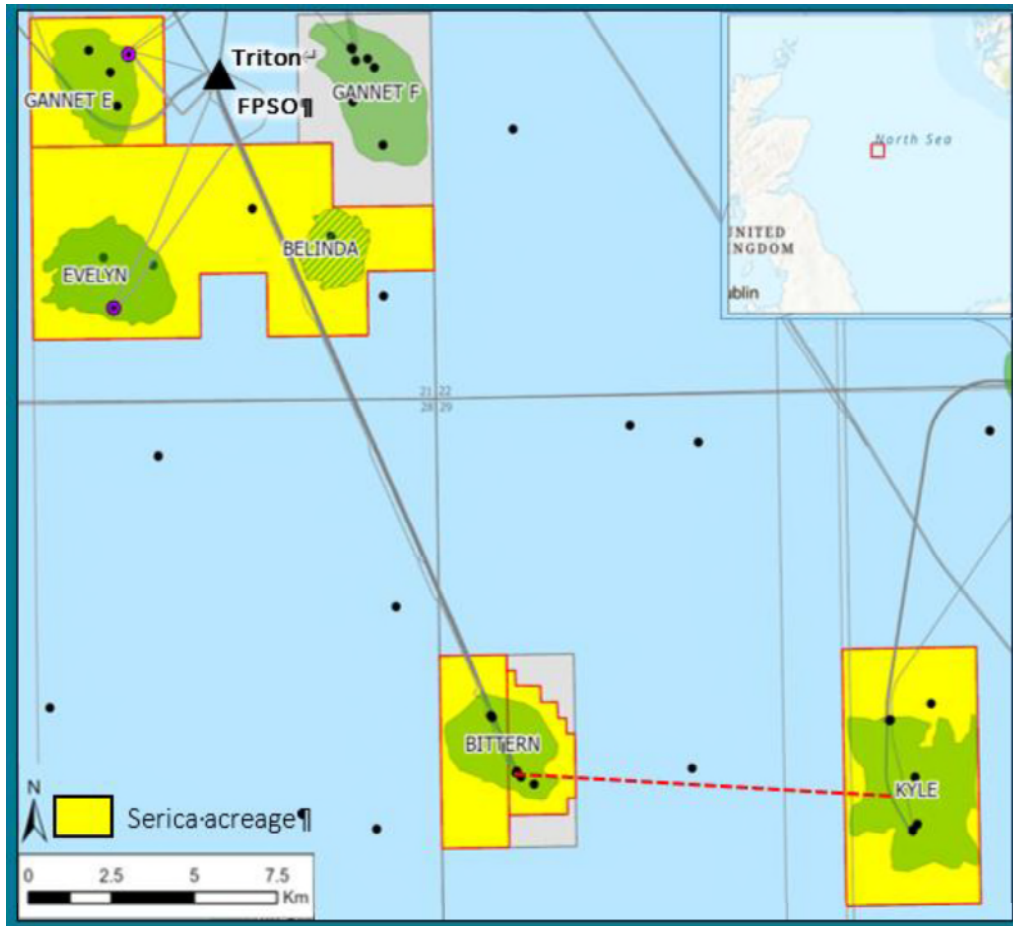


Kyla Field Development Environmental Statement



OPRED Ref No: ES/2025/021

Serica Doc. No: KYL-SECL-HSE-DOC-0001

March 2026

ENVIRONMENTAL STATEMENT DETAILS

Section A: Administrative Information

A1 – Project Reference Number

Number: ES/2025/021

A2 – Developer Contact Details

Company Name: Serica Energy Chinook Limited

Contact Name: [REDACTED]

Contact Title: HSE 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]	Orbis Energy Limited	Director	Over 20 years environmental consultancy experience in the oil and gas industry. She has a first class B.Sc (Hons) degree in Environmental Science.
[REDACTED]	Orbis Energy Limited	Director	Over 20 years environmental consultancy experience in the oil and gas industry. He has a M.Sc (by research) in Environmental Science (Environmental Toxicology) and a B.Sc (Hons) in Marine & Freshwater Biology.
[REDACTED]	Orbis Energy Limited	Senior Consultant	Over 12 years environmental consultancy experience in the oil and gas industry. He has a first class master's degree in Environmental Science (MEnvSci).
[REDACTED]	Orbis Energy Limited	Consultant	Over 3 years environmental consultancy experience in the oil and gas industry. She has a B.Sc (Hons) degree in Marine Biology.
[REDACTED]	Orbis Energy Limited	Consultant	Over 2 years environmental consultancy experience in the oil and gas industry. She has a B.Sc (Hons) degree in Environmental Management.
[REDACTED]	Orbis Energy Limited	Consultant	Over 2 years environmental consultancy experience in the oil and gas industry. He has a first class B.Sc (Hons) degree in Geography.

A5 – Licence Details

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

Licence number(s): P.2616

b) Please confirm licences and current equity

Licence Number: P.2616	
Licensee	Percentage Equity
Serica Energy Chinook Limited	100%

Section B: Project Information

B1 – Nature of Project

a) Please specify the name of the project.

Name: Kyla Development

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

As above.

c) Please provide a brief description of the project:

Serica Energy Chinook Limited (hereafter referred to as ‘Serica’) is planning to develop the Kyla oil field located in United Kingdom Continental Shelf (UKCS) Block 29/2c in the Central North Sea (CNS), approximately 196 kilometres (km) to the southeast of Peterhead on the Scottish coastline and 72 km to the south west of the UK/Norway transboundary line. Kyla (previously developed as ‘Kyle’) is a ceased-production oil field which sits within Licence P.2616 at a water depth of approximately 90 m. Serica was awarded 100% equity and operatorship of Licence P.2616 in the 33rd Licence Round on 1st December 2023.

The Kyle field was originally developed via four subsea production wells, with first oil achieved in 2000. The wells were tied back to the Curlew Floating Production Storage and Offloading (FPSO) facility before being re-tied back to the Banff FPSO in 2005. The Kyle field ceased production following sand control issues with one of the wells and was decommissioned, along with the Banff FPSO, in 2020.

Serica is proposing to develop the Kyla field via a single subsea well tied back via 12 – 13.2 km long production pipeline, gas lift pipeline and umbilical to one of the existing Bittern drill centre manifolds (either DCA or DCB). Tie-in to the Bittern DCA manifold is the base case, however the DCB manifold has been considered as the back-up case option. The Bittern manifolds are in turn tied back to the Triton FPSO, with both assets operated by Dana Petroleum (E&P) Limited (hereafter referred to as ‘Dana’). Kyla hydrocarbons will be processed on the Triton FPSO with Kyla oil exported as part of the Triton FPSO blend via shuttle tanker and sales gas routed with other Triton area gas to the St Fergus terminal onshore via the Fulmar gas pipeline.

Production from Kyla will be from an 8 inch pipeline with a piggybacked 3 inch gas lift pipeline, with gas supplied from Triton via Bittern. An electro/chemical/hydraulic and control umbilical will also be extended from Bittern to Kyla, which will run adjacent to the pipelines.

Subject to the necessary permits and consents being in place, development drilling is scheduled to be undertaken between Q4 2027 and Q1 of 2028 and subsea installation activities to be undertaken between Q2 and Q3 of 2028. First oil is targeted for end of Q3 2028.

Kyla production rates are anticipated to peak in 2029 at 928 tonnes (1,112 cubic metres) of oil per day and 144,720 cubic metres (5.11 million cubic feet) of gas per day (High case).

The Kyla field is expected to produce hydrocarbons for 8 years, depending on the reserves, the production rate and the life of the Triton FPSO. On cessation of production (CoP), the Kyla facilities will be decommissioned in accordance with the requirements of the prevailing UK and International law.

B2 – Project Location

a) Please indicate the offshore location(s) of the main project elements.

Aspect	Kyla Drill Centre	Kyla Valve Skid	Bittern Drill Centre Tie-in Location (existing)	
			Manifold A (existing)	Manifold B (existing)
Location (Lat/Long) ¹	56° 53' 01.13"N; 01° 13' 50.70"E	56° 53' 0.43"N; 01° 13' 49.04"E	56° 54' 10.88"N; 01° 02' 14.02"E	56° 55' 2.93"N; 01° 01' 32.60"E
UKCS Block	29/2		29/1	
ICES Rectangle	42F1		42F1	
Distance to nearest coastline (Peterhead)	196 km	196 km	183 km	182 km
Distance to nearest median line (UK / Norway)	72 km	73 km	83 km	84 km
Nearest Marine Protected Area	13 km SW of East of Gannet and Montrose Fields NCMPA	13 km SW of East of Gannet and Montrose Fields NCMPA	17 km SW of East of Gannet and Montrose Fields NCMPA	16 km SW of East of Gannet and Montrose Fields NCMPA

¹ ED50 TM 0 N.

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.

N/A

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Abbreviations

µg.g⁻¹	Micrograms per gram
µm	Micrometres
"	Inch
%	Percentage
° C	Degrees Celsius
‰	Parts per thousand
3D	Three-dimensional
ACA	Action Co-ordinating Authority
AET	Apparent Effects Threshold
AHV	Anchor Handling Vessel
AIS	Automatic Identification System
Al	Aluminium
ALARP	As Low as Reasonably Practicable
API	American Petroleum Institute
APS	Announced Pledges Scenario
AR5	Assessment Report Five
AR6	Assessment Report Six
ARPA	Automatic Radar Plotting Aids
As	Arsenic
AUV	Autonomous underwater vehicle
Ba	Barium
BAC	Background Assessment Criteria
BAOAC	Bonn Agreement Oil Appearance Code
bbl	Barrels
BC	Background Concentration
BEIS	Department for Business, Energy & Industrial Strategy
BGS	British Geological Survey
BoCC	Birds of Conservation Concern
boe	Barrel of Oil Equivalent
BOP	Blowout Preventer
Bscf	Billion Standard Cubic Feet
Ca	Cadmium
ca.	Circa
CAPEX	Capital Expenditure
CB	Carbon Budget
CBGDP	Carbon Budget and Growth Delivery Plan
CCC	Climate Change Committee
CCS	Carbon Capture and Storage
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFU	Compact Flotation Unit

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CH₄	Methane
CHARM	Chemical Hazard Assessment and Risk Management
cm	Centimetres
CNS	Central North Sea
CO	Carbon Monoxide
CO₂	Carbon Dioxide
CO₂e/boe	Carbon Dioxide equivalent per Barrel of Oil Equivalent
CO₂e	Carbon dioxide equivalent
COLREG	International Regulations for Preventing Collisions at Sea
COP	Conference of the Parties
CoP	Cessation of Production
cP	Centipoise
CPI	Carbon Preference Index
Cr	Chromium
CSV	Construction Support Vessel
CtL	Consent to Locate
Cu	Copper
Dana	Dana Petroleum (E&P) Limited
dB	Decibel
dB re 1µPa @ 1 m	Decibels relative to one micro-Pascal
DCA	Drill Centre A
DCB	Drill Centre B
DESNZ	Department for Energy Security and Net Zero
DP	Dynamically Positioned
DSV	Diving Support Vessel
EBS	Environmental Baseline Survey
EC	European Commission
ECMWF	European Centre for Medium-Range Weather Forecasts
EDGAR	Emissions Database for Global Atmospheric Research
EDR	Effective Deterrent Range
EEMS	Environmental Emissions Monitoring System
EHC	Electro-hydraulic control
EIA	Environmental Impact Assessment
EJ	Exajoules (10 ¹⁸ J)
EMODnet	European Marine Observation and Data Network
EMS	Environmental Management System
ENVID	ENVironmental impact IDentification
EOL	End of Line
EPO	Environmental Protection Objective
EPS	European Protected Species
ERAP	Emissions Reduction Action Plan
ERL	Effects Range Low

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ERM	Effects Range Median
ERRV	Emergency Rescue and Recovery Vessel
ES	Environmental Statement
ESAS	European Seabirds at Sea
ESG	Environmental, Social and Governance
ESP	Electrical Submersible Pump
ETS	Emissions Trading Scheme
EU	European Union
EUNIS	European Nature Information System
F	Far-field
FCS	Favourable Conservation Status
FeAST	Feature Activity Sensitivity Tool
FDP	Field Development Plan
FLO	Fisheries Liaison Officer
FO	First Oil
FPSO	Floating Production, Storage and Offloading
FRP	Favourable Reference Population
Ft	Feet
g/cm³	Grams per cubic centimetre
GBS	Gravity-based Structure
GCB	Global Carbon Budget
GEBCO	General Bathymetric Chart of the Oceans
GHG	Greenhouse Gas
GML	Global Monitoring Laboratory
GOR	Gas to Oil Ratio
GST	Global Stocktake
Gt	Gigatonnes (10 ¹² kg)
GWP	Global Warming Potential
H	Height
HA	Habitat Assessment
HC	Hydrocarbon
HD	High Definition
HF	Hydrofluoric acid
HF	High Frequency
Hg	Mercury
HM	Heavy Metal
HMCS	Harmonised Mandatory Control Scheme
hMPA	historic Marine Protected Areas
HMW	High Molecular Weight
HPAI	Highly Pathogenic Avian Influenza
HPHT	High Pressure High Temperature
HSE	Health, Safety and Environment

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HSEQ	Health, Safety and Environmental Quality
HYCOM	Hybrid Coordinate Ocean Model
HYDROMAP	Tidal and Hydrodynamic Modelling System
Hz	Hertz
I	Intermediate-field
ICES	International Council for the Exploration of the Seas
IEA	International Energy Agency
IEMA	The Institute of Environmental Management and Assessment
IFT	Interfacial Tension
IMO	International Maritime Organization
INTOG	Innovation and Targeted Oil and Gas
IOGP	International Association of Oil and Gas Producers
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ISO	International Standards Organisation
ITOPF	International Tanker Owner Pollution Federation
IUCN	International Union for the Conservation of Nature
J	Joule
JNCC	Joint Nature Conservation Committee
JV	Joint Venture
kg	Kilograms
kg/m³	Kilograms per cubic metre
kHz	Kilohertz
kJ	Kilojoules
km	Kilometres
Km²	Square kilometres
KPIs	Key Performance Indicators
kt	Kilotonnes (10 ⁶ kg)
L	Length
LE,p	Sound Exposure Level
LE,p,ss	Sound Exposure Level, single strike
LF	Low Frequency
Li	Lithium
LMW	Low Molecular Weight
LNG	Liquified Natural Gas
LOC	Loss of Containment
Log Pow	Octanol-water partition coefficient
Lp,pk	Sound Pressure Level peak
LTOBM	Low toxicity oil based mud
m	Metres
m²	Square metres
m³	Cubic metres

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MARPOL	International Convention for the Prevention of Pollution from Ships
MAT	Master Application Template
MPS	Marine Policy Statement
Mbbl	Million barrels (10^6 bbl)
MCA	Maritime and Coastguard Agency
MCZ	Marine Conservation Zones
MD	Measured Depth
MEG	Monoethylene Glycol
MEI	Major Environmental Incident
MER	Maximising Economic Recovery
mg/cm²/day	Milligrams per centimetre squared per day
mg/L	Milligrams per litre
mm	Millimetres
Mm³	Million cubic metres (10^6 m ³)
MMMU	Marine Mammal Management Unit
MMO	Marine Mammal Observer
MMscf	Million standard cubic feet
MMstb	Million Standard Barrels
mN/m	Dynes
MNCR	Marine Nature Conservation Review
MODU	Mobile Offshore Drilling Unit
mol	Moles
MPA	Marine Protected Area
ms⁻¹	Metres per second
Mt	Megatonnes (10^9 kg)
MU	Management Unit
MUDMAP	Three-dimensional dispersion model
MW	Megawatt
N	Near-field
N₂O	Nitrous Oxide
NAC	North Atlantic Current
NAEI	National Atmospheric Emissions Inventory
NAVAREA	Navigational Area
NAVDEM	Navy Global Environmental Model
NAVTEX	Navigational Telex
NC MPA	Nature Conservation Marine Protected Area
NCODA	Navy Coupled Ocean Data Assimilation
NCPs	National Contingency Plans
NDC	Nationally Determined Contribution
NE	No Exceedance
Ni	Nickel
NMFS	National Marine Fisheries Service

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NM	Nautical mile
NMP	National Marine Plan
NMPi	National Marine Plan Interactive
NOAA	National Oceanic and Atmospheric Administration
NORM	Naturally Occurring Radioactive Material
NO_x	Nitrogen Oxides
NPD	Naphthalenes, phenanthrenes and dibenzothiophene
NPT	Non-Productive Time
NPV	Net Present Value
NSTA	North Sea Transition Authority
NSTD	North Sea Transition Deal
NZE	Net Zero Emissions by 2050 Scenario
OBM	Oil Based Mud
OESEA	Offshore Energy Strategic Environmental Assessment
OGA	Oil and Gas Authority
OGMP	Oil and Gas Methane Project
OIW	Oil in Water
OMAR	Offshore Major Accident Regulator
OMS	Operations Management System
OOC	Oil on cuttings
OPEP	Oil Pollution and Emergency Plan
OPOL	Offshore Pollution Liability Agreement
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
OSPAR	Oslo and Paris Commission
OSRL	Oil Spill Response Limited
PAHs	Polycyclic Aromatic Hydrocarbons
PAM	Passive Acoustic Monitoring
PARLOC	Pipeline and Riser Loss of Containment
Pb	Lead
PCW	Phocid Carnivores in Water
PE	Parabolic Equation
PETS	Portal Environmental Tracking System
Pg	Petagrams
PGR	Production Gap Report
PIG	Pipeline Integrity Gauge
PLONOR	Pose Little or No Risk
PMF	Priority Marine Feature
PON	Petroleum Operations Notice
ppb	Parts per billion
ppm	Parts per million
PSA	Particle Size Analysis
PSD	Particle Size Distribution

