will invest in Carbon Offsets for an increasing-portion of the Group's residual emissions year-on-year

The Tolmount East project will be carbon neutral across its full lifecycle, with respect to Scope 1 and Scope 2 GHG emissions through the application of direct design features as well as, where necessary, through investments to offset emissions (including the purchase of carbon credits). This fully supports the Harbour Energy policy commitment of achieving Net Zero across the entire portfolio by 2035.

8.5.2 Tolmount East Scope 1 and Scope 2 GHG Emissions

Scope 1 Emissions are defined in Premier's Group Environmental Performance Reporting Standard (CP-CP-PMO-HS-ZZ-ST-0026) and include (but are not limited to) stationary combustion (gas and diesel power generation), mobile combustion (vessels and drilling rigs), direct emissions (including leaks, unplanned releases, routine vents and process emissions) and fugitive emissions.

Scope 2 Emissions are defined in Premier's Group Environmental Performance Reporting Standard and include purchased electricity consumption. Scope 2 Emissions are not relevant to the Tolmount East subsea development.

The Tolmount East development emissions are approx. 33,793 t CO_2e (Table 8.1), with life of field emissions only coming from subsea related maintenance/inspection scopes, and any relevant maintenance required on brownfield modifications on the Tolmount MFP. Specific to Tolmount East, scope 1 emissions are discussed in the following sections.

8.5.2.1 Stationary combustion

Power demand for the Tolmount East Development will be met from the existing power generation facilities and associated operational philosophy at the Tolmount MFP, which has been subject to a comprehensive BAT assessment (AB-TO-WGP-TO-ME-SU-0002). The BAT assessment identified that power demands should be met by use of a 200 kW fuel gas driven generator with a 200 kW diesel driven generator as back-up for emergency power. The resulting emissions for the Tolmount MFP were assessed in the Tolmount Area Development Environmental Statement which concluded that the lifecycle power generation emissions from Tolmount MFP would be 34,962 tonnes CO_2.

The proposed Tolmount East Development will draw its power requirements from existing capacity generated on the Tolmount MFP, with no incremental Scope 1 power generation emissions directly related to the Tolmount East Development.

8.5.2.2 Mobile combustion - vessels and drilling rigs

There is no legislative mandate for contractors and suppliers to adhere to Scope 1 emissions reductions. However, Premier can influence the Scope 1 emissions performance and activities of key contractors (and their sub-contractors) in its supply chain. This is achieved through implementation of Premier's HSES Contractor Management process and HSES input to major contracts. Premier aims to select contractors with best-in-class HSES performance. Premier will drive improvements from suppliers as far as practicable to ensure that key contracts are being placed with responsible contractors. Furthermore, HSES measures may be incorporated as performance KPIs for key contractors. Emissions are tracked as part of Premier's Environmental Reporting standard, and reported to Premier's Corporate HSES function.

8.5.2.3 Unplanned releases, routine vents and process emissions

There will be a small amount of brownfield modifications undertaken at Tolmount MFP to tie in the Tolmount East Development. Any fugitive emissions from Tolmount MFP brownfield infrastructure will be calculated and attributed to Tolmount East as required. Any pipeline blowdown/venting from Tolmount MFP brownfield infrastructure will be attributed to Tolmount East emissions.

8.5.3 Tolmount East Scope 1 and Scope 2 GHG Emissions

The Scope 1 CO_2 emissions for the Tolmount East development are predominantly short-term project based emissions. Therefore, carbon neutral status for the Tolmount East development will be achieved through investments to offset emissions (including the purchase of carbon credits). This will primarily relate to the offshore drilling and subsea infrastructure phases as, with exception of subsea maintenance scopes through life-of-field, there are no direct atmospheric emissions for the Tolmount East subsea development. The emissions from the construction phase will be reduced due to the change in drilling plan to one well.

8.6 Management and mitigation

Premier will ensure that correct management procedures are in place to ensure the following:

- All vessels and the rigs employed during drilling and installation activities will comply with the Merchant Shipping (Prevention of Air Pollution from Ships)

(Miscellaneous Amendments) Regulations 2019 and will have the appropriate UKAPP or IAPP in place as required.

- There is no combustion equipment for Tolmount East. Therefore, Premier will be using the Tolmount MFP fuel generators. All combustion equipment will be subject to regular monitoring and inspections to ensure an effective maintenance regime is in place, ensuring all combustion equipment runs as efficiently as possible;
- Drilling and vessel operations will be carefully planned to reduce vessel numbers and the duration of operations; and
- Low sulphur diesel will be used (as per UK regulatory requirements).
- It is expected that the Tolmount East Development will be offset in a nature based scheme through investments including the purchase of carbon credits. This will relate primarily to the drilling and subsea construction phases as, with the exception of subsea maintenance scopes throughout life of field, there are no direct atmospheric emissions for the Tolmount East Development during the operational phase.
- Monitoring and reporting of atmospheric emissions associated with the Tolmount East Development (as part of the wider Tolmount Development), which will be assessed against business performance contract with an annual emissions target.
- No flaring is to be carried out as part of the operation of the Tolmount East Development, with minimal flaring, if at all required, as part of the well clean up and pre-commissioning.

8.7 Cumulative and Transboundary Impacts

8.7.1 Local air quality

Atmospheric emissions will be produced throughout the drilling, installation, commissioning and operation of the Tolmount East Development, which have the potential to have local or regional (including transboundary) effects. Any releases from drilling, installation and commissioning vessels will be transitory, whilst emissions from operational activities will be relatively constant (but minimal) throughout the life of the field. The Tolmount Development ES power generation has already accounted for the Tolmount East operations; therefore, it is difficult to attribute any emissions purely to Tolmount East.

As noted above, there is not expected to be any significant increment in emissions from Tolmount MFP as a result of Tolmount East coming online. The closest platform to the Tolmount MFP is the Minerva platform which is 14.3 km from the Tolmount MFP. The activities associated with the Tolmount East Project will be at closest approximately 29 km from the UK coast at Flamborough Head. This project is not expected to result in any impact on local air quality in the coastal area. Additionally, as the Tolmount East Development will utilise the existing Tolmount MFP, no cumulative impacts as a result of atmospheric emissions are expected.

The Project is 152 km from the UK/ Netherlands transboundary line at its closest point. The emissions are expected to be localised and to represent a very small increase in the baseline for the area, therefore a significant transboundary impact is not expected.

8.7.2 Global climate change

To understand the potential impact from the atmospheric emissions associated with the Tolmount East Development, it is useful to set the emissions in the context of wider UK emissions. Whilst, an exact figure for offshore emissions in UK waters does not exist, the contribution of emissions from shipping activities can be summed with oil and gas industry emissions to provide a benchmark against which the Tolmount East Development can be considered. The latest available total annual CO_2 emissions estimate from oil and gas exploration and production is 13,200,000 tonnes (for 2018, Oil and Gas UK, 2019) and the latest total annual CO_2 emissions estimate for UKCS vessel use is approximately 7,800,000 tonnes (for 2017, BEIS, 2019a), giving a total of 21,000,000 tonnes of CO_2. The total CO_2 emissions from the drilling and completion, installation and operation of the Tolmount East Development over the lifetime of the Project are estimated to be approximately 30,816 tonnes, which will contribute approximately to 0.006% of the atmospheric emissions associated with UK offshore shipping and oil and gas activities on average per year. Whilst this is a very small percentage of current UK offshore emissions, the UK Government has set a target of reducing the UK's overall GHG emissions to Net Zero by 2050 as part of the Climate Change Act 2008 and a series of phased budgets have been implemented (Table 8-2), with the 6th carbon budget setting a 78% reduction by 2035. As such, it is likely that the total annual emissions from the UK will decline over the life of the Tolmount East Development and it is important therefore to examine how the Tolmount East Development will sit within the context of declining UK emissions.

Table 8-2 UK Carbon Budget

Budget	Annual carbon budget	% reduction below base year (1990)
1st carbon budget (2008 to 2012)	3,018 million tonnes (Mt) CO_2e	23%
2nd carbon budget (2013 to 2017)	2,782 MtCO_2e	29%
3rd carbon budget (2018 to 2022)	2,544 MtCO_2e	35% by 2020
4th carbon budget (2023 to 2027)	1,950 MtCO_2e	50% by 2025
5th carbon budget (2028 to 2032)	1,765 MtCO_2e	57% by 2030
6th carbon budget (2033 to 2037)	965 MtCO_2e	78% by 2035

Table 8-3 presents Tolmount East Project CO_2e emissions against UK carbon budgets. The 6th carbon budget was published in December 2020 which allows the quantification of the percentage of Tolmount East Development up until 2037. As carbon budgets are not yet determined past 2037, it is not possible to quantify the percentage of Tolmount East Development CO2e emissions between 2037 and 2048 (the estimated end date for the project). Therefore, these values are not presented in Table 8-3, although they are considered and discussed with respect to the Project atmospheric emissions in Table 8-1.

Table 8-3 Tolmount East Project CO2e emissions against UK carbon budget (Committee on Climate Change, 2019; Committee on Climate Change, 2020)

Emission Item	Carbon Accounting Period			
	2018 to 2022	2023 to 2027	2028 to 2032	2033 to 2037
UK carbon budget for period (tonnes CO_2e)	2,544,000,000	1,950,000,000	1,765,000,000	965,000,000
Tolmount East Development emissions for period (tonnes CO_2e)	11,094	19,235	59	59
Tolmount East Development CO_2e emissions as % of UK budget	**0.0004%**	**0.001%**	**0.000003%**	**0.000006%**

The large majority of emissions from the Tolmount East Project occurs in the 4th UK carbon budget period from 2023 to 2027. For this carbon budget period, the UKs total carbon budget is 1,950 MT CO_2e. The total estimated Tolmount East Project CO_2e emissions for this five year period is reduced to 19,235 tonnes with the redesign of the drilling program, equating to less than 0.0001% of the UK budget, a very small component of the overall emissions in the UK. It should also be noted that, to an extent, the additional CO_2 emissions from the Tolmount East Project will be offset by reducing emissions associated with currently declining production in other UK oil and gas fields. In addition, the smaller amount of subsea infrastructure also reduces the amount of embedded carbon associated with the Tolmount East Development.

Overall, this assessment shows that the potential emissions from the Tolmount East Project will likely have a very limited cumulative effect in the context of the release of GHGs into the environment and their contribution to global climate change (i.e. will have no cumulative or transboundary impact).

8.8 Decommissioning

At the end of field life, the Tolmount East Development will be decommissioned. The decommissioning process will generate atmospheric emissions both directly from cessation operations such as well plug and abandonment activities, associated vessel traffic, and indirectly through the reuse and recycling of materials (e.g. steel). It is not possible at this stage to fully quantify the likely atmospheric emissions as carbon budgets for these periods have not yet been published, and exact emissions will depend on the removal technologies available at that time, as well as the regulatory requirements. It is anticipated that energy use and atmospheric emissions are likely to be limited compared to those seen during installation and commissioning activities since the main source of such emissions are the installation and well clean - up activities (Table 8-1). The total emissions from the MODU for plug and abandonment is predicted to be 3,347 tonnes CO_2e, which is reduced due to the change in drilling programme to one well.

8.9 Protected sites

Atmospheric emissions associated with the Tolmount East Project will not occur within any SAC, SPA, NCMPA or MPA. The atmospheric emissions are expected to represent a very small percentage (0.1%) of UK emissions and there is considered to be no cumulative impact from the Project with regards to the potential impact on protected sites. As such there is considered to be no Likely Significant Effect on SACs and SPAs and hence no impact on conservation objectives or site integrity. This assessment also considers there to be no potential for atmospheric emissions to interact with protected features of an NCMPA or MPA and there is therefore no significant risk to the conservation objectives of any NCMPA or MPA. No impact is expected on the seabed habitat features identified in FEAST.

8.10 Residual impacts

Given the temporally restricted nature of the majority of the atmospheric emissions from the Project and taking into account the distance that the Tolmount East Project is from any potentially sensitive receptors, it is not expected that atmospheric emissions will negatively impact local air quality.

In terms of global climate change (i.e. cumulative and transboundary impacts), the Tolmount East Project will add a relatively small increment to the overall offshore emissions of the UK and the release of GHG into the environment and their contribution to global warming will be negligible or minor in relation to those from the wider offshore industry and outputs at a national or international level. Premier aims to achieve carbon neutral status for the Tolmount East Development in line with its Climate Change Strategy. Low carbon goals were implemented in the design process with the aim to reduce emissions through the use of BAT and improved engineering (Section 8.5). Any cumulative impact is therefore considered not to have a direct impact on climate change.

Considering all of the above, including that there will be no impact on protected sites or on species from protected sites, the residual consequence of atmospheric emissions is ranked as negligible. As emissions will occur throughout the life of the Tolmount East Project, the frequency is defined as regular. As a result, the residual risk of atmospheric emissions from the Tolmount East Project will be negligible and is therefore not significant.

<table>
<tr><th>Receptor</th><th>Sensitivity</th><th>Vulnerability</th><th>Value</th><th>Magnitude</th></tr>
<tr><td>Atmosphere</td><td>Low</td><td>Low</td><td>Low</td><td>Minor</td></tr>
<tr><td colspan="5">Rationale</td></tr>
<tr><td colspan="5">The information in the Environment Description (Chapter 4) has been used to assign the sensitivity, vulnerability and value of the receptor as follows.

On the basis that the atmosphere has the capacity to accept the emissions without change, the receptor sensitivity is ranked as Low. As the sensitivity is ranked as low and the magnitude is ranked as minor, vulnerability is considered to be low. A ranking of low has been assigned to the value of the receptor as there are no air quality issues identified in the vicinity and the impact will only impact on a small area of the atmosphere in the immediate vicinity of the Tolmount East Project. In a global climate context, the anticipated emissions from the Project activities are limited. Considering this, including that effects unlikely to be discernible or measurable, the magnitude of impact is ranked as minor. On this basis, the consequence is negligible and the impact not significant.</td></tr>
<tr><td colspan="2">Consequence</td><td colspan="3">Impact Significance</td></tr>
<tr><td colspan="2">Negligible</td><td colspan="3">Not significant</td></tr>
</table>

9 ACCIDENTAL EVENTS

9.1 Introduction

All marine activities carry with them some risk of accidents. Accidents caused by human error, equipment failure or by extreme natural conditions may result in environmental impacts. The risk of accidental hydrocarbon releases is inherent in all offshore oil and gas activities, and an area of public concern that may have potentially significant impacts on water quality, flora, fauna and other users of the sea.

The potential impact of an accidental hydrocarbon or chemical release will be determined by the characteristics of the released hydrocarbon or chemical, its weathering properties, its trajectory and its proximity to environmental sensitivities. These environmental sensitivities will have spatial and temporal variations. Therefore, the likelihood of any accidental release having a potential impact on the environment must consider the likelihood of the release occurring against the probability of that hydrocarbon or chemical reaching a sensitive area, and the environmental sensitivities present in that area at the time.

This section assesses the effects of accidental events resulting from the Project. The Tolmount oil spill modelling report (Xodus Group Limited, 2020) is a supporting study which contributes to the accidental events impact assessment.

9.2 Regulatory controls

In addition to the EIA regulations detailed in Chapter 1.4, there are other requirements of UK and EU legislation, international treaties and agreements relevant to the assessment of impacts on accidental discharge events.

The following legislation is key in relation to accidental discharges from the proposed project in terms of the potential impacts to the offshore environment:

- The International Convention on Oil Pollution, Preparedness, Response and Co-operation (OPRC), which has been ratified by the UK, requires the UK Government to ensure that operators have a formally approved Oil Pollution Emergency Plans (OPEP) in place for each offshore operation or agreed grouping of facilities. This is enacted through The Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998;

- The Offshore Installations (Emergency Pollution Control) Regulations 2002 gives the UK Government the power to intervene in the event of an incident involving an offshore installation where there is, or may be, a risk of significant pollution, or where an operator has failed to implement proper control and preventative measures. These Regulations apply to accidental hydrocarbon releases;
- EU Directive 2013/30/EU on the safety of offshore oil and gas operations (the Offshore Safety Directive) came into force on June 2013. The objectives of the directive are to reduce as far as possible the occurrence of major accidents relating to offshore oil and gas operations and limit their consequences, thus increasing the protection of the marine environment and coastal economies against pollution. The directive aims to achieve this objective by establishing minimum conditions for safe hydrocarbon exploration and exploitation offshore as well as improving the response mechanisms in case of an accident; thereby limiting possible disruptions to the European Union indigenous energy production. The implementation of this directive in the UK is the joint responsibility of the Department for BEIS and the Health & Safety Executive (HSE), and it came into force 19th July 2015; and
- EC Directive 2004/35 on Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage (the Environmental Liability Directive) enforces strict liability for prevention and remediation of environmental damage to ‘biodiversity’, water and land from specified activities and remediation of environmental damage for all other activities through fault or negligence.

An assessment may also be required to determine if there could be any ‘likely significant effects’ from spill risk on any SACs or SPAs designated under the European Directives listed below, which are transcribed into UK legislation by the Conservation Regulations 1994 (as amended) for any sites located within 12 nm of the coastline and the Offshore Marine Conservation Regulations 2007 (as amended) for sites located beyond 12 nm. These regulations require the project developer to provide the information required by the competent authority (BEIS) to undertake such an assessment.

- EC Directive 92/43/EC (Habitats Directive). The Habitats Directive aims to “contribute towards ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora”. The central component of the Habitats Directive is the creation of the Natura 2000 network of SACs (also see Birds

Directive below). Once a SAC is established member states should ensure the protection and restoration of the sites in accordance with Article 6 outlining the minimum conservation measures to be ensured; and

- EC Directive 2009/147/EC (Birds Directive). This came into force on 15 February 2010 and replaced Directive 79/409/EEC. The directive produces a framework for the conservation and management of human interactions with wild birds in Europe. The directive sets out a broad spectrum of objectives although the precise legal mechanisms are at the discretion of the Member States. The Birds Directive also sets up a system of conservation designations for SPAs along the lines of SACs and the Habitats Directive. Together SPAs and SACs form the Natura 2000 network.

9.3 Description and quantification of potential impacts

9.3.1 Events and likelihood of occurrence

The industry standard terminology used to describe the probability of a spill has been adopted (Table 9-1).

Table 9-1 Terminology applied to describe oil spill probability

Term Used	Probability
Likely	More than once per year
Possible	Once every 1 to 10 years
Unlikely	Once every 11 to 100 years
Remote	Once every 101 to 1,000 years
Extremely Remote	Once every 1,001 to 10,000 years

Analysis of the UKCS historical data between 1975 and 2007 (UK Offshore Operators Association (UKOOA), 2006 and TINA Consulting Ltd pers. comm., 2013) shows that the majority of spills from offshore oil and gas operations are less than 1 tonne. This trend is particularly evident in recent years, where approximately 300 release events have equated to less than 100 tonnes of oil being released (Figure 9-1). UKOOA (now known as Oil and Gas UK (OGUK)) reports that, from 1975 to 2006, 46% of accidental release records relate to crude oil, 18% relate to diesel, and the other 36% relate to condensates, hydraulic oils, oily waters and other unknown types of hydrocarbon (UKOOA, 2006). This trend continues into more recent years, for example OGUK reported that in 2018 39% of accidental releases were related to crude oil, 22% related to diesel and the other 39% due to other types of hydrocarbons (OGUK, 2019).

During the period 1975 to 2013 inclusive, a total of 17,298 tonnes (approximately 20,500 m^3) of oil (excluding regulated discharges from produced water systems but including spills of base oil and oil-based mud) were released from 7,387 individual events on the UKCS. Whilst the number of reported spills increased over this period, since 1990 (with the exception of 1997) the overall volume of hydrocarbons spilled has been substantially reduced (UKOOA, 2006).

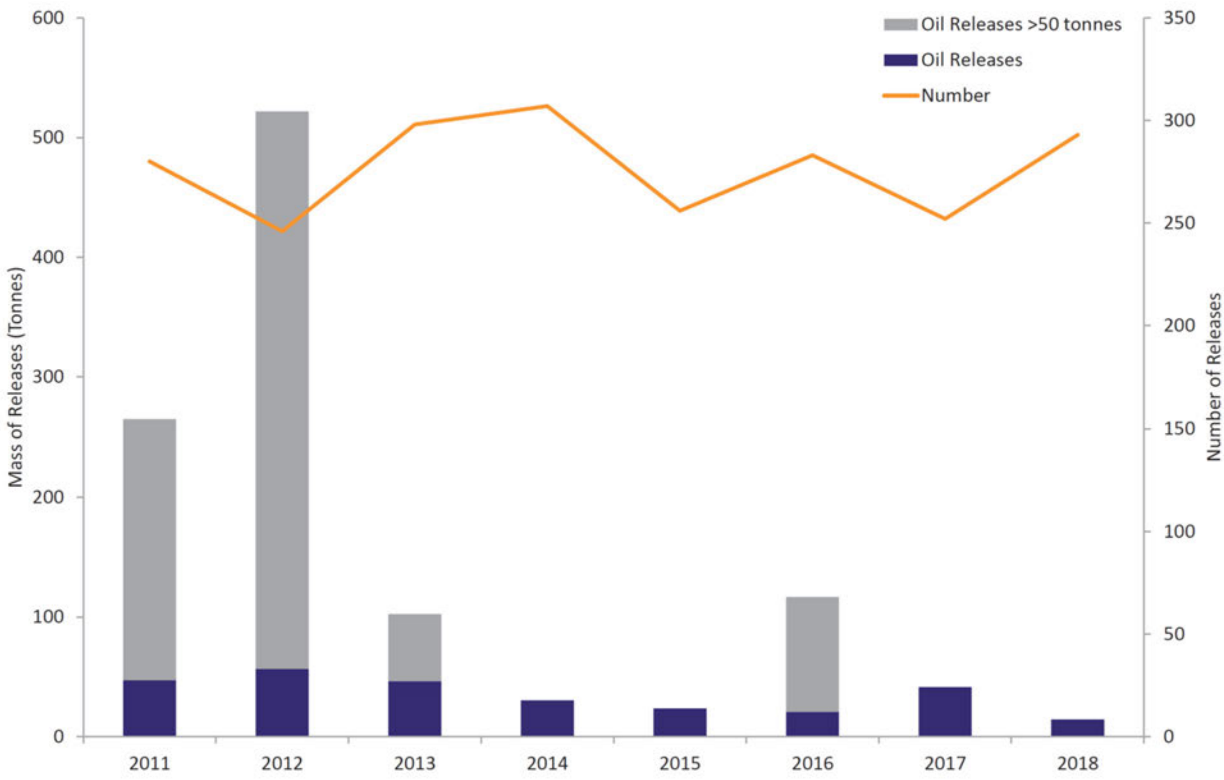


Figure 9-1 Time series of the number of accidental oil releases and the associated released amount from 2011 to 2018 (OGUK, 2019)

9.3.1.1 Blowout and well release

A surface blowout is defined as an uncontrolled flow of formation hydrocarbons from the reservoir to the surface which occurs as a result of loss of the primary and secondary well controls, i.e. oil flowing from a well from some point where a flow was not intended.

An underground blowout may occur if the downhole pressure exceeds the fracture pressure of a formation and hydrocarbons flow into the weaker formation.

Primary well control is the process which maintains the hydrostatic pressure in the wellbore which is greater than the pressure of the hydrocarbons in the formation being drilled, but less than the formation fracture pressure. If the formation pressure is greater than the pressure of the drilling fluid in the wellbore (i.e. mud hydrostatic) the well will flow, and the hydrocarbons will enter into the wellbore. If the primary well control fails this flow may be stopped by closing the BOP, which is the initial stage of secondary well control. Secondary well control is completed by circulating out and displacing the wellbore with a high-density fluid to shut in the well. If the primary and secondary well controls fail, then a blowout may occur.

Historical data on the frequency of blowouts from MODUs and production units on the UKCS between 1990 and 2007 is detailed in Table 9-2. The data does not provide information on the severity of the event or whether the blowout or well leak led to an accidental oil release. The most notable UK blowout from a MODU was in 1988 when an explosion led to a fire on a semi-submersible rig drilling a high-pressure high temperature (HPHT) field in the central North Sea.

Table 9-2 Blowout frequency per unit per year on the UKCS (OGUK, 2009)

Type of facility	Number of blowout events for a given period					
	1990 - 1999		2000 - 2007		1990 - 2007	
	Number	Frequency	Number	Frequency	Number	Frequency
MODU	13	0.020	3	0.0066	16	0.014
Production Unit	3	0.0034	1	0.0012	4	0.0023

Blowouts are extremely rare events in modern drilling. Table 9-3 shows the occurrences of blowouts during the different operational phases of hydrocarbon production between 1980 and 2014. Whilst over 6,000 development wells were drilled on the UKCS between 1980 and 2010 (UKOOA, 2010), Sintef (2017) reports that only 11 development drilling blowouts were recorded over the same period (and those blowouts also include the Norwegian sectors of the North Sea). The most recent serious UK blowout was in 2012 when an underground gas blowout led to evacuation of a platform and surrounding platforms in the central North Sea.

Table 9-3 Well blowouts during different operational phases 1980 – 2014 (Sintef, 2017)

Descriptor	Drilling			Completion	Workover	Production causes		Wireline	Total
	Development drilling	Exploration	Other			External*	Internal		
Number of well blowouts	11	33	1	7	14	1	5	10	84
Percentage (%)	13.1	39.3	1.2	8.3	6.7	1.2	6.0	11.9	87.7
*External causes include storm, military and ship collision									

Based on the definition in Table 9-1, the likelihood of a blowout or well release is considered remote to extremely remote.

9.3.1.2 Mobile offshore drilling unit (MODU) spills

The proposed re-entry and sidetrack of the existing appraisal well will be from a MODU (in this case a jack-up drilling rig). Potential accidental releases of hydrocarbon inventory from MODUs may be caused by mechanical failure, operational failure or human error, and potential accidental release sources include diesel, drilling muds, oil and chemicals and hydraulic fluids.

During the period 2001 to 2007, the operating drilling rigs on the UKCS had a combined total of 172 years of operation. No accidental releases greater than 100 tonnes were recorded on the UKCS between 2001 and 2007 and the majority of accidental releases recorded were less than 1 tonne (Table 9-4).

The most common types of accidental releases from MODUs were found to be associated with drilling (42%), but of these, 94% were less than 1 tonne. The second most common type of accidental release was found to come from maintenance/operational activities (27%). However, 97% of these were also less than 1 tonne.

Table 9-4 Number of accidental releases from MODUs based on UKCS historical data by release size and source during period 2001 to 2007 (TINA Consultants Ltd personal communication, 2013)

Accidental release cause	10 to <100 tonnes	1 to <10 tonnes	0.1 to <1 tonne	10 to <100 tonnes	10 to <100 kg	1 to <10 kg	All releases
Maintenance/ operational activities	***	1	5	4	14	10	35
Bunkering	***	***	9	2	9	2	22
Subsea releases	1	2	1	3	3	1	12
Drilling	1	2	15	15	6	12	54
ROV associated	***	***	***	1	3	1	5
Other production	***	***	1	***	***	***	1
All accidental releases	2	8	42	40	42	35	179
*Includes accidental releases of unknown size **Did not occur within the report period ***Includes accidental releases of unknown cause and accidental releases that could not be categorised							

The number and frequency of accidental releases from MODUs on the UKCS between 1990 and 2007 are shown in Table 9-5 with the number and frequency of accidental releases decreasing over time.

Table 9-5 Number and frequency of accidental releases per unit year from MODUs in the UKCS, 1990 – 2007 (OGUK, 2009)

Type of facility	Period					
	1990 - 1999		2000 - 2007		1990 - 2007	
	Number	Frequency	Number	Frequency	Number	Frequency
MODU	160	0.246	78	0.172	238	0.215

Table 9-6 highlights the number and frequencies of explosions, collisions and vessel contacts per unit for MODUs. These data indicate a reduction in the frequency of such incidents between 1990 and 2007. Whilst not indicating whether an accidental release occurred from the explosion, collision or vessel contact, this data indicates that the likelihood of incidents which could lead to an accidental release decreased during this period.

The potential MODU discharge scenarios (other than blowouts) which could result in the greatest impact are from incidents such as vessel grounding, collision or explosion. These could lead to a total loss of the hydrocarbon inventory (most likely to be marine diesel or base oil), although this is unlikely as the diesel/hydrocarbon stock is stored in multiple locations in separate tanks and containers.

Table 9-6 Number and frequency of explosions, collisions and vessel contacts per unit year from MODUs in the UKCS, 1990 to 2007 (OGUK, 2009)

Type of facility	Period					
	1990 - 1999		2000 - 2007		1990 - 2007	
	Number	Frequency	Number	Frequency	Number	Frequency
Vessel contact – MODU	108	0.166	25	0.55	133	0.120
Collision – MODU	14	0.021	1	0.0022	15	0.014
Explosion - MODU	10	0.015	No Data	No Data	10	0.009

9.3.2 Behaviour of hydrocarbons at sea

The potential environmental impact of a hydrocarbon release depends on a wide variety of factors, which in the offshore environment include:

- the release volume;
- the type of hydrocarbon released;
- the slick trajectory;
- the weathering properties of the hydrocarbon; and
- any environmental sensitivities present in the path of the slick (these may change with time) including potential beaching locations.

The Oil Spill Contingency and Response (OSCAR) model was developed by Sintef to model the fate of accidentally released hydrocarbons at sea. It has built-in databases which contains over 110 oils along with various gridded wind and current files, originally produced by the Norwegian Met Office. OSCAR is a three-dimensional model, designed to predict the fate of oil particles at the surface, sub-surface and once dissolved.

Seasonal (winter – December to February, spring – March to May, summer – June to August and autumn – September to November) stochastic modelling using OSCAR was undertaken in line with the OPEP guidance provided by BEIS (2019b). A minimum of 110 runs were performed for each season, with the historical meteorological data used to inform the model spanning a period of 5 years from 2008–2013.

The accidental release scenarios modelled for this project are detailed in Table 9-7. In line with current regulatory and industry commentary and experience with the worst case scenario identification, the following assumptions have been made while undertaking modelling:

- Interactions: all scenarios are run with the assumption that there is no response from any party, operator local or national government. This approach is taken in order to view the worst case predictions of a spill and should be used for guidance only to build and define oil spill contingency and response plans; and
- Timeframes: all modelled runs included at least an additional 10 days following cessation of release. The extra run time was in order to fully examine the fate of the released hydrocarbons.

In order to set limits for when the spilled hydrocarbon can be considered insignificant in the environment, the following thresholds have been used:

- The Bonn Agreement Oil Appearance Code is based on experimental evidence that has linked the visual appearance of surface oiling to known oil thicknesses. Under most viewing conditions, oil layers less than 0.04 µm in thickness cannot be easily detected by the human eye and appear silvery/grey up to a thickness of 0.3 µm. For this reason, a minimum surface oil thickness threshold of 0.3 µm has been used for all modelled scenarios.
- The limit of 0.1 litres/m^2 for shoreline oiling was applied to all scenarios in agreement with the lowest band of light oiling, as set out by ITOPF (2011).

As Tolmount East is only 4 km northeast of the Tolmount MFP, the results from the most up-to-date modelling scenarios undertaken for the Tolmount MFP Development have been used, where applicable, in the impact assessment as follows:

- **Scenario 1 - Well blowout** - the volumes modelled for a well blow-out in the Tolmount field are larger than those predicted for the Tolmount East well and the type of hydrocarbons expected (gas and condensate) are similar. Additionally, the Tolmount East is further offshore than the well in the Tolmount field so there will be less chance of beaching. The modelling results for Tolmount have therefore been used as they represent a worse scenario than a well blowout at Tolmount East;
- **Scenario 2 – Loss of MODU diesel inventory** - The MODU to be used is expected to be the same or similar to that used to drill the Tolmount well and, given that Tolmount East well is only 4 km away and also further offshore, the modelling conducted for Tolmount is also applicable for Tolmount East.
- **Scenarios 3a, 3b and 3c – Loss of pipeline inventory** – As the new flowline between Tolmount East and Tolmount MFP is only 12″ diameter and lies further offshore, the assessment is based on modelling of releases from three points along the Tolmount to Easington export pipeline as these represent representative worst cases for a pipeline release. The modelling takes account of the export of combined fluids from both Tolmount and Tolmount East.

Table 9-7 Summary of accidental release scenarios modelled for the Project

Scenario No.	Scenario description	Hydrocarbon type	Release volume	Modelled depth of release	Model type
1	Well blowout at Tolmount using the highest unconstrained well flow rate for 95 days	Tolmount condensate	97,052 m^3 (1,022 m^3/day for 95 days)	Seabed	Stochastic
2	Loss of MODU diesel inventory at Tolmount Platform	Marine diesel	600 m^3	Seabed	Stochastic
3a	Instantaneous pipeline inventory loss 15 km from shore	Tolmount condensate	500 m^3	24 m below the sea surface	Stochastic
3b	Instantaneous pipeline inventory loss at the midpoint	Tolmount condensate	500 m^3	24 m below the sea surface	Stochastic
3c	Instantaneous pipeline inventory loss at the installation	Tolmount condensate	500 m^3	24 m below the sea surface	Stochastic

Scenario 1: Well blowout at Tolmount

The probability of surface oiling following the well blowout scenario is presented in Figure 9-2. The model predicts the release area to be restrained to the east coast of England, with a potential to cross the Netherlands waters during Spring and Summer. The model predicts this scenario to cause a hydrocarbon contamination within 150 km of the installation with the majority of the contaminated area being less than 5 μm thick (Figure 9-3).

The probability of shoreline contamination is presented in Figure 9-4. The greatest probability of oiling is predicted in the East Riding area of Yorkshire (100 %) during the winter and spring scenarios. During the summer scenario shoreline oiling was predicted on the coastlines of North Lincolnshire, East Riding of Yorkshire, Northeast Lincolnshire, Boston District, Scarborough District, East Lindsey District, East Suffolk District and Great Yarmouth District. During the spring scenario it was predicted to occur on the coastlines of County Durham, East Riding of Yorkshire, Northeast Lincolnshire, Hartlepool, Redcar and Cleveland, Boston District, Scarborough District, Tendring District, East Lindsey District, East Suffolk District and Great Yarmouth District. During the autumn scenario it was predicted to occur on the coastlines of County Durham, East Riding of Yorkshire, Northeast Lincolnshire, Hartlepool, Redcar and Cleveland, Boston District, Scarborough District, East Lindsey District and Great Yarmouth District. Whilst during the winter scenario it was predicted to occur on the Scottish Borders, Fife, Sunderland District, North Tyneside District, South Tyneside District, County Durham, North Lincolnshire, East Riding of Yorkshire, Northeast Lincolnshire, Hartlepool, Redcar and Cleveland, Boston District, Scarborough District, Tendring District, East Lindsey District, East Suffolk District and Great Yarmouth District coastlines (Xodus Group Limited, 2020).

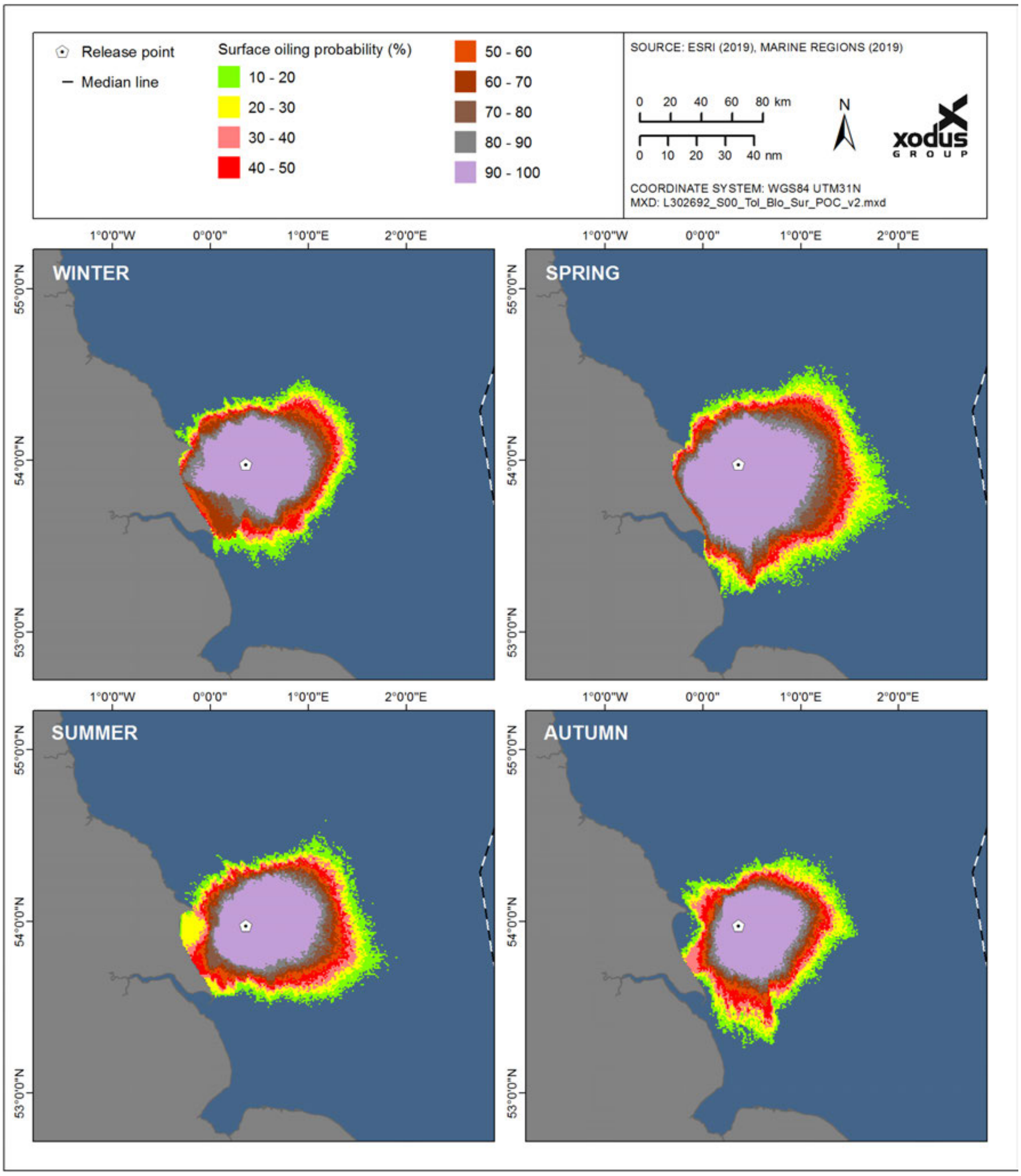


Figure 9-2 **Scenario 1 – well blowout: surface probability of contamination (above 0.3 µm thick)**

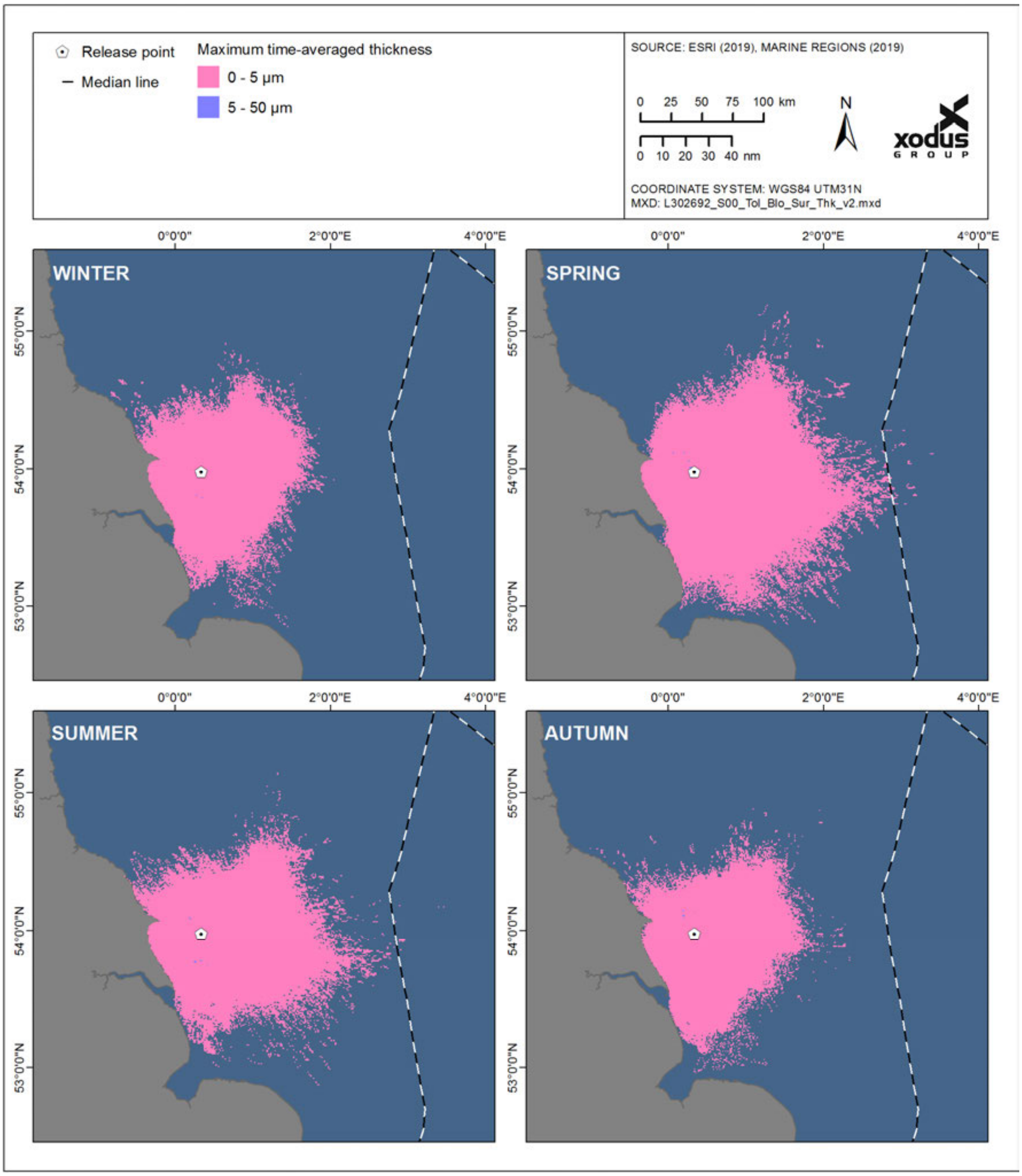


Figure 9-3 **Scenario 1 – well blowout: maximum time-averaged surface oil thickness (above 0.3 µm thick)**

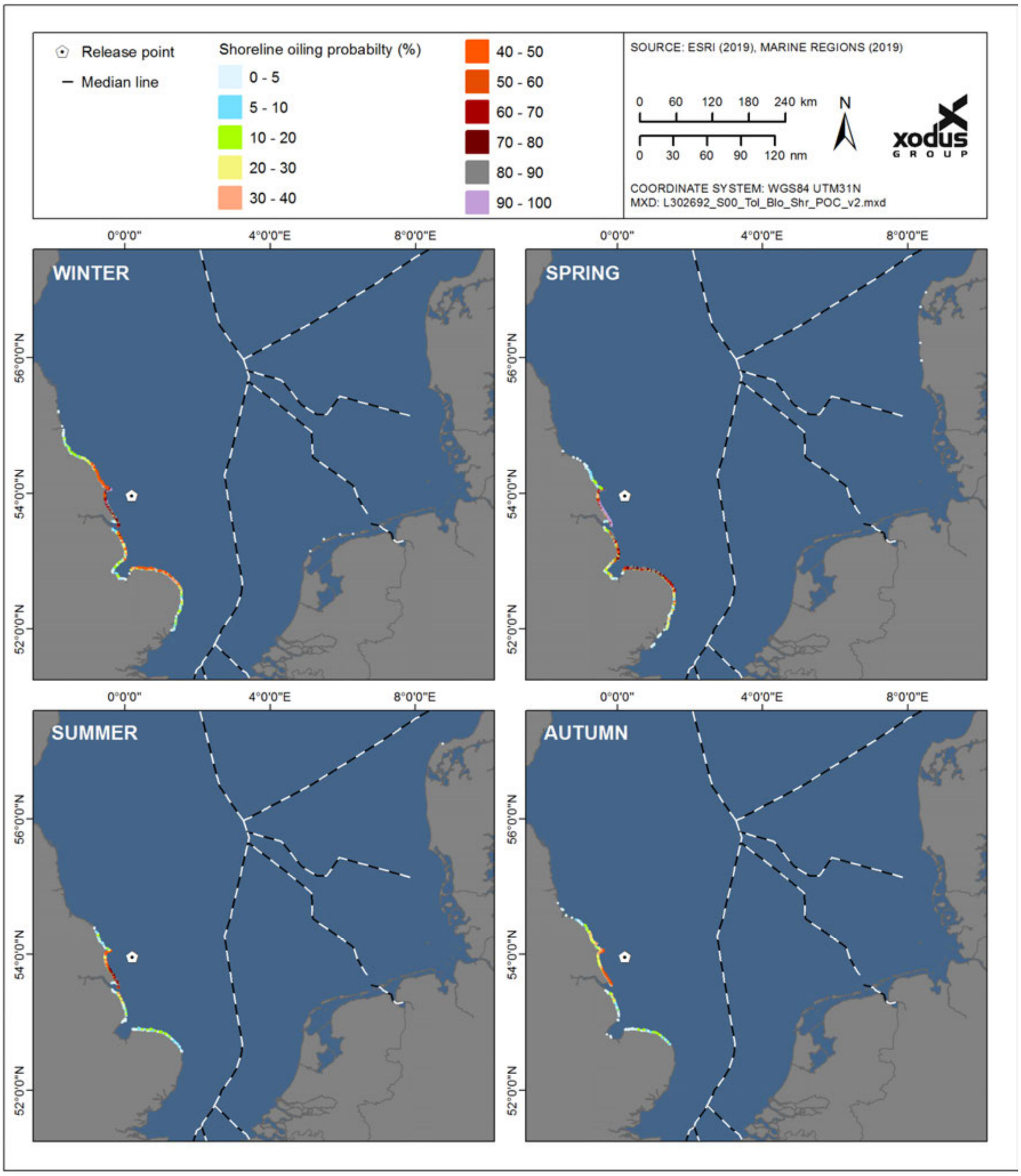


Figure 9-4 Scenario 1 – well blowout: shoreline probability of contamination

Scenario 2: Loss of MODU diesel inventory

The predicted probability of surface oiling is presented in Figure 9-5. The predicted area of contamination is relatively small; being restricted to an area off the Yorkshire coast. The release is not predicted to cross any maritime boundaries. Figure 9-6 shows the predicted maximum time-averaged surface thickness of the release. The release is predicted to be thickest close to the release location, up to a maximum of 1000 μm, but the majority of the surface area is predicted to receive oil thicknesses of less than 50 μm.

The probability of shoreline oiling is presented in Figure 9-7. Beaching is predicted to occur on the North Lincolnshire, East Riding of Yorkshire, Northeast Lincolnshire, Scarborough District and East Lindsey District coast coastlines during the winter scenario. The East Riding of Yorkshire, Northeast Lincolnshire, Scarborough District and East Lindsey District coastlines are predicted to be reached during the spring and summer scenarios. Shoreline oiling was predicted during the autumn scenario on the East Riding of Yorkshire, Scarborough District and East Lindsey District coastlines. The maximum probability of beaching is predicted in East Riding area of Yorkshire (51 %) during the summer scenario.

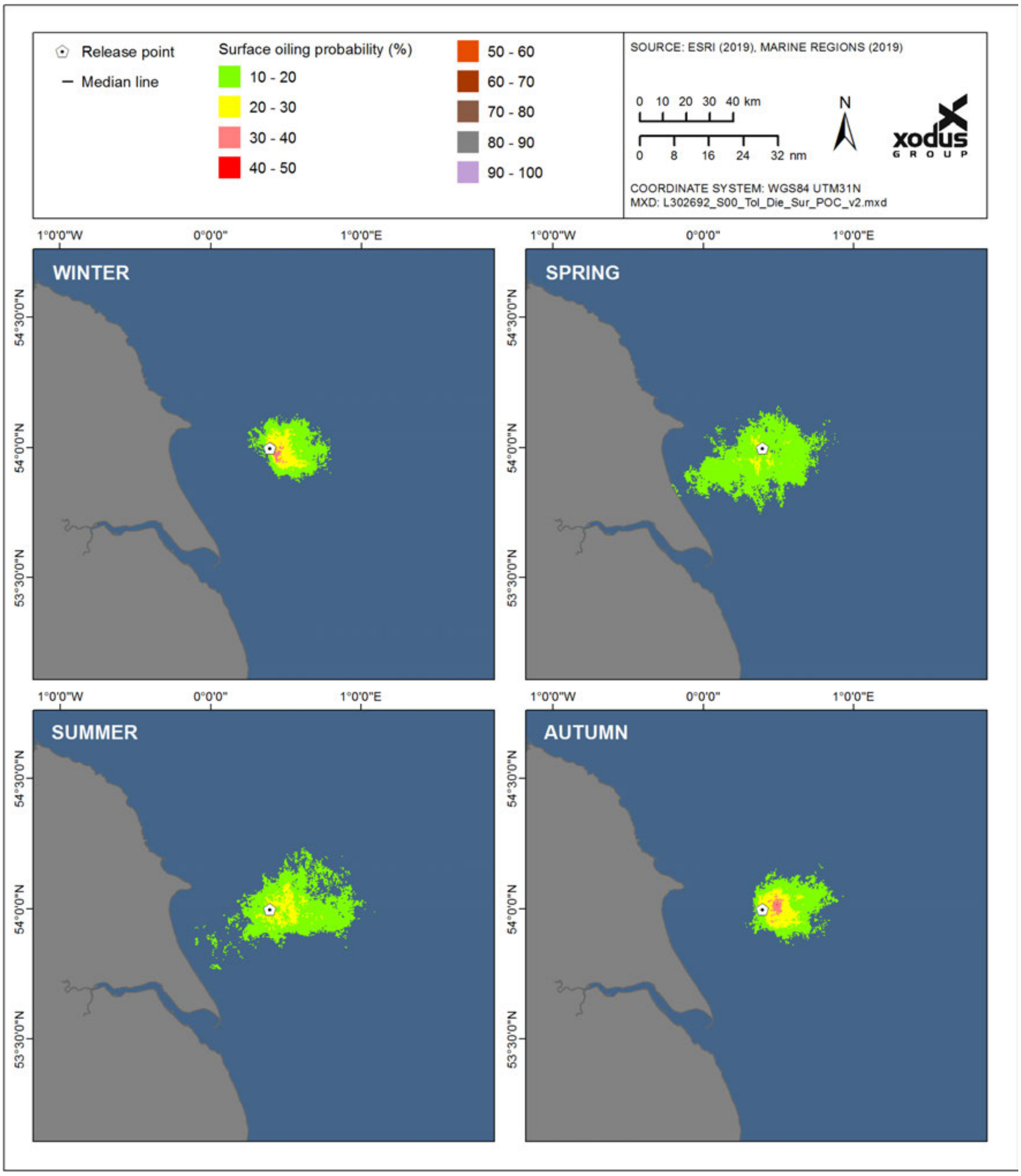


Figure 9-5 Scenario 2 – diesel release: surface probability of contamination (above 0.03 µm thick)