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PTS	Permanent Threshold Shift
PWA	Pipeline Works Authorisations
RCP	Representative Concentration Pathway
REF	Reference
ROV	Remotely Operated Vehicle
RQ	Risk Quotient
RVP	Reid Vapour Pressure
SAC	Special Area of Conservation
SAT	Subsidiary Application Template
SCANS	Small Cetacean Abundance of the North Sea
SCR	Safety Case Regulations
SDG	Sustainable Development Goal
SEL	Sound Exposure Level
SEPA	Scottish Environmental Protection Agency
Serica	Serica Energy Chinook Limited
SFF	Scottish Fishermen's Federation
SFGT	St. Fergus Gas Terminal
SGMD	Scottish Government Marine Directorate
SIMOPS	Simultaneous Operations
SIMPROF	Similarity Profile Analysis
SNCBs	Statutory Nature Conservation Bodies
SNS	Southern North Sea
SO₂	Sulphur Dioxide
SOL	Start of Line
SOPEP	Ship Oil Pollution Emergency Plan
SOSI	Seabird Oiling Sensitivity Index
SO_x	Sulphur Oxides
SPA	Special Protection Area
SPL	Sound Pressure Level
SSD	Species Sensitivity Distribution
SSP	Shared Socio-economic Pathways
SUB	Substitution
t	Tonne (10 ³ kg)
TCFD	Taskforce on Climate-related Financial Disclosures
TD	Total Depth
THC	Total Hydrocarbon Concentration
Tm³	Trillion cubic metres (10 ¹² m ³)
TOC	Total Organic Carbon
TOG	Targeted Oil & Gas
TOM	Total Organic Matter
TS	Threshold Shift
TSS	Total Suspended Solids

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TTS	Temporary Threshold Shift
TVDss	True Vertical Depth Below Sea Level
UHB	Upheaval Buckling
UK	United Kingdom
UK BAP	United Kingdom Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UKETS	UK Emissions Trading Scheme
UKHO	United Kingdom Hydrographic Office
UKOOA	UK Offshore Operators Association
UN	United Nations
UNEP	United Nations Environmental Programme
UNFCCC	UN Framework Convention on Climate Change
VHF	Very High Frequency
VMS	Vessel Monitoring System
VOCs	Volatile Organic Compounds
W	Width
W/m²	Watts per square metre
WBM	Water Based Mud
WMO	World Meteorological Organization
WMP	Waste Management Plan
WOAD	Worldwide Offshore Accident Database
WOC	Waiting on Cement
yr	Year
Zn	Zinc
ZRF	Zero Routine Flaring

Non-Technical Summary

Introduction

Serica Energy Chinook Limited (hereafter referred to as 'Serica') is planning to develop the Kyla oil field located in United Kingdom Continental Shelf (UKCS) Block 29/2c in the Central North Sea (CNS), approximately 196 kilometres (km) to the southeast of Peterhead on the Scottish coastline and 72 km to the south west of the UK/Norway transboundary line (Figure 1). Kyla is a ceased-production oil field which sits within Licence P.2616. Serica was awarded 100% equity and operatorship of Licence P.2616 in the 33rd Licence Round on 1st December 2023.

The Kyla field is located within a water depth of approximately 90-95 m. Previously known as 'Kyle', the field was discovered in 1993, with field development activities taking place from 2000 to 2002. The Kyle field was initially tied back to the Curlew Floating Producing Storage and Offloading (FPSO) before being re-tied back to the Banff FPSO in 2005, where it produced oil and gas until 2018 when sand control issues caused one of the production wells to fail leading to the field being decommissioned in 2020. Serica is now proposing to develop the Kyla field and is aiming to deliver first oil by the end of Q3 2028.

An Environmental Statement (ES) has been prepared to present the findings of the Environmental Impact Assessment (EIA) carried out for the proposed Kyla development, as required under The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020. The ES has been prepared by Serica in conjunction with Orbis Energy Limited (the EIA Consultant). This section forms the non-technical summary of the ES. The EIA has been undertaken with reference to the new supplementary guidance for assessing the effects of downstream scope 3 emissions on climate from offshore oil and gas projects (DESNZ, 2025c).

Project Description

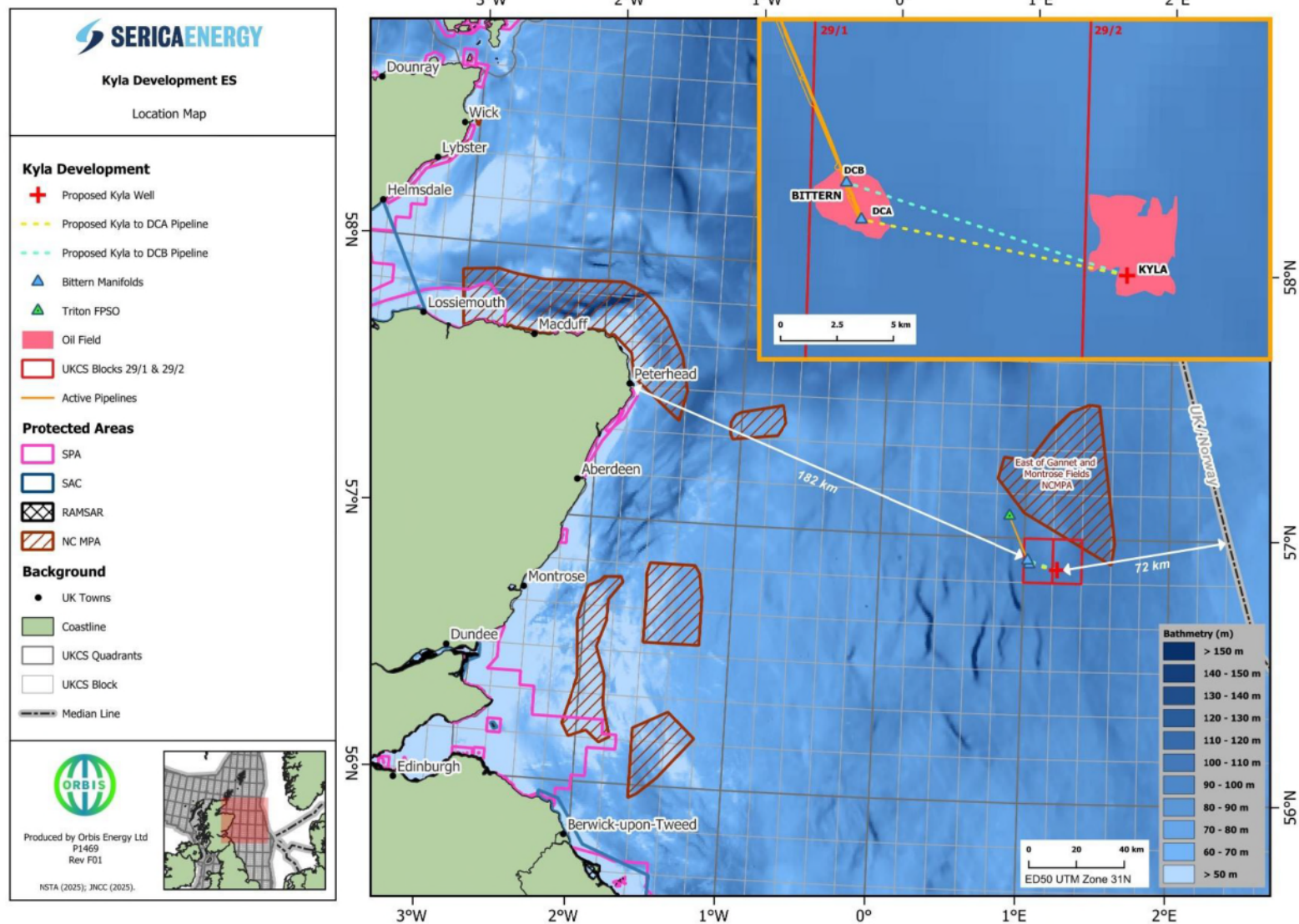
The Kyla field will be developed as a single subsea well tied back via 12 – 13.2 km long 8-inch production and 3-inch piggybacked gas lift rigid pipelines to one of the existing Bittern drill centre manifolds (either DCA or DCB). The base case is to tie-back to the DCA manifold, but this will be confirmed during detailed design. The Bittern manifolds are located approximately 2 km from each other and are both suitable for connecting the Kyla production, gas lift and electro/chemical/hydraulic and control umbilical services. For the purposes of this ES, the longest tie-back which is to the DCB manifold has been assessed as this represents the worst case scenario in terms of impact to the seabed.

The Bittern manifolds are in turn tied back to the Triton FPSO, with both assets operated by Dana Petroleum (E&P) Limited (hereafter referred to as 'Dana'). An electro/chemical/hydraulic and control umbilical will be extended from Bittern to Kyla, which will run adjacent to the pipelines, 50 - 75 m apart. Kyla hydrocarbons will be processed on the Triton FPSO, with Kyla oil exported as part of the Triton FPSO blend via shuttle tanker and sales gas routed with other Triton area gas to the St Fergus Gas Terminal (SFGT) onshore for onwards transmission to the UK's National Transmission System.

Serica proposes to drill and complete one subsea horizontal production well (29/02c-K16) in the Kyla field targeting the Palaeocene sandstone. By using a single, high-productivity horizontal well with existing lift gas, the development avoids the need for multiple wells reducing drilling activity, subsea infrastructure, and associated seabed disturbance compared with the alternative designs.

The proposed tophole location for this well sits within UKCS Block 29/2c at 56° 53' 01.13"N, 01° 13' 50.70"E (ED50 TM 0 N). A mobile offshore drilling unit (MODU) has yet to be contracted for the project but given the water depth at Kyla (ca. 90 m), it is expected that the subsea well will be drilled and completed from a semi-submersible drilling rig which will be held in position over the Kyla location by anchors and chains.

Figure 1: Location of the Proposed Kyla Development



The top two hole sections of the well will be drilled using a water-based fluid, before being lined with steel casings that are cemented in place. Cuttings from these top-hole sections will be discharged directly from the wellbore at the seabed.

Offset well experience within the Triton area has shown that water-based muds have limited performance in the deeper formations. The use of low toxicity oil base mud (LTOBM) is therefore considered the most suitable and lowest-risk fluid system for the deeper hole sections of the proposed Kyla well. LTOBM contaminated cuttings will either be skipped and shipped to shore for disposal or thermally treated offshore to an acceptable overboard disposal limit (<1% oil on cuttings) and discharged from the MODU. For the purposes of this ES, modelling of the discharge of the drill cuttings has been carried out to support the impact assessment, assuming the treatment and discharge of the LTOBM contaminated cuttings.

It is anticipated that it will take up to 100 days to drill and complete the well. Once drilling operations are completed and the production equipment has been installed downhole, a vertical Xmas tree will be landed on top of the wellhead, installed directly from the MODU. The Xmas tree will sit above the seabed, locked onto the wellhead as it emerges from the seabed. Once the tree is secure on top of the wellhead, four telescopic legs will be lowered to the seabed. These are designed to deflect any fishing lines or trawl boards over the tree and prevent any lines or trawl boards getting into the wellhead / conductor area, negating the need for a specific Xmas tree protection structure. This tree will remain on the seabed for the life of the field (ca. 8 years), providing well control and supporting the production of hydrocarbons.

The Kyla pipelines and umbilical are likely to be installed by a reel-lay vessel and will be surface laid on the seabed prior to trenching and burial, similar to the other pipelines which form part of the Triton area. The umbilical will be trenching and buried separately to the pipelines. Trenching can be achieved by towed plough, with a separate backfill pass, or by tracked vehicle either jetting to fluidise the soil or mechanical cutting. The final trenching method for Kyla will be selected by the installation contractor. For the purposes of this ES, trenching and backfilling via a plough has been assessed, as this represents the worst case scenario for seabed disturbance and fuel consumption by vessels.

Boulders inhibit the use of the trenching equipment and therefore some boulders may need to be removed from the lay corridor prior to trenching. Boulder clearance will be minimised as far as practical via pipeline routing exercises as part of the detailed design process. If any boulders are removed from the lay corridor they will be relocated to the edges of the installation corridor, ideally within a 5 m corridor downstream of the prevailing current to minimise likelihood of scour developing on the route, with the as-left position of each boulder recorded.

Burial of the pipelines will assist in protection against upheaval buckling, where temperature changes cause the pipeline to move to relieve the expansion forces. Rock is considered the most appropriate mitigation measure for upheaval buckling. Based on experience from the wider Triton area, it has been calculated that up to 26,000 tonnes of rock may be needed to mitigate for upheaval buckling along the pipelines. The requirement for rock to be deposited along the pipelines will be determined by reviewing as-trenched and as-backfilled survey data against the critical trench imperfection criteria defined during detailed design. The umbilical will not require any rock placement provided it is suitably trenching below mean seabed level. However, as a contingency it is assumed up to 10,000 tonnes of rock may be deposited if target trenching isn't achieved. Additional rock (up to 30,000 tonnes) will need to be deposited where the pipelines and umbilical exit the trenches at Kyla and Bittern. Rock and concrete mattresses are also required to be deposited along the proposed route of the Kyla pipelines and umbilical cross the existing 44-inch Langeled and the 36-inch CATS gas export pipelines, both of which are surface laid and exposed. Any rock required will be deposited by a rock placement vessel. The spread of rock placement will be restricted through the use of a fall pipe system held a few metres above the seabed to accurately place rock material.

A valve skid ('fishing friendly') will be installed at Kyla to route gas lift and production fluids to and from the Kyla well and Bittern manifold and act as the connecting point for the Kyla umbilical. There may also be a requirement to install a separate tie-in structure ('fishing friendly') at Bittern, depending on the tie-in arrangement. Two foundation concepts, piled versus gravity-based, are currently being considered for these structures. For the purposes of this ES, a piled structure foundation concept has

been assumed as worst case for the underwater noise assessment and a gravity-based structure (GBS) has been assumed as worst case for the seabed disturbance assessment

As Kyla will be a subsea development, production from the field will be processed offshore at the Triton FPSO with processing equipment and support facilities shared with several other producing assets. As such, there will be no emissions and discharges to the marine environment during routine production operations at the Kyla well location, although there will be incremental emissions and discharges at the Triton host facility as a result of Kyla coming online.

Power generation on the Triton FPSO supports operations of major seawater pumps, compressors, accommodation, utilities, and various other pumping systems. Once online, Kyla will only impact export compressors operational loads and will not impact on power increase for other requirements (refer to Section 3.5.5 of the ES). There will be no increase in flaring or diesel use at Triton due to Kyla coming online, but some additional gas will be cold vented from the oil storage tanks on Triton as a result of Kyla production (refer to Section 3.5.4). There is no produced water reinjection on the Triton FPSO, so produced water from Kyla shall be treated by the existing Triton produced water system where it will be discharged to sea (in accordance with the Triton Oil Discharge Permit), with the monthly average oil concentration not exceeding 30 mg/l (refer to Section 3.5.3 of the ES). It is anticipated that chemicals required for the production of hydrocarbons from Kyla will be the same as those being used at Triton at the time of first oil, although quantities used are likely to increase.

The Kyla subsea infrastructure is expected to produce hydrocarbons for 8 years depending on the reserves, the production rate and the life of the Triton infrastructure. On CoP, the Kyla facilities will be decommissioned in accordance with the requirements of the prevailing UK and International law.

Concept Selection

The selected concept for the Kyla Development project is a single subsea well tied back to a suitable host facility. A standalone development concept is not economically viable for Kyla and has been discounted. Concept select work therefore focused on screening hosts which could support the development of Kyla as a subsea tie-back.

Several potential host facility and tie-back route options were explored during the project feasibility/pre-concept phase conducted in 2024, as illustrated in Figure 2, namely:

- Tie-in to Triton FPSO (operated by Dana) via:
 - Direct tie-in at the Triton FPSO riser base;
 - Tie-back to Evelyn or Belinda manifolds;
 - Tie-back to one of the Bittern Drill Centre manifolds (DCA or DCB);
- Tie-in to Gannet Alpha platform (operated by Adura);
- Tie-in to Catcher FPSO (operated by BW Offshore);
- Tie-in to Anasuria FPSO (operated by Anasuria Operating Company).

The outcome of the assessments conducted during the project feasibility/pre-concept phase resulted in the direct tie-back options to Gannet Alpha, Catcher and Anasuria being discounted and recommended that Kyla be redeveloped as a subsea tie-back to the Triton FPSO via one of the Bittern manifolds (DCA or DCB).

The Bittern DCA/DCB manifolds are located the shortest distance from Kyla (12 – 13.2 km), with the other tie-back options entailing longer pipelines (ranging from 24 km to 50 km), thereby minimising seabed impact and construction and installation emissions.