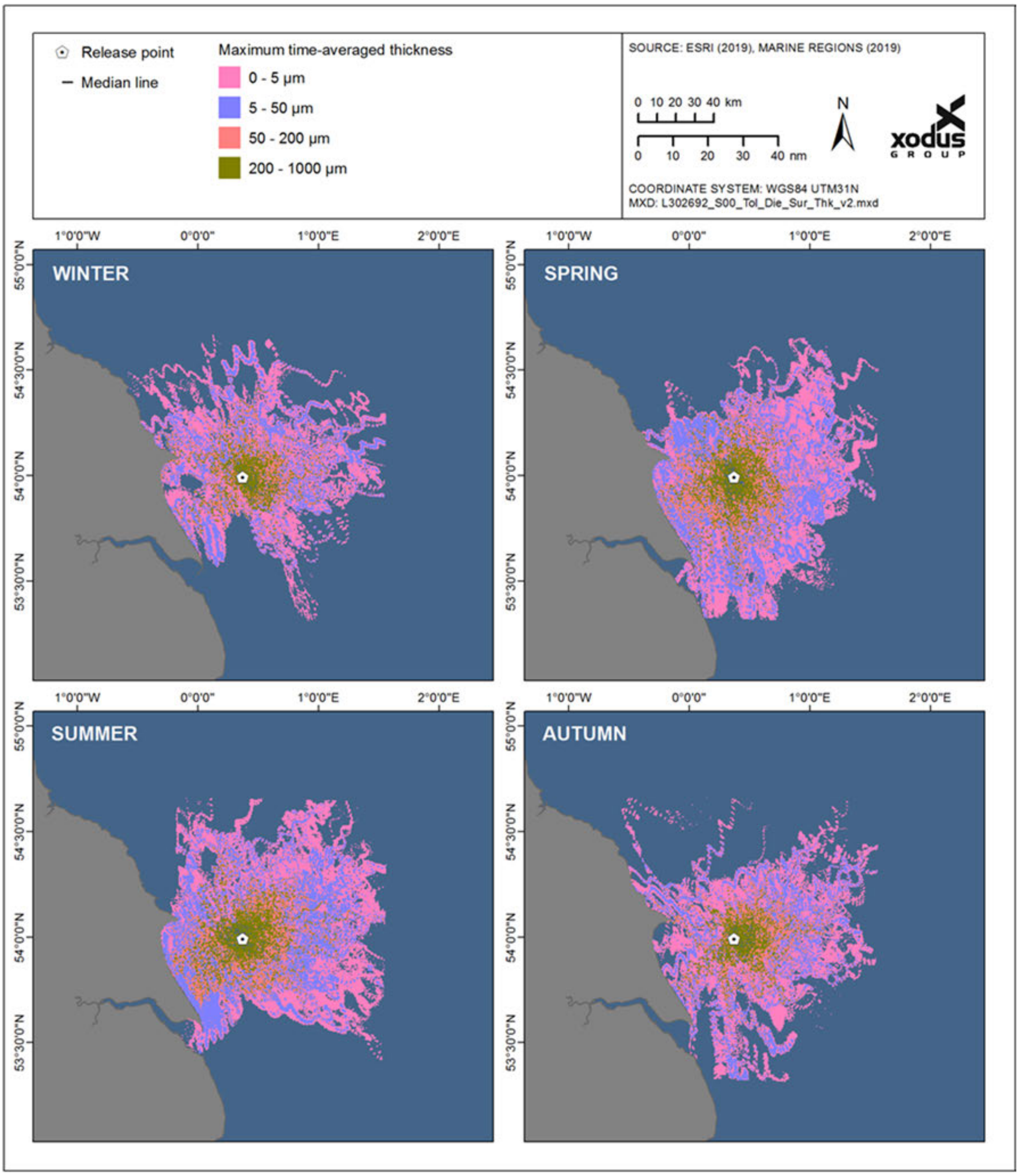


Figure 9-6 **Scenario 2 – diesel release: maximum time-averaged surface oil thickness (above 0.3 µm thick)**

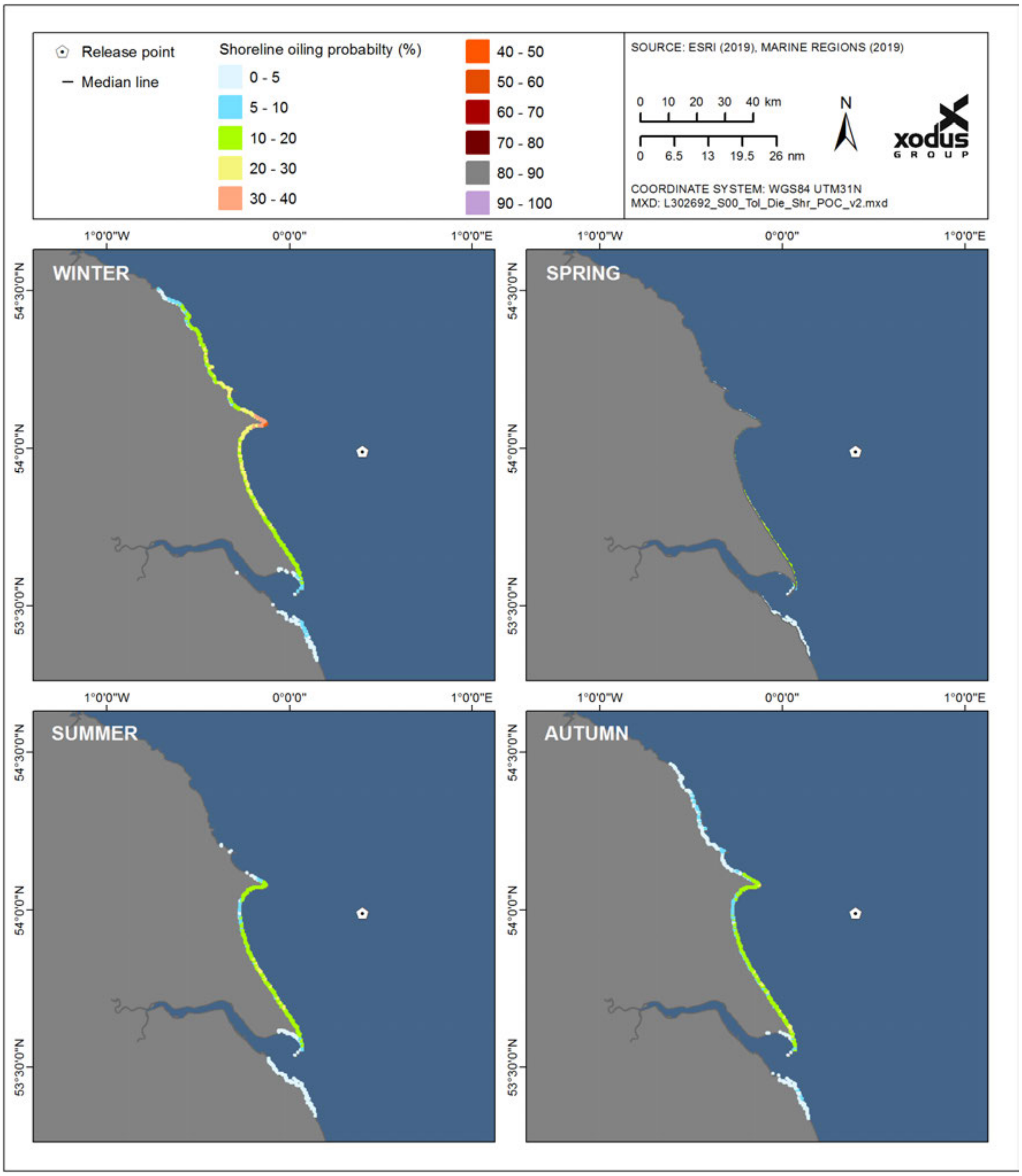


Figure 9-7 Scenario 2 – diesel release: shoreline probability of contamination

Scenario 3a: Instantaneous pipeline inventory loss 15 km from shore

The predicted probability of surface oiling is presented in Figure 9-8. The release is not predicted to cross any maritime boundaries. Figure 9-9 shows the predicted maximum time-averaged surface thickness of the release. The release is predicted to be thickest close to the release location and less than 5 μm across much of the contaminated area.

The predicted probability of shoreline oiling is presented in Figure 9-10. Beaching is predicted during all seasons in East Riding of Yorkshire, Northeast Lincolnshire and East Lindsey District. In Scarborough District shoreline oiling is predicted to occur during the spring and winter scenarios. The greatest probability of oiling is predicted in East Riding in Yorkshire (41.3 %) during the spring scenario.

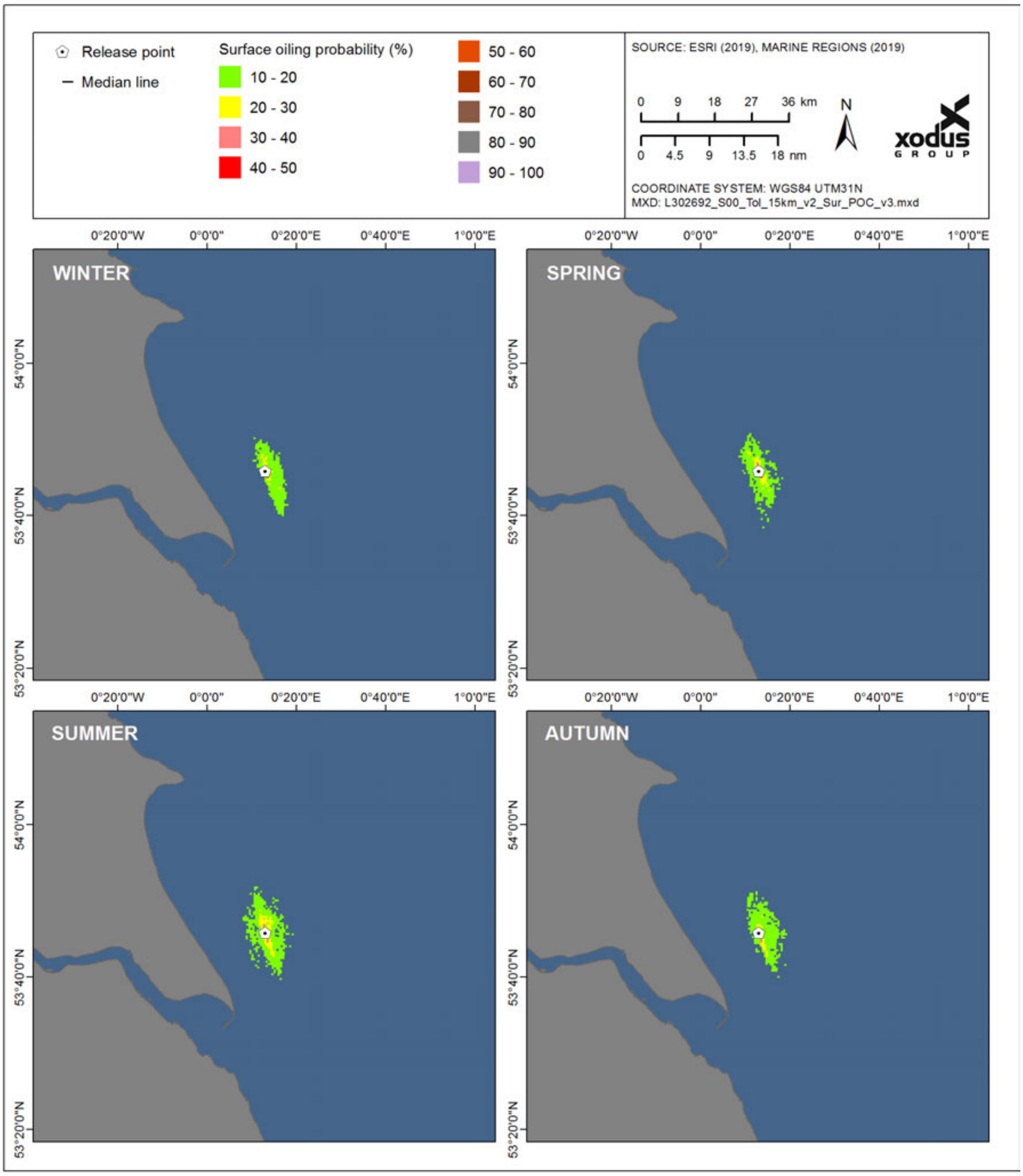


Figure 9-8 **Scenario 3a – pipeline release 15 km from shore: surface probability of contamination (above 0.03 µm thick)**

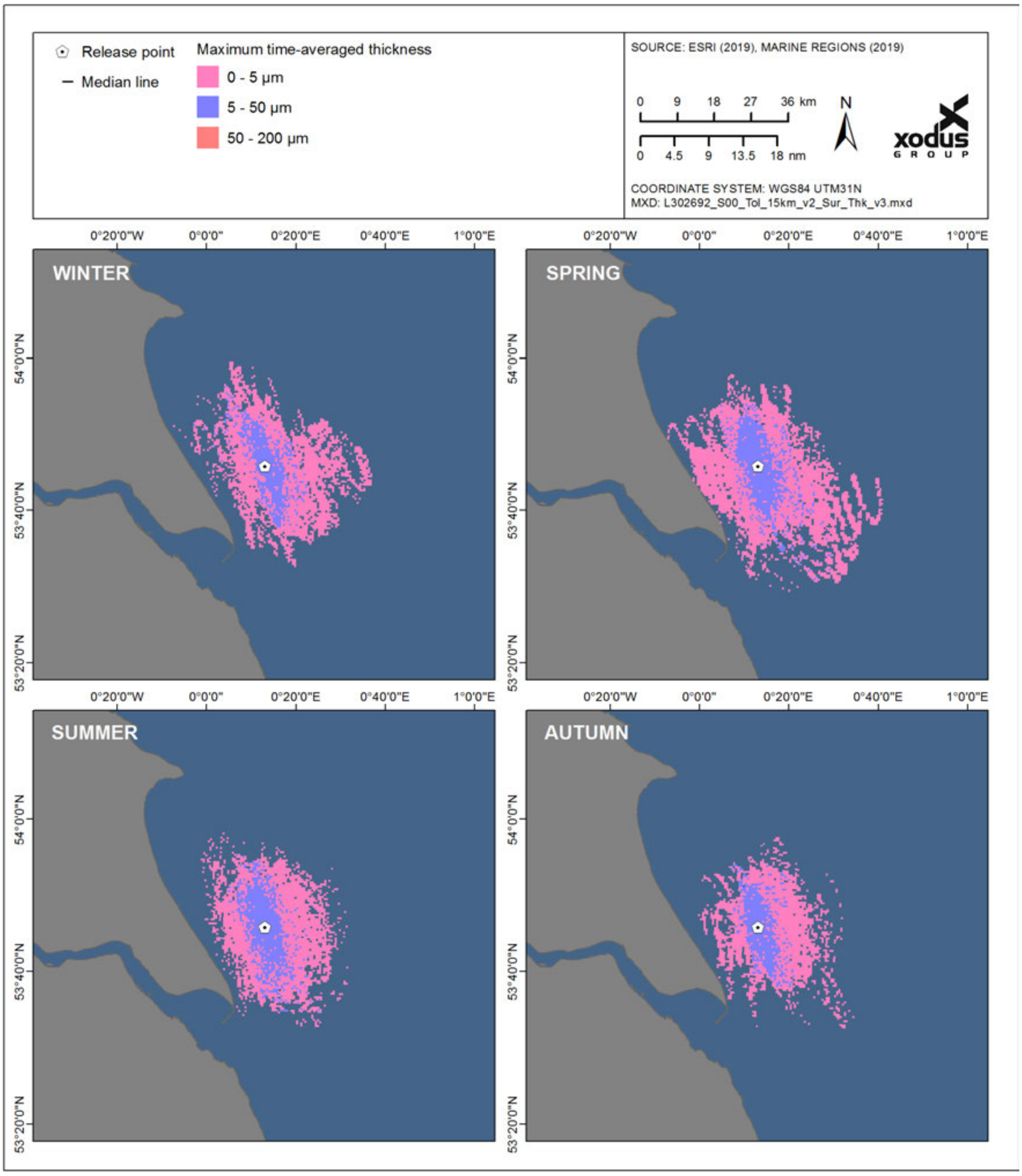


Figure 9-9 **Scenario 3a – pipeline release 15 km from shore: maximum time-averaged surface oil thickness (above 0.3 µm thick)**

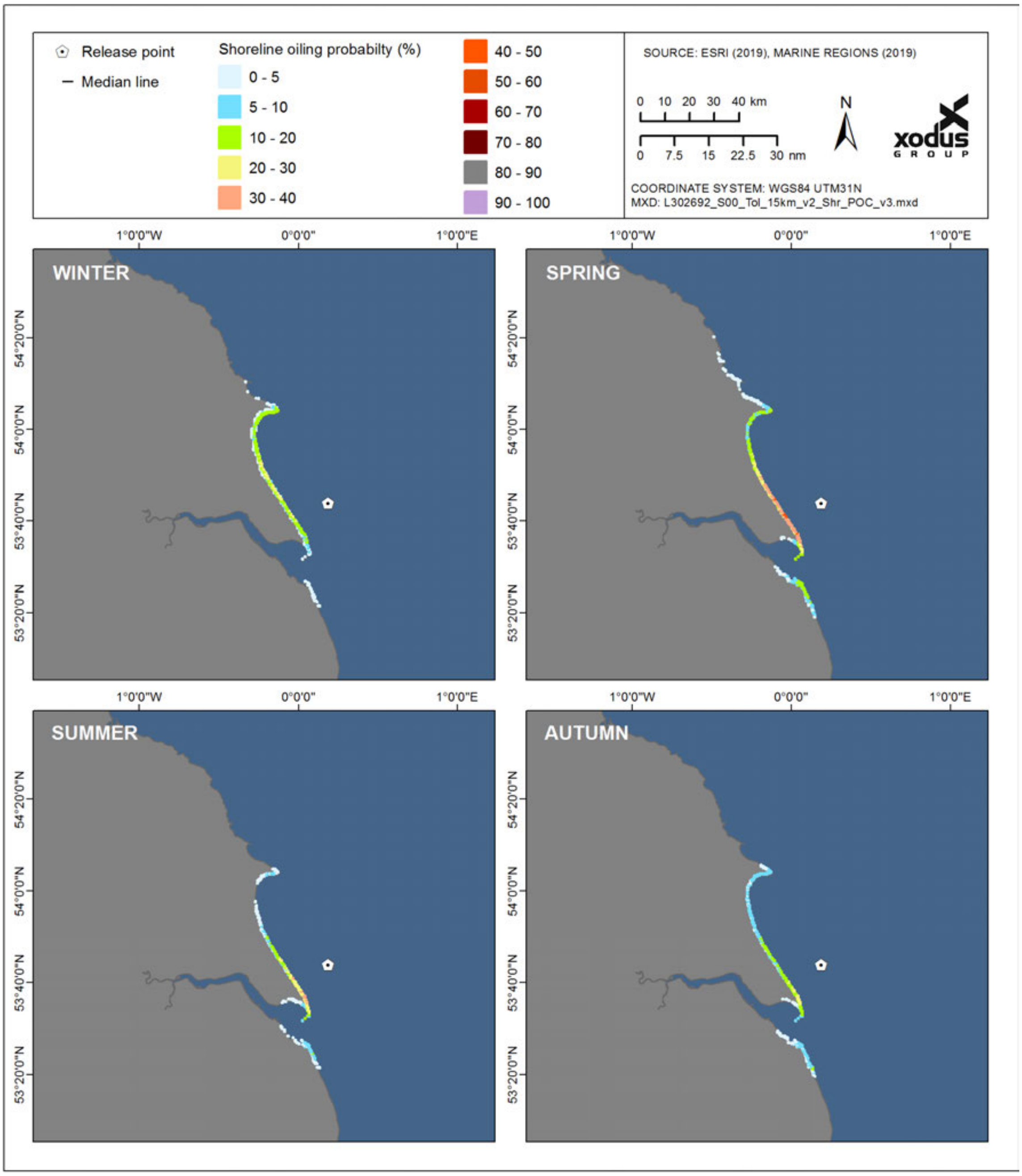


Figure 9-10 **Scenario 3a – pipeline release 15 km from shore: shoreline probability of contamination**

Scenario 3b: Instantaneous pipeline inventory loss at the midpoint

The predicted probability of surface oiling is presented in Figure 9-11. The release is not predicted to cross any maritime boundaries. Figure 9-12 shows the predicted maximum time-averaged surface oil thickness. The release is predicted to be thickest close to the release location and less than 5 μm across much of the contaminated area.

The predicted probability of shoreline oiling is presented in Figure 9-13. Beaching is predicted during all seasons in East Riding of Yorkshire and East Lindsey District. In Northeast Lincolnshire it is predicted to occur during the spring and winter scenarios. In the Scarborough District beaching is predicted during all of the scenarios except summer. The greatest probability of oiling is predicted in East Riding in Yorkshire (29.8 %) during the spring scenario.

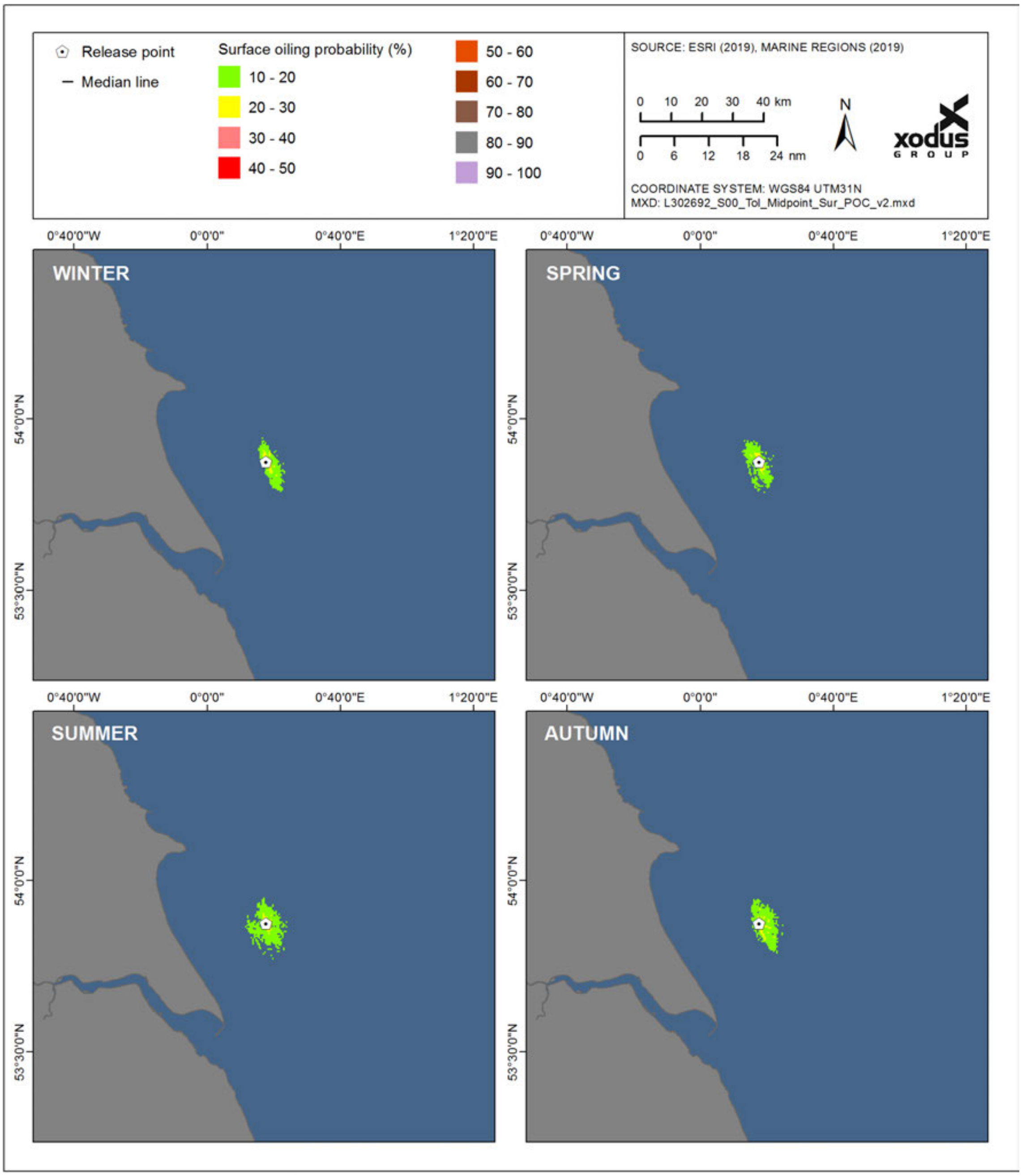


Figure 9-11 Scenario 3b – pipeline release at the midpoint: surface probability of contamination (above 0.03 µm thick)