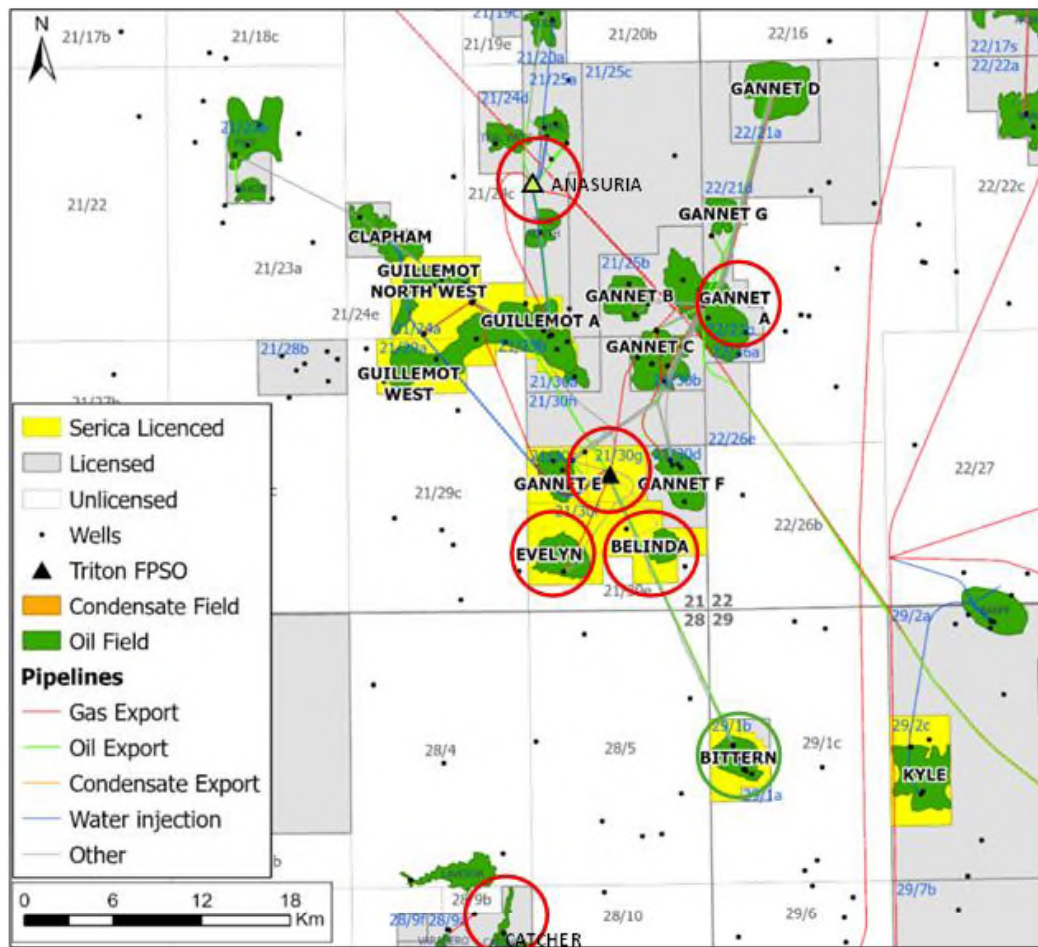
Aligned with the North Sea Future Plan (DESNZ, 2025b) and in accordance with the Oil and Gas Authority (OGA) Strategy and OGA Plan to reduce UKCS Greenhouse Gas (GHG) emissions from oil and gas extraction, the selection of the development concept for Kyla has been informed by carbon intensity and infrastructure reuse considerations. Key benefits of the chosen concept include:

- Reuse of existing subsea and topsides facilities, avoiding the need for new-build processing or export infrastructure;

- Low incremental power requirements, Triton FPSO has sufficient capacity within existing power generation systems;
- Optimisation of gas management, with produced gas used for fuel and lift, and surplus gas exported, minimising flaring;
- Estimated 20% reduction in carbon intensity across Triton FPSO production when Kyla comes onstream, through economies of scale.

In summary, the selected development concept reflects the optimal development plan for Kyla, maximising hydrocarbon recovery whilst minimising capital risk and costs, maximising use of existing North Sea oil and gas infrastructure, and significantly reduces the carbon footprint of production when compared with standalone or long-distance tie-back alternatives.

Figure 2: Location of the Proposed Kyla Development



¹ Red circles indicate potential/discounted tie-back options. Green circle indicates selected tie-back option

Project Schedule

The indicative timeline for the proposed Kyla Development is provided in Figure 3.

Figure 3. Indicative Timeline for the Kyla Development

	2027				2028			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Topside Modifications								
Development Drilling								
Subsea Installation								
First Oil								

The Existing Environment

The EIA process requires a comprehensive review of the existing environment in order to provide a basis for assessing the potential interactions between a project and the receiving environment. A high-level summary of the environmental sensitivities within the vicinity of the proposed Kyla Development area is provided below.

The description of the baseline environment is largely based on data provided in the UK Offshore Energy Strategic Environmental Assessment (OESEA) Reports (BEIS and predecessors) (2003-2016), as well as other published data sources, supported by site-specific survey data as detailed below.

To inform the EIA, a habitat assessment (HA) (Gardline, 2025a) and environmental baseline survey (EBS) (Gardline, 2025b) was carried out within the proposed Kyla Development area by Gardline, on behalf of Serica, between the 15th and 20th July 2025. The survey included a total of 18 sampling stations, co-located with camera transects ranging in length from 80 to 100 m, arranged in tidally aligned cruciform pattern centred on a proposed Kyla well location and along the proposed Kyla to Bittern pipeline route at 5 km intervals, as well as along a now discounted route between Kyla to Triton (refer to Figure 4). In addition, historic site environmental data exists for the field from the Kyle pre-decommissioning survey conducted in 2020 (Fugro, 2020; CNRI, 2021).

The oil and gas infrastructure in the wider area has also been subject to a number of site-specific surveys over the years. Several of these surveys are in close proximity to the proposed Kyla Development area, including historic surveys at Bittern (as illustrated in Figure 4), and have therefore been used to inform the environmental baseline description, where relevant.

Physical Environment

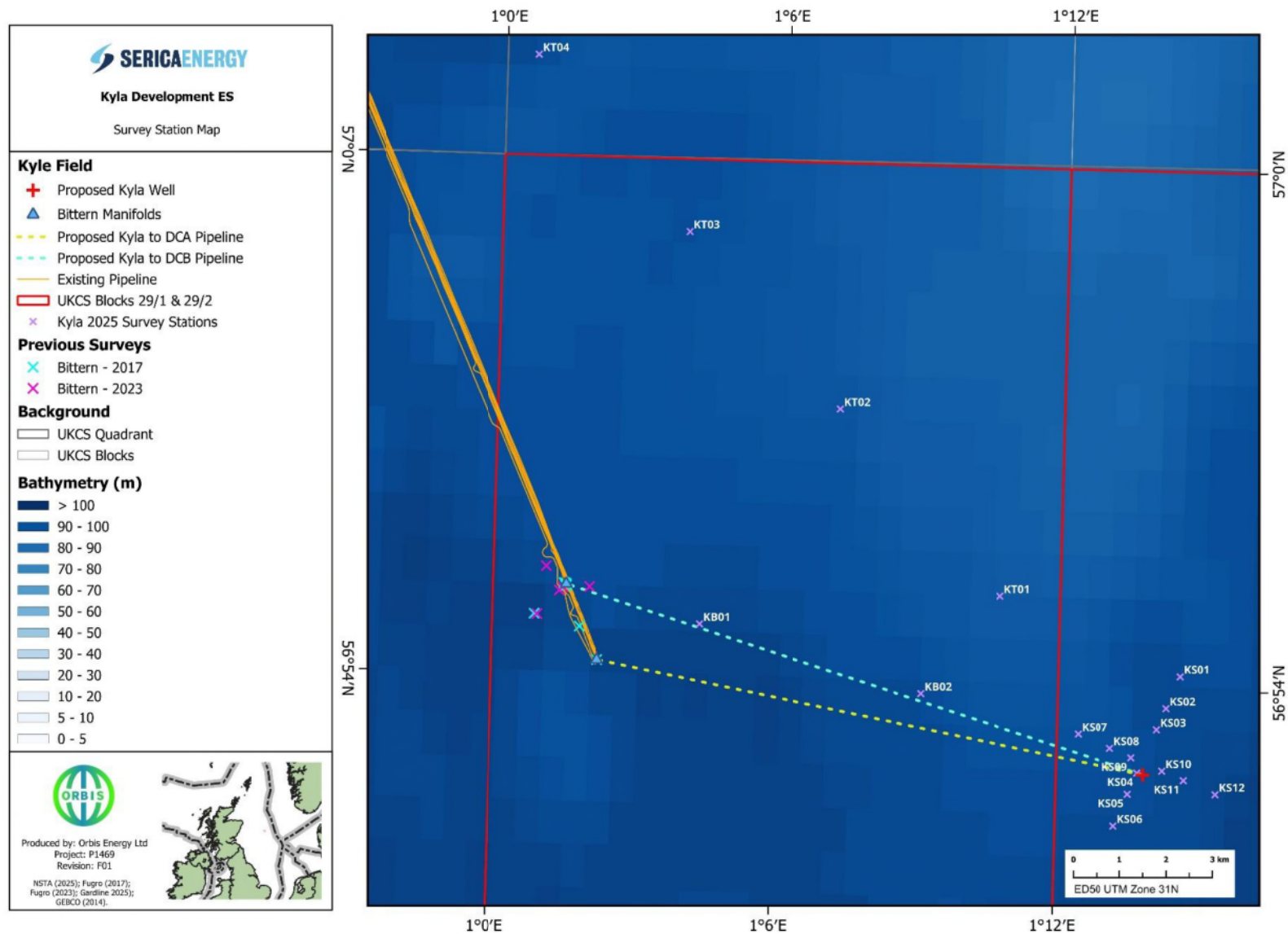
The bathymetry at both Kyla and Bittern and along the proposed pipeline route is relatively flat with water depths in the range of 90-95 m (CNRI, 2021; Fugro, 2017; Fugro, 2023; Gardline, 2025a).

The seabed imagery collected during the 2025 survey indicates that the seabed habitat in the proposed development area predominantly consists of a homogeneous sediment type, characterised by silty fine sand with varying proportions of shell fragments (Gardline, 2025a). This is similar to surveys of Bittern which found the seabed sediment to be poorly to very poorly sorted fine to very fine sand (Fugro, 2017; Fugro, 2023).

Sediment samples gathered from the proposed Kyla Development area were subjected to particle size analysis (PSA). The results of the PSA indicated that in the vicinity of both the proposed well location and along the proposed Kyla to Bittern pipeline route the sediment types were generally homogenous, comprising sand, fines and gravel (Gardline, 2025a, 2025b). Folk Classification identified 'Muddy sand' and 'Slightly gravelly muddy sand'. Previous surveys confirm that the samples taken from proposed Kyla Development area are broadly consistent with the seabed sediment types previously found. Total organic carbon (TOC) and total organic matter (TOM) for the majority of sampling stations was typical of background levels.

The exceedance of background hydrocarbons levels in marine sediments can indicate past and/or present anthropogenic sources. Crude oil is a complex mixture of compounds, including n-alkanes and aromatics (e.g. polycyclic aromatic hydrocarbons; PAHs). Within the vicinity of the proposed Kyla well location and along the proposed pipeline route the mean Total Hydrocarbon Concentrations (THCs) was 8.86 micrograms per gram ($\mu\text{g.g}^{-1}$). To put this into context, UKOOA (2001) reported a mean THC concentration of 9.51 $\mu\text{g.g}^{-1}$. All stations in the current survey recorded THC concentrations below the UKOOA (2001) 95th percentile and can therefore be considered consistent with background concentrations (BC). The overall mean n-alkane concentration within the vicinity of the proposed Kyla well location and pipeline route was 0.307 $\mu\text{g.g}^{-1}$. To put these results into context, UKOOA (2001) recorded a mean total n-alkane concentration of 0.40 $\mu\text{g.g}^{-1}$. As all concentrations were below the UKOOA (2001) 95th percentile, they can be considered consistent with the wider area. PAH concentrations at the proposed Kyla well location and along the pipeline route were also consistent with the UKOOA (2001) CNS mean, suggesting limited contamination and confirming that the overall hydrocarbon profile is typical of background conditions for the region.

Figure 4: Location of Kyla Site Specific Survey Stations



Barium (Ba) is a key tracer for anthropogenic pollution, specifically from drilling activities, as it is used as barite in drilling fluids. Since barite is largely insoluble, its presence in sediments provides a reliable indicator of drilling mud dispersion after discharge. The Kyla Development area mean for Ba was above that of the CNS UKOOA (2001) background stations and above the 95th percentile for most of the stations sampled. Concentrations of Ba can therefore be considered above the background levels for the Kyla area. This is not unexpected as Kyla is a redevelopment of the decommissioned Kyle field. Concentrations of other heavy and trace metals were considered consistent with background for sediments in the wider area with some localised elevation in Lead (Pb) and Zinc (Zn).

The hydrodynamics of the CNS are primarily driven by the North Atlantic Current (NAC), which introduces warm, subtropical water into the region (DESNZ, 2022). Tidal currents are generally weak and atypical, being easily overridden by winds and density circulation; modelled peak flows in the Kyla area range from 0.007 metres per second (ms^{-1}) and 0.054 ms^{-1} for neap and spring peak flows respectively (ABPMer 2008). Prevailing winds are from the south-west and north-north-east, although anticyclones over Europe can establish persistent south/south-easterly winds (DESNZ, 2022; UKHO 2013). Winter wind strengths typically fall between Beaufort 4-6 ($6\text{--}11 \text{ ms}^{-1}$) with higher winds of force 8-12 ($17\text{--}32 \text{ ms}^{-1}$) being much less frequent. Winds of force 5 (8 ms^{-1}) and greater are recorded 60-65% of the time in winter and 22-27% of the time in summer (DESNZ, 2022). Furthermore, the wave climate for the Kyla area is dominated by west and south-west directions, with the annual mean significant wave height around the proposed development area being approximately 2.11 m to 2.4 m (NMPI, 2025).

Climate Change and GHG Emissions

Over recent decades, scientific consensus has confirmed that the Earth's climate is undergoing significant change, largely driven by anthropogenic GHG emissions. Global mean concentrations for well-mixed GHGs (carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)) in 2019 correspond to increases of about 47%, 156%, and 23%, respectively, above the levels in 1750 (representative of the pre-industrial era) (high confidence) (IPCC, 2023) and in nearly all considered scenarios and modelled pathways, global warming is predicted to continue to increase in the near term (2021–2040) (IPCC, 2023b).

The United Nations Framework Convention on Climate Change (UNFCCC) commits countries to stabilise GHG levels, with the Conference of the Parties (COP) as its decision-making body. COP21 in 2015 created the Paris Agreement, requiring nations to limit warming to well below 2°C and pursue 1.5°C through nationally determined contributions (NDCs). Progress against the Paris Agreement is reviewed every five years via the Global Stocktake (GST) process, which at COP28 in 2023 showed warming projections of $2.4\text{--}2.6^\circ\text{C}$, above the 1.5°C goal, demanding rapid cuts of 43% by 2030 and Net Zero CO_2 by 2050. It is still considered technically possible that we can limit long-term global temperature rise to 1.5°C (WMO, 2025), however, at the recent COP30 in Brazil it was acknowledged that the world is likely to breach this threshold in the next decade, at least temporarily.

The GST process was informed by the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) cycle. AR6 defines five plausible future storylines (SSP1-5) describing global societal development (population, economy, technology and energy) to understand challenges for climate mitigation/adaptation. These are combined with Representative Concentration Pathways (RCPs), which define different levels of GHG forcing, to create scenarios like SSP1-2.6 (sustainable world with strong climate action) or SSP5-8.5 (fossil-fuelled world with high emissions), used in IPCC reports to model future climate impacts and vulnerability.

Biodiversity

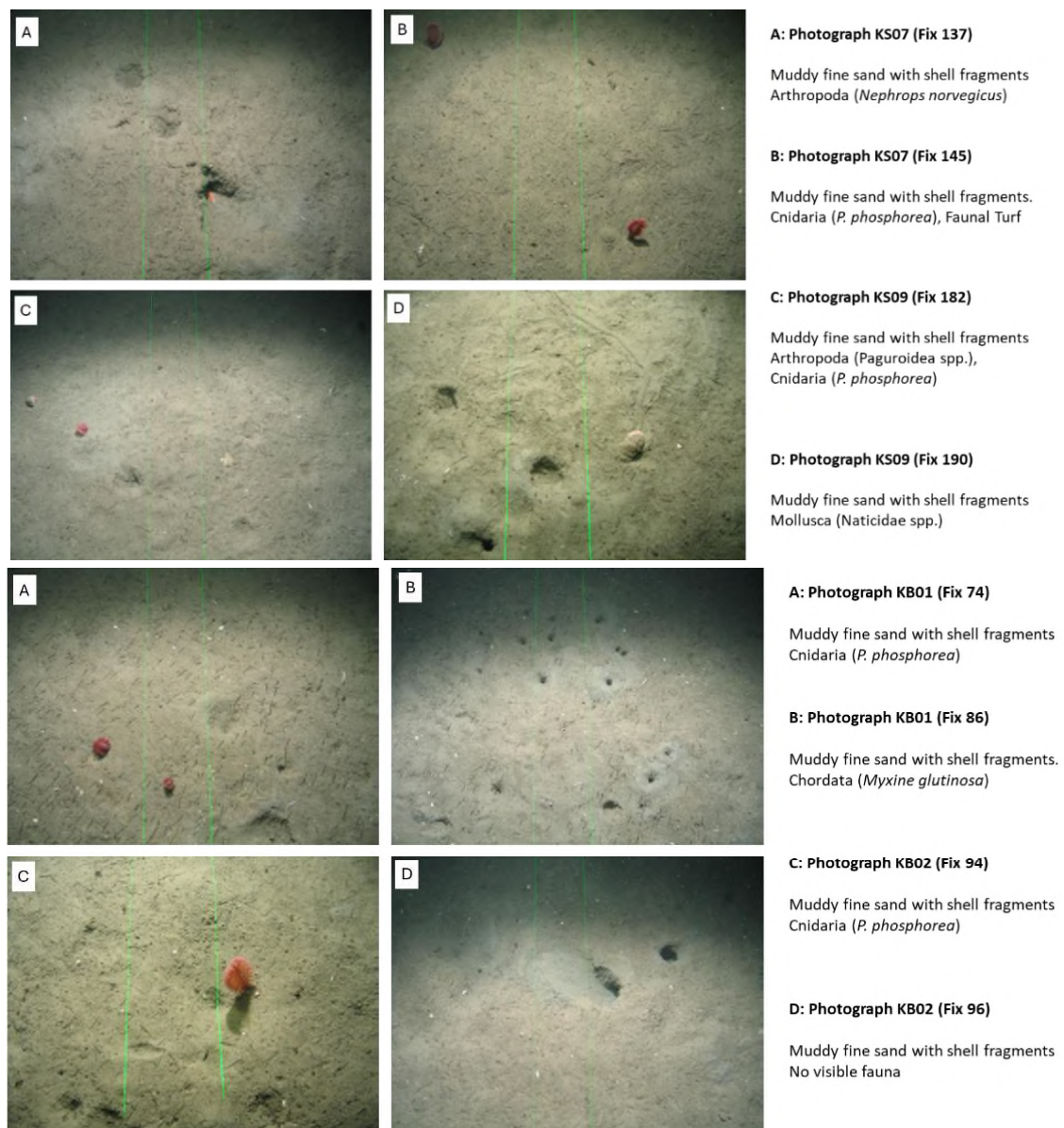
The collective term plankton describes the plants (phytoplankton) and animals (zooplankton) that live freely in the water column and drift passively with the water currents. The Scottish continental shelf typically exhibits a spring phytoplankton bloom, sometimes followed by a smaller autumn peak (DESNZ, 2022).

Benthos describes the organisms that live within and on the seabed. Benthic organisms can be classified further into infauna, organisms that live within the sediment, and epifauna, organisms that

live on top of the seabed (attached or mobile). The habitat investigation of the proposed Kyla Development area, based on a detailed review of the seabed imagery (refer to Figure 5) and analysis of the sediment samples, classified the entire survey area into the Level 4 European Nature Information System (EUNIS) biotope complex MD621: Faunal communities of Atlantic circalittoral mud. This deep, relatively stable mud habitat is generally characterized by the presence of sea pens (*Virgularia mirabilis* and *Pennatulula phosphorea*), the burrowing anemone *Cerianthus lloydii*, and the brittlestar *Amphiura* spp., often supporting communities of burrowing megafauna like the prawn *Nephrops norvegicus* (EEA, 2022). Additionally, three stations in the vicinity of the proposed Kyla well location were classified further to level five as EUNIS biotope MD6216: Seapens and burrowing megafauna in Atlantic circalittoral fine mud, reflecting the high visual presence of sea pens (most commonly *P. phosphorea*) and faunal burrows.

Across the entire survey, *P. phosphorea* was the most frequently observed species, while other common fauna included various crabs, shrimps, faunal turf (Hydrozoa/Bryozoa), and flatfish, with burrows and faunal turf present at the majority of locations (Gardline, 2025a). Overall, the benthic community showed high species richness, dominated by Annelids, with community structure primarily driven by natural physical characteristics.

Figure 5: Example Seabed Images within the proposed Kyla Development Area (Gardline, 2025a)



The Kyla HA and EBS paid particular attention to establishing whether or not the following habitats and/or species occurred within the survey area:

- Seapen and burrowing megafauna communities (Burrowed mud);
- Ocean quahog (*Arctica islandica*);
- Herring Spawning Grounds;
- Sandeel Spawning Grounds.

The Kyla survey confirmed the presence of the Seapen and burrowing megafauna habitat, classified as an OSPAR threatened and/or declining habitat across all stations, with sea pen and burrow density reaching the OSPAR "frequent" threshold at most sites, although the specific burrowing megafauna species were rarely confirmed.

The sea pen and burrowing megafauna communities habitat is also listed as a key component biotope within the broader Burrowed mud habitat, which is designated as a Priority Marine Feature (PMF) in Scottish waters. Sediments across the Kyla survey area were classified as muddy sand to slightly gravelly muddy sand, suggesting some ecological similarities to the Burrowed mud PMF.

Ocean quahog (*A. islandica*) is listed as an OSPAR Threatened and/or Declining species and is a PMF in Scottish waters. Thirty-one juvenile *A. islandica* individuals were recorded across the Kyla survey area, with no adults observed within samples.

The Kyla survey determined that the site was unsuitable for both herring and sandeel spawning due to the sediment composition (lack of gravel for herring and high fine content for sandeel).

No other sensitive habitats or species of conservation interest were observed within the Kyla survey area.

The North-East Atlantic and North Sea is split into statistical grids called International Council for the Exploration of the Sea (ICES) Rectangles in order to map statistical information about the area. A number of fish species are likely to be present within the Kyla Development area within ICES Rectangle 42F1. Species that may spawn within the vicinity include cod, lemon sole, mackerel (high intensity), Norway pout (high intensity), and sandeel (although, as noted above, the Kyla survey indicates the area is unsuitable for sandeel spawning). The area surrounding the Kyla Development may also act as a nursery grounds for Anglerfish, blue whiting, cod (high intensity), European hake, haddock, herring, ling, mackerel, Norway pout, plaice, sandeel, spurdog (also known as spiny dogfish) and whiting (Coull et al., 1998; Ellis et al., 2012b). Species of sharks, skates and rays may also be present in the vicinity of the Kyla Development, including cuckoo skate, lesser-spotted dogfish (small spotted catshark), spurdog (spiny dogfish) and starry ray / thorny skate.

A number of seabird species are present in the vicinity of the Kyla Development area throughout the year; including fulmar, kittiwake and guillemot over winter, and fulmar during the breeding season. The proposed Kyla Development area is located approximately 182 km from the nearest UK coast and is therefore remote from sensitive seabird breeding areas. Seabird Sensitivity to Oiling in the Kyla Development area is low all year round, bar November, where no data was available for any block (Webb et al., 2016).

Species of marine mammals likely to be present in the waters of the CNS, and the vicinity of the proposed Kyla Development include bottlenose dolphin, harbour porpoise, Risso's dolphin, common dolphin, minke whale, white-beaked dolphin and white-sided dolphin (IAMMWG, 2022; Reid et al., 2003). Additionally, fin whale have been observed in the waters surrounding the proposed development (Gilles et al., 2023). The distribution of grey and harbour seals in the proposed Kyla Development area is predicted as very low (Carter et al., 2022).

The proposed Kyla Development area is located 13.4 km south of the East of Gannet and Montrose Fields Nature Conservation Marine Protected Area (NC MPA), designated for the protection of ocean quahog (*Arctica islandica*) aggregations. No other MPAs are located within 40 km of the proposed Kyla Development area.

Human Environment

The North Sea has important fishing grounds and is fished throughout by UK and international fishing fleets, targeting a mix of demersal, shellfish and pelagic fish stocks. Commercial fishing can be quantified by landings (catch weight and monetary value) and effort (days fished). The proposed Kyla Development is located within ICES Rectangle 42F1. Across a ten year period from 2015 – 2024 the most valuable species caught in terms of average weight and monetary value from ICES Rectangle 42F1 were *Nephrops* (Norway Lobster), herring and Monks or Anglers (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025). Fishing effort within ICES Rectangle 42F1 is low, with the most popular gear used to target fisheries being trawls. A regional fishing intensity study focused on the Bittern to Triton FPSO pipeline also indicates that fishing activity is relatively low in the area (Xodus, 2025).

The Kyla Development is located within an area which experiences moderate volumes of routine shipping traffic compared to the other North Sea areas. Shipping lane traffic (including cargo vessels and tankers) and in-field traffic (defined as vessels operating within the hydrocarbon field complex) contribute almost equally to the routine traffic in the area.

Apart from Bittern, the closest producing field to Kyla is the Starling subsea gas field (operated by Adura), located in UKCS Block 29/3a approximately 12 km to the northeast, which is tied back to the Shearwater platform. The nearest FPSO is the Triton FPSO (operated by Dana) which is located approximately 20 km northwest of the Bittern DCB manifold and 30 km northwest of the proposed Kyla well. The nearest platform to the proposed Kyla well is the West Franklin platform (operated by Total Energies) which is located approximately 36 km northeast. The nearest platform to the Bittern DCB manifold is the Gannet A platform (operated by Adura) located approximately 30 km north. The Belinda field which is currently in development (expected to be producing in Q1 2026) is located approximately 14 km north of the Bittern DCB manifold and 24 km northwest of the proposed Kyla well.

Two active pipelines cross with the proposed Kyla pipeline route, the CATS pipeline (PL774) operated by the Wood Group and the Langeled pipeline (PL2071) operated by GASSCO AS (NSTA, 2025c). No submarine cables cross the proposed Kyla Development area.

There are currently no carbon storage licensing blocks or carbon storage licensing round blocks on offer in the vicinity of the proposed Kyla Development (Crown Estate Scotland, 2025; NMPI, 2025).

There are no dredging or aggregate activities in the vicinity of the proposed Kyla Development (Crown Estate Scotland, 2025).

There are no operational, under construction or consented offshore windfarms in the vicinity of the proposed Kyla Development. The closest offshore windfarm is the Cerulean Winds Cedar Project, currently in the pre-planning stage, located approximately 9.5 km southwest of the Kyla Development which is an Innovation and Targeted Oil and Gas (INTOG) offshore wind project (Crown Estates Scotland, 2025).

In addition, there are no military Practice and Exercise Areas or wrecks designated as historic Marine Protected Areas, scheduled monuments or war graves within the vicinity of the proposed Kyla Development.

The risk of interaction with tourism and leisure-based activities is extremely low given the far offshore location of the proposed Kyla Development (ca. 182 km from Peterhead on the eastern Scottish coastline).

Identification and Assessment of Potentially Significant Impacts

The EIA process undertaken for the Kyla Development has aimed to identify and assess all potentially significant environmental effects arising from the proposed project (both from planned activities and unplanned (accidental) events). Cumulative and transboundary impacts have also been considered.

For planned activities, the significance of environmental effects has been evaluated by considering the sensitivity of the receptor affected in combination with the magnitude of impact that is likely to arise. For unplanned events, such as accidental hydrocarbon releases, significance has been determined using a risk assessment approach, where the likelihood (probability) of the unplanned event occurring is considered against the consequence (significance of effect) if the event was to occur.

An initial scoping exercise identified a number of aspects (activities or events) which could potentially result in significant environmental effects. A comprehensive assessment was therefore undertaken for these aspects and, where necessary, measures identified to prevent or reduce what might otherwise be significant adverse environmental effects through design evolution or operational mitigation measures. These aspects were then reassessed assuming the successful implementation of the identified mitigation measures to determine residual effects.

A summary of the main findings of the EIA process is provided below.

Physical Presence

The physical presence of the Kyla Development, both above and below the sea surface, has the potential to interfere with the activities of other users of the sea (specifically shipping and commercial fishing).

The temporary presence of the MODU and other working vessels, at the surface can pose a navigation hazard, and may lead to an accidental event such as a collision. The greatest increase in vessel presence in the Kyla Development area will be before and during drilling operations, during installation of the subsea infrastructure and, following CoP, during decommissioning operations. However, any discernible increase in vessel presence in the area will be temporary in nature. The risk of a collision will be minimised by implementing measures, including temporary establishing a 500 m safety zone around the MODU during the proposed drilling operations, which will be patrolled by an Emergency Rescue and Recovery Vessel (ERRV) equipped with an Automatic Identification System (AIS) and/or Automatic Radar Plotting Aids (ARPA). Notifications to other sea users will be issued via Notices to Mariners and Kingfisher Bulletin to communicate the location of the works.

Although the 500 m safety zone around the MODU will be temporary, Serica will apply for a 500 m safety zone to be in place around the subsea infrastructure at Kyla drill centre once the drilling operations are complete. Vessels will therefore be excluded from an area of 0.8 km² throughout the life of the field, however, this represents a very small proportion of the entire fishing area available in the CNS. To further reduce the risk of snagging; the Kyla xmas tree and Kyla valve skid, as well as the potential tie-in structure at Bittern (which will be located within an existing 500 m safety zone) will be designed to be 'fishing friendly'. Where concrete mattresses are used as part of the pipeline crossings design, or in other open water relocations outside the 500 m safety zones at Bittern and Kyla, rock cover will be provided to minimise risk of snagging with fishing gear.

Fishing vessels (particularly benthic trawlers and those with pelagic mobile gear) may also be temporarily displaced from a slightly larger area of ca. 8 km² as a result of the MODU anchors and ground chains, which will extend outside the 500 m safety zone. This is a conservative figure as it assumes loss of access to a radius equal to the length of the anchors around the MODU, which is unlikely to be the case. The MODU anchors and mooring lines will be pre-laid on the seabed up to 20 days ahead of MODU arrival and will remain in place for up to 20 days following the MODU departure. To reduce the snagging risk during this period, if required a guard vessel will be used to deter vessels from the area, thereby preventing potential interaction with the mooring lines while the MODU is not on location.

During subsea installation activities, the main risk of snagging will be after pipe lay, pending trenching and burial. To minimise this risk, whilst installation activities are ongoing, a guard vessel will be used to patrol the length of the lines. Following pipeline trenching and burial operations, Serica will liaise with the Scottish Fishermen's Federation (SFF) to ameliorate any safety risks for the fishermen in the event mud berms are left behind, although this is considered unlikely given the sandy nature of the seabed sediments within the Kyla Development area.

In conclusion, no significant adverse residual effects to other sea users (shipping and commercial fishing) are predicted as a result of the physical presence of the MODU (including pre-laid anchors and ground chains) and vessels during drilling, installation, inspection and maintenance and decommissioning activities or the long-term presence of the Kyla subsea infrastructure and associated rock cover and concrete mattress protection.

Seabed Disturbance

The seabed will be disturbed through the mooring of semi-submersible MODU (anchors and ground chains), deposit of drill cuttings and cement and installation of the Kyla subsea infrastructure, including pipelines, umbilical and rock and concrete mattresses for protection, stability and trench transitions. Impacts to the seabed have the potential to interfere and cause adverse effects to seabed sediments, seabed communities (i.e. benthic flora and fauna) and fish. Of note, the Kyla Development area is not located within or near to a MPA. The closest site, the East of Gannet and Montrose Fields NC MPA, designated for the protection of ocean quahog (*Arctica islandica*) aggregations, is located 13.4 km north of the Kyla location.

The Kyla well will be drilled from a semi-submersible drilling rig, which will be held in position over the Kyla location using anchors and mooring chains. It is assumed that the MODU mooring system will consist of eight anchors and mooring lines, with all anchors laid up to a distance of 1,600 metres (m) from the rig centre. The total area of seabed which will be temporary disturbed from the mooring of the MODU is estimated to be ca. 76,272 m² (0.0763 km²). Direct impacts include the compression of the seabed where anchors settle, and localised abrasion damage to habitats and species caused by the continuous sweeping motion of mooring lines (ground chains and pennant wires). Furthermore, the retrieval process can leave scars and anchor mounds on the seabed. Indirect effects involve sediment re-suspension and subsequent smothering of seabed habitats and species. However, impacts to seabed sediments and communities will be localised and are only predicted to persist in the short to medium term given the sediment type and moderate energy environment of the Kyla location.

As a worst case, it has been assumed that the drill cuttings discharged from the Kyla well (up to 2,387 tonnes) have the potential to be deposited within an area of up to 0.12 km² surrounding the release location (based on a threshold for bottom deposition of 1.0 mm) (RPS, 2025). Any cement pumped to the seabed during cementing operations will also be deposited within this area. In the CNS, near-bed current velocities and sediment mobility are generally sufficient to prevent detectable local accumulation of cuttings, as seen during the pre-decommissioning survey for the Kyle field, which did not identify a discernible physical cuttings pile. For the Kyla well, the deeper wells sections will be drilled with LTOBM. In the event that the LTOBM contaminated cuttings are discharged, thermal cuttings treatment will be used to treat the cuttings to an acceptable overboard disposal limit (<1% oil on cuttings), thereby resulting in no significant changes to the natural benthic community or re-colonisation of the seabed.