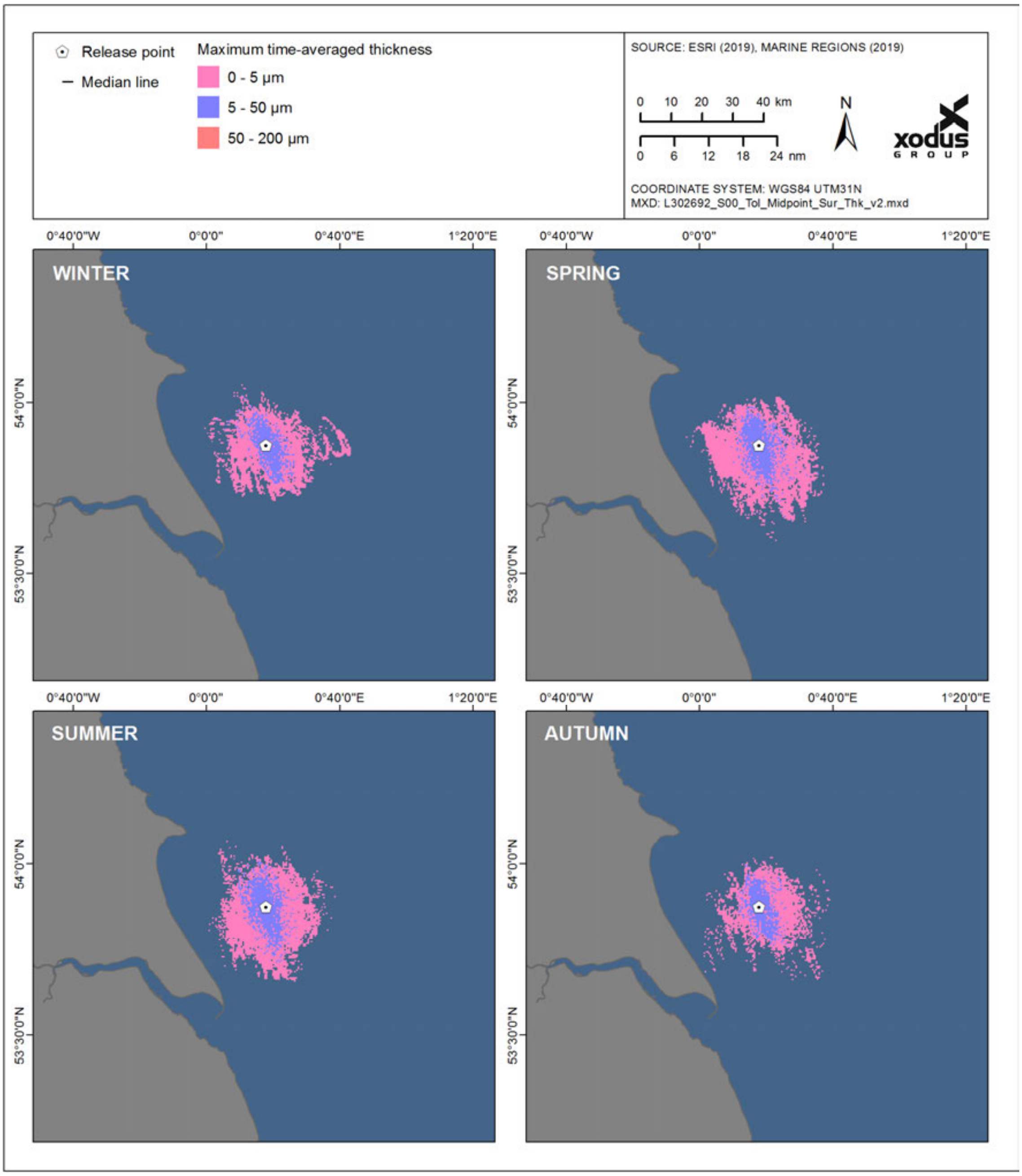


Figure 9-12 Scenario 3b – pipeline release at the midpoint: maximum time-averaged surface oil thickness (above 0.3 µm thick)

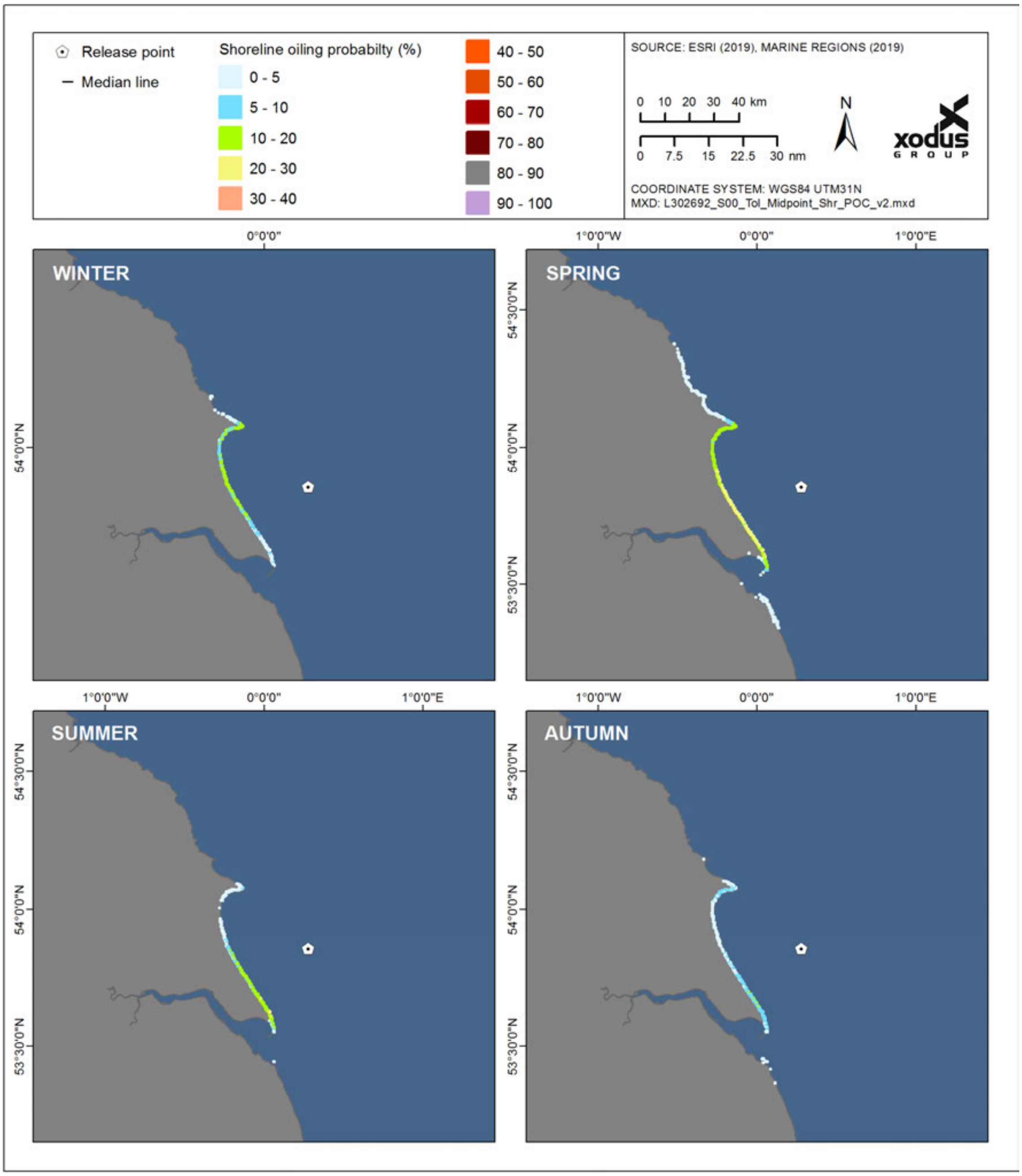


Figure 9-13 **Scenario 3b – pipeline release at the midpoint: shoreline probability of contamination**

Scenario 3c: Instantaneous pipeline inventory loss at the installation

The predicted probability of surface oiling is presented in Figure 9-14. The release is not predicted to cross any maritime boundaries. Figure 9-15 shows the predicted maximum time-averaged surface thickness during the release. The release is predicted to be thickest close to the release location and less than 5 µm across much of the contaminated area.

The predicted probability of shoreline oiling is presented in Figure 9-16. Beaching is predicted to occur during all seasons in East Riding of Yorkshire and East Lindsey District. In the Scarborough District beaching is predicted to occur during all scenarios except summer. In Northeast Lincolnshire beaching is predicted to occur during the spring scenario. The greatest probability of oiling is predicted in East Riding in Yorkshire (29.8 %) during the spring scenario.

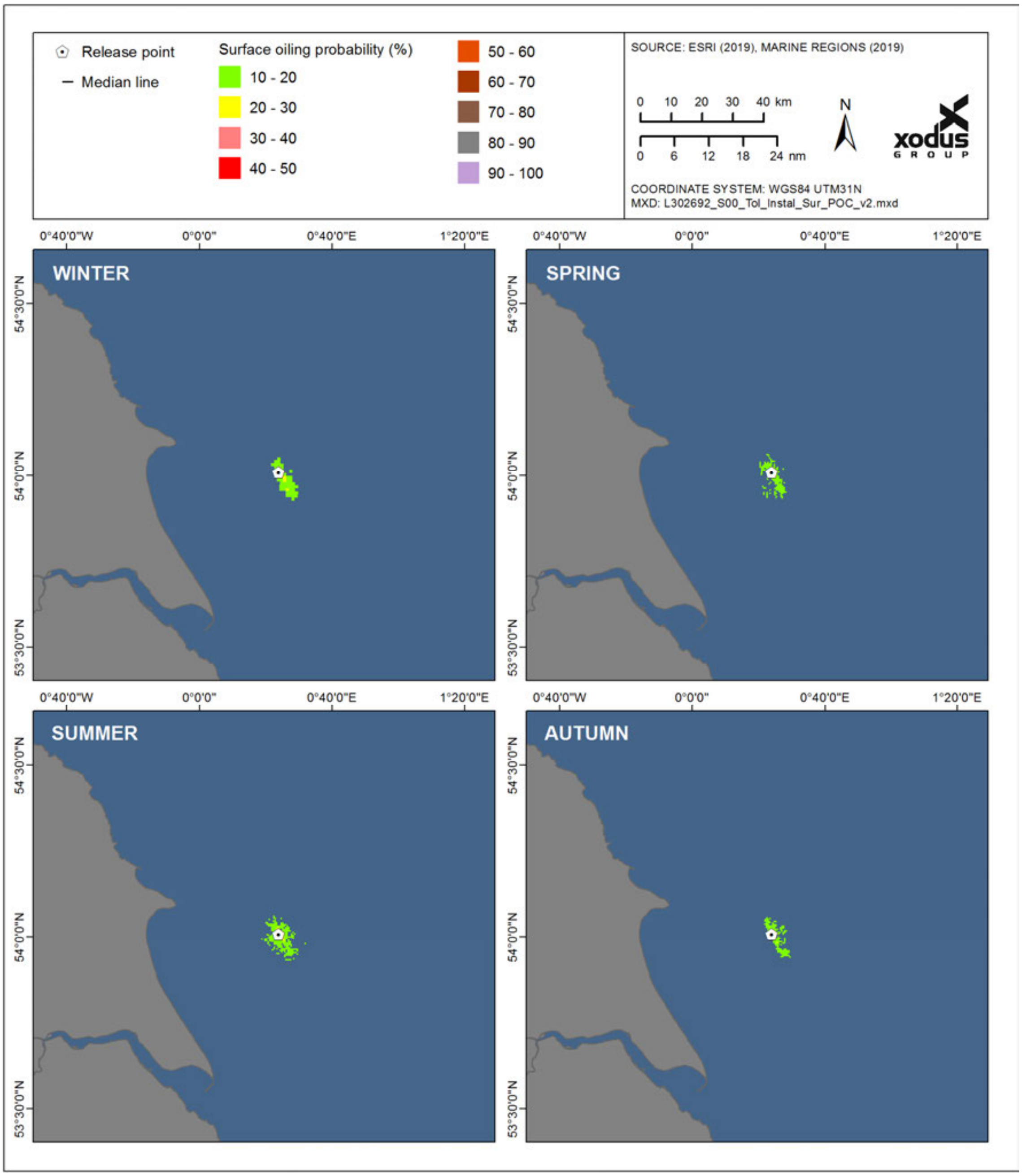


Figure 9-14 **Scenario 3c – pipeline release at the installation: surface probability of contamination (above 0.03 µm thick)**

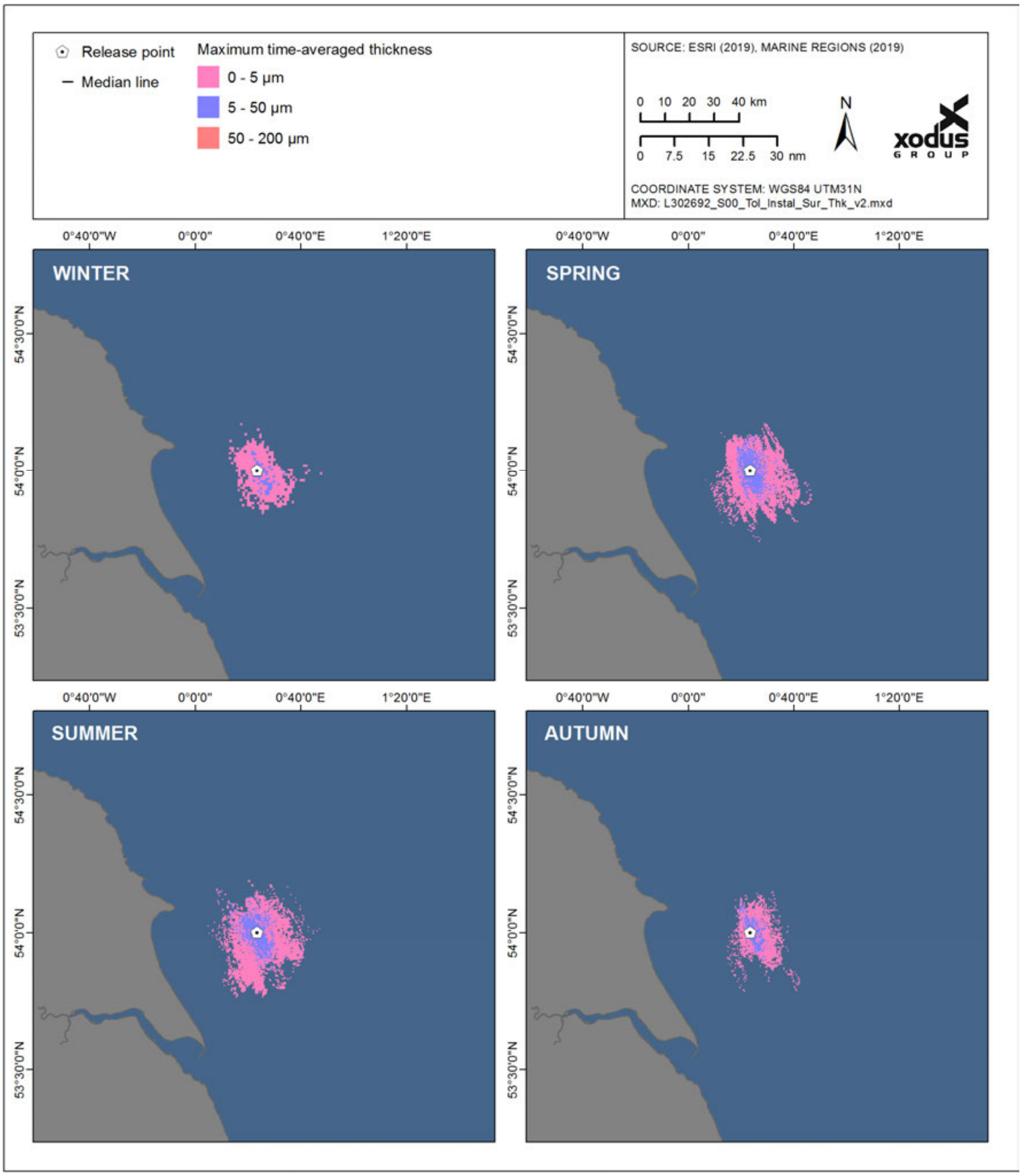


Figure 9-15 **Scenario 3c – pipeline release at the installation: maximum time-averaged surface oil thickness (above 0.3 µm thick)**

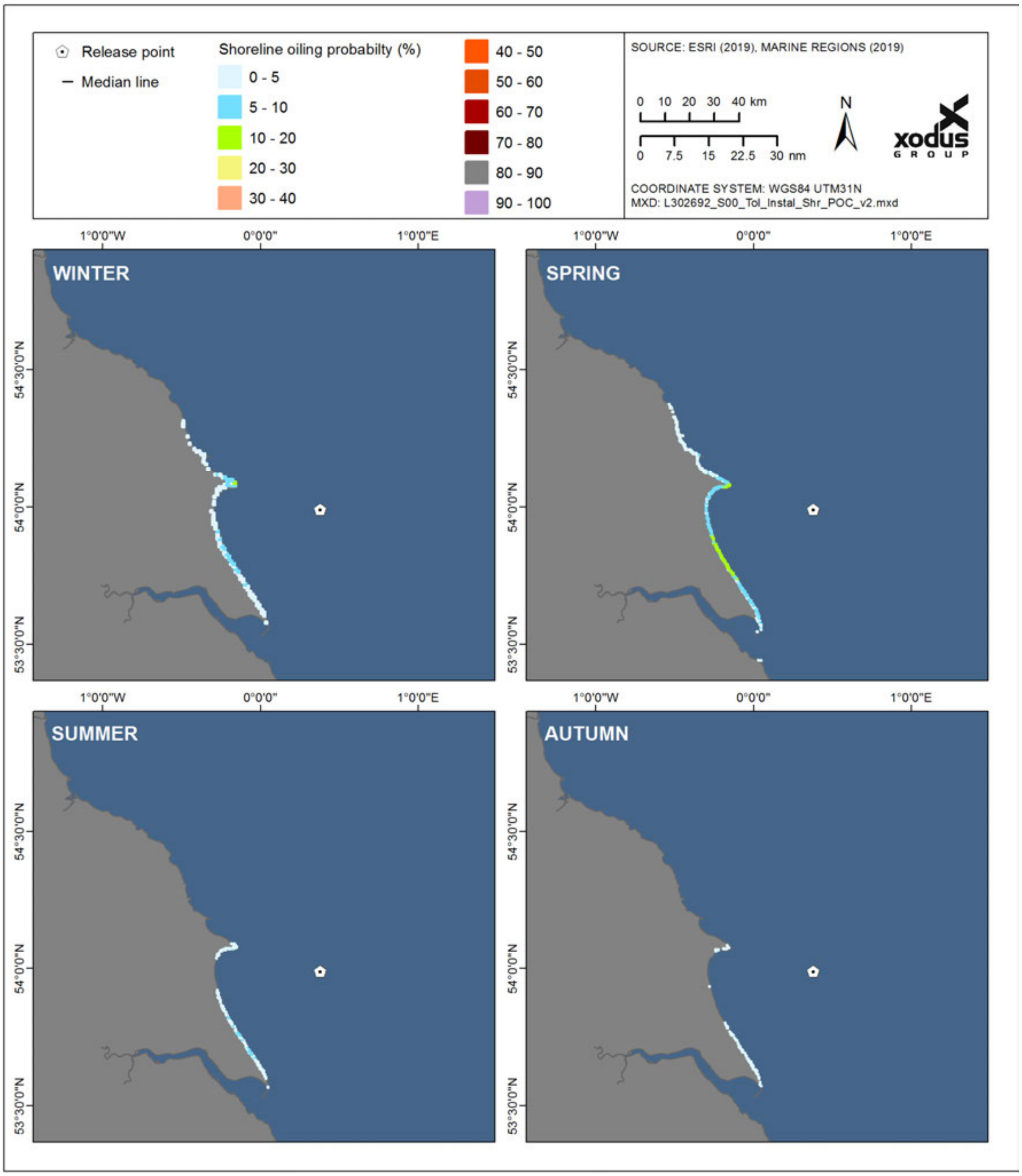


Figure 9-16 Scenario 3c – pipeline release at the installation: shoreline probability of contamination

9.3.2.1 Environmental vulnerability to hydrocarbon releases

Environmental vulnerability to spills is a function of both the likelihood of impact from a spill (as considered in previous sections) and the sensitivity of the environment. Offshore and coastal vulnerabilities need to be considered separately as different parameters will apply.

There can be impacts on plankton in the immediate area of the release, and for the duration of the release, due to the dissolution of aromatic fractions into the water column. Such effects will be greater during a periods of plankton blooms and during fish spawning. The contamination of marine prey, including plankton and small fish species, may lead to aromatic hydrocarbons accumulating in the food chain. These could have long-term chronic effects such as reduced fecundity and breeding failure on fish, bird and cetacean populations. This may affect fish stocks of commercially fished species. A major release could also have a localised effect on the fishing industry, should certain areas be temporarily closed to fishing.

Juvenile fish and eggs are potentially the most sensitive life-stage to hydrocarbon discharges. As outlined in Section Fish, a number of commercially important pelagic and demersal fish species are found in the vicinity of the project.

The JNCC has stated in a memorandum to the UK Parliament that the greatest risks to nature conservation of oil on the offshore sea surface are to seabirds (JNCC, 2011). The seasonal vulnerability of seabirds to surface pollutants in the immediate vicinity of the project, derived from JNCC block-specific data, suggest that seabird vulnerability in this area ranges from low to very high depending on the time of year. Very high vulnerability is observed in February, March and June, whilst high vulnerability is observed in May, July to September and November (Section 3.3.5). The magnitude of any impact will depend on the number of bird’s present, the percentage of the population present, their vulnerability to spilled hydrocarbons and their recovery rates from oil pollution. The physical impact of a spill is one of plumage damage leading to loss of insulation and waterproofing.

Cetaceans are also present in the vicinity of the project area (see Section 3.3.6). In the event of a spill, the potential impact, will depend on the species and their feeding habits; the overall health of individuals before exposure; and the characteristics of the hydrocarbons. It is thought unlikely that a population of cetaceans in the open sea would be affected by a spill in the long-term (Aubin, 1990). Baleen whales are particularly vulnerable whilst feeding, as oil may stick to the baleen if the whales "filter feed" near surface slicks. Cetaceans are pelagic (move freely in the oceans) and migrate. Their strong attraction to specific areas for breeding or feeding may override any tendency cetaceans have to avoid hydrocarbon contaminated areas.

The severity of a release and its persistence time is largely dependent on the physical properties of the hydrocarbon being released. The hydrocarbons associated with the project that may beach in the event of a spill are Tolmount condensate which is light with a high API gravity[xvi]. Condensates and refined hydrocarbons, such as marine diesel, are both very light and as such their fate in the marine environment is dominated by evaporation within a short period of time (i.e. 24 to 36 hours).

The likelihood of a hydrocarbon spill impacting the coastal environment is a function of the likelihood of a hydrocarbon spill occurring and the probability of the spilled hydrocarbons beaching. The level of impact is also directly related to the volume of the hydrocarbons released, the volume of hydrocarbon beaching, the composition of the beached hydrocarbons (as discussed above), and the type of beach.

Coastal environmental sensitivities to spills include nearshore breeding seabird populations, shore birds, over wintering diver and duck species, marine mammals, mariculture operations and sub-littoral and coastal habitats including SACs and SPAs.

Intertidal areas of the coast show varying degrees of sensitivity to spills, the function of both actual effects on specific organisms and the physical fate of the release substances within the habitat concerned. For example, high energy rock, boulder or cliff coastlines are of low vulnerability to hydrocarbon pollution, while in contrast, sheltered, low energy shorelines are of moderate to high vulnerability. In general terms, these shores are of low vulnerability to hydrocarbon pollution (Gundlach and Hayes, 1978).

As outlined in Section 9.2 an appropriate assessment may also be required to determine if there could be any ‘likely significant impacts’ from an accidental event on any SACs or SPAs designated under the European Directives from activities carried out during the proposed drilling project. Further details in relation to all protected sites are provided in Section 9.8.

[xvi] API is a measure of how heavy or light a petroleum liquid is compared to water: if its API gravity is greater than 10, it is lighter and floats on water; if less than 10, it is heavier and sinks.

The impacts from a hydrocarbon release will largely be associated with the plumes in the water column. These impacts will be highly dependent on environmental sensitivities, prevailing sea state and the weather conditions. The sea and weather conditions at the proposed drilling location (see weather and sea chapter) indicate that a minor spill will normally be broken up rapidly and dispersed.

9.4 Emergency preparedness

Premier is aware of the risk of a spill event occurring during operations at the proposed well location and the crew of the drilling rig will therefore undergo environmental awareness and emergency response training.

The main spill risk of reservoir hydrocarbons is from an incident involving a loss of well control. To prevent this type of incident, the drilling rig will be fitted with a blowout preventer. In addition, a full risk assessment will be performed as part of well planning.

The highest risk of a diesel spillage will occur during fuel bunkering operations between the drilling rig and supply vessels. Bunkering operations will only take place during hours of good visibility, in suitable weather conditions, and with a continuous watch posted at both ends of the fuel hose. All hoses used during bunkering are segmented with pressure valves that will close automatically in the event of a drop in pressure, such as might be caused by a broken connection or sudden leak. All hoses will be managed in line with a Hose Management Procedure, including frequent pressure testing and replacement.

The appointed installation operator will have an approved OPEP in place for the proposed well, conforming to the Merchant Shipping (Oil Pollution, Preparedness, Response and Co-operation Convention) Regulations 1998, the Offshore Installations (Emergency Pollution Control) Regulations 2002, and also Premier's internal EMS. The OPEP will fully consider the oil spill response requirements of the proposed Project, taking into account the location, the prevailing meteorological conditions and the environmental sensitivities of the area. It will be designed to assist the decision making process during a spill, indicate what resources are required to combat the spill, minimise any further discharges, and mitigate its impacts. Small spills, which disperse quickly and pose little threat to environmental sensitivities, will generally be controlled by on-site resources. Larger spills, with the potential to impact the surrounding environment (particularly seabirds), may be managed onshore and could involve external expertise and equipment. A major spill event of national importance would lead to the mobilisation of all resources available to Premier and possibly assistance from the MCA Counter

Pollution Branch. All spills (including chemical spills) will be reported to the relevant authorities using an EPON1 and by telephone as appropriate.

9.5 Spill response

In total, it is estimated that it will take up to 95 days (worst case) to source a drilling rig suitable to drill a relief well, drill the well and kill a blowout from the proposed well. A full breakdown of the time required to drill the relief well will be detailed in the OPEP for the proposed operations.

In the event that a relief well should be required in response to a well blow out, Premier has a relief well response strategy. Any decision to cap the well or to drill a relief well will be taken by the UK Operations Director along with the Premier UK Management team, following consultation with well control advisors, well partners and UK Government bodies (e.g. HSE). As members of OPOL, Premier can demonstrate economic responsibility should there be the need to drill a relief well.