Installation of the Kyla subsea infrastructure, particularly the trenching and backfill operations during pipeline and umbilical installation, will also result in temporary disturbance to seabed from sediment suspension and re-settlement within an area of ca. 0.623 km². However, given the relatively fine nature of the sediment at Kyla any sediment plumes or re-suspended sediment will tend to settle quickly and will not be prolonged or affect large areas. It is acknowledged that the Kyla survey confirmed the presence of the seapen and burrowing megafauna habitat, classified as an OSPAR threatened and/or declining habitat within the proposed Kyla Development area. However, the species that inhabit this type of benthic habitat are deemed to be highly recoverable and the area impacted will be relatively small. In addition, high rates of siltation may adversely affect ocean quahog, an OSPAR threatened and/or declining species, but any mortality caused to individual specimens as a result of the proposed operations is not considered to be significant given that impacts will be highly localised.

Exposure to increased turbidity caused by the proposed Kyla Development operations may also reduce the visual acuity of fish utilising the area potentially affecting foraging behaviour. Fish may also be temporarily displaced from their spawning and nursery areas. However, given the localised area of impact and the mobile nature of the species, any displaced fish are likely to find foraging opportunities, as well as suitable spawning and nursery areas in adjacent locations.

Installation of the Kyla subsea infrastructure will result in the loss of some sandy and muddy sediment habitat, and also the introduction of novel hard substrata. The total area of sandy sediment habitat permanently lost is estimated to be approximately 0.115 km² for the life of the Kyla Development (ca. 8 years) and beyond depending on how the infrastructure is decommissioned. This area is small in comparison to the area of similar habitat available across the wider area. The area beneath the subsea infrastructure, rock and concrete mattresses will become unavailable for re-colonisation by sandy and muddy sediment inhabiting infauna and over time a new rocky substrate habitat will become

established. Ultimately, this new seabed feature is expected to be colonised by the same types of mobile and encrusting epifaunal animals already present on cobbles and boulders in the wider area. The introduction of novel hard substrata by the Kyla Development is very small and, whilst it will represent a change to the benthic environment locally it is not expected to cause any widespread changes to the marine life present in the area.

In summary, no significant adverse residual effects to seabed sediments, seabed communities and fish are predicted from seabed disturbance associated with the Kyla Development operations.

Underwater Noise Emissions

Underwater noise emissions generated during the proposed Kyla Development have the potential to disturb, or cause injury to, a number of species in the marine environment, particularly fish and marine mammals. However, the only Kyla Development activity which results in underwater noise emissions with the potential to result in significant effects on marine fauna is the potential piling operations during the installation of the valve skid at the proposed Kyla well location and the tie-in structure, if required, at the Bittern manifolds (DCA or DCB). The maximum piling duration per structure is anticipated to be up to 8 hours. It is acknowledged that the vessels associated with drilling, subsea installation, inspection and maintenance and decommissioning operations will generate underwater noise of a continuous nature, but this will only cause temporary and localised changes in distribution of marine mammals and fish in the immediate vicinity of the vessel. In addition, the noise emissions from construction activities e.g. trenching or rock placement, are usually dwarfed by the noise emissions from the vessels themselves.

To reduce the risk of injury or behavioural disturbance to marine mammals and fish from the proposed piling operations, Serica will ensure that the Joint Nature Conservation Committee (JNCC) protocol for minimising the risk of injury to marine mammals from piling noise is followed (JNCC, 2010b). Piling operations will therefore not commence until monitoring confirms that a 500 m “mitigation zone” is clear of marine mammals and soft-starts will be incorporated into the piling schedule design. As such, it is possible that marine fauna may be subject to short term behavioural effects as a result of the underwater noise emissions generated from the proposed Kyla Development, but impacts will be mitigated such that any residual effects are not predicted to be significant.

Greenhouse Gas Emissions

GHG emissions to the atmosphere will be produced during the life of the Kyla Development. These emissions can be categorised into:

- Scope 1 emissions, the direct GHG emissions a company produces from its own operations;
- Scope 2 emissions, GHG emissions associated from the energy a company purchases (non-applicable to this ES); and
- Scope 3 emissions, which include other GHG emissions upstream (indirect) (from e.g. transportation) and downstream (indirect) (e.g. end use of sold products).

During the development of the Kyla field, combustion of hydrocarbons for power generation on the MODU, vessels, and helicopters, will result in atmospheric emissions, referred to as ‘indirect, upstream scope 3 emissions’.

During the production phase, hydrocarbons from the Kyla field will be processed at the Triton FPSO with processing equipment and support facilities shared with several other producing assets. This minimises the incremental energy demand caused by the development. The incremental GHG emissions associated with processing at Triton as a result of Kyla coming online, for the purposes of this assessment, are identified as ‘Scope 1 emissions’ as Kyla production is controlled by Serica. In addition, Serica has significant interest in Triton (holding a 46% equity interest in the asset) and therefore has influence over the operator of Triton (Dana).

Once the hydrocarbons have been processed on Triton, oil is typically tankered to Rotterdam where oil volumes are integrated into the wider European oil sales market and converted into usable fuels such as gasoline, diesel, and jet fuel. Gas is piped from Triton to the St Fergus terminal where it enters the UK’s national transmission system and is delivered to end users, such as gas-fired power stations, large industrial users, or regional gas distribution networks that connect to individual homes and businesses.

Once the Kyla hydrocarbons have been processed at the Triton FPSO and sold, further GHG emissions will arise from transportation, further processing and distribution, as well as from the end use of the sold product (namely, the presumption that all end use Kyla hydrocarbons are eventually combusted). Collectively, these emissions are referred to as 'indirect downstream Scope 3 emissions'.

In summary, the total gross GHG emissions generated over the life of the Kyla Development are estimated to be ca. 7,134.45 kilotonnes of carbon dioxide equivalent (CO₂e), based on the High production case (P10 profile), which represents the highest emissions generated from the Kyla P10 production profiles. It should be noted, however, that there is only a 10% probability that recovered volumes will meet or exceed the P10 case estimate. Scope 3 emissions represent by far the largest component of the total GHG emissions generated over the life of the field (ca. 81%).

The total gross GHG emissions generated as a result of the proposed Kyla Development are considered to be compatible with global emissions reduction pathways and targets, including those set out by The Paris Agreement. The Paris Agreement is a legally binding international treaty adopted in 2015 that commits countries to limit global warming to under 2°C above pre-industrial levels and pursue efforts to keep it below 1.5°C. Future global GHG emissions will be dependent on the success of international collaborative efforts to decarbonise the global energy system; however, Kyla's contribution represents a very small fraction of projected global GHG emissions under the IPCC's low (SSP1-2.6) emissions pathway consistent with limiting warming to 2°C (ca. 0.00320% of median global GHG emissions in 2030). Kyla will also contribute a very small percentage towards predicted global oil and gas production rates in international pathways consistent with limiting warming to under 2°C (ca. 0.00602% in 2030 and ca. 0.00321% in 2035 of global oil production and ca. 0.00113% in 2030 and ca. 0.00059% in 2035 of global gas production). Of note, Kyla will cease production in or before 2038, well before the global target for Net Zero emissions by 2050. Development of the Kyla field is therefore not expected to affect the trajectory of global temperature rise or the achievement of international climate targets in a significant way on its own.

In a national context, the GHG emissions associated with the Kyla development represent a small proportion of GHG emissions typically arising from oil and gas developments in the UKCS and will contribute a small fraction of CO₂e emissions towards future UK carbon budget targets (ca. 0.28549% of Carbon Budget 5 and ca. 0.21826% of Carbon Budget 6) and the UK's Nationally Determined Contribution (NDC) commitments (ca. 0.50692% of the 2030 NDC inventory target and ca. 0.41615% of the 2035 NDC inventory target). Given these non-significant proportions, the GHG emissions generated by the Kyla Development would have no material influence on the UK's ability to meet its Carbon Budget and NDC emissions reduction targets.

Notwithstanding the above, it is recognised that the proposed Kyla Development will contribute to global GHG emissions in combination with the other projects and activities emitting GHG emissions. Serica is committed to minimising the amount of GHG emissions produced, with the chosen development concept for Kyla representing one of the lowest carbon emissions impact means of recovering the remaining hydrocarbons in the Kyla field. During drilling and installation operations, vessel days and fuel consumption will be reduced, as far as practicable. Responsibility for identification and implementation of emissions reduction initiatives at Triton resides with the Triton FPSO operator (Dana). However, Serica (as the operator of Kyla) will support Dana as they continue to assess and implement reasonable decarbonisation strategies for Triton FPSO. Since the use of the produced products is not within the control of Serica, no mitigation measures that could be taken by the Kyla Development to reduce Scope 3 downstream emissions are available to implement.

The UK Net Zero Growth Plan (DESNZ, 2023b) acknowledges that fossil fuels will retain a crucial role in the energy system until there are credible clean energy alternatives that can replicate their role. The Independent Review of Net Zero (Mission Zero, 2023) also recognises that in the short term the UK will still need oil and gas to secure our energy independence and as transition fuels towards 2050. In addition, the global demand for oil, particularly for use in petrochemical feedstocks and heavy transport, is forecast to persist through the energy transition period (IPCC, 2022; IEA, 2025). Furthermore, the UK is the second largest oil producer in Europe, a market with a massive oil supply deficit, meaning the UK is critical to Europe's integrated energy system exporting crude oil and importing refined oil products largely within the Northwest European market (OEUK, 2025c).

Over the life of the Kyla field, the Triton FPSO with the input of Kyla will have an average carbon intensity of 29.9 kg carbon dioxide per barrel of oil equivalent (CO₂/boe) in the unabated scenario, decreasing to 23.3 kgCO₂/boe if all abatement projects identified in the Triton Emissions Reduction Action Plan (ERAP) are implemented over the period from 2028 to 2035. In comparison, the average carbon intensity for FPSOs in the CNS in 2024 was 30.5 kg CO₂/boe. When filtering by installation age (>25 years old) this increases to 37.5 kgCO₂/boe (NSTA, 2025b). The emissions intensity for UKCS offshore fields in 2024 was 24.0 kg CO₂/boe (NSTA, 2025a).

By operating within an already-licensed area (the previously decommissioned Kyle field) and maximising use of existing North Sea oil and gas infrastructure, Kyla contributes to maintaining secure domestic supply during the UK's broader energy transition while ensuring responsible stewardship of remaining offshore reserves.

Given the above, in a Paris Aligned oil and gas production pathway, the effect of the Kyla Development's GHG emissions on the global climate is therefore not considered to be significant.

Marine Discharges

The main operational discharges into the marine environment from the proposed Kyla Development will occur as a result of the discharge of drill cuttings, muds and cement during drilling, the discharge of chemicals during drilling, hook-up and commissioning of subsea infrastructure, subsea intervention activities and decommissioning operations, as well as the incremental increase in produced water discharges at the Triton FPSO (host facility) as a result of Kyla coming online.

Upon release, these discharges will be subject to rapid dilution and dispersion and are not expected to persist within the marine environment. Additionally, a number of studies have shown that any impacts will be limited to the local area in the immediate vicinity of the discharge location and therefore no significant adverse residual effects are predicted.

Serica will implement a range of measures to mitigate any potential impacts including undertaking a chemical risk assessment to identify the risk profile of chemicals being used and / or discharged in accordance with the requirements of the Offshore Chemicals Regulations 2002 (as amended). Where practicable, chemicals with a higher risk profile will be substituted out in favour of those with an improved environmental profile.

For assessment purposes, thermal cuttings treatment is being evaluated to treat the LTOBM contaminated cuttings to an acceptable overboard disposal limit (<1% oil on cuttings). If not selected / considered to be feasible, the LTOBM contaminated cuttings would be skipped and shipped onshore for disposal.

During the production operations, any discharges of residual reservoir hydrocarbons in the produced water stream will be treated to meet oil in water limits of the Triton Oil Discharge Permit SAT. The discharge streams will also be monitored and sampled in accordance with the permit conditions.

Accidental Events

All offshore activities associated with the Kyla Development will carry a potential risk of hydrocarbon pollution to sea; however, hydrocarbon spills from normal oil and gas operations are uncommon and can be effectively mitigated against. In planning its activities, Serica's primary focus is to ensure that all practicable measures are taken to prevent the occurrence of such accidental events and, should they occur, mitigate their effects. The consequences of an accidental release will vary depending on the quantity and type of hydrocarbon spilt, the wind speed and direction and sea state and the sensitivity of receptors depending on the time of year.

The worst case spill scenario from the Kyla Development would be an uncontrolled and unmitigated subsea blowout scenario from the Kyla well, releasing ca. 867,861 m³ of crude oil to the marine environment over 132 days (time it takes to drill a relief well). Oil spill modelling has been conducted to determine the fate of Kyla hydrocarbons released from this worst case scenario. Given the proximity to the UK/Norway median line, located approximately 72 km east of Kyla, there is a 100% probability for a surface slick of oil to cross the median line in all seasons. Other median lines which could be crossed include Denmark (83% in winter), Germany (56% in winter), Sweden (54% in winter) and the

Netherlands (41% in winter). The highest probability of shoreline oiling on the UK mainland is 39% in spring, with the shortest arrival time after 23 days in summer, although the risk of shoreline oiling is highest in Denmark in the winter (57%), with beaching occurring after 34 days. However, the Kyle crude is an ITOPE Group 2 (37.8° API) oil that undergoes rapid evaporation, dispersion and biodegradation upon release, and concentrations decline quickly following cessation of any blowout, and the oil is not predicted to persist in the water column, at the sea surface, or on the shoreline.

The risk of an accidental release occurring from the Kyla Development will be minimised through the implementation of physical barriers such as downhole safety valves, maintenance and inspection to minimise the risk of any leaks, and the development and implementation of handling and operational procedures and training. Measures to respond to a spill from the MODU or the Kyla subsea facilities once operational will be covered in approved oil pollution emergency plans (OPEP), which will be prepared in advance of drilling operations commencing offshore. As such, the overall risk to the marine environment from an accidental release of hydrocarbons from the Kyla Development is considered to be Medium to Low depending on the receptor impacted, but in all cases the risk has been reduced through mitigation measures and good industry practice and is therefore not considered to be significant.

Waste Management

Several different waste streams will be generated throughout the lifespan of the Kyla Development. Waste management will be undertaken in compliance with current environmental legislation and Serica's own waste procedures which includes the waste hierarchy; Prevent, Re-use, Recycle, Recover, Disposal (from most favourable to least favourable). The management of offshore waste generated on the UKCS is strictly regulated and the UK has well-established infrastructure in place to manage this waste effectively.

Environmental Management

Serica Energy Chinook Limited is a subsidiary of Serica Energy plc and operates under the Group's policies. Serica's Operations Management System (OMS) provides the framework for systematic management of Health, Safety, Environmental and Quality (HSEQ) across the Serica organisation and is designed to ensure the delivery of safe, environmentally responsible, and reliable operations in accordance with defined policies, practices, procedures and standards.

The structure and content of the OMS recognises the principles of ISO 14001 (Environmental Management Systems) and ensures that risks to the environment are reduced to As Low as Reasonably Practicable (ALARP). This system provides the structured management framework within which environmental impacts are identified, assessed, controlled, and monitored.

Serica's Environmental Management System (EMS) was successfully verified against the requirements of OSPAR 2003/5 in April 2025. The Serica EMS is the mechanism that ensures the company standards are maintained, that the commitments specified in the ES are met and that unforeseen aspects of the proposed Kyla Development are detected.

Conclusion

In summary, it is concluded that the proposed Kyla Development will not result in any significant environmental effects provided that all identified mitigation measures are implemented. Serica's management approach will be used to ensure that the on-going process of identification, assessment and control of environmental risks will continue throughout planning and operations of the Kyla Development. In addition, no significant in-combination, cumulative or transboundary effects are considered likely to arise from the proposed Kyla Development.

1 Introduction

1.1 Background

Serica is planning to develop the Kyla oil field located in UKCS Block 29/2c in the CNS, approximately 196 km to the southeast of Peterhead on the Scottish coastline and 72 km to the south west of the UK/Norway transboundary line (Figure 1.1). Kyla (previously developed as 'Kyle') is a ceased-production oil field which sits within Licence P.2616 at a water depth of approximately 90 m. Serica was awarded 100% equity and operatorship of Licence P.2616 in the 33rd Licence Round on 1st December 2023.

The Kyle field was originally developed via four subsea production wells, with first oil achieved in 2000. The wells were tied back to the Curlew FPSO facility before being re-tied back to the Banff FPSO in 2005. The Kyle field ceased production following sand control issues with one of the wells and was decommissioned, along with the Banff FPSO, in 2020. All textual references within this ES have been updated to reflect the fact that the Kyle field has been renamed the Kyla field, although some diagrams, and drawings may still display the former Kyle field name.

Serica is proposing to develop the Kyla field via a single subsea well tied back via a 12 – 13.2 km (depending on the precise tie-in point) long production pipeline, gas lift pipeline and umbilical to one of the existing Bittern drill centre manifolds (either DCA or DCB). Tie-in to the Bittern DCA manifold is the base case, however the DCB manifold has been considered as the back-up case option.