Premier has access to specialist oil spill response services provided by Oil Spill Response Limited (OSRL) including access to aerial surveillance, aerial dispersant spraying and clean-up equipment and specialist staff.

9.6 Cumulative, in-combination and transboundary impacts

Existing hydrocarbon spill risks in the North Sea are associated primarily with oil and gas industry activities as well as other marine industries such as merchant shipping and fishing. Aside from the Tolmount MFP, the closest oil and gas developments to the Tolmount East are the Rough CD, BP and BD and Rough AD platforms located 23 km and 25 km from Tolmount East respectively (Section 3.5.2). As indicated by historical data, the likelihood of one major accidental release occurring is remote or extremely remote, limiting the cumulative impact from the Tolmount East and other existing installations. Detailed OPEPs will be in place, outlining the response measures to be implemented in the event of any accidental release.

The worst case spill modelling scenario indicates that there is a remote to extremely remote probability that in the event of an I release a transboundary impact could result. Therefore, consultation under the Espoo Convention is not required as a result of the Tolmount East Development. The Espoo Convention requires notification and consultation only for projects likely to have a significant adverse environmental impact across boundaries.

The risk of a spill having a transboundary impact, particularly from North Sea operations, is recognised by the UK Government and other governments around the North Sea. International agreements are in place for dealing with transboundary spill incidents. In the event of a major spill which is predicted to drift into Norwegian waters, the Norway-United Kingdom Joint Contingency (NORBRIT) plan will be activated. This plan operates within the framework of the National Contingency Plans and is oriented towards major spills. It becomes operational when agreement to the request for its implementation is reached. Responsibility for implementing joint action rests with the Action Co-ordinating Authority (ACA) of the country on whose side of the median line a spill originated. The UK's ACA is the Counter Pollution Branch of the MCA.

9.7 Decommissioning

The cessation of production will remove one of the main sources of potential accidental hydrocarbon release, since there will no longer be a hydrocarbon flow from the well or through the pipeline system. Additional vessels will be required to execute decommissioning activities, with potential impacts related to accidental hydrocarbon and chemical release from those vessels likely to occur at a similar magnitude to that of installation activities.

9.8 Protected sites

Based on the results from the stochastic modelling (Xodus Group Limited, 2020) as discussed in Section 9.3.2, this section lists the protected sites (SPAs, SACs and MCZs) which have been identified as potentially being at risk of oiling. Information about these sites including their distance from the proposed drilling project and qualifying features are listed in Table 9-8 to Table 9-10. It should be noted that the distances provided are to the proposed drilling location at its closest point, and not to the nearest extent of the spill modelling. A hydrocarbon impact (offshore or coastal) has been included in this assessment when the probability of occurrence is equal to or greater than 10%.

9.8.1 Coastal protected sites

The protected sites in Table 9-8 have been identified as having the potential to be impacted as a result of shoreline oiling. The qualifying features at the majority of sites are seabed features which will not be affected by coastal oiling. Habitats most likely to be negatively affected by hydrocarbon contamination are mudflats and sandflats due to the species utilising them for foraging and the lack of clean-up response for mudflats.

The oil spill modelling conducted is considered to be very conservative in terms of beaching volumes due to the use of an assumed beach width of 2 m. The most sensitive mudflat and sandflat habitats are much wider than this, therefore the hydrocarbon contamination will be spread over a larger area and at lower concentrations. Long-term environmental impacts are not anticipated for the sites detailed in Table 9-8 due to the lightness of the condensate and the nature of the qualifying features. As such, there is considered to be no LSE on coastal SACs, SPAs and MCZs and hence no impact on conservation objectives or site integrity.

Table 9-8 Coastal sites potentially impacted as a result of oiling (>10% probability of shoreline contamination)

Site	Distance from Project Area (km)	Maximum % probability of shoreline oiling					Qualifying Feature
		Sc1	Sc2	Sc3a	Sc3b	Sc3c	
Flamborough Head SAC	29	34	52	26	34	25	Reefs Vegetated Sea Cliffs of the Atlantic and Baltic Coasts Submerged or Partially Submerged Sea Caves
Holderness Inshore MCZ	35	33	48	58	49	28	Intertidal mixed sediments Subtidal course sediments Subtidal sand Peat and clay exposures Ross worm reefs (*Sabellaria spinulosa*) Subtidal chalk Subtidal sands and gravels Spurn Head
Humber Estuary SAC	50	n/a	27	32	14	n/a	Estuaries Mudflats and sandflats not covered by seawater at low tide
Runswick Bay MCZ	90	n/a	19	n/a	n/a	n/a	High energy circalittoral rock High energy infralittoral rock Moderate energy circalittoral rock Moderate energy infralittoral rock Subtidal coarse sediment Subtidal mixed sediments Subtidal sand Ocean quahog (*Arctica islandica*)

9.8.1.1 Offshore SACs and MCZs

For offshore locations the predicted occurrence of surface oiling has been taken as indicating a potential impact. Sites predicted to have a greater than 10% probability of surface oiling are detailed in Table 9-9. For these sites the likelihood of a potential impact will be determined by the trajectory of the release, the amount of oil released, the prevailing weather and sea conditions and the water depth.

The Tolmount East Development will produce a condensate with an API gravity of approximately 53° API and will therefore float on water[xvii]. Once the lighter fractions of the hydrocarbon have evaporated, the remaining fraction is expected to form a stable water-in-oil emulsion. Results from the modelling of the blowout and pipeline release scenarios demonstrate that the surface hydrocarbon coverage is modelled to have a maximum time-averaged thickness of less than 50 µm (i.e. <0.05 mm), with the majority of the surface coverage being less than 5 µm (i.e. less than 0.005 mm). Modelling results from the diesel release scenario indicate that the surface hydrocarbon coverage is predicted to have a maximum time-averaged thickness of less than 1 mm, with the majority of the surface coverage being less than 50 µm (i.e. less than 0.05 mm). The vulnerability of seabed communities to oil from surface spills is primarily dependent on the water depth, as ecologically-significant concentrations of dissolved or dispersed oil from surface slicks rarely reach below 10 metres (IPIECA 2015a; IPIECA 2015b). Therefore, it is very unlikely that hydrocarbons would be redistributed to these depths in sufficient quantities or thickness to affect the protected seabed features.

The harbour porpoise is a qualifying feature for The Southern North Sea SAC. Whilst it is possible that marine mammals may come into contact with surface oil and would therefore be susceptible through inhalation or skin absorption, their ability for avoidance and the lightness of the condensate would reduce the potential for impact. It is therefore considered unlikely that the harbour porpoise would be impacted on a population level.

Taking into account that:

- The SACs and MCZs would only be at risk in the event of a credible hydrocarbon release scenario, which is highly unlikely to occur (Section 9.3.1);

[xvii] If API gravity is greater than 10, the hydrocarbon is lighter than water and floats; if less than 10, it is heavier and thus sinks.

- In the event of this scenario occurring, there is a low probability of effects on sublittoral features of any particular site at levels that may lead to ecological effects;
- There are specific spill response, mitigation measures and remediation that will be put in place to protect the most sensitive coastal sites (Section 9.5);
- The properties of the condensate; and
- The potential for recovery of harbour porpoise populations.

It is concluded that long term environmental impacts are not anticipated for the sites detailed in Table 9-9. As such, there is considered to be no LSE on offshore SACs, SPAs and MCZs and hence no impact on conservation objectives or site integrity.

Table 9-9 Offshore sites potentially impacted as a result of oiling (>10% probability of surface contamination)

Site	Distance from Project Area (km)	% probability of surface oiling					Qualifying Feature
		Sc1	Sc2	Sc3a	Sc3b	Sc3c	
Holderness Inshore MCZ	35	12	14	n/a	n/a	n/a	Intertidal mixed sediments Subtidal course sediments Subtidal sand Peat and clay exposures Ross worm reefs (*Sabellaria spinulosa*) Subtidal chalk Subtidal sands and gravels Spurn Head
Holderness Offshore MCZ	11	99	17	100	100	n/a	Subtidal coarse sediment Subtidal mixed sediments
Southern North Sea SAC	1	100	41	20	100	31	Harbour porpoise

9.8.1.2 SPAs

Surface oiling was predicted to occur at the Greater Wash SPA. The qualifying features for this site are detailed in Table 9-10. The potential effects on birds associated with these sites, in the very unlikely event of a credible worst case accidental release scenario, and of levels of surface oiling occurring at these sites at levels that could have an ecological effect, are considered below.

Oiling of seabirds is one of the greatest environmental risks posed by accidental hydrocarbon release events. This is primarily due to the high affinity of oil for seabird's plumage. Once oil becomes incorporated into the feathers, there is a high chance of death due to loss of body heat, starvation, drowning or oil ingestion. Plumage is essential to flight, waterproofing and heat insulation and even small effects on any of these functions can result in mortality.

As discussed by Furness (2014) it is very difficult to apportion seabirds which may move offshore into the area of potential hydrocarbon surface oiling to specific SPAs. Furness (2014) used existing data and literature in order to determine biologically defined minimum population scales for key seabird species. For many seabirds, once breeding is complete, individuals are no longer restricted to foraging within certain distances (i.e. foraging ranges) from their breeding colony, as there is no longer any requirement to return to eggs or chicks. For a number of key species, there is strong evidence that once birds leave the breeding colony, they become widely dispersed over large distances, often intermingling with birds from other breeding colonies (typically of the same species) and in some cases birds that have migrated from overseas breeding colonies (Furness, 2014).

The vulnerability of bird species to oil pollution is dependent on a variety of factors including time spent on the water, total biogeographical population, reliance on the marine environment, and the potential rate of population recovery.

Potential recovery rates may range from 1 to 10 or more years, depending on the species affected and the extent of population loss. The recovery rates depend on numerous factors including:

- The percentage of the breeding population killed (and therefore numbers remaining);
- The number of juveniles lost (affecting recruitment rates in following years);

- Size of the existing pre-breeding pool and rates of recruitment into the colonies;
- Rates of reproduction of individual species;
- Long-term loss of feeding grounds and prey species; and
- Sub-lethal effects which may affect reproductive success.

Taking into account:

- That these SPAs would only be at risk in the event of a credible worst case accidental release scenario, which is highly unlikely to occur (Section 9.3.1);
- The specific spill response, mitigation measures and remediation that will be put in place to protect the most sensitive coastal sites (Section 9.5); and
- The potential for recovery of bird populations.

It is concluded that an accidental release will result in negligible impacts on the protected bird populations at the Greater Wash SPA.

Table 9-10 SPAs potentially impacted as a result of oiling (>10% probability of surface contamination)

Site	Distance form Project Area (km)	% probability of surface oiling					Qualifying Feature
		Sc1	Sc2	Sc3a	Sc3b	Sc3c	
Greater Wash SPA	27	26	14	14	n/a	n/a	This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive: Common Tern *Sterna hirundo* Little Tern *Sterna albifrons* Sandwich tern *Sterna sandvicensis* Little gull *Hydrocoloeus minutus* (over winter) Red-throated diver *Gavia stellata* (over winter) This site also qualifies under **Article 4.2** of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species: Common scoter *Melanitta nigra*

9.8.2 Major environmental incident assessment

A MEI is defined as “an incident which results, or is likely to result, in significant adverse effects on the environment in accordance with Directive 2004/35/EC of the European Parliament and of the Council on environmental liability with regard to the prevention and remedying of environmental damage”. A MEI can only occur as a consequence of a Major Accident Hazard (MAH) scenario as identified in the Safety Case or Well Notification.

A significant hydrocarbon release, such as from a well blow-out, is the most likely to result in a MEI due to the potential for a large volume of crude oil released in the marine environment.

However, the Tolmount Area Development ES determined that there were no potential significantly adverse impacts associated with shoreline or surface oiling from a worst case blowout, and therefore there are no modelled scenarios which are predicted to constitute a MEI. As the major fate pathway for the Tolmount condensate is evaporation followed by dissolution in the water column, significant surface oiling is unlikely to occur and based on the results from the Tolmount EIA MEI assessment, the potential for a MEI to occur at Tolmount East is also unlikely.

9.9 Residual impacts

9.9.1 Accidental hydrocarbon release

Although the probability of a catastrophic release from the Tolmount East Development is remote, even with comprehensive prevention measures in place, the residual risk of accidental release, and thus impact on the marine environment remains. This is recognised to be true for the offshore oil and gas industry in general and the formulation of detailed and fully tested contingency response plans is thus integral to such projects. As such, Premier will have in place a range of response/mitigation measures to address these risks (detailed in Section 9.5). All activities will be covered by appropriate OPEPs and SOPEPs which will set out the responses required and the available resources for dealing with spills of all sizes. The planning, design and support of all activities will aim to eliminate or minimise potential environmental risks. These impacts are being mitigated through the equipment design, spill risk reduction measures and provision of appropriate spill response arrangements. Premier's management processes will ensure that these mitigation commitments are implemented and monitored.

As the drilling programme has been reduced to one well only, the length of time that the rig will be on location will be reduced and the risk from a blowout will be reduced.

9.9.2 Chemical spills

In addition to the hydrocarbon spill risk, there is also the risk of a chemical spill. Chemical spills may occur during chemical transfer, chemical/mud handling, or through mechanical failure on the MODU. The fate of any chemical entering the water column is dependent upon how physicochemical properties influence its partitioning between seawater and its susceptibility to degradation (DTI, 2001). Given the high energy marine environment of the wider area, chemical spills are expected to disperse in the offshore marine environment with a possible negligible to minor localised and transient impact on plankton or fish egg/larvae, depending on the season.

The spill prevention measures in place will encompass chemicals as well as hydrocarbon spills. Pre-mobilisation audits and bridging documentation will ensure that these prevention procedures are in place on drill rigs, support and supply vessels. Personnel will also be given full training in environmental awareness and spill prevention methods. Procedures will be in place to further reduce the risk of spillage, in particular written procedures, regular inspection of equipment and provision of spill kits. Chemical spill risks at Tolmount East will be covered under MODU specific procedures and other spill prevention measures.

To reduce the potential risk of chemicals offshore, Premier continually works with its chemical suppliers to ensure that chemical use is minimised without compromising technical performance. Furthermore, Premier recognises that substitution is an important part of the OSPAR HMCS and is committed to use of non-substitution chemicals and to the investigation of alternative where this is not possible. Information on specific chemical use and associated environmental impact assessment will be provided in the relevant permit (e.g. Master Application Template/Subsidiary Application Template) prior to the commencement of activity. Premier endeavour to use chemicals with a good environmental profile (PLONOR, Cefas OCNS group E or Gold banded chemicals) where possible to reduce potential impacts from these chemicals on the marine environment. With the reduced drilling programme, the risk from a chemical spill will also be reduced

10 ENVIRONMENTAL MANAGEMENT

10.1 Premier HSES management system[1]

The Harbour Energy Health, Safety, Environment and Security (HSES) policy is illustrated in Figure 10-1. Under this policy, the Premier Oil Health, Safety, Environment and Security Management System (HSES-MS) exists to provide a systematic approach to the management of HSES issues in order to protect people and the environment and comply with UK legislation. Premier considers that health, safety, environment and security have equal status with other primary business objectives and are of strategic importance to Premier. Safe working practices and due consideration of environmental impact are vital to the overall efficiency and continued success of the business.

Premier's HSES-MS is based on the industry model prepared by the IOGP and embraces the principles of quality management as found in the ISO 14001:2015 and ISO 45001:2018 international standards. The environmental elements within the management system have been independently verified by approved certification bodies in February 2020 and April 2017, and will continue to be independently verified on a two-yearly basis in addition to internal monitoring and assessment. During the most recent audit the EMS was in compliance with ISO 14001:2015 and 18001:2007 standards.

The HSES-MS has ten individual elements as shown in Figure 10-2. Each element contains a set of concise expectations that are mandatory for implementation and maintenance within all the constituent parts of the Premier Oil group of companies (the Group). They define what is expected by the Group in order to manage HSES risk during execution of work activities.

[1] Following creation of the enlarged Harbour Energy plc company, work is underway to integrate the pre-existing Premier and Chrysaor management systems. Until the integration is completed, the Premier management system will take precedence for this development under the Harbour Energy HSES Policy

Harbour Energy

Health, Safety, Environment and Security

Policy

Harbour Energy is committed to operating responsibly and securely, never compromising our Health, Safety, Environmental or Security (HSES) standards. Harbour Energy will do all that is reasonably practicable to reduce HSES risks, ensure the safety and security of everyone affected by our operations, protect the environment by minimising our environmental impacts, and protect our assets and business data.

To achieve this Harbour Energy will:

- Provide strong, visible leadership and commitment at all levels of the business
- Effectively identify hazards, threats and vulnerabilities to assess and manage risks
- Meet or surpass our legal and other requirements (e.g., compliance obligations)
- Set objectives and targets to drive improvement
- Support and train our people and assure their competence
- Provide appropriate resources
- Encourage open and honest communication
- Effectively manage the HSES risks associated with contracted work
- Maintain safe, clean, healthy and secure workplaces to protect our people, environment, assets and data
- Maintain protected high quality documented systems and processes
- Plan and prepare for potential emergencies
- Report, investigate and learn from any incidents and near misses
- Routinely inspect the workplace and audit systems and processes
- Seek opportunities to continually improve our performance

It is the responsibility of everyone in Harbour Energy to conform to our Policies and Standards and to assist the business in their implementation.

Linda Z Cook
CEO Harbour Energy Plc
01 April 2021

HAE-GLO-HSE-POL-0001, Revision 1

Figure 10-1 Harbour Energy HSES Policy

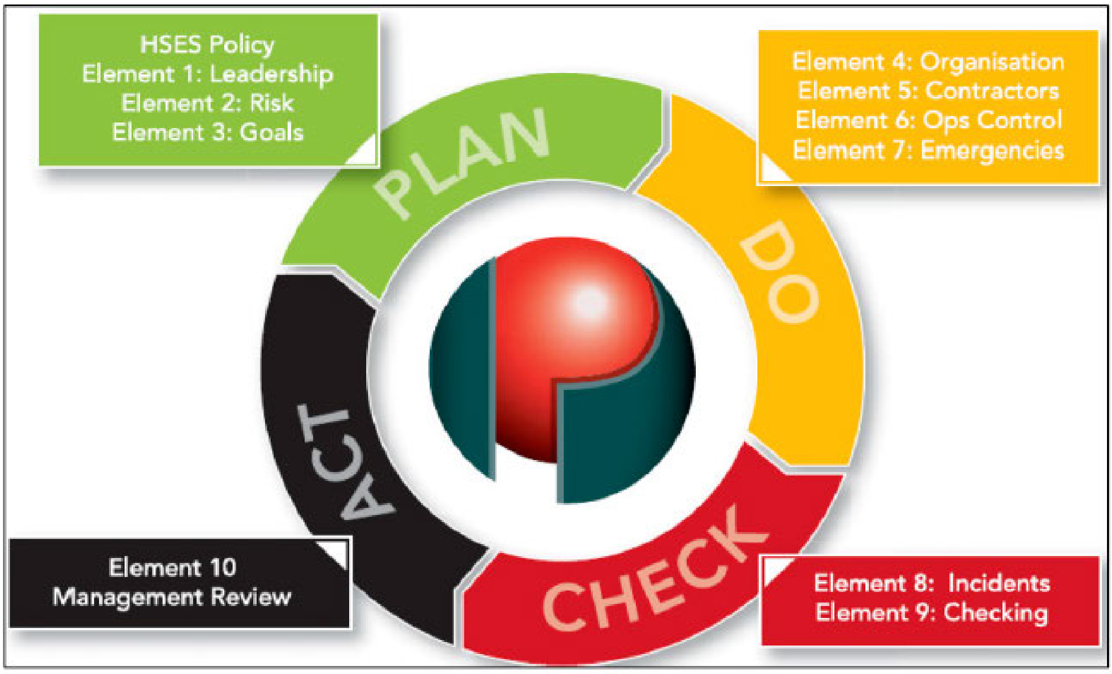


Figure 10-2 Premier's HSES-MS framework

Premier's overall aim is to minimise environmental impact during all operations. In addition to ensuring risks are identified and controlled, the system assists Premier in compliance with internal policies and procedures; it facilitates continual improvement through the setting of objectives and targets and provides a systematic approach for identifying and reviewing compliance with current and future regulatory requirements. Overall, the system is designed to firstly promote a positive impact on environmental management and performance. Secondly it ensures that continual improvement is held as being of the utmost importance in our everyday operations. These objectives are achieved by:

Leadership and Commitment

- Providing strong and visible leadership and commitment in HSES performance.

Policy and Strategic Objectives

- Setting policy and strategic objectives that support the commitment to compliance with all relevant statutory legislation and continuous improvement and take due account of industry codes and practices and any other requirements to which the company subscribes.

Organisation, Resources & Documentation

- Establishing and populating a fit for purpose organisational structure for the effective management of HSES and fully defining the HSES responsibilities of each function.
- Appointing management representatives who are responsible for and have the resources to implement this policy.
- Ensuring that all employees and contractors have adequate HSES awareness, skills and competence.
- Selecting and managing contractors to ensure their HSES performance meets Premiers requirements.
- Maintaining appropriate HSES documentation.

Risk Evaluation and Management

- Identifying health, safety, environmental and security risks to people, the local biodiversity and physical assets arising from Premier operations.
- Managing risks to levels that are as low as reasonably practicable in line with legal and other obligations and the strategy for continual improvement.

Planning

- Ensuring that HSES critical facilities and equipment are fit for purpose and meet defined HSES and reliability targets.
- Controlling activities and operations through the use of documented procedures and practices.
- Managing changes in people, plant and processes to avoid adverse HSES consequences.
- Maintaining emergency preparedness to manage the response to mitigate the effect of and facilitate recovery from unplanned events.

Monitoring and Implementation

- Monitoring HSES performance to determine compliance and keeping records in support of the HSES Management System.
- Recording areas of non-compliance and addressing these through corrective actions.
- Open reporting and investigation of all HSES related incidents.

Audit and Review

- Auditing and reviewing compliance with the HSES Policy and the adequacy of the HSES Management System.

Premier has a dedicated External Audit Plan to ensure that contractors' systems are adequate and consistent with Premier's HSES policy. Interface documents between Premier and its contractors and partners will identify the management structure and division of responsibilities, the methodology for undertaking the work programme, and the emergency response procedures during operations.

Continuous improvement in environmental performance is sought through effective project planning and implementation, emission reduction, waste minimisation, waste management, and energy conservation.

Premier's HSES-MS follows the 'plan, do, check, act' model, which aims to ensure continual improvement (Figure 10-2). The MS is subject to an annual management review in order to adapt to changing statutory requirements, corporate aspirations and new knowledge and techniques.

10.2 Tolmount East Project environmental management and commitments

A commitments register is presented in Table 11-1 which summarises all mitigation and management measures above and beyond regulatory requirements identified during the EIA process that will be implemented as part of the proposed Tolmount East Project. Each commitment will be reviewed regularly to ensure that it is being met. Objectives and targets are also used for setting goals for continuous improvement in performance as part of Premier's HSES-MS. In this way, environmental management is an ongoing process and will continue beyond implementation of mitigation measures identified during this EIA in order to strive for continuous improvement.

Table 10-1 Commitments log

Section number	Issue	Mitigation or management action
2	Project Description	Premier has and continues to optimise the project design for the Tolmount East Development to work towards and support the Net Zero organisations goals.
5.5	Discharges to sea	Premier commit to skip and ship to shore drilling mud and cuttings associated with the appraisal well sidetrack and completion.
5.5	Discharges to sea	No discharge of LTOBM or LTOBM contaminated cuttings to sea
5.5	Discharges to sea	Alternatives to chemicals carrying substitution notifications will be sought
5.5	Discharges to sea	Chemicals with no or low potential for environmental impact (e.g. PLONOR) will be selected wherever practicable;
5.5	Discharges to sea	The actual concentrations of chemicals discharged will be significantly lower than those applied to the pipeline(s), as the chemicals will be used up whilst protecting the pipeline before it is dewatered
5.5	Discharges to sea	A rig audit will be conducted to the ensure drilling rig is in compliance with all relevant guidelines and legislation
5.5	Discharges to sea	Environmental risk assessment as part of OCR approval process, and identification of measures to reduce risk including chemical selection procedures, will be carried out to obtain approval for chemical use prior to operations commencing
5.5	Discharges to sea	Cementing procedures will be implemented to reduce unused cement
5.5	Discharges to sea	Premier, in conjunction with its chemical suppliers, regularly investigates alternative technologies which may reduce the requirement for production chemical use. In addition, Premier is committed to trialling chemicals which have more environmentally acceptable components and which are not listed for substitution. An annual chemical substitution plan for sourcing, developing and trialling alternative non-sub chemicals across Premier's operations is maintained and submitted to OPRED.
5.5	Discharges to sea	There will be no discharges to sea of produced water. All produced water from Tolmount East will be treated onshore at the Easington Terminal.

Section number	Issue	Mitigation or management action
6.5	Seabed impacts	Seabed surveys have been undertaken to identify the habitats and species present, and to assess the potential for herring spawning
6.5	Seabed impacts	Stakeholder consultation has been conducted to identify areas of stakeholder concern and draw on a wide expertise with regard to potential sensitivities
6.5	Seabed impacts	A detailed anchor pattern for the MODU will be developed prior to mobilisation; this will take account of any environmental sensitivities
6.5	Seabed impacts	Pipeline route optimisation has been conducted (where relevant) to minimise impacts on potential features of conservation interest
6.5	Seabed impacts	The spread of rock armour during placement will be reduced through use of a fall-pipe system held a few meters above the seabed to accurately place rock material
6.5	Seabed impacts	The volumes and locations of rock and concrete mattresses used will be refined during Detailed Design to reduce the footprint on the seabed to the minimum extent practicable
6.5	Seabed impacts	Monitoring of placement/laying operations using ROV will allow controlled placement of the spool pieces, concrete mattresses and rock armour by minimising the impact to the seabed
6.5	Seabed impacts	Decommissioning will be performed in line with regulatory requirements at the time, which is likely to entail public consultation and a decommissioning EIA to minimise environmental impacts
7.5.1	Increased vessel traffic and collision risk	A Consent to Locate will be in place at the relevant time for the MODU and Premier to consult with relevant authorities and organisations to minimise interference impacts resulting from the proposed drilling activities
7.5.1	Increased vessel traffic and collision risk	A standby safety vessel will operate on site for the duration of drilling operations
7.5.1	Increased vessel traffic and collision risk	For the duration of the MODU being on site for drilling operations, navigation aids will be present on the vessel
7.5.1	Increased vessel traffic and collision risk	When the MODU comes on site, it will have a 500 m safety zone around it. Once the MODU departs at the end of drilling, the 500 m safety zone will cease to exist
7.5.1	Increased vessel traffic	The main operators of ships passing in proximity to the Project activities will be provided with advanced notice of the drilling and

Section number	Issue	Mitigation or management action
	and collision risk	installation operations. This will allow these vessels to revise their passage to take account of the operations at the site, should they consider it necessary
7.5.1	Increased vessel traffic and collision risk	Reporting of the MODU move will take place in line with the requirements of Part 4a of the Energy Act and HSE Operations Notice 6 guidance. This includes informing the MOD Hydrographer and MCA. This will ensure details of the MODU locations are distributed via Notices to Mariners, Navtex and NAVAREA warnings, as well as to the appropriate MRCC;
7.5.1	Increased vessel traffic and collision risk	As part of the licence conditions for the Tolmount field, notification of the Project will be made to the MoD at least 12 months prior to operations commencing
7.5.1	Increased vessel traffic and collision risk	The crew of the standby vessel attending the MODU will be experienced in traffic monitoring duties and should be briefed on the main routes of concern in the area
7.5.1	Increased vessel traffic and collision risk	An automated AIS-based maritime traffic survey will be performed during the drilling operation to record the positions and characteristics of ships passing in the vicinity of the MODU
7.5.1	Increased vessel traffic and collision risk	The MODU will be marked with AIS transceivers in order for vessels to observe the MODU on their AIS
7.5.1	Increased vessel traffic and collision risk	A collision risk management plan will be developed for the drilling operation to record the pre-planning measures taken to minimise the risk of ship collision, and to define the guarding role of the safety standby vessel whilst on location.
7.5.2	Temporary exclusions	Premier has reduced the vessel requirements and the number of vessels days as far as practicable whilst adhering to all safety and emergency response requirements
7.5.3	Snagging risk	The location of any anchors and associated anchor lines will be communicated to other sea users through standard communication channels, including Notices to Mariners and Kingfisher bulletins. This will be in the form of general communication that pipelay operations are being conducted and that there is an anchor spread, but precise anchor/wire positions will not be given as this will be a 24/7 activity
7.5.3	Snagging risk	Premier has a FLO, who will act as the Premier contact with fisheries organisations. Stakeholder engagement with local

Section number	Issue	Mitigation or management action
		fishermen (the NFFO) has already commenced for Tolmount East and existing relationships will be maintained
7.5.3	Snagging risk	Regular maintenance and pipeline route survey inspections will be carried out during the Project lifetime to ensure the pipeline remains in a favourable condition with minimal snagging risks
7.5.3	Snagging risk	The rock berms utilised are designed to be overtrawlable
7.5.4	Dropped objects	Personnel will be suitably trained as to minimise the potential for dropped objects: Lift planning will be undertaken to manage risk during lifting activities, and all lifting equipment will be tested and certified; All deck items will be securely stowed; All equipment and material on pipeline installation vessels will be adequately stowed or sea fastened; Transfers of objects will use specialist equipment and consider environmental conditions; and Procedures will be put in place to ensure that the location of any lost material is recorded and that significant objects are recovered where practicable and reported using PON 2 notification.
7.5.4	Dropped objects	The drilling contractor will have a dropped objects procedure which will be used for the proposed drilling operations to minimise any issues with dropped objects
7.5.4	Dropped objects	LOLER including inspection/testing
7.5.4	Dropped objects	Surveys will be undertaken to identify any debris within the Project location and along the pipeline route centreline prior to installation operations commencing. A post-installation debris survey will be performed once activities are completed. Specific debris surveys will not be undertaken along the pipeline route post installation, however 'as-built' surveys will be performed, which are likely to identify any significant dropped objects along the route
8.5	Atmospheric emissions	All vessels and the rigs employed during drilling and installation activities will comply with the Merchant Shipping (Prevention of Air Pollution from Ships) (Miscellaneous Amendments) Regulations 2019 and will have the appropriate UKAPP or IAPP in place as required.
8.5	Atmospheric emissions	All combustion equipment will be subject to regular monitoring and inspections to ensure an effective maintenance regime is in place, ensuring all combustion equipment runs as efficiently as possible

Section number	Issue	Mitigation or management action
8.5	Atmospheric emissions	Drilling and vessel operations will be carefully planned to reduce vessel numbers and the duration of operations
8.5	Atmospheric emissions	Use of low sulphur diesel (as per UK regulatory requirements).
8.5	Atmospheric emissions	Premier will monitor atmospheric emissions against business performance contract with an annual emissions target.
8.5	Atmospheric emissions	No flaring will be carried out during routine production operations, with only minimal flaring, if required, as part of the well clean up and pre-commissioning.
9.9.2	Accidental hydrocarbon releases; Chemical spills	Relevant personnel will receive environmental awareness training, and a trained On Scene Commander will be present during manned operations.
9.4	Accidental hydrocarbon releases	Bunkering operations will only take place during hours of good visibility, in suitable weather conditions, and with a continuous watch posted at both ends of the fuel hose. All hoses will be managed in line with a Hose Management Procedure, including frequent pressure testing and replacement.
9.9.1	Accidental hydrocarbon releases	Potential impacts are mitigated by the equipment design and spill risk reduction measures (subject to principles of BAT) and provision of appropriate spill response arrangements via an approved OPEP and access to specialist oil spill response services provided OSRL. Premier's management processes will ensure that these mitigation commitments are implemented and monitored.
9.9.1	Accidental hydrocarbon releases	The MODU, pipeline installation vessels and other support vessels will maintain approved Shipboard Oil Pollution Emergency Plans (SOPEPs) as required by the Merchant Shipping Regulations.
9.9.2	Chemical spills	Approved OPEP / procedures will include consideration of chemical spill risk and prevention measures and response strategies.
9.9.2	Chemical spills	Premier endeavours to use chemicals with a good environmental profile (PLONOR, Cefas OCNS group E or Gold banded chemicals) where possible to reduce potential impacts from these chemicals on the marine environment.

11 CONCLUSION

11.1 Marine plans

The Project EIA has considered the objectives and marine planning policies of the East Inshore and East Offshore Marine Plans across the range of policy topics including biodiversity, natural heritage, cumulative impacts and oil and gas. Premier considers that the Project is in broad alignment with such objectives and policies; the extent to which the Project is aligned is summarised in Appendix C.

11.2 Protected sites

There are a number of offshore and coastal conservation areas along the east coast of England that have been designated under the Habitats Directive as SACs (such as the Humber Estuary SAC and Southern North Sea cSAC), under the EU Birds Directive as SPAs (such as the Humber Estuary SPA and the Greater Wash pSPA) and under the Marine and Coastal Access Act 2009 as MCZs (such as the Holderness Inshore MCZ and Offshore rMCZ). The potential for significant impacts on any such site has been considered within each impact assessment.

Given the relatively short term duration of installation activities (reduced further by the change in the drilling programme and a single well development), the subsea nature of the Project and the distance to the surrounding protected areas, this Project is not expected to significantly impact any protected sites in the vicinity of the Project area.

11.3 Cumulative and transboundary impacts

A review of each of the potentially significant environmental impacts associated with the Project and the mitigation measures proposed against the range of other activities in the region (detailed in Chapters 5 - 9) indicates that no significant cumulative impacts are expected.

With regards to impacts that could occur outside of the UKCS, hydrocarbon release modelling undertaken for the Project indicates that in the event of an accidental hydrocarbon release a transboundary impact could result across the UK/Netherlands median line. However, the assessment demonstrates that the likelihood of a release large enough to lead to such a transboundary impact is remote to extremely remote, and that potential transboundary impacts are much reduced when likely intervention strategies are considered. A review of this potential scenario along with other potentially significant environmental impacts associated with the Project indicates that no significant transboundary impacts are expected.

Therefore, consultation under the Espoo Convention, is not required as a result of the Project. The Espoo Convention requires notification and consultation only for projects likely to have a significant adverse environmental impact across boundaries.

11.4 Environmental impacts

The significance of the key potential environmental impacts for the Project (i.e. following application of any mitigation) is summarised in Table 11-1.

Table 11-1 Summary of potential environmental impacts

Impact	Summary	Significance
Discharges to Sea		
Drilling, installation and commissioning	No drilling mud, cuttings, LTOBM or chemicals will be discharged to sea, instead these will be skipped and shipped onshore for processing and disposal. The only discharges relates to a very small amount of cement associated with the sidetrack of the appraisal well and equipment washdown. This discharge will be short and temporary and is therefore not considered to have any impact on the benthic community or water column as the volumes released will be small, with any toxicity being quickly diluted.	Not significant

	Discharges during pipeline commissioning, the largest being the dewatering of the 12" Tolmount East flowline, are likely to cause a small and short-lived plume of potentially toxic levels of chemicals, thereby impacting organisms within the water column. However, the duration of discharge will be relatively short and temporary, and the plume is expected to be rapidly diluted. Furthermore, mitigation measures will be in place with respect to appropriate selection and use of chemicals.	
Seabed impacts		
Drilling, installation and commissioning	Indirect impacts are expected to be temporary and local in scale, and when set against the low sensitivity of the biotopes present, are expected to be of negligible significance. As the worst case, the direct impact magnitude has been presented here. No EC Habitats Directive Annex I habitats were identified in the infield survey area, and there was no evidence for the	Not significant

	presence of FOCI, as defined by JNCC and Natural England, or OSPAR listed threatened / declining habitats or species. The benthic biotopes present along the proposed pipeline route are expected to have some tolerance to the predicted impact, with some ability to recover, therefore receptor sensitivity is low. Whilst full recovery of the benthic fauna is expected across the majority of the affected area, there will be a permanent impact over a very small area due to rock armour placement, therefore vulnerability is medium. The benthos in the area is present across a wide area of the SNS and there are no known protected species or habitats in the impact area, therefore receptor value is considered low. While there will be a very small area of seabed that is permanently affected, this is not expected to degrade the function or value of the existing habitat and benthos, therefore the consequence is considered low. The magnitude of direct impacts will be local in scale (0.101 km^2) and the majority of the impact will be short-term,	

	with a very small proportion of long-term or permanent direct impact assessed as a worst case assumption. As such the direct impact magnitude is considered minor. Adult and sub-adult fish found in the affected area are expected to be tolerant to the expected scale and duration of direct impact and show rapid recovery following cessation of activities. Eggs and young juveniles, including of benthic spawners such as herring are expected to show low capacity to tolerate disturbance and therefore sensitivity is considered to be medium. Effects are expected to be short-term, with recovery in the season following cessation of disturbance. It is considered unlikely that there will be long-term effects above the level of natural variation, therefore vulnerability is expected to be low. Herring appears on the UK BAP list; therefore, receptor value is deemed to be medium. The long-term function and value of the fish population is not expected to be affected and therefore the consequence is considered to be low. Even with the occurrence of delays in the	

	installation programme, the completed impact assessment is still considered to be applicable due to the short duration of works and associated short-term effects. As the consequences of the expected impact are low for all receptors, the impact is considered not significant.	
Physical presence		
Drilling, installation and commissioning	The temporary presence of vessels used for installation activities has the potential to interfere with other sea users thereby increasing collision risk, as well as temporarily limiting access to areas. However, with standard mitigation measures such as Notice to Mariners and use of navigation aids and safety standby vessels, this risk is not expected to be significant. Furthermore, there is sufficient sea space in the wider area for all routes to avoid the Project without significant alterations to routes.	Not significant

	The formation of mounds in the seabed from deployment and recovery of anchors, as well as dropped objects, during construction have the potential to create a snagging risk for fishermen. Departure of the heavy lift vessel and "as-built" surveys will be performed along the pipeline route. The seabed sediments in the Project area mostly comprise sand and gravel and the location is within a high energy environment; therefore, any anchor mounds are likely to persist for a short duration only. The presence of Project vessels increases the risk of vessel collision. However, vessels involved in the Project are likely to be travelling relatively slowly and therefore collision risk is expected to be lower than that typically posed by commercial shipping activity. The reduced drilling program also means that the rig and vessels will be in the field for a reduced length of time therefore the risk will be reduced.	

Operation	The Project is entirely subsurface therefore its long-term presence should not act in combination with any already active projects in terms of increasing collision risk. The placement of rock armour over the pipeline in certain locations (should it be needed) has the potential to create a snagging risk for fishermen; these rock berms will be designed to be overtrawlable. Regular maintenance and pipeline route survey inspections will be carried out during the Project lifetime to ensure the pipeline remains in a favourable condition with minimal snagging risks.	Not significant
Atmospheric Emissions		
Drilling, installation and commissioning	Activities including drilling, well clean-up, pipeline installation and vessel movements will generate emissions of greenhouse gases that could potentially reduce air quality and contribute to climate change.	Not significant

	Whilst the majority of Project emissions will be during the drilling, installation and commissioning phases, emissions during this phase of the Project will be small in comparison with other UKCS emissions (approximately 0.001% of total UK carbon budget for the accounting period between 2023 and 2027, within which most of the Tolmount East construction will occur). As the drilling programme has been reduced the emissions from this phase have also been reduced from the original plan.	
Operation	The subsea nature of the development means no flaring is to occur during the operational phase. Emissions during this phase will only relate to vessel activity and will therefore be small in comparison with other UKCS emissions (This is at approx. 0.000003% and 0.000006% of total offshore shipping and oil and gas emissions for the for the accounting period between 2028 and 2032 and 2033 to 2037 respectively).	Not significant

Accidental Events		
Drilling, installation and commissioning	A well blowout during drilling may result in a significant release of hydrocarbons to sea (condensate), as could an accidental release of the hydrocarbon inventory from the MODU caused by mechanical failure, operational failure or human error (marine diesel). Oil on the sea surface can affect the structure of birds' feathers and therefore could result in an impact on birds floating on the sea surface. The Tolmount EIA determined that there were no potential significantly adverse impacts associated with shoreline or surface oiling from a worst case blowout. To reduce the risk of a release, the MODU will be fitted with a BOP and the likelihood of a blowout or well release from Tolmount is considered remote to extremely remote. The potential to cause significant adverse impacts is low and are not predicted to constitute a MEI. Pre-mobilisation audits and bridging documentation will ensure that spill prevention	Not significant

	procedures are in place on the MODU, support and supply vessels. All activities related to the Project will be covered by appropriate OPEPs and SOPEPs and Premier has access to specialist oil spill response services provided by OSRL. Accidental chemical spills may also occur during chemical transfer, chemical/mud handling (during drilling operations only), or through mechanical failure, with the potential to impact plankton or fish egg/larvae. However, given the high energy marine environment of the wider area, chemical spills are expected to rapidly disperse in the offshore marine environment. Procedures will be in place to reduce the risk of spillage, in particular written procedures, regular inspection of equipment and provision of spill kits. As the drilling program has been decreased the risk from blowouts is limited to only one well and also the risk of other spills at that location is also reduced.	

Operation	A hydrocarbon release from the TE flowline once operational is unlikely, but may occur if the flowline was to rupture. Although the probability of a catastrophic release from the Tolmount East Project is remote, even with comprehensive prevention measures in place, the residual risk of accidental release, and thus impact on the marine environment, remains. All activities will be covered by appropriate OPEPs and SOPEPs which will set out the responses required and the available resources for dealing with spills of all sizes	Not significant

11.5 Final remarks

As the operational phase of the Project will see the operation of only subsea infrastructure with occasional visits by survey vessels, the majority of the impacts associated with the Project will occur during drilling and installation of the manifold, WHPS, pipeline and umbilical. Most of the potential impacts during these activities are not unique to an offshore installation project of this type. As the drilling program has been reduced from three to one well, the environmental impacts and risks have therefore been reduced.

Premier's Health, Safety, Environment and Security Management System will ensure that all the measures described herein to minimise and mitigate against environmental impact will be delivered by the Project through the establishment of an environmental management plan for the installation, commissioning and production operations on the Tolmount East Project.

Overall, it is concluded that the proposed Project will not result in any significant negative environmental impacts.

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13 GLOSSARY

Appraisal well	A well drilled as part of an appraisal drilling programme which is carried out to determine the physical extent, reserves and likely production rate of a field.
Bathymetry	The measurement of water depths in oceans, seas and lakes.
Benthos	The plant and animal community living on or in the seabed, including both intertidal and subtidal.
Bentonite spud mud	Type of drilling fluid containing clay.
Bern Convention	A signed agreement to protect endangered migratory species by conserving wild flora and fauna and their habitats.
Blowout	Uncontrolled release of reservoir fluids into the wellbore and sometimes to the surface wellbore or casing.
Blowout preventer	A large valve at the top of a well that may be closed if the drilling crew loses control of formation fluids. By closing this valve (usually operated remotely via hydraulic actuators), the drilling crew usually regains control of the reservoir, and procedures can then be initiated to increase the mud density until it is possible to open the BOP and retain pressure control of the formation.
Biota	The flora or fauna occurring in a particular area.
Biotope	The physical habitat with its biological community; a term which refers to the combination of the physical environment (habitat) and its distinctive assemblage of conspicuous species.
Birds Directive	European directive to protect habitats of wild bird species through the designation of Special Protection Areas (SPAs). The directive provides a framework for the conservation and management of, and human interactions with, wild birds in Europe. The objective is to create a coherent network of protected species which meets the protection requirements of endangered and migratory bird species.
Bonn Agreement	Is the mechanism of the North Sea States to carry out surveillance as an aid to detecting and combating pollution at sea.
Boulders	The largest category of sediment particle size; a stone or rock with a diameter greater than 256 mm.
Caisson	Length of pipe extending vertically downwards from an offshore installation into the sea as a means of disposing of waste waters.
Casing	Steel pipe cemented in place during the construction process to stabilise the wellbore. The casing forms a major structural component of the wellbore and serves several important functions: preventing the formation wall from caving into the wellbore, isolating the different

	formations to prevent the flow or crossflow of formation fluids, and providing a means of maintaining control of formation fluids and pressure as the well is drilled. The casing string provides a means of securing surface pressure control equipment and downhole production equipment, such as the drilling blowout preventer (BOP) or production packer. Casing is available in a range of sizes and material grades.
Cetaceans	Collective term for whales, dolphins and porpoises.
Choke valve	A type of control valve, mostly used in oil and gas production wells to control the flow of well fluids being produced.
CO_2e	Carbon dioxide equivalent is a measure used to compare the emissions from various greenhouse gases based upon their global warming potential.
Cobbles	A category of sediment particle size; a stone or rock with a diameter of 64 to 256 mm.
Commissioning	Preparatory testing work, servicing etc. usually on newly installed equipment prior to coming into full production.
Copepod	A large family of aquatic organisms belonging to the class Crustacea of the phylum Arthropoda, living in fresh water or sea water. Many are free living in the plankton or in seabed sediments, whilst others are parasitic.
Demersal	Applies to fish living or occurring in the water at or near the seabed or at the base of a water body.
Dewatering	The process of removing water from pipelines.
Development well	Any well drilled in the course of extraction of reservoir hydrocarbons whether specifically a production well or injection well.
Dynamic position	The stationing of a vessel at a specific location in the sea by the use of computer-controlled propulsion units called thrusters.
Echinoderms	Refers to marine animals belonging to the phylum Echinodermata e.g. starfish, crinoids or feather stars and sea urchins.
Echolocation	The locating of objects using sound.
Environmental Impact Assessment (EIA)	Systematic review of the environmental effects a proposed project may have on its surrounding environment.
Environmental Management System (EMS)	System established to manage an organisation’s processes and resultant environmental impacts.

Environmental sensitivity	The susceptibility of the environment to potentially adverse impacts.
Environmental Statement	Formal document presenting the findings of the EIA process for a proposed project.
Epifauna	Benthic organisms living on the seabed.
European Protected Species	These are plants and animals (other than birds) that are protected by law throughout the European Union. Several hundred different species are provided protection by way of inclusion on Annexes II and IV of the European Habitats Directive.
Formation	A layer of rock with distinct features such as texture or mineral composition. The thickness of a formation can range from a few feet to several hundred feet.
Freespan	A freespan on a pipeline is where the stiffness of a new pipeline being installed prevents it from laying down on the seabed and is instead suspended above the seabed.
Fugitive emissions	Gas or vapour emissions from pressurized equipment as a result of leaks or other unintended gas releases.
Greenhouse gas	Gases in the atmosphere that absorb and emit radiation within the thermal infrared range. Primary greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide and ozone.
Guard vessels	Vessels guarding offshore assets.
Habitats Directive	The Habitats Directive (together with the Birds Directive) forms the cornerstone of Europe’s nature conservation policy. It is built around two pillars: the Natura network of protected sites and the strict system of species protection. The directive protects over 1,000 animals and plant species and over 200 so called “habitat types” (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.
Haul-out sites	Areas of coastal and inland water ways where pinnipeds temporary leave the water.
Hook up	The activity following offshore development installation during which all connections and services are made operable for commissioning and start up.
Hydraulic Power Unit (HPU)	Provides hydraulic fluid power to the subsea control system.
Hydrocarbons	Organic compounds of carbon and hydrogen atoms. There are a vast number of these compounds and they form the basis of all

	petroleum products. They may exist as gases and liquids. Examples include methane, hexane and crude.
Hydrotesting	Conducting hydrostatic testing on pressure vessels including pipelines. Vessels can be tested for strength and leaks.
ICES rectangle	A statistical area of the sea that is 0.5° north by 1° west, defined by the International Committee for the Exploration of the Sea and used for the reporting of fisheries statistics.
Infauna	Benthic organisms, typically invertebrates, living within the sediments on the seabed or lake bed.
Kyoto Protocol	An international treaty signed in 1997 binding obligations set on industrialised countries to reduce emissions of greenhouse gases. The protocol became effective in 2005.
Manifold	An arrangement of piping or valves designed to control, distribute and typically monitor fluid flow.
Marine Mammal Observer (MMO)	A MMO will be present during offshore operations that create potentially harmful underwater noise. MMOs will ensure operators adhere to regulations or follow industry best practice. They advise personnel onboard to delay or shutdown operations until any marine mammals in the vicinity have moved to a safe distance and also to record behaviour and sightings at other times.
Mattress	A flexible set of connected concrete blocks typically 6 m x 3 m used to protect or support pipelines and other subsea infrastructure.
Mean low water	The average height of all low tides over a 19-year period
Migration	Any regular animal journey along well-defined routes, particularly those involving a return to breeding grounds.
Minimum Facilities Platform	An oil or gas platform that typically houses the surface wellheads and trees, but does not include extensive process or separation facilities. As such, multi-phase production fluid may be exported from the MFP either to an adjacent production facility or into a larger field production network to be processed on existing assets.
Mobile Offshore Drilling Unit	A MODU is a term for floating drilling units such as semi-submersibles, jack-up rigs etc.
OSPAR	Convention for the protection of the marine environment of the north-east Atlantic (Oslo – Paris convention).

Passive Acoustic Monitoring (PAM)	Deployment of underwater hydrophone cables and monitoring of in-coming signals on computers to aid marine mammal detection before and during offshore operations. Used in conjunction with visual observations from a MMO or in place of the MMO during hours of darkness.
Pelagic	Referring to the ocean water column and the organisms living therein.
Permanent threshold shift (PTS)	A permanent decrease in hearing sensitivity caused by exposure to loud noise.
Phytoplankton	Planktonic plants, sometimes microscopic, e.g. diatoms and dinoflagellates.
Pigging	The process of controlled flooding, cleaning, gauging or inspecting a pipeline by propelling mechanical devices (called 'pigs') through the pipeline using differential pressure.
Piggyback	Where a small diameter pipeline is connected to a large diameter pipeline enabling simultaneous installation of the two pipelines.
Piling	The process by which tubular or sheet metal piles are driven into the ground/seabed.
Pinnipeds	Marine mammals that include seals, sea lions and walruses.
Pipelay	The process by which a pipeline is installed onto the seabed from a specialist construction vessel.
Plankton	Tiny plants and animals that drift in the surface water of seas and lakes. Of great economic and ecological importance as they are a major component of marine food chains.
Polychaetes	Bristle worms are a class of segmented worms belonging to the phylum Annelida, generally marine. Each body segment has a pair of fleshy protrusions called parapodia that bear many bristles, called chaetae, which are made of chitin.
Pre-lay	Various construction activities that are required to prepare the seabed for pipeline installation.
Pre-lay survey	A survey conducted shortly before a pipeline is installed to ensure the pipeline route is free of obstacles. Surveys are conducted using side scan sonar and/or ROVs. Pre-lay surveys do not include collection of further geotechnical survey data.