The Bittern manifolds are in turn tied back to the Triton FPSO, with both assets operated by Dana. Kyla hydrocarbons will be processed on the Triton FPSO with Kyla oil exported as part of the Triton FPSO blend via shuttle tanker and sales gas routed with other Triton area gas to the St Fergus terminal onshore via the Fulmar gas pipeline.

In order to obtain a Development and Production Consent for the Kyla Development project, Serica is required to submit a Field Development Plan (FDP) to the North Sea Transition Authority (NSTA). As the proposed Kyla Development will extract more than 500 tonnes of oil per day, the FDP must be supported by an ES, which needs to be submitted to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) for approval under The Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020.

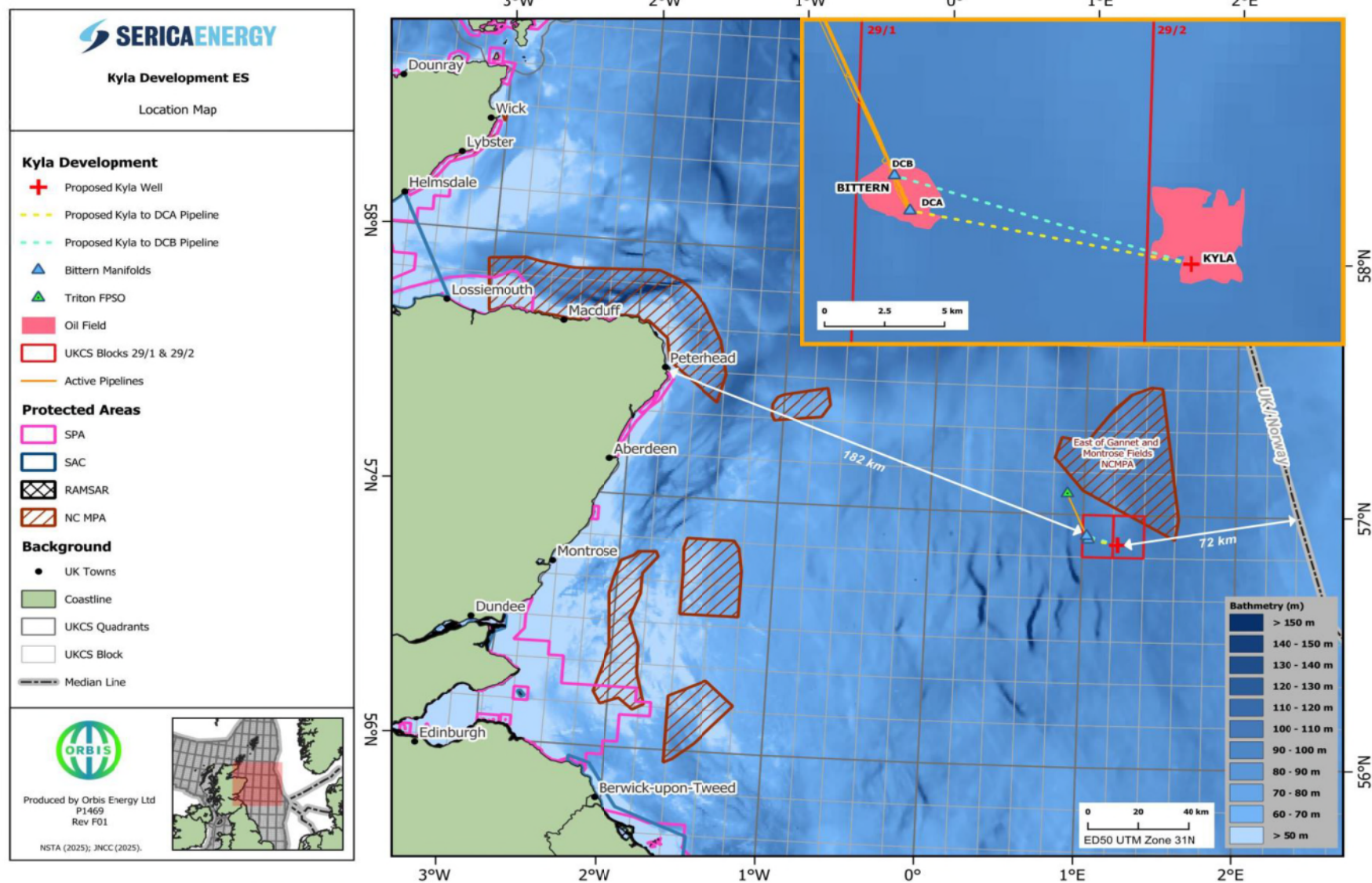
This document is the ES for the proposed Kyla Development (the "Project") and presents the findings of the EIA undertaken to determine if the Project is likely to have any significant effects on the environment.

1.2 Project Overview

It is proposed to develop Kyla via a single subsea horizontal well located in UKCS Block 29/2c, drilled from a semi-submersible MODU.

Kyla production fluids will be exported via a new 12 to 13.2 km long 8-inch production carbon steel pipeline to either the Bittern DCA (base case) or Bittern DCB manifold located in UKCS Block 29/1. From Bittern, Kyla production will be co-mingled with Bittern production and routed via the existing Bittern pipelines to the Triton FPSO located in UKCS Block 21/30. The Triton FPSO is operated by Dana (52% equity), with joint venture partners Serica (46%) and Waldorf Petroleum Resources Limited (2%). The Triton FPSO has suitable process facilities and spare capacity to support and service Kyla with relatively minor topsides modifications. Kyla production will be processed on Triton with oil exported as part of the Triton FPSO blend via shuttle tanker and sales gas routed to the St Fergus terminal, located near Peterhead on the North East coast of Scotland, via the Fulmar gas pipeline.

Figure 1.1: Location of the Proposed Kyla Development Infrastructure



Production from Kyla will require artificial lift (gas lift), with gas supplied from Triton via Bittern. A 3-inch gas lift carbon steel pipeline will be piggybacked to the Kyla production pipeline to supply gas lift to the Kyla well. An electro/chemical/hydraulic and control umbilical will also be extended from Bittern to Kyla, which will run adjacent to the pipelines.

A 'fishing friendly' valve skid will be installed at Kyla to route gas lift and production fluids to and from the Kyla well and Bittern manifold (DCA or DCB) and act as the connecting point for the Kyla umbilical. There may also be a requirement to install a separate 'fishing friendly' tie-in structure at Bittern, depending on the tie-in arrangement.

The location of the proposed Kyla Development infrastructure is summarised in Table 1.1.

Table 1.1. Location of Proposed Kyla Development Infrastructure

Aspect	Kyla Drill Centre	Bittern Drill Centre Tie-in Location	
		Manifold A	Manifold B
Location (Lat/Long)	56° 53' 01.13"N; 01° 13' 50.70"E	56° 54' 10.88"N; 01° 02' 14.02"E	56° 55' 2.93"N; 01° 01' 32.60"E
UKCS Block	29/2	29/1	
ICES Rectangle	42F1	42F1	
Distance to nearest coastline (Peterhead)	196 km	183 km	182 km
Distance to nearest median line (UK / Norway)	72 km	83 km	84 km
Nearest Marine Protected Area	13 km SW of East of Gannet and Montrose Fields NCMPA	17 km SW of East of Gannet and Montrose Fields NCMPA	16 km SW of East of Gannet and Montrose Fields NCMPA

¹ ED50 TM 0 N

First oil is currently targeted for Q3 2028. Subject to the necessary permits and consents being in place, drilling, completion and subsea installation activities will be undertaken between Q4 2027 and Q3 2028.

The field is expected to produce hydrocarbons for circa eight years, until 2035, depending on the reserves, the production rate and the life of the Triton FPSO (refer to Appendix G).

On cessation of production, the Kyla infrastructure will be decommissioned in accordance with the requirements of the prevailing UK and International law.

1.3 Scope and Purpose of the ES

The scope of the EIA and resultant ES includes the following Project phases:

- The drilling and completion of the single subsea well at the Kyla field;
- Installation of subsea infrastructure, including production pipeline, piggybacked gas lift pipeline and umbilical, valve skid (at the Kyla well location) and tie-in structure at Bittern to support tie-back of the well to the Bittern drill centre manifold (A or B);
- Operation, maintenance and inspection of the Kyla subsea facilities, including incremental operational greenhouse gas emissions at the Triton FPSO due to Kyla coming online;
- Decommissioning of the Kyla infrastructure on cessation of production.

The purpose of the ES is to provide an assessment of the likely significant environmental effects that may arise from the proposed Kyla Development and to identify the measures which will be put in place to minimise these effects.

The following Project activities have been subject to detailed assessment, as justified in Section 5:

- Physical presence:
 - Presence of drilling rig and/or vessels during drilling, installation, inspection and maintenance and decommissioning activities;
 - Ongoing presence of subsea infrastructure and associated material (rock / concrete mattresses) for protection, stability and trench transitions.
- Seabed disturbance:
 - Mooring of drilling rig and deposit of drill cuttings and excess cement on the seabed during drilling operations;
 - Installation of subsea infrastructure (pipelines and umbilical, valve skid and tie-in structure) and deposit of material (rock / concrete mattresses) for protection, stability and trench transitions.
- Underwater noise emissions:
 - Piling operations to install the Kyla valve skid and tie-in structure.
- Greenhouse gas emissions:
 - Fuel consumed for power generation on the drilling rig, vessels and helicopters during drilling, installation, inspection, maintenance and decommissioning activities;
 - Incremental emissions from the Triton FPSO as a result of processing Kyla fluids;
 - Further refinement, transportation and distribution of Kyla hydrocarbons once they leave Triton, but prior to end use of sold products;
 - Burning of the extracted Kyla hydrocarbons (i.e. end use of sold products, based on the presumption that all end use Kyla hydrocarbons are eventually combusted).
- Marine Discharges:
 - Discharge of drill cuttings at the sea surface;
 - Discharge of drilling, cementing, completion and rig chemicals during drilling operations;
 - Discharge of chemicals during hook-up and commissioning of subsea infrastructure, including commissioning and preservation fluids;
 - Incremental increase in produced water discharges at the Triton FPSO (host facility) as a result of Kyla coming online and discharge of entrained reservoir hydrocarbons and production chemicals;
 - Discharge of chemical or hydrocarbons during subsea intervention activities and during decommissioning operations.
- Accidental Releases:
 - Well blowout (releasing large quantities of oil) in the event of a loss of well control;
 - Drilling rig or vessel collision (loss of diesel inventory);
 - Production pipeline rupture and subsequent release of hydrocarbons to sea.

1.4 Structure of the ES

The structure of this ES is summarised in Table 1.2 on the following page.

Table 1.2. ES Structure

Section Content	Content
Non-Technical Summary	A high level summary of the EIA to allow the non-specialist reader to understand the proposed Kyla Development (the Project) and its main environmental impacts and proposed mitigation measures.
Main Document	
Section 1: Introduction	Introduces the Project, outlines the scope and purpose of the ES, lists applicable environmental legislation, identifies areas of uncertainty and summaries the key issues raised during the stakeholder engagement process.
Section 2: Project Alternatives	Outlines the main concept options (alternatives) considered for the Project.
Section 3: Project Description	Describes the subsea infrastructure to be installed for the Project and provides an overview of each lifecycle phase of the Kyla Development, including drilling, installation, production, inspection and maintenance, and decommissioning activities.
Section 4: Existing Environmental Baseline	Describes the baseline environment in the Project area, with particular emphasis on those aspects which are likely to be affected by the proposed development activities.
Section 5: Assessment Methodology	Presents the impact assessment methodology used for the EIA and identifies those aspects of the environment that are likely to be significantly affected by the Project.
Sections 6 – 11: Assessment Sections	These sections assess if the Project is likely to have any significant effects on the environment, define the proposed mitigation measures which will be implemented and determine the residual impacts (i.e. they document the assessment results). Where relevant, transboundary, in-combination and cumulative impacts are also assessed.
Section 12: Waste Management	Provides a high-level description of Serica's waste management strategy for the Project.
Section 13: Environmental Management	Describes Serica's EMS and the management processes that will be applied throughout the Project to ensure adverse impacts on the environment are minimised. Includes a register of Project commitments.
Section 14: Conclusions	Reports the conclusions of the EIA process.
Section 15: References	List sources of information referenced throughout the ES.
Section 16: Glossary	A list of a list of technical terms with definitions.
Appendices	
Appendix A: Legislation and Marine Policy	Provides a summary of applicable environmental legislation and marine policy pertinent to the Project.
Appendix B: ENVID Registers	Presents the results from the ENVID workshop undertaken for the Project.
Appendix C: Drill Cuttings Modelling	Presents the results of the drill cuttings and muds dispersion modelling study undertaken for the Project.
Appendix D: Underwater Noise Modelling	Presents the results of the underwater noise modelling study undertaken for the Project.
Appendix E: Quantification of GHG Emissions	Sets out the methodology (calculations, emissions factors and assumptions) used to quantify the total greenhouse gas (GHG) emissions generated from the Project.
Appendix F: Oil Spill Modelling	Presents the results of the oil spill modelling study undertaken for the Project.
Appendix G: Production Profile Tables	Presents the Kyla Development high, low and mid case production profiles.

1.5 Legislation and Policy Framework

1.5.1 Environmental Legislation

The Petroleum Act 1998 establishes the regulatory regime which is applicable to oil and gas exploration and production in the UK. It vests all rights to the nation's petroleum resources in the Crown but permits the NSTA to grant licences that confer exclusive rights to 'search and bore for and get' petroleum.

The NSTA regulate and influence the UK oil and gas industry, supporting UK energy security and helping to drive North Sea energy transition.

The Petroleum Act is supplemented by various environmental Acts and Regulations. OPRED is responsible for regulating environmental and decommissioning activity for offshore oil and gas operations on the UKCS and is part of the Department for Energy Security and Net Zero (DESNZ).

The EIA undertaken for Kyla as reported in this ES has been carried out in accordance with the Offshore Oil and Gas Exploration, Production, Unloading and Storage (Environmental Impact Assessment) Regulations 2020 (the 'EIA Regulations'). These regulations require that where a project falls within Schedule 1 of the Regulations there is a mandatory requirement for an EIA and the application for a development and production consent must be supported by an ES. The Kyla Development qualifies as a Schedule 1 project as it will involve the extraction of oil for commercial purposes where the amount extracted exceeds 500 tonnes per day. The EIA has been undertaken with reference to the Offshore EIA Regulations Guidance (DESNZ, 2021), as well as the new supplementary guidance for assessing the effects of downstream scope 3 emissions on climate from offshore oil and gas projects (DESNZ, 2025c).

Other environmental Acts and Regulations pertinent to the proposed Kyla Development and therefore considered during the EIA process include, but are not limited to:

- The Climate Change Act 2008 (as amended);
- The Climate Change (Scotland) Act 2009 (as amended);
- The Energy Act 2008 (as amended);
- Marine and Coastal Access Act 2009 (as amended);
- The Marine (Scotland) Act 2010;
- The Merchant Shipping (Oil Pollution Preparedness, Response and Cooperation) Regulations 1998 (as amended);
- The Offshore Chemicals Regulations 2002 (as amended);
- The Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015;
- The Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (as amended);
- The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended).

Further detail on this legislation, as well as other international treaties and agreements such as the Oslo and Paris (OSPAR) Convention, applicable to the Project is provided in Appendix A.

1.5.2 Marine Planning Policy

The Marine and Coastal Access Act 2009 and The Marine (Scotland) Act 2010 established a legislative and management framework for the marine environment allowing the competing demands on the sea to be managed in a sustainable way across all of Scotland's seas.

The framework includes the following elements:

- UK Marine Policy Statement (MPS): the UK Administrations share a common vision of having clean, healthy, safe, productive and biologically diverse oceans and seas.
- Scottish National Marine Plan (NMP): sets out strategic policies for the sustainable development of Scotland's marine resources out to 200 nautical miles (nm).

The Scottish NMP sets out specific key issues for the oil and gas sector in supporting the objectives of the plan, including:

- Maximise extraction;
- Re-use infrastructure;
- Co-operation with the fishing industry;
- Noise impacts to sensitive species;
- Chemical and oil contamination of water, sediments and fauna; and
- Habitat changes.

The proposed Kyla Development has been assessed against all relevant NMP objectives and policies (see Appendix A for further details).

1.5.3 UK Government's Energy Policy and Net Zero Target

The UK's Climate Change Act 2008 (as amended) sets a legal requirement to achieve a 100% reduction in net greenhouse gas (GHG) emissions by 2050 relative to 1990 levels ('Net Zero'). This delivers on the commitment that the UK made by signing the Paris Agreement¹.

The North Sea Transition Deal (BEIS, 2021) sets out a plan for how the UK's offshore oil and gas sector and the UK Government will work together to meet certain GHG emissions reduction targets, including development and implementation of the NSTA's Net-Zero Asset Stewardship Expectation 11 (NSTA, 2021). The deal includes reductions in offshore production emissions of 25% by 2027; and 50% by 2030, against a 2018 baseline, in line with the aim of creating a Net Zero basin by 2050.

Further requirements for the oil and gas industry to meet the UK's Net Zero obligation are outlined in the OGA Plan to reduce UKCS GHG emissions (NSTA, 2024a), which builds on and consolidates guidance on flaring and venting and the NSTA's Net-Zero Asset Stewardship Expectation 11.

In October 2025, the UK Government published the Carbon Budget and Growth Delivery Plan (CBGDP) (HM Government, 2025) which sets out how the government plans to meet its statutory carbon budgets (five-year caps on emissions levels set under the Climate Change Act 2008).

Following this, in November 2025, the UK Government published the North Sea Future Plan (DESNZ, 2025b), which outlines a comprehensive strategy aimed at managing the North Sea's oil and gas resources while transitioning to clean energy. Further information on UK climate legislation and policies designed to reduce GHG emissions and reach Net Zero by 2050, including sector specific strategies of relevance to the proposed Kyla Development, is provided in Section 9.3.

1.6 Areas of Uncertainty

This ES has been prepared prior to detailed engineering studies being conducted. As a result, some uncertainties have been carried during the EIA process, including:

- The Kyla Development well (via Kyla valve skid) will be tied back to the Bittern DCA manifold (base case) however the DCB manifold has been considered as a back-up case option. This will be confirmed during detailed design. The Bittern manifolds are located approximately 2 km from each other and are both suitable for connecting the Kyla production, gas lift and electro/chemical/hydraulic and control umbilical services. For the purposes of this ES, the

¹ The Paris Agreement aims to restrict global temperature change to well under 2°C, and pursue efforts to keep it below 1.5°C.

longest tie-back which is to the DCB manifold has been assessed as this represents the worst case scenario.

- LTOBM will be used to drill the lower sections of the Kyla Development well. For the purposes of the ES, thermal cuttings treatment is being evaluated to treat the LTOBM contaminated cuttings to an acceptable overboard disposal limit (<1% oil on cuttings). If not selected / considered to be feasible, the LTOBM contaminated cuttings would be skipped and shipped onshore for disposal.
- Depending on the tie-in arrangement, there may be a requirement to install a 'fishing friendly' tie-in structure at Bittern. The potential tie-in structure at Bittern and the proposed valve skid at Kyla will either be piled or gravity based structures. For assessment purposes, a piled structure has been assessed from an underwater noise perspective and the gravity based structure has been assessed for seabed disturbance as it has a larger footprint.
- The pipeline and umbilical will be trenched and buried, similar to the other lines which form part of the Triton area. Trenching may be carried out using a pipeline plough (worst case), jet trenching tool or mechanical cutter.
- To assess the effects of downstream scope 3 emissions on climate from the Kyla Development, Serica has made the assumption that all end use Kyla hydrocarbons are eventually combusted (refer to Section 9). This assumption is consistent with the guidance for assessing the global environmental impacts of proposed oil and gas projects issued by DESNZ in June 2025.

1.7 Key Stakeholder Engagement

In September 2025, as part of the informal stakeholder engagement process, Serica issued a Scoping Report to OPRED, JNCC, SFF and the Scottish Government Marine Directorate (SGMD). The Scoping Report provided an overview of the Project and the impacts to be assessed in the ES, with recipients of the report invited to comment on the Project and scope of the ES. The feedback received and how the issues raised have been considered during the EIA process and, where applicable, addressed in this ES are detailed in Table 1.3.

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Table 1.3. Summary of Key Issues Raised during the Stakeholder Engagement Process

Organisation	Comments Raised	Considered by the Project / Addressed in ES
OPRED	Serica should ensure there is clear and appropriate demonstration of the reasonable alternatives for the development in the assessment.	Concept Screening for Host Facility and Tie-Back Options is detailed in Section 2.2.
	Whilst exact detail is not required, OPRED expect a submission to provide a high-level overview of decommissioning considerations and a written commitment that any infrastructure installed is capable of being removed at end of field life. Particularly, you should note the UK's clear seabed policy and be fully familiar with the Department's decommissioning guidance. OPRED (ODU) expect that all new bundles are to be removed at end of field life (i.e. they are not subject to comparative assessment). Please consider whether your proposals would fit that category and be subject to that particular obligation. In addition, given the short life of the field (8 years), the ES should also consider what design and/or construction methods have been considered with easier and perhaps less damaging decommissioning in mind (such as minimising rock dumping so that pipelines can more easily be removed, post operational phase).	Decommissioning considerations for the Kyla Development are identified in Section 3.6
	<p>Serica's consideration of Net Zero and their policies/practices etc. for achieving this will need to be included for construction/drilling and commissioning and operational phases, for example emissions reduction opportunities, flaring and venting, power generation (electrification opportunities, if relevant). Emissions should be calculated and assessed on a worst case (likely to be high case production) and an assessment provided in the context of Net Zero. Power demand increases should be considered on a cumulative basis to determine significance.</p> <p>In addition, minor topside modifications are noted for Triton. Please ensure sufficient clarity is provided (whether scoped in or out) in terms of quantifying 'minor' or 'minimal' changes. For example, minimal additional power generation requirements should be clarified and set into context of all other developments that are requiring 'minimal' power gen requirements. Are they utilising existing ullage/capacity to run more efficiently or do they collectively require additional kit to be run, for example?</p> <p>Any other impacts of increased operational demands would similarly need to be considered and assessed with cumulative impacts in mind (e.g. produced water discharges).</p>	<p>The increased operational demands at the host facility (Triton FPSO) are identified in Section 3.5 and resulting impacts assessed in Section 9 (GHG Emissions) and Section 10 (Marine Discharges).</p> <p>Net zero considerations are discussed in Sections 1.5.3 (UK Government's Energy Policy and Net Zero Target), Section 2.2.4 (Development Concept Net Zero Considerations) and Section 9 (GHG Emissions). Appendix E sets out the methodology used to calculate the total quantity of GHG emissions generated from the Project – a high case P10 scenario has been assumed as worst case.</p>

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Organisation	Comments Raised	Considered by the Project / Addressed in ES
OPRED	It would be useful to provide a short section or table in the ES to demonstrate why some aspects have been scoped out from detailed assessment. Furthermore, you should ensure that the ES appropriately assesses the impact of all phases of the Project (i.e., construction, commissioning, operation and maintenance) and include any in-combination or cumulative impacts as part of that assessment (as mentioned elsewhere). It is advised that no effects are scoped out of the ES assessment with regards to shipping and navigation pending the outcome of a navigational risk assessment (expected within the ES) and further stakeholder consultation.	<p>A justification for aspects scoped out from detailed assessment has been provide in Section 5.2.2.</p> <p>All phases of the Project and, where relevant, in-combination or cumulative impacts have been assessed in Sections 6 to 11.</p>
	Environmental impacts should cover the full scope of activities that are intended to be consented (NSTA). For example, any proposed modelling of cuttings will need to include the potential to undertake one re-spud and a mechanical sidetrack, to reflect the (standard) NSTA well consent, with the mechanical sidetrack being based on the section which generates that largest volume of cuttings. Similarly, Serica should ensure alignment with the development and production consent application and supporting FDP. Alignment with the Pipeline Works Authorisations (PWA) is also likely to be needed, given anticipated consenting timelines (we are aware that this timeline often results in the PWA likely to be provided ahead of some key engineering information). Where alternative engineering options have not yet been decided, the ES must describe and assess the worst-case options that can result from either option being selected (i.e. whether the pipeline routes to DCA or DCB);	<p>The drill cuttings and muds dispersion modelling study has considered the potential to undertake one re-spud and a mechanical sidetrack (refer to Appendix C ad Section 3.3.4).</p> <p>Serica also confirms that the information presented in the ES aligns with the development and production consent application and supporting FDP.</p> <p>Where alternative engineering options still remain, the environmental worst-case option has been assessed, as identified in Section 1.6 (Areas of Uncertainty).</p>
	The ES will need to demonstrate how the proposed project accords with any of the constraints and objectives of any relevant marine plans and the underlying policies.	This has been demonstrated in Appendix B.
	Serica may wish to consider the supplementary guidance by JNCC guidance for the use of Passive Acoustic Monitoring in UK waters, published in December 2023.	This has been considered in Section 8 (underwater noise emissions).
	Survey data (including pipeline routing) will need to be presented in sufficient detail to support the assessment being made. This is often best served by appropriate figures to demonstrate the nature of the habitats and/or seabed, such as side-scan sonar or bathymetry data.	Survey data has been presented in Section 4 (The Existing Environment).

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Organisation	Comments Raised	Considered by the Project / Addressed in ES
OPRED	We would expect to see a variety of visual clarifications for the extent of relevant attributes (such as spawning areas, ICES rectangles, Scans IV survey areas, seal satellite tracking, shipping risk and oil and gas and other industry locations) to provide clear evidence of extent of such things in the baseline information section.	Maps have been included, where relevant, in Section 4 (The Existing Environment).
	In respect of Ocean Quahog and Seapen habitats, we would like to clarify generic advice from JNCC. Neither the OSPAR nor PMF definition explicitly states that only aggregations of Ocean Quahog are protected and therefore, we would consider this species to be present where any individuals are found (adult or juvenile). Similarly, "sea pen and burrowing megafauna communities" cannot be dismissed just because sediments are within an area classified, say, as very fine sand or fine sand. At a meeting of the OSPAR Contracting Parties in Bergen in November 2011, a key recommendation was that the relevant biological communities may sometimes be found on "sandy muds" as well as "fine muds" and therefore, it is important to present the survey data with this in mind.	This advice has been considered when drafting the baseline text in Section 4 (The Existing Environment) and when undertaking the Seabed Disturbance impact assessment documented in Section 7.
	If necessary, fisheries data should be updated before submission to reflect any publication of full statistics. https://www.gov.scot/publications/provisional-scottish-sea-fisheries-statistics-2024/ , for example, are provisional statistics, and the full data was due to be updated in Sept 25. Serica should ensure that they refer to as complete figures as possible, given our understanding that the ES is due to be submitted sometime after this	Up-to-date fisheries data (at the point of ES submission) has been presented in Section 4.4.1 (Commercial Fisheries).
	The ES should consider and justify the choice of pipeline (such as whether the umbilical can be laid within the same trench as the production line and the gas-lift line or whether the chosen option is likely to result in a higher likelihood of rock dump requirements). The use of evidence from previous operations in the area would be valuable evidence to demonstrate expectations of burial success and/or frequency or volumes of rock dump required.	The feasibility of different pipeline installation methods has been discussed in Section 2.4 (Pipeline / Umbilical Route Selection and Installation).
	The ES would be expected to clearly specify the history of the area and confirm the presence or absence of any remaining cuttings piles.	This has been discussed in Section 4.4.4 (Offshore Oil and Gas Activity).

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Organisation	Comments Raised	Considered by the Project / Addressed in ES
JNCC	We note that the operator has found juvenile ocean quahog (<i>Arctica islandica</i>) during surveys. The wording within the scoping report suggests that these juveniles have not been considered by the operator as an OSPAR threatened and/or declining species or as a PMF under Scottish legislation. Ocean quahog is a declining species in the North Sea region and there is uncertainty in its ability to recover. We would like to highlight that protection is afforded to quahog at all life stages, including juvenile quahog, and it is classed as an OSPAR threatened and/or declining species (and PMF in Scottish waters). The presence of juveniles in an area can be an indication of a wider population, therefore impacts should be avoided wherever possible to allow the population to grow.	This advice has been considered when drafting the baseline text in Section 4 (The Existing Environment) and when undertaking the Seabed Disturbance impact assessment documented in Section 7.
	JNCC note that the top two sections of the well will be drilled riserless and cuttings discharged to seabed, while LTOBM will be used for the other sections with cuttings either thermally treated or skipped and shipped to shore. For discharges to sea, we would expect to see detailed drill cuttings dispersion modelling that identifies the thickness/radius of the dispersion, and the possible impact that might have on the surrounding benthic environment.	A copy of the drill cuttings and muds dispersion modelling study has been provided in Appendix C. The results have been used to inform the impact assessment documented in Section 7 (Seabed Disturbance) and Section 10 (Marine Discharges).
	<p>JNCC acknowledge that both the production and gas lift pipeline and the umbilical will be trenched and buried either by plough, jet trencher or mechanical cutter. Rock placement will be required at crossings, trench transitions and potentially to mitigate buckling. We encourage the operator to continue to minimise the amount of hard substrate material used. We note that the long-term effect of the introduction of hard substratum into muddy seabeds is not fully understood at present and should be carefully considered. Where stabilisation material cannot be avoided, we recommend using a targeted placement method, e.g. fallpipe vessel rather than using vessel-side discharge methods. JNCC expect detail commentary on stabilisation operations to be included, to understand the potential nature conservation impacts. This should include:</p> <ul style="list-style-type: none"> • Location of deposit 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 	Details on the installation method for the pipelines and umbilical, including requirements for stabilisation material, are provided in Section 3.4.3.

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Organisation	Comments Raised	Considered by the Project / Addressed in ES
JNCC	JNCC note that a new habitat assessment and environmental baseline survey was conducted in July 2025. We would request the operator provide detail on what was carried out during the survey and where. In particular, we would expect to see a map detailing site locations in relation to proposed activities and what types of sampling occurred at those locations (e.g. drop-down video transects, number of grab samples etc.).	Survey data has been presented in Section 4 (The Existing Environment). In particular, refer to location maps in Section 4.1
	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. 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 the ES. We would also expect that subsequent licence applications associated with the proposed works include an assessment of the worst-case scenario and, where this includes the possible use of anchored vessels or rigs, this should include the impact of potential associated seabed disturbance.	Serica acknowledges this advice. Where assumptions have been made, the environmental worst-case option has been assessed, as identified in Section 1.6 (Areas of Uncertainty).
SFF	Considering the soft nature of seabed sediment in the project area (comprised of sand and muddy sand, we propose that where the pipelines and umbilical are going to be rock protected, the rock placement to be carried out to industry standards, in respect of size of rock (1"-5") and rock berm profile (1:3) followed by an over-trawl sweep and long term monitoring to ensure no snagging risk is posed to fishing gears.	Serica confirms that rock placement will be carried out to industry standards, as documented in Section 3.4.3. An over-trawl sweep has previously not been conducted for other projects in wider Triton area and is not planned for the Kyla Development.
	Where any an electro/chemical/hydraulic and control umbilicals are laid adjacent to pipelines, a minimum separation distance of 50 m should be maintained. This precaution is necessary to prevent destabilisation and reduce the risk of snagging by fishing gear—particularly trawl doors.	Typically, with trenched and backfilled pipelines and umbilical's trawl gear destabilisation and snagging is avoided. A 50 m separation would be more appropriate for surface laid products. However, in this instance the sperate distances between the proposed pipelines and umbilical will be at least 50 m.
	Being concerned of fishing vessels safety, SFF is against use of protection materials such as concrete mattresses and grout/rock bags in open waters (< 800m depth). Where use of concrete mattresses is inevitable e.g. in crossing points, we would recommend that any such mattresses installed in open waters are subject to a covering of rock dump.	All mattresses in open water outwith 500m safety zones, for example at crossing locations, will be covered by rock placement where required.

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Organisation	Comments Raised	Considered by the Project / Addressed in ES
SFF	Over the years fishermen have voiced serious safety concerns over mud berms being left behind following pipeline trenching operations. Therefore, we would propose appropriate embedded mitigations to be carried out to eliminate safety risk for the fishermen.	The likely soil conditions and trenching methods are unlikely to leave any significant mud berms as evidenced by the numerous trenched and buried pipelines in the Triton area. Nevertheless, following pipeline trenching operations, Serica will liaise with the SFF to ameliorate any safety risks for the fishermen from mud berms being left behind (refer to Section 6.3).
	<p>To safeguard fishermen, and mitigate snagging risks, SFF propose the deployment of a guard vessel in the following scenarios:</p> <ul style="list-style-type: none"> Where pipeline trenching activities are scheduled but not carried out concurrently, increasing the risk of exposed infrastructure Where pre-lay anchors are required for well intervention and either a 500m safety zone has not been issued, or the anchor footprint extends beyond the designated 500m safety zone 	Serica commits to the deployment of a guard vessel in these scenarios as documented in Section 6.3.
	The monetary value of commercial fisheries landings from ICES rectangle 42F1 should be included within the ES. In addition, there is the potential for displacement impacts associated with the ban on bottom trawling within Scottish Marine Protected Areas which came into effect on 16 October 2026. This could reduce the availability of fishing grounds, potentially redirecting fishing efforts towards the Kyla project area. In addition, SFF's plotter data confirms active <i>Nephrops</i> fishing within the project area, located ca. 700 m from the Kyla drill centre.	The monetary value of commercial fisheries landings from ICES rectangle 42F1 has been documented in Section 4.4.1, along with a discussion on potential displacement implications. This data has been considered when assessing the potentially significant impacts to commercial fisheries from the proposed Kyla Development in Section 6.
	The commercial fisheries baseline data used to inform the EIA should span a ten-year period. This allows consideration of fisheries activity that may have temporarily ceased due to Brexit-related disruptions from 2016 onward. Additionally, commercial fisheries plotter data should be incorporated into the baseline description to provide a more accurate and detailed picture of fishing activity within the project area.	This advice has been considered when drafting the baseline text in Section 4 (The Existing Environment).