Priority Marine Features (PMF)	Priority marine features are habitats and species which SNCBs consider to be marine nature conservation priorities. The aim of the Priority Marine Features work is to produce a focused list of marine habitats and species to help target future conservation work.
Produced sand	Sand produced by the migration of formation sand caused by the flow of reservoir fluids.
Produced water	Water produced along with oil and gas from the reservoir, initially comprising the formation water. It contains a range of inorganic and organic compounds.
Produced water breakthrough	Point at which water, previously isolated or separated from production, gains access to a producing wellbore.
Production header	Gas production and testing valves to control the flow of each well, thus directing the produced fluids to production or testing vessels.
Production separator	A cylindrical or spherical vessel used to separate oil, gas and water from the total fluid stream produced by a well.
Production well	A development well specifically for the extraction of reservoir fluids. Production is the full-scale extraction of oil and gas reserves.
Reef	Bedrock and stony reefs are both types of rocky reef. These occur where the bedrock or stable boulders and cobbles arise from the surrounding seabed creating a habitat that is colonised by many different marine animals and plants. Rocky reefs can be very variable in terms of both their structure and the communities that they support. They provide a home to many species such as corals, sponges and sea squirts as well as giving shelter to fish and crustaceans such as lobsters and crabs.
Ramsar	Wetlands of international importance.
Reservoir	A porous, permeable sedimentary rock formation containing quantities of oil and or gas enclosed or surrounded by layers of less-permeable or impervious rock; a structural trap; or stratigraphic minerals.
Rock placement	The process by which rock is deposited on the seabed for engineering purposes for example through a fall-pipe deployed from a specialist vessel.
Special Area of Conservation (SAC)	Areas considered important for certain habitats and non-bird species of interest in a European context. One of the main mechanisms by which the EC Habitats and Species Directive 1992 is implemented.

Shut-down	A period during which the platform ceases production while essential maintenance work is undertaken.
Significant wave height	Significant wave height (Hs) approximates to the mean wave height (trough to crest) of the highest third of the waves. The most common waves are lower than Hs. However, as this definition implies, the highest waves will be higher than the significant wave height, and the maximum wave height will be the highest of all.
Snagging risk	The risk of a trawled fishing net getting caught and snagged on a subsea structure.
Special Protection Area (SPA)	Sites designated under the EU Birds Directive for the protection of birds.
Spudding	The start of the drilling process where rock etc. is moved by the drill bit.
Stakeholder	Any individual or groups of people who are affected by, or have interest in, the activities and/or outcome of the project.
Start-up	Commencement of production operations.
Strategic Environmental Assessment (SEA)	A systematic decision support process, aiming to ensure that environmental and possibly other sustainability aspects are considered effectively in policy, plan and programme making.
Tophole	The first section of the well.
Tree	Assembly of valves, spools, and fittings used to control the flow into or out of the well, usually oil or gas.
Water Framework Directive	EU Directive aimed at elevating the status of all EU waterways and bodies.
Well abandonment	When the economic limit of an oil/gas well is reached, the well is sealed, associated infrastructure recovered, and the well is abandoned.
Well clean-up	Leaving the well bore clean after drilling by displacing mud and cuttings to bring on production.
Well release	An unintended incident where hydrocarbons flow from the well and the flow was stopped by use of the barrier system that was available on the well at the time of the incident.

Well testing	Testing in an exploration or appraisal well is directed at estimation of reserves in communication with that well, in addition to the well productivity. Testing in a production well also monitors the effects of cumulative production on the formation.
Wellhead	A top of casing and the attached control and flow valves. The wellhead is where the control valves, testing equipment and take-off piping are located.
Wireline	Related to any aspect of logging that employs an electrical cable to lower tools into the borehole and to transmit data. Wireline logging is distinct from measurements-while-drilling (MWD) and mud logging.
Workover	The process of performing maintenance or remedial treatments on an oil or gas well. In many cases, workover implies the removal and replacement of the production tubing string after the well has been killed using a workover rig. Through-tubing workover operations, using coiled tubing, snubbing or slickline equipment, are routinely conducted to complete treatments or well service activities that avoid a full workover where the tubing is removed. This operation saves considerable time and expense.
Zooplankton	Free floating animals, mostly microscopic.

Appendix A ENVID MATRIX

The worst case ENVID presented below was completed for the original project design. Following the ENVID, the project has been revised and optimised, leading to a reduced project footprint and environmental impact discussed within the Environmental Statement.

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
Discharges to Sea							
DTS 1	Discharge of drill cuttings to sea, from both pile installation and well drilling	Cuttings, hydrocarbons, dissolved metals, dissolved organics and chemicals discharged to sea on cuttings may cause detrimental impacts on local water and seabed quality and associated marine flora and fauna.	Drilling	Yes	- Predominant discharges to sea are tophole (WBM) cuttings; - OBM and payzone cuttings to be skipped/shipped or treated and discharged offshore via Thermomechanical Cuttings Cleaner (TCC); - If using Thermomechanical Cuttings Cleaner, Premier may drill a 16.5" hole instead of 17.5"; - Drill cuttings dispersion modelling; - Selection of chemicals with less potential for environmental impact as per Premier's Drilling Management System; - Premier's contractor selection process; - Environmental risk assessment through the MATs/SATs system (OCR and OPPC);	Yes	Scoped In
			Construction, installation and commissioning	Yes	- No drilling for piles. The piles will be hammer-driven through pile sleeves offset from each corner of the subsea infrastructure.; - Premier's contractor selection process; - Environmental risk assessment through the MATs/SATs system (OCR and OPPC).		
			Operations	No	N/A		
			Decommissioning	No	- Premier's contractor selection process; - Environmental risk assessment through the MATs/SATs system (OCR and OPPC); - Subject to option Comparative Assessment and Decomissioning EIA.		
DTS 2	Chemical use and discharge to sea	Chemicals discharged to sea may cause contamination of seawater and disturbance to aquatic ecosystem.	Drilling	Yes	- OBM and payzone cuttings to be skipped/shipped or treated and discharged offshore via Thermomechanical Cuttings Cleaner (TCC); - If using Thermomechanical Cuttings Cleaner, Premier may drill a 16.5" hole instead of 17.5"; - Selection of chemicals with less potential for environmental impact as per Premier's Business Unit Management System; - Premier's contractor selection process; - Environmental risk assessment through the MATs/SATs system (OCR).	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Volumes to be recorded and reported annually - Selection of chemicals with less potential for environmental impact as per Premier's Business Unit Management System; - Premier's contractor selection process; - Environmental risk assessment through the MATs/SATs system (OCR).		
			Operations	Yes	- Compliant produced water treatment system (located on the TM MFP) with BAT assessment; - Selection of chemicals with less potential for environmental impact as per Premier's Business Unit Management System; - Premier's contractor selection process; - Environmental risk assessment through the MATs/SATs system (OCR).		
			Decommissioning	Yes	- Wells plug and abandon to be carried out compliant with decommissioning regulations; - Selection of chemicals with less potential for environmental impact as per Premier's Business Unit Management System; - Premier's contractor selection process; - Environmental risk assessment through the MATs/SATs system (OCR); - Subject to option Comparative Assessment and Decomissioning EIA.		
DTS 3	Discharge of hydrocarbons to sea, including produced water	Oil, dissolved metals and dissolved organics discharged to sea in produced water may cause detrimental impacts on local water quality and marine flora and fauna. Potential for oily sheens to appear and possible seabird contamination.	Drilling	Yes	- OBM and payzone cuttings to be skipped/shipped or treated and discharged offshore via TCC; - Environmental risk assessment through the MATs/SATs system (OPPC).		

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
			Construction, installation and commissioning	No	N/A	Yes	Scoped In
			Operations	Yes	The fluids from the wells will be transported to TM MFP, where depending upon the produced water level will either be separated offshore at the existing TM MFP or shall bypass the TM MFP separator and be directed straight into the 20" export pipeline. - Discharge on TM MFP will meet regulator requirements for oil in water content (Premier targetting 15 mg/l but will be below 30mg/l); - Environmental risk assessment through the MATs/SATs system (OPPC); - Onboard metering to monitor compliance of produced water & EEMS returns		
			Decommissioning	Yes	- Discharge will meet regulator requirements for oil in water content (Premier targetting 15 mg/l but will be below 30mg/l); - Environmental risk assessment through the MATs/SATs system (OPPC).		
DTS 4	Routine discharge of ballast water and removal/fall-off of fouling growth from ships.	Ballast water and marine growth on ships coming into the Project area may contain non-native organisms. Some species may survive and establish themselves. Non-native species may cause serious ecological impacts, particularly if they become invasive.	Drilling	Yes	- IMO Ballast Water Management Convention guidelines, including Ballast water plan and log book; - Vessel audits / assurance; - Contractor selection.	Unsure	Scoped In
			Construction, installation and commissioning	Yes	- IMO Ballast Water Management Convention guidelines, including Ballast water plan and log book; - Vessel audits / assurance; - Contractor selection.		
			Operations	No	- All vessels to be from UK.		
			Decommissioning	Yes	- IMO Ballast Water Management Convention guidelines, including Ballast water plan and log book; - Vessel audits / assurance; - Contractor selection.		
DTS 5	Routine blackwater production (i.e. sewage), grey water (i.e. from showers, laundry, hand and eye wash basins and drinking fountains) and food waste (macerated) disposal (from vessels and drilling rig).	Discharge of sewage, grey water and macerated food has an associated BOD and may contribute to organic enrichment in the vicinity of the discharge possibly leading to a small increase in plankton and fish population.	Drilling	Yes	- Treatment to IMO (MARPOL) standards; - Premier vessel assurance programme.	No	Scoped Out
			Construction, installation and commissioning	Yes	- Treatment to IMO (MARPOL) standards; - Premier vessel assurance programme.		
			Operations	Yes	- Treatment to IMO (MARPOL) standards; - Premier vessel assurance programme.		
			Decommissioning	Yes	- Treatment to IMO (MARPOL) standards; - Premier vessel assurance programme.		
DTS 6	Routine seawater usage for cooling (e.g. engine cooling).	Discharge may be at a higher temperature than the surrounding water.	Drilling	Yes	- Quantities assumed to be low enough so any effect is likely to be minimal due to dilution effects; - Most cooling circuits to be closed loop; - Vessels to be compliant with MARPOL.	No	Scoped Out
			Construction, installation and commissioning	Yes	- Quantities assumed to be low enough so any effect is likely to be minimal due to dilution effects; - Vessels to be compliant with MARPOL.		
			Operations	Yes	- Quantities assumed to be low enough so any effect is likely to be minimal due to dilution effects; - Vessels to be compliant with MARPOL.		
			Decommissioning	Yes	- Quantities assumed to be low enough so any effect is likely to be minimal due to dilution effects; - Vessels to be compliant with MARPOL.		
DTS 7	Produced sand from Tolmount East reservoir discharged to sea.	Oil, dissolved metals and dissolved organics discharged to sea in sand and scale may cause detrimental impacts on local water quality, the seabed and marine flora and fauna (e.g. smothering of benthic fauna).	Drilling	No	N/A	No	Scoped Out
			Construction, installation and commissioning	No	N/A		
			Operations	Yes	- Premier plan to control sand generation by way of open hole gravel packs installed in the well completions.		
			Decommissioning	No	N/A		
Physical Presence							

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
PP 1	Seabed disturbance from: - Cuttings mounds; - Installation of piled drilling template and subsea manifold (inc. mud mats); - Trenching, installation and burial of pipeline/umbilical (trenched and buried to be the base case), including pre-sweeping of megaripples; - Spot rock placement for upheaval buckling and at pipeline transitions; Rock dumpng of the 4 km of entire pipeline/umbilical instead of trenching may need to be undertaken. This represents a realistic worst case for assessment. This may be individual berms or a combined. - Mattresses (required for exposed pipeline/umbilcal and spoolpieces between the trench exit and tie-in location; - Spoil storage alongside the trench and replaced into the trench, post pipelay; - Positioning of vessels, inc. jackup drilling rig (spud cans) and pipeline laybarge.	- Direct and indirect damage to benthic habitats and species; - Direct damage to archaeology; - New structures / rock armour may also provide an artificial reef effect.	Drilling	Yes	- Stakeholder consultation; - Tophole (WBM) cuttings only; - Drill cuttings dispersion modelling; - Environmental risk assessment through the MATs/SATs system; - Dynamic positioning of vessels will be utilised to avoid disturbance from anchoring.	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Environmental risk assessment through the MATs/SATs system; - Detailed project design / micrositing of pipeline/umbilical route. Minor sandwaves have been identified, however any microrouting will minimise impacts on benthic features; - Depth of burial of pipeline to provide protection over lifetime (25 years design life) in light of seabed erosion; - Lessons learnt from previous pipelines/umbilcals; - Contractor selection and management; - Re-use of trenched materials wherever possible; - Volumes and locations of rock and mattresses to be used will be refined during detailed design to reduce the footprint on the seabed to the extent practicable; - Spread of rock placement to be restricted through use of a fall pipe system; - Dynamic positioning of vessels will be utilised to avoid disturbance from anchoring.		
			Operations	Yes	- Pipeline, drilling template and subsea manifold inspections; - Scheduled surveys of buried pipeline to ensure not becoming uncovered due to erosion; - Environmental risk assessment through the MATs/SATs system.		
			Decommissioning	Yes	- Decommissioning philosophy to be included in design phase of the project; - Stakeholder consultation; - Subject to option Comparative Assessment and Decomissioning EIA.		
PP 2	Physical presence of: - Vessels (including guard vessels during installation and pipelaying. - The drilling template and subsea manifold (including deposited material) for the life of the development and/or abandoned structures.	- Short term potential obstruction or exclusion from vessel use may impede commercial fishing activities and other sea users. Includes temporary safety zones; - Long term potential obstruction or exclusion from structures laid/fixed on seabed, e.g. pipeline, drilling template and subsea manifold may impede commercial fishing activities (including through snag risk) and other sea users; - Helicopter movements may impact nearby offshore developments (e.g. offshore windfarms, O&G etc.).	Drilling	Yes	- Establishment of 500m safety zone around the drilling rig while on location & use of a guard vessel; - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings); - Consultation will be undertaken with relevant authorities and organisations; - Consent to Locate (CTL) SATs.	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Establishment of 500m safety zone around construction vessel if required; - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings); - Consultation will be undertaken with relevant authorities and organisations; - Consent to Locate (CTL) SATs; - Development and implementation of a fishery liaison strategy; - Pipeline to be trenched and buried for majority of length to minimise snag risk; - Trench spoil to be used for backfill over pipeline so minimal snag risk; - Rock berms designed to be overtrawlable.		
			Operations	Yes	- A vessel will be present during maintenance operations. Estimated at every 180 days; - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings); - Consultation will be undertaken with relevant authorities and organisations; - Consent to Locate (CTL) SATs; - Regular maintenance and pipeline route inspection surveys; - Stakeholder engagement as necessary.		

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
			Decommissioning	Yes	- Establishment of 500m safety zone around work vessel if required; - UKHO standard communication channels including Kingfisher, Notice to Mariners and radio navigation warnings); - Consultation will be undertaken with relevant authorities and organisations; - Consent to Locate (CTL) SATs.		
PP 3	Physical presence of drilling rig, drilling template, subsea manifold and vessels (including light emissions) causing disturbance to wildlife.	- Disturbance to wildlife (e.g. seabird communities and marine mammals) and designated sites (Southern North Sea SAC (harbour porpoise)); - Could lead to exclusion of marine species from an area, or to collision between vessel and animals.	Drilling	Yes	- Environmental awareness training; - CTL conditions.	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Environmental awareness training; - CTL conditions; - Vessel management plan may be implemented in line with best practice; - Stakeholder engagement;		
			Operations	No	- CTL conditions		
			Decommissioning	Yes	- Environmental awareness training; - Stakeholder consultation.		
PP 4	Noise emissions from: - Drilling rig and vessel activities (inc. DP noise) - Hammered piling of drilling template and subsea manifold piles - Helicopter movements	- Disturbance and/or injury potential to marine mammals, fish and seabirds.	Drilling	Yes	- Limit the duration of the noise emitting activities as much as practicable; - Account for seasonal sensitivities if possible; - Helicopter movements to be minimised as far as possible.	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Limit the duration of the noise emitting activities; - Account for seasonal sensitivities if possible; - Implement vessel management plan; - Use of JNCC guidelines for minimising impact to wildlife during piling (e.g. soft start); - Stakeholder consultation.		
			Operations	Yes	- Limit the duration of noise emitting activities		
			Decommissioning	Yes	- Limit the duration of the noise emitting activities; - Account for seasonal sensitivities if possible; - Stakeholder consultation.		
PP6	Physical presence of hot conductors and pipeline	- Impacts to water quality and marine wildlife.	Drilling	No	N/A	No	Scoped Out
			Construction, installation and commissioning	No	N/A		
			Operations	Yes	- Rapid cooling due to ocean currents is likely to negate the effects of this aspect.		
			Decommissioning	No			
Atmospheric Emissions							
AE 1	Fuel combustion by drilling rig, vessels, helicopter	- Resource use; - Emissions of CO2, CH4, CO, VOCs, SOx, NOx and particles of carbon (soot) may contribute to global warming, acid precipitation, ozone depletion and deterioration of local air quality.	Drilling	Yes	- Low sulphur fuels; - Premier contractor selection; - Regular maintenance, monitoring and EEMS returns.	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Low sulphur fuels; - Premier contractor selection; - Regular maintenance, monitoring and EEMS returns.		
			Operations	No	- Low sulphur fuels; - Regular maintenance, monitoring and EEMS returns		
			Decommissioning	Yes	- Low sulphur fuels; - Premier contractor selection.		
AE 2	Flaring on the drilling rig	- Emissions of CO2, CH4, CO, VOCs, SOx, NOx and particles of carbon (soot) may contribute to global warming, acid precipitation, ozone depletion and deterioration of local air quality.	Drilling	Yes	- Flaring management plan (for the drill rig); - Flaring to occur only during well clean-up, no well tests are planned at this stage; - Well clean-up to be short duration (not Extended Well Test (EWT)); - Environmental risk assessment through the MATs/SATs system & monitoring via EEMS returns.	Yes	Scoped In
			Construction, installation and commissioning	No	N/A		

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
			Operations	Yes	- Well intervention frequency expected to be once per life of field; - Pipeline de-pressurisation to be covered via onshore terminal & onshore ES.		
			Decommissioning	No	N/A		
AE 3	Fugitive emissions (e.g. from seals, welds, valves, pipes, pumps, flanges etc. (drilling rig and vessels).	- Emissions of VOCs and CH4 may contribute to global warming, formation of localised photochemical smog, and deterioration of local air quality.	Drilling	Yes	- Maintenance programme.	No	Scoped Out
			Construction, installation and commissioning	Yes	- Maintenance programme.		
			Operations	Yes	- Maintenance programme.		
			Decommissioning	Yes	- Maintenance programme.		
AE 4	Emissions of F Gases and similar compounds from gaseous fire fighting system	- Detrimental impact to ozone layer.	Drilling	No	N/A	No	Scoped Out
			Construction, installation and commissioning	No	N/A		
			Operations	No	N/A		
			Decommissioning	No	N/A		
AE 5	Venting of hydrocarbons to atmosphere.	- Emissions of methane and non-methane hydrocarbons, water vapour may contribute to global warming, ozone depletion and deterioration of local air quality.	Drilling	No	N/A	No	Scoped Out
			Construction, installation and commissioning	No	N/A		
			Operations	No	N/A		
			Decommissioning	No	N/A		
Waste							
W 1	Routine generation and disposal of non-hazardous waste streams.	- Disposal to land of inert waste materials.	Drilling	Yes	- Premier EMS; - Project / Asset waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy.	No	Scoped Out
			Construction, installation and commissioning	Yes	- Premier EMS; - Project / Asset waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy		
			Operations	Yes	- Premier EMS; - Project / Asset waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy.		
			Decommissioning	Yes	- Premier EMS; - Project / Asset waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy.		
W 2	Routine generation and disposal of special/ hazardous wastes, e.g. oily rags, medical waste, solvents, batteries, computers, fluorescent tubes, oil/grease/chemical cans/drums/sacks, contaminated produced sand, contaminated cuttings, pigging waste.	- Disposal to land of special/ hazardous waste materials.	Drilling	Yes	- Premier EMS; - Project / Assest waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy; - OBM and payzone cuttings to be skipped/shipped or treated and discharged offshore via Thermomechanical Cuttings Cleaner (TCC); - Skip and ship of OBM managed through Premier's EMS/existing contractors.		
			Construction, installation and commissioning	Yes	- Premier EMS; - Project / Assest waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy.		

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
			Operations	Yes	- Premier EMS; - Project / Assest waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy; - Sand from separator to be emptied and brought to shore for disposal; - Wax from pigging waste receiver to be covered under onshore ES as pigging runs from offshore to onshore.	No	Scoped Out
			Decommissioning	Yes	- Premier EMS; - Project / Assest waste management plan; - Contractor selection / audits; - Use of licensed waste contractors/sites; - Waste transfer notes; - Waste heirarchy; - Sand from separator to be emptied and brought to shore for		
W 3	Routine generation and disposal of radioactive wastes (disposal onshore) (e.g. LSA scale, contaminated cuttings, radiation sources in safety/ detection equipment etc.).	- Disposal to land of radioactive wastes.	Drilling	Yes	- Include brief mention of permitting of nucleonics as separate section in waste chapter in the ES.; - Covered under Premier's or the installaion operators PLANC Register	No	Scoped Out
			Construction, installation and commissioning	No	N/A		
			Operations	Yes	- Compliance to regulations; - Use of licensed waste contractors/sites; - Waste consignment notes, further assessment as part of permits to handle such waste; - Maintenance procedures; - Use of scale inhibiters if scale problem is detected.		
			Decommissioning	Yes	- Nucleonics in separators to be permitted under RSA permit.		
Accidental Events							
AE 1	LARGE SCALE - Well blowout leading to release of gas/condensate; - Loss of pipeline containment leading to release of gas/condensate; - Loss of fuel inventory from rig or vessel.	- Contamination of surrounding water and atmosphere; - Impact on seabird populations; - Potential shoreline impact.	Drilling	Yes	- Blow out preventer; - Appropriate well design and inspection; - TOOPEP, including spill modelling and appropriate response planning; - Inspection procedures; - SIMOPs; - Mitigation as per safety case.	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Inspection procedures; - SIMOPs; - Mitigation as per safety case; - SOPEPs; - OPEP, including modelling and appropriate response planning.		
			Operations	Yes	- Blow out preventer during drilling of future wells and workover operations; - OPEP, including modelling and appropriate response planning; - Inspection procedures; - SIMOPs; - Mitigation as per safety case.		
			Decommissioning	Yes	- Wells to be abandoned to UKCS decommissioning regulations and procedures; - Inspection procedures; - SIMOPs; - Mitigation as per safety case.		

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
AE 2	SMALL SCALE Accidental discharge/ spill of oil/condensate/chemcials to sea from: - Mechanical failure - Human error - Corrosion & erosion	- Smaller spills may cause localised, short-term contamination of seawater and limited damage to the aquatic ecosystem; - Chemicals discharged to sea may cause contamination of seawater and disturbance to aquatic ecosystem.	Drilling	Yes	- Rig piping system to be closed loop; - Bunkering hoses to be fitted with marine break coupling on hose connections; - Bunkering and mud-handling procedures; - Personnel training; - Maintenance procedures; - Vessel selection; - Pre-mobilisation audits including oil spill prevention procedures; - Appropriate oil/chemical storage areas with drip trays and bunding; - Permit to Work, Lock out/Tag out system.	Yes	Scoped In
			Construction, installation and commissioning	Yes	- Bunkering procedures; - Personnel training; - Maintenance procedures; - Vessel selection; - Pre-mobilisation audits including oil spill prevention procedures; - Appropriate oil/chemical storage areas with drip trays and bunding; - Permit to Work, Lock out/Tag out system.		
			Operations	Yes	- Personnel training; - Maintenance procedures; - Vessel selection; - Pre-mobilisation audits including oil spill prevention procedures; - Appropriate oil/chemical storage areas with drip trays and bunding; - Permit to Work, Lock out/Tag out system.		
			Decommissioning	Yes	- Bunkering procedures; - Personnel training; - Maintenance procedures; - Vessel selection; - Pre-mobilisation audits including oil spill prevention procedures; - Appropriate oil/chemical storage areas with drip trays and bunding; - Permit to Work, Lock out/Tag out system.		
AE 3	Accidental deposit of materials on the seabed (e.g. dropped objects, pipelines, ROV etc.).	- Interaction/damage to seabed/species (direct or indirect) and other sea users (e.g. exclusion, snag risk) and infrastructure (e.g. drilling template, subsea manifold and pipeline).	Drilling	Yes	- Compliance to LOLER including inspection/testing; - Personnel training; - Lift planning, including consideration of prevailing environmental conditions and the use of specialist equipment; - All lifting equipment to be tested and certified; - Record location of lost materials, with significant objects to be recovered where practicable and reported using PON 2 notification; - Debris clearance surveys.	No	Scoped Out
			Construction, installation and commissioning	Yes	- Pipeline protected by rock dump/concrete matresses; - Compliance to LOLER including inspection/testing; - Personnel training; - Lift planning, including consideration of prevailing environmental conditions and the use of specialist equipment; - All lifting equipment to be tested and certified; - Record location of lost materials, with significant objects to be recovered where practicable and reported using PON 2 notification; - Debris clearance surveys.		

ID	Project aspect	Description of potential effects	Project stage relevance?		Mitigation	Potentially significant environmental impact and/or stakeholder concern	Take forward further in EIA?
			Operations	Yes	- Pipeline protected by rock dump/concrete matresses; - Compliance to LOLER including inspection/testing; - Personnel training; - Lift planning, including consideration of prevailing environmental conditions and the use of specialist equipment; - All lifting equipment to be tested and certified; - Record location of lost materials, with significant objects to be recovered where practicable and reported using PON 2 notification; - Debris clearance surveys.		
			Decommissioning	Yes	- Compliance to LOLER including inspection/testing; - Personnel training; - Lift planning, including consideration of prevailing environmental conditions and the use of specialist equipment; - All lifting equipment to be tested and certified; - Record location of lost materials, with significant objects to be recovered where practicable and reported using PON 2 notification; - Debris clearance surveys.		

Appendix B CONSULTATION SUMMARY

Comments and Issues raised	Comments on issues raised and ES section in which addressed
OPRED / BEIS Environmental Statement D/4254/2020 with reduced project scope	
Comments received from BEIS on the original Tolmount East ES D/4254/2020	Comments were addressed as applicable. For example, comments relating to piling were not relevant as piling was removed from the scope.
Advice from BEIS during consultation in relation to the updated project description to alignment with the updated EIA guidance https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation#the-offshore-oil-and-gas-exploration-production-unloading-and-storage-environmental-impact-assessment-regulations-2020	The updated environmental statement is in alignment with the requirements of the updated guidance
Comments received prior to submission of the original ES with wider scope D/4254/2020	
JNCC	
Survey data should at least include the area of proposed operations, unless justification is provided as to why wider area surveys are sufficiently representative of conditions at the site of proposed operations.	A number of site-specific surveys have been conducted within the Tolmount area, encompassing the proposed Tolmount East development area and Tolmount Main. These surveys are detailed in Section 3.
Survey data should provide adequate evidence that habitats and species of nature conservation concern (including Annex I habitats) are not present.	A number of site- specific surveys conducted within the Tolmount Area and have been used to identify the presence or absence of habitats and species of nature conservation concern (including Annex I habitats). The analyses of these surveys included drop down video, camera transects and sediment sampling (used for sediment and macrofaunal analysis) at 23 sampling locations. There was no evidence of Annex I habitats of features of conservation interest at any of the sampling locations and this is considered to be sufficient evidence that habitats and species of nature conservation concern are not present. This is discussed in Section 3.
It is good practice to include a diagram indicating the surveyed area in the context of the proposed activity and to identify any sample points or the location of photographic evidence. Data provided should also include high resolution acoustic data, video and/ or still images.	A figure detailing the environment sampling points of site-specific surveys in the Tolmount area is provided in Section 3 alongside examples of digital stills at some of the sampling locations.

Comments and Issues raised	Comments on issues raised and ES section in which addressed
To allow the best provision of accurate and meaningful advice, JNCC request that the operator considers the following points in any future EIA/ES submissions: • As per BEIS 2019, the environmental description should focus on that of the actual area to be developed and not just provide a generic description of the local environment. Evidence should be presented within the application confirming that the data are still relevant. • Any gaps or limitations in environmental information should be acknowledged with, where appropriate, strategies to address these gaps or limitations; • While environmental description should focus on the proposed site of operations, this area should also be placed in the context of its surroundings.	Site-specific surveys have been used to inform the environmental baseline (Section 3). These site-specific surveys were conducted in 2015 and 2018 and are thus considered to provide an up to date characterisation of the surrounding environment. A Survey Gap Analysis was also conducted, and it was concluded that the overall survey coverage was sufficient for characterising the environment of the Tolmount East development and pipeline. The environmental description focuses on the proposed site of operations, and the wider area of the Southern North Sea, as described in Section 3.
The purpose of the Seabird Oil Sensitivity Index (SOSI) is to identify areas where seabirds are likely to be most sensitive to oil pollution by considering factors that make a species more or less sensitive to oil-related impacts. Therefore, when assessing the impacts of accidental events on seabird populations, inclusion of this information is appropriate. We recommend that the method outlined in http://jncc.defra.gov.uk/PDF/Using%20the%20SOSI%20to%20inform%20contingency%20planning%202017.pdf is used to fill in areas of no data, where possible. We highlight, however, that this index is not intended to inform environmental baselines on seabird populations. We recommend consideration of other data sources when describing the baseline biological environment in the EIA e.g. Kober et al., 2010.	The SOSI data has been used to describe the sensitivity of seabirds in the surrounding environment to oil pollution, using the method described in the linked document (Section 3). This was then used to inform the impact assessment for Accidental Events such as oil spills (Section 10). An ornithological report was used to provide a characterisation of the ornithological conditions in the Tolmount East Area, as described in Chapter 3.

Comments and Issues raised	Comments on issues raised and ES section in which addressed
JNCC would also like to highlight that JNCC and BEIS are currently in the process of revising the periods of concern for drilling activities, based on the Seabird Oil Sensitivity Index (SOSI). While previous recommendations were considering periods of concern when there were two or more sequential months of very high seabird vulnerability (OVI), the updated periods of concern of drilling will be defined as any single month that represents, in a given licence block, either a very high or extremely high seabird oil sensitivity (SOSI). We therefore ask Permier Oil to consider a period of concern, for drilling, within Block 42/28d during the months of February to April and during June when the SOSI is recorded as either very high or extremely high in the block and surrounding blocks.	The periods of concern have been listed as February, March, April and June in Chapter 3.
The application may involve the introduction of hard substrate into a variable substrate environment. Although the changes are not necessarily considered as having a significant impact in this instance, we still encourage the operator to continue working to minimise the amount of hard substrate material used. We note that the long-term effect of the introduction of substratum into naturally sandy or muddy sea beds is not fully understood at present and would be carefully considered by the regulators. We welcome detailed commentary on stabilisation operations to allow further understanding of their actual nature conservation impact. This would include: • Location of dump sites • Size / grade of rock to be used • Tonnage / volume to be used • Contingency tonnage / volume to be used • Method of delivery to the seabed • Footprint of rock • Assessment of the impact • Expected fate of deposit after end of production, i.e. will it be left in situ or recovered.	To minimise the amount of hard substrate material used, the pipeline if possible. The environmental impacts on the seabed as a result of infrastructure is considered within Section 6. The description and quantification of materials required for stabilisation operations is provided also provided in Section 2.
JNCC considers it best practice to consider the full worst-case scenario to enable a meaningful assessment of the full environmental impacts of a project. We understand that until jacket design is decided, the worst case design will be assessed in the ES.	Where there is uncertainty in the data provided to inform the environmental impact assessment, the worst-case assumptions have been made, as described in Chapter 2.

Comments and Issues raised	Comments on issues raised and ES section in which addressed
JNCC suggests that the proposed operations are assessed alongside approved developments under construction, approved developments that have not yet commenced construction, developments submitted for approval but not yet approved, as well as any other significant appropriate development for which some realistic figures are available.	Cumulative impacts have been assessed as detailed in each of the impact assessment chapters (Sections 5 to 10). Publicly available data has been used where possible to identify any developments within the vicinity of the Tolmount East development which may induce cumulative effects.
Whilst JNCC appreciate specific vessels and their movements cannot be established at this date, an estimation of worst-case seabed disturbance caused by anchoring of vessels, jackets or rigs should be provided. Within the scoping letter anchoring is acknowledged, so clarity of spread, chain disturbance and contingency would be appreciated.	Details on the spread, including chain disturbance, and contingency are provided within Chapter 2 and Chapter 6.
Whilst JNCC appreciates that not all of the detailed project design is finalised at the time of ES submission, JNCC notes that best practice would not be to submit applications where stabilisation / protection material requirements are incrementally increased. The worst-case scenario should be assessed in the ES to enable a meaningful assessment of the whole environmental impact of the project to be undertaken (as per DECC 2011). It is understood that activities evolve over time, and that subsequent stages are often contingent on the outcome of the earlier activities. However, every effort should be made to predict the likely outcome and carry out an assessment on that basis so that all the elements have been assessed and presented in an ES.	Where there is uncertainty in the data provided to inform the environmental impact assessment, the worst-case assumptions have been made, as described in Section 2.
JNCC ask that the operator confirm if any of the operations highlighted in the scoping document will result in the disturbance of historical drill cuttings. If such drill cuttings will be disturbed we ask the operator to establish if they are water-based muds or oil-based muds, and whether they are within the OSPAR Thresholds. We also ask that the total volume of disturbed/removed drill cuttings is also considered with the total area of disturbed seabed, both directly and indirectly, be included in the assessment.	No historic drill cuttings piles will be disturbed from these activities.

The proposed works lies 1.1km from the Southern North Sea (SNS) SAC, designated for harbour porpoise. The Conservation Objectives (COs) for this site are: To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status (FCS) for Harbour Porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that: 1. Harbour porpoise is a viable component of the site; 2. There is no significant disturbance of the species; and 3. The condition of supporting habitats and processes, and the availability of prey is maintained. Disturbance of harbour porpoise generally, but not exclusively, originates from activities that cause underwater noise, and piling is considered to pose a medium risk of impact to harbour porpoise. JNCC recognises the identification of potential noise disturbance to marine mammals in the scoping letter and would like to make recommendations on the use of the references detailed. For disturbance, in line with the recommendations in Southall 2017 (and in JNCC's 2010 Draft EPS guidance) for multi-pulsed sounds like from piling, JNCC recommends the potential ranges of disturbance be estimated based on empirical evidence for similar situations and species. This is because it is difficult to come up with quantitative sound level criteria for the onset of disturbance since the level of sound received by the animal does not seem to be the sole important aspect in determining the response and its significance. Field sound measurements which point to lower sound levels (Jiang et al. 2015, MacGillivray 2018), and the smaller scale of porpoise behavioural responses reported in Graham et al. (2019), suggest a smaller deterrence range for small diameter piles such as the ones proposed in the project when compared to monopiles. We therefore advise the use of a precautionary 15km distance to assess the effects of disturbance on harbour porpoise. Significant disturbance is more likely where an activity causes persistent noise in an area for long periods of time. Given the scale of the proposed piling, 4 small piles, it is unlikely that there will be significant effects. Nevertheless, the	A detailed noise impact assessment has been included in Section 7 which uses noise modelling data from the previous development concept which represents a worst-case scenario. This modelling was used to predict the risk or injury to harbour porpoise in the Southern North Sea SAC. The 15 km disturbance range, as reported in Graham et al., (2019) was used to assess the risk of disturbance to harbour porpoise. A HRA was undertaken within each impact chapter (Section 5 to 10) to assess any impacts on the Southern North Sea SAC.

Comments and Issues raised	Comments on issues raised and ES section in which addressed
regulator will need to undertake a HRA given the location of the development and potential impact to the site from the proposed activities.	
JNCC requests that basic spatial and temporal information for piling activities is submitted to the Marine Noise Registry (MNR; https://mnr.jncc.gov.uk/). This information will be added to other data provided for licensed activities therefore helping generate a more accurate picture of impulsive noise occurring in UK waters. The MNR is an online platform administered by JNCC for industry and regulators to enter activity information including location, date and source property data. The MNR collects data at 2 stages; before the activity begins at the planning stage and true activity data after the activity is completed.	The details of the piling activities will be uploaded to the JNCC Marine Noise Registry.
OPRED/BEIS	
You should familiarise yourself with the requirements of the Department's EIA Guidance https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation#the-offshore-petroleum-production-and-pipelines-assessment-of-environmental-effects-regulations-1999-as-amended which was updated in February 2019. Proposals which will exceed the thresholds set out in the regulations and guidance will require to be supported by ES.	Premier are familiar with the EIA Guidance and acknowledge that an ES is required for the proposed development. This is described in Section 1.
Overall we are content with the EIA Strategy identified in your Scoping Document, we would highlight that the ES should clearly describe the main alternatives for the proposed project which have been considered, the advantages/disadvantages of each option and associated environmental implications, and summarise which option was selected and why (safety, environment, technical feasibility etc), this is particularly important where a number of options for a project have been identified and progressed to some extent.	All options considered and the reasoning that they were not brought forward is provided in Section 2.
It is noted that mention is made of the possibility of using a well through leg design, a clear explanation for this should be provided in the ES including the reasons for selection/consideration. It is noted that access will be via a walk to work system, the ES should summarise how such an arrangement will allow relevant management and maintenance e.g navaids.	This is no longer applicable for the subsea development concept.

Comments and Issues raised	Comments on issues raised and ES section in which addressed
You will be aware of the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015 (SCR 2015) transposed the requirements of the OSDR, and came into force on 19 July 2015. The primary aim of SCR 2015 is to address major accident hazards and reduce the associated risks to the health and safety of the workforce employed on offshore installations or in connected activities. However, SCR 2015 also aims to increase the protection of the marine environment and coastal economies against pollution and to ensure appropriate response mechanisms are in place in the event of such an incident. There is already a requirement to assess worst-case oil spill scenarios resulting from major accidents in an EIA, summarising the likely fate and impact of potential releases. ESs should also give due consideration to the potential for operations to result in Major Environmental Incidents (MEI) as defined under OSDR. In most cases, the worst-case scenario relating to the identified major accident hazards will equate to the worst-case potential release assessed under the EIA process. The assessment in the EIA will therefore be relevant and will additionally confirm whether there is likely to be a significant impact that would constitute a MEI.	A Major Environmental Incident (MEI) Assessment was conducted as part of the Accidental Events impact assessment chapter (Section 10).
Consideration should be given to the proposed operations in the context of the relevant Marine Plans- see https://www.gov.uk/government/publications/east-inshore-and-east-offshore-marine-plans In addition you may wish to familiarise yourself with the Department's own Guidance on Consideration on Marine Plans in Environmental Submissions https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation#the-marine-and-coastal-access-act-2009	Appendix D provides information on how the relevant policies of the East Marine Plans have been considered in the ES.
OPRED confirms that we would not expect a separate Habitat Regulations Assessment document or Appendix to be submitted, any information relevant to consideration of the proposals under the Habitats Regulations should be contained within the ES itself. Sufficient information should be provided to enable OPRED to undertake (if required) an assessment under the Habitats Regulations of the development's potential impact on protected sites (SPAs and SACs) and any assessment required under the MCAA of potential impacts on Marine Protected Areas.	All impact assessment chapters (Section 5 to 10) have a section assessing the impacts on protected sites.
Marine and Coastguard Agency	

Comments and Issues raised	Comments on issues raised and ES section in which addressed
MCA have no objections in principle, but we would expect to see a Shipping & Navigation section included in the Environmental Statement so that we can make an assessment of the potential risks to vessels posed by the developments. Assuming no issues are raised MCA would be likely to apply our standard advice regarding navigation to BEIS / OPRED once consulted.	The impacts on shipping and navigation have been incorporated into the Other Sea Users impact assessment (Section 8). This has assessed the impacts of the increased vessel traffic caused by the project activities as well as any impacts from temporary exclusion areas.

Appendix C COMPLIANCE WITH MARINE PLAN

Policy	Objective / Policy	Details of how the Tolmount East Project meets the requirements of the Objective/ Policy
EC1	Proposals that provide economic productivity benefits which are additional to Gross Value Added currently generated by existing activities should be supported.	The added economic value provided by the Project is described in section 1.2.
EC2	Proposals that provide additional employment benefits should be supported, particularly where these benefits have the potential to meet employment needs in localities close to the marine plan areas.	Local employment opportunities provided by the Project are described in section 1.2. In addition, the Project provides new pipeline infrastructure that may facilitate future gas developments in the area, i.e. there is also potential longer term economic benefit.
ECO1	Cumulative impacts affecting the ecosystem of the East Marine Plans and adjacent areas (marine and terrestrial) should be addressed in decision-making and plan implementation.	Cumulative impacts have been considered for each potential impact assessment carried out for the Project (Chapters 5-9). No significant cumulative impacts are anticipated, including to the ecosystems of the East Marine Plans.
ECO2	The risk of release of hazardous substances as a secondary effect due to any increased collision risk should be taken account of in proposals that require an authorisation.	The potential for vessel collision risk has been considered in Chapter 7 and Accidental spills have been considered in Chapter 9. No significant impacts are anticipated as a result of either. Several mitigation measures are suggested to reduce any risk or impact of accidental spills.
BIO1	Appropriate weight should be attached to biodiversity, reflecting the need to protect biodiversity as a whole, taking account of the best available evidence including on habitats and species that are protected or of conservation concern in the East Marine Plans and adjacent areas (marine and terrestrial).	The Project has used site-specific environmental surveys and the baseline information to inform the proposed Project footprint and identify protected sites, habitats and species within the Project area. Details on the potential for interaction with protected habitats and species, or those of conservation importance, and the measures that have or will be taken to limit potential impact is described in each impact assessment (Chapters 5-9).
BIO2	Where appropriate, proposals for development should incorporate features that enhance biodiversity and geological interests.	Where necessary, mitigation measures have been implemented to protect biodiversity and geology; however, it is not deemed necessary for the Project to incorporate features that enhance these interests.

CC1	Proposals should take account of: a) How they may be impacted by, and respond to, climate change over their lifetime and; b) How they may impact upon any climate change adaptation measures elsewhere during their lifetime. Where detrimental impacts on climate change adaptation measures are identified, evidence should be provided as to how the proposal will reduce such impacts.	It is not anticipated that climate change will impact the development or that the development will impact the climate change adaptation measures of other developments.
CC2	Proposals for development should minimise emissions of greenhouse gases as far as is appropriate. Mitigation measures will also be encouraged where emissions remain following minimising steps. Consideration should also be given to emissions from other activities or users affected by the proposal.	An impact assessment for atmospheric emissions has been carried out and is presented in Chapter 8. Atmospheric emissions primarily occur during drilling and installation, with limited emissions over the operational life of the Project.
FISH1	Within areas of fishing activity, proposals should demonstrate in order of preference: a) That they will not prevent fishing activities on, or access to, fishing grounds; b) How, if there are adverse impacts on the ability to undertake fishing activities or access to fishing grounds, they will minimise them; c) How, if the adverse impacts cannot be minimised, they will be mitigated; and d) The case for proceeding with their proposal if it is not possible to minimise or mitigate the adverse impacts.	An assessment into the potential impacts to fisheries has been undertaken in Chapter 7. Whilst it is acknowledged that there could be some temporary access restrictions during installation, there will be no permanent exclusion area. Although there may be some snagging risk, this is considered to present no adverse impact on the fishing industry, once mitigation measures are implemented.

FISH2	Proposals should demonstrate, in order of preference: a) That they will not have an adverse impact upon spawning and nursery areas and any associated habitat; b) How, if there are adverse impacts upon the spawning and nursery areas and any associated habitat, they will minimise them; c) How, if the adverse impacts cannot be minimised they will be mitigated; and d) The case for proceeding with their proposals if it is not possible to minimise or mitigate the adverse impacts.	The potential impact on nursery and spawning areas has been considered in the seabed impacts impact assessment (Chapter 6). Although the Project area is considered to be within spawning and nursery grounds for some species, as discussed in the environmental baseline (Chapter 3), the greatest potential for impact is during drilling and installation of the subsea infrastructure. These activities will be short-lived and cover only a small area of the available spawning habitat. The Project will not have any long term impacts on these areas.
GOV2	Opportunities for co-existence should be maximised wherever possible.	Chapter 7 has assessed the impacts from the physical presence of the project, as well as the installation activities, on other users of the area and indicates that the Project can co-exist alongside other sea users such as shipping and navigation and fisheries.
GOV3	Proposals should demonstrate in order of preference: a) That they will avoid displacement of other existing or authorised (but yet to be implemented) infrastructure; b) How, if there are adverse impacts resulting in displacement by the proposal, they will minimise them; c) How, if the adverse impacts resulting in displacement by the proposal, cannot be minimised, they will be mitigated against; or d) The case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts of displacement.	A description of all infrastructure in the vicinity of the Project area is provided in Section 2. As part of the Cumulative Impact Assessments for each impact chapter (Section 5 to 9), consideration has been given to all projects in the area, whether in operation or with consent in place but not yet constructed. The Project will not result in the displacement of other existing or authorised infrastructure.

DEF1	Proposals in or affecting Ministry of Defence Danger and Exercise Areas should not be authorised without agreement from the Ministry of Defence.	No military danger or exercise areas occur within the vicinity of the Project, as described in Section 3.
MPA1	Any impacts on the overall Marine Protected Area network must be taken account of in strategic level measures and assessments, with due regard given to any current agreed advice on an ecologically coherent network.	As part of each impact assessment (Sections 5 - 9) the potential for impacts to Marine Protected Areas is considered as part of the HRA process. As described in the assessment chapters, some interaction with the Southern North Sea SAC, located 1.1 km from Tolmount East, is expected. This site is designated for harbour porpoise which are particularly sensitive to underwater noise emissions associated with piling activities. However, with the scale of the piling activities and the mitigation measures being adopted or built into design, there is considered to be no impact on the integrity of the Southern North Sea SAC and the activities are not expected to go against the conservation objectives of this site.
SOC2	Proposals that may affect heritage assets should demonstrate, in order of preference: a) That they will not compromise or harm elements which contribute to the significance of the heritage asset; b) How, if there is compromise or harm to a heritage asset, this will be minimised; c) How, where compromise or harm to a heritage asset cannot be minimised it will be mitigated against; or d) The public benefits for proceeding with the proposal if it is not possible to minimise or mitigate compromise or harm to the heritage asset.	The seabed impact assessment (Section 6) considers potential impacts to cultural heritage assets in the vicinity of the Project. As described in Section 3.5.8, there is only one wreck located 280 m north west of the Tolmount MFP. As this is outside the Development area, the Project is not considered to be capable of compromising or harming the wreck in any way.

SOC3	Proposals that may affect the terrestrial and marine character of an area should demonstrate, in order of preference: a) That they will not adversely impact the terrestrial and marine character of an area; b) How, if there are adverse impacts on the terrestrial and marine character of an area, they will minimise them; c) How, where these adverse impacts on the terrestrial and marine character of an area cannot be minimised they will be mitigated against; or d) The case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.	Potential impacts to the current condition of the marine environment have been given due consideration throughout the EIA process. Potential changes to the character of the marine and terrestrial environment are described throughout the impact assessment sections (Chapters 5 - 9). The surrounding area of the development is relatively well developed with oil and gas infrastructure. As such, the development is considered to be characteristic of the surrounding marine area. As this is a subsea development, it will not be visible in the seascape once drilling and installation activities are completed.
OG1	Proposals within areas with existing oil and gas production should not be authorised except where compatibility with oil and gas production and infrastructure can be satisfactorily demonstrated.	The Project is within a mature area of oil and gas development. Given the nature of the Project it is deemed to be wholly compatible with other oil and gas activity in the area. The Project has undertaken a thorough assessment of the alternative development options and the chosen development option makes use of existing infrastructure at the Tolmount Main platform as appropriate for the Project, as well as the gas export pipeline from Tolmount Main to Easington Terminal. In addition, the construction of the new Tolmount East flowline infrastructure could facilitate future development.
OG2	Proposals for new oil and gas activity should be supported over proposals for other development.	Noted.

WIND1	Developments requiring authorisation, that are in or could affect sites held under a lease or an agreement for lease that has been granted by The Crown Estate (TCE) for development of an offshore wind farm, should not be authorised unless: a) They can clearly demonstrate that they will not compromise the construction, operation, maintenance, or decommissioning of the offshore wind farm; b) The lease/agreement for lease has been surrendered back to TCE and not been re-tendered; c) The lease/agreement for lease has been terminated by the Secretary of State; d) In other exceptional circumstances.	A number of offshore windfarm developments occur in the vicinity of the Project, as described in Section 3.5.6. The main way the Project could impact on these operations is by disruption to shipping activities associated with the developments. Potential impacts to shipping are considered in the Other Sea Users impact assessment (Section 7). As described in the impact assessment chapter, there is considered to be minimal overlap between the shipping routes for the development and the nearby wind farms. The short term nature of the drilling and installation activities and the fact that this is a subsea project means that no significant impact is anticipated.
CCS1	Within defined areas of potential carbon dioxide storage, proposals should demonstrate in order of preference: a) That they will not prevent carbon dioxide storage; b) How, if there are adverse impacts on carbon dioxide storage, they will minimise them; c) How, if the adverse impacts cannot be minimised, they will be mitigated; or d) The case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.	The Tolmount East development area is not located in a known area of potential carbon dioxide storage and therefore no impacts are predicted.

PS2	Proposals that require static sea surface infrastructure or that significantly reduce under-keel clearance should not be authorised in International Maritime Organization designated routes.	The Project does not require static sea surface infrastructure once the drilling and installation phases are complete. The Project will not significantly reduce under-keel clearance. The area of the Project is known to be within a relatively busy shipping area. A collision risk assessment and consideration of potential impacts to navigation have been carried out (Section 7) and it is considered that through employment of the proposed mitigation and management there will be no significant impact to navigation in the area.
PS3	Proposals should demonstrate, in order of preference: a) That they will not interfere with current activity and future opportunity for expansion of ports and harbours; b) How, if the proposal may interfere with current activity and future opportunities for expansion, they will minimise this; c) How, if the interference cannot be minimised, it will be mitigated, d) The case for proceeding if it is not possible to minimise to mitigate the interference	Given that the development is located far offshore, there are considered to be no impacts on the future expansion of ports and harbours.
AGG1	Proposals in areas where a licence for extraction of aggregates has been granted or formally applied for should not be authorised unless there are exceptional circumstances.	As described in Section 3.5.9, the closest licenced aggregate extraction site is 44 km from the Project area. As such, no impacts would be expected on the activities within that licence area.
AGG2	Proposals within an area subject to an Exploration and Option Agreement with TCE should not be supported unless it is demonstrated that the other development or activity is compatible with aggregate extraction or there are exceptional circumstances.	The Project area does not lie within an area for Exploration and Option agreement for aggregate extraction.

AGG3	Within defined areas of high potential aggregate resource, proposals should demonstrate in order of preference: a) That they will not, prevent aggregate extraction, b) How, if there are adverse impacts on aggregate extraction, they will minimise these, c) How, if the adverse impacts cannot be minimised, they will be mitigated, d) The case for proceeding with the application if it is not possible to minimise or mitigate adverse impacts.	The Project area does not lie within an area of high potential aggregate resource and is therefore not expected to prevent or interfere with any future aggregate extraction activities.
TR1	Proposals for development should demonstrate that during construction and operation, in order of preference: a) They will not adversely impact tourism and recreation activities; b) How, if there are adverse impacts on tourism and recreation activities, they will minimise them; c) How, if the adverse impacts cannot be minimised, they will be mitigated; or d) The case for proceeding with the proposal if it is not possible to minimise or mitigate the adverse impacts.	No adverse impacts to tourism and recreation is expected, given the offshore location of the Project area.