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Organisation	Comments Raised	Considered by the Project / Addressed in ES
SFF	SFF note that boulders of different size have been noticed during surveys conducted for Bittern and Belinda. It is requested that efforts be made to not relocate any boulders observed within the Kyla project area as these activities can significantly alter seabed habitats and create new snagging hazards for fishing gear. Where relocation occurs, boulder coordinates should be shared in a format compatible with fishing plotters (DD° MM.MMM, WGS 84).	Boulder removal / relocation will be minimised as far as practical via pipeline routing exercises as part of the design process and potentially local the pipeline micro routing prior to pipe or umbilical lay. However, boulder relocation cannot be 100% ruled out. As such, where boulder relocation occurs these will be documented as part of the as built construction information and shared in a DD° MM.MMM, WGS 84 co-ordinate system.
	To avoid the risk of juvenile fish and shellfish mortality, it is proposed that all construction activities be scheduled outwith the spawning and nursery periods of the relevant species present within the project area. This precautionary approach is essential to protect sensitive life stages and maintain the ecological integrity of commercially important stocks. Additionally, the ICES Advice on Fishing Opportunities, Catch, and Effort for the Greater North Sea Ecoregion, published on 30 April 2025, advises that no activities should be permitted on spawning habitats unless their effects have been thoroughly assessed and demonstrated to be non-detrimental.	This advice has been considered in Section 7 (Seabed Disturbance) when assessing the potential impacts to juvenile fish and shellfish from seabed disturbance resulting from proposed Kyla Development construction activities.
	<p>SFF proposes the following embedded mitigations to be considered to eliminate any snagging risks to fishermen and mitigate any disruptions to the fishing industry during the project lifespan:</p> <ul style="list-style-type: none"> • Issue Notice to Mariners with sufficient time ahead of any construction and decommission work • Comply with the ColReg to mitigate risk of collision with fishing vessels • Remove all development related subsea infrastructure (including drill cuttings) during decommissioning period followed by overt-trawl sweep to make sure the project area is safe for fishing operations to resume. 	These measures have been considered in Section 6 (Physical Presence) when assessing the potential impacts to commercial fisheries from the Kyla proposed Development.

2 Project Alternatives

2.1 Introduction

Serica has explored various concepts during the planning process to develop the Kyla oil field. This section of the ES describes the main alternatives considered, the associated environmental implications of each option and the reasons why the selected concept has been chosen. It references the Kyla Development Concept Select Report (Serica, 2025), which was undertaken to determine the optimum development plan for the field in terms of economics, technical risk and environmental impact.

The proposed Kyla Development concept has been selected and defined with consideration to:

- The central obligation of the NSTA Strategy (OGA, 2020), namely to secure the maximum value of economically recoverable hydrocarbon reserves and take appropriate steps to assist the Secretary of State in meeting the Net Zero target;
- The OGA Plan (NSTA, 2024a) to reduce UKCS GHG emissions from oil and gas extraction.

And with cognisance of the requirements of NSTA's Net Zero Stewardship Expectation 11 (NSTA, 2021).

The NSTA provided its non-objection to the selected concept on 21 October 2025.

2.2 Development Concept

2.2.1 Subsea Tie-back

The selected concept for the Kyla Development project is a single subsea well tied back to a suitable host facility. A standalone development concept is not economically viable for Kyla and has been discounted. Concept select work therefore focused on screening hosts which could support the development of Kyla as a subsea tie-back.

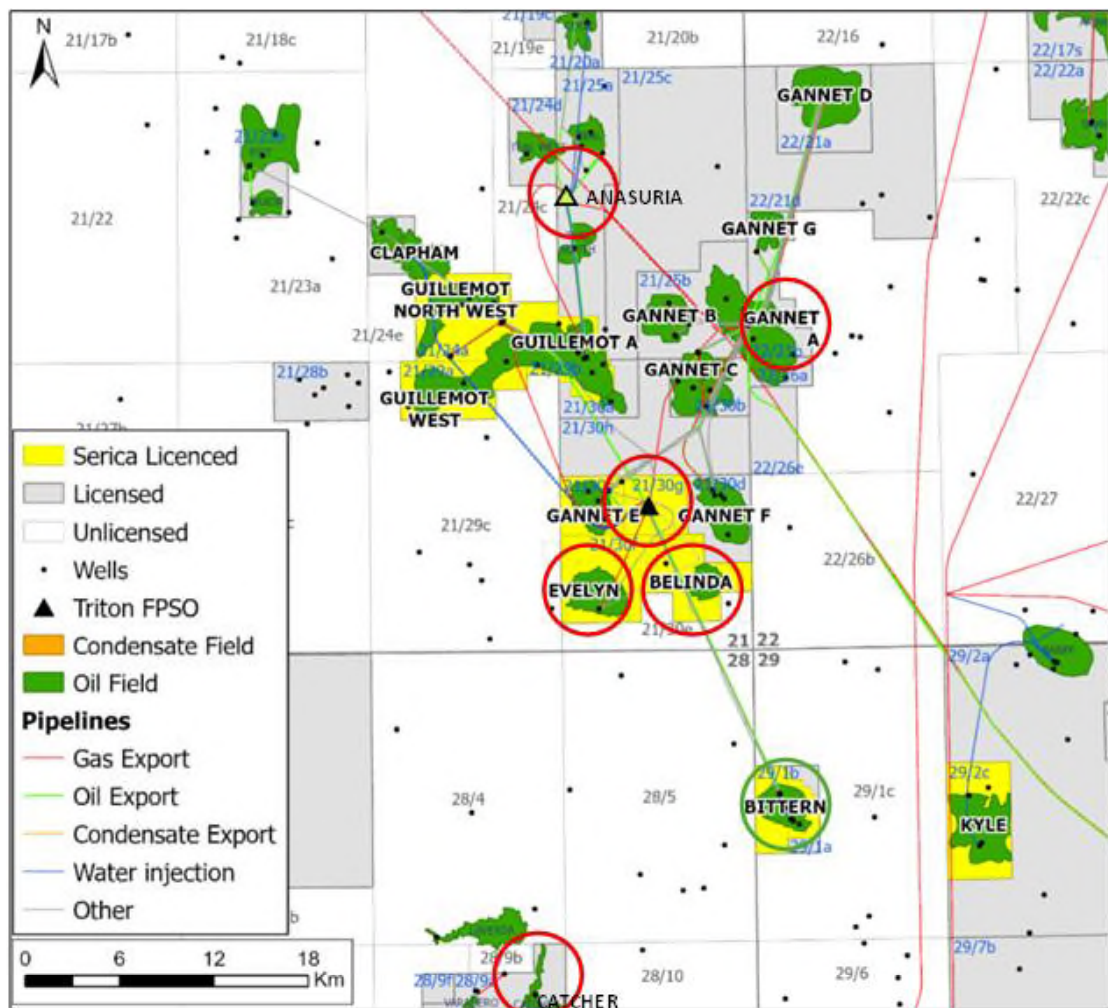
Concept Decision: Subsea tie-back

2.2.2 Host Facility / Tie-back Screening

Several potential host facility and tie-back route options were explored during the project feasibility/pre-concept phase conducted in 2024, namely:

- Tie-in to Triton FPSO (operated by Dana) via:
 - Direct tie-in at the Triton FPSO riser base;
 - Tie-back to Evelyn or Belinda manifolds;
 - Tie-back to one of the Bittern Drill Centre manifolds (DCA or DCB);
- Tie-in to Gannet Alpha platform (operated by Shell UK);
- Tie-in to Catcher FPSO (operated by BW Offshore);
- Tie-in to Anasuria FPSO (operated by Anasuria Operating Company).

Figure 2.1 illustrates the location of the Kyla field in relation to the potential host tie-in points.

Figure 2.1: Kyla Development Host Facility and Tie-back Route Options ¹


¹ Red circles indicate potential tie-back options. Green circle indicates selected tie-back option

During this stage of the Project, numerous subsurface, subsea and topside evaluation and optioneering assessments were conducted, the results of which are summarised in Table 2.1.

To enable a comparative evaluation of the key aspects influencing the selection of a development option for Kyla, Table 2.1 adopts a Red-Amber-Green scoring methodology. The following key selection criteria were considered when assigning a Red-Amber-Green score:

- Capital Expenditure (CAPEX) (£ million)
- Maximisation of Existing Infrastructure
- Environmental Impact (subsea, construction, and production emissions)
- Impact on Other Fields / Kyla Recovery
- First Oil (FO) Schedule
- Host Facility Modifications

Where data was unavailable for a specific criterion due to schedule constraints a neutral score has been assigned. This score matches that of the optimal option, ensuring the development option is not unfairly penalised due to the absence of information.

The outcome of the assessments, as shown in Table 2.1, resulted in the direct tie-back options to Gannet Alpha, Catcher and Anasuria being discounted and recommended that Kyla be redeveloped as a subsea tie-back to the Triton FPSO via one of the Bittern manifolds.

Of note, minimal incremental production related emissions are identified for all host facility options shown in Table 2.1. Processing of Kyla hydrocarbons via Triton existing processes were evaluated during the concept select phase and were considered to be minimal due to the following factors:

- No impact on flaring or diesel use;
- Very low level of incremental cold venting from oil storage tanks, which in Triton overall trend is declining as other fields production is in downward trend;
- Low level of fuel gas use for processing of Kyla gas via the export compressors, which will not be any different from processing via any of the other host facility options.

From an operational emissions point of view, it is not believed that the emissions forecasts for the other host facility options would be any lower than the Triton option and therefore all have been ranked as 'minimal' in the concept screening table (Table 2.1).

2.2.3 Selected Host Facility / Tie-back Option

The base case concept for the Kyla Development project is a single subsea well tied back via the Bittern DCA manifold which will route Kyla production, co-mingled with Bittern production, to the Triton FPSO via the existing Bittern pipelines. There is also an option to tie-back to the Bittern DCB manifold, this has been considered in the ES as the back-up case option. The two Bittern manifolds (DCA and DCB) are approximately 2 km distance from each other and are both suitable for connecting the Kyla production, gas lift and electro/chemical/hydraulic and control umbilical services. The Triton FPSO has suitable process facilities and spare capacity to support and service Kyla with relatively minor topsides modifications. Kyla oil will be exported as part of the Triton FPSO blend via shuttle tanker and sales gas will be routed with other Triton area gas to St Fergus terminal via the Fulmar gas pipeline.

The selected development concept reflects the optimal development plan for Kyla, maximising hydrocarbon recovery whilst minimising capital risk and costs, maximising use of existing North Sea oil and gas infrastructure, and significantly reduces the carbon footprint of production when compared with standalone or long-distance tie-back alternatives.

The Bittern DCA/DCB manifolds are located the shortest distance from Kyla (12 – 13.2 km), with the other tie-back options entailing longer pipelines (ranging from 24 km to 50 km), thereby minimising seabed impact and construction and installation emissions.

Kyla fluids will be processed within the existing power generation capacity of the Triton FPSO with minimal additional power generation requirements. Kyla produced gas will be used for fuel and gas lift, with surplus gas exported via the existing gas export system. Consequently, Kyla production via existing Triton processes is not deemed to result in additional flared carbon emissions from the Triton FPSO.

Serica has significant interest in Triton (holding a 46% equity interest in the asset) and have a proven partnering experience with Dana in delivery of other similar Triton projects, namely Evelyn, Gannet E Expansion and Belinda. Routing Kyla via Triton will also contribute towards the life extension of the Triton FPSO.

Host / Tie-back Decision: Tie-back to one of the Bittern manifolds (DCA or DCB), with Kyla production processed on the Triton FPSO

Serica Energy Chinook Limited: Kyla Field Development Environmental Statement

Table 2.1: Concept Screening for Host Facility / Tie-Back Options

Parameter Assessed	Host Facility / Tie-Back Option					
	Direct Tie-In at Triton FPSO Riser Base	Tie-in to Evelyn or Belinda manifolds and Process via Triton FPSO	Tie-in to Bittern manifolds and Process via Triton FPSO	Tie-in to Gannet Alpha Platform	Tie-in to Catcher FPSO	Tie-in to Anasuria FPSO
Key: Red = Score of 0. Indicates the development option performs significantly worse than alternatives for the given criterion. Example: CAPEX is approximately twice that of the least capital-intensive option, or pipeline lengths exceed twice the distance of the shortest option. Amber = Score of 5. Indicates moderate underperformance compared to other options. Example: CAPEX is around 1.5 times higher than the lowest-cost option, or pipeline length is 1.5 to 2 times longer than the shortest development option. Green = Score of 10. Indicates the development option performs optimally against the criterion. Example: It has the lowest CAPEX or shortest pipeline requirement among all options.						
CAPEX £mm/ Maximising Existing Infrastructure Use	>£300mm ~30km long pipelines & umbilical. Work required on Triton Riser Base. All subsea infrastructure will be new and thus not maximising existing infrastructure use.	>£250mm ~24km long pipelines & umbilical. Does not maximise the use of existing infrastructure.	~£185mm (Lowest CAPEX option) ~12km to 14km long pipelines and umbilical. Maximises use of existing infrastructure.	>£300mm ~35km long pipelines & umbilical. All subsea infrastructure will be new and thus not maximising existing infrastructure use.	>£300mm ~30km long pipelines & umbilical. All subsea infrastructure will be new and thus not maximising existing infrastructure use.	>£300mm ~50km long pipelines & Umbilical. All subsea infrastructure will be new and thus not maximising existing infrastructure use.
Environmental Impact	Minimal incremental production related emissions from Triton as no change to Triton operations due to inclusion of Kyla. Moderate seabed impact and construction emissions as pipelines and umbilical are more than twice the distance of the shortest option (tie-in to Bittern).	Minimal incremental production related emissions from Triton as no change to Triton operations due to inclusion of Kyla. Moderate seabed impact and construction emissions as pipelines and umbilical are more than twice the distance of the shortest option (tie-in to Bittern).	Minimal incremental production related emissions from Triton as no change to Triton operations due to inclusion of Kyla. Least seabed impact and construction emissions as shortest distance pipelines and umbilical.	Minimal incremental production related emissions from Gannet Alpha assumed. Moderate seabed impact and construction emissions as pipelines and umbilical are more than twice the distance of the shortest option (tie-in to Bittern).	Minimal incremental production related emissions from Catcher assumed. Moderate seabed impact and construction emissions as pipelines and umbilical are more than twice the distance of the shortest option (tie-in to Bittern).	Minimal incremental production related emissions from Anasuria assumed. Significant seabed and construction emissions impact as longest pipelines and umbilical route in this option.

Serica Energy Chinook Limited: Kyla Field Development Environmental Statement

Parameter Assessed	Host Facility / Tie-Back Option					
	Direct Tie-In at Triton FPSO Riser Base	Tie-in to Evelyn or Belinda manifolds and Process via Triton FPSO	Tie-in to Bittern manifolds and Process via Triton FPSO	Tie-in to Gannet Alpha Platform	Tie-in to Catcher FPSO	Tie-in to Anasuria FPSO
Key: Red = Score of 0. Indicates the development option performs significantly worse than alternatives for the given criterion. Example: CAPEX is approximately twice that of the least capital-intensive option, or pipeline lengths exceed twice the distance of the shortest option. Amber = Score of 5. Indicates moderate underperformance compared to other options. Example: CAPEX is around 1.5 times higher than the lowest-cost option, or pipeline length is 1.5 to 2 times longer than the shortest development option. Green = Score of 10. Indicates the development option performs optimally against the criterion. Example: It has the lowest CAPEX or shortest pipeline requirement among all options.						
Back-out/ Kyla Recovery	Direct Tie-in at P2 riser base leads to least back-out of Bittern & Gannet E production (~0.5 million stock tank barrels (MMstb)). Delivers Kyla fluids to ca. 12MMstb.	Significantly backs-out Belinda, Gannet E & Evelyn production (ca. 3.5MMstb)	Tie-in at one of the Bittern manifold leads to low level back-out of Bittern production (0.4 to 0.7MMstb). Delivers Kyla fluids to ca. 12MMstb.	Unlikely to be significantly different than Kyla recovery from the tie-back directly to Triton.	Unlikely to be significantly different than Kyla recovery from the tie-back directly to Triton.	Given the length of pipelines (ca. 50km), recovery of Kyla fluids is likely to be lower than the tie-back to Triton.
FO Schedule	FO in Q3 2028 may not be possible due to extensive work required at Triton riser base and within Triton Swing Circle.	FO in Q3 2028 is possible, based on previous experience of Evelyn, Gannet E Expansion & Belinda Projects	FO in Q3 2028 is possible, based on previous experience of Evelyn, Gannet E Expansion & Belinda Projects	The extent of the subsea scope and work required with the Host is likely to push FO oil into 2029, which on its own erodes project Net Present Value (NPV).	The extent of the subsea scope and work required with the Host is likely to push FO oil into 2029, which on its own erodes project NPV.	The extent of the subsea scope and work required with the Host is likely to push FO oil into 2029, which on its own erodes project NPV.
Host Facility Mods and Cessation of Production	Minimal modifications expected on Triton. Kyla fluids will be processed via Bittern Separation train. Triton Life Extension project looking at 2035 and 2040. Q3 2028 FO allows Kyla mid to high case recovery by 2035.	Minimal modifications expected on Triton. Kyla fluids will be processed via Bittern Separation train. Triton Life Extension project looking at 2035 and 2040. Q3 2028 FO allows Kyla mid to high case recovery by 2035.	Minimal modifications expected on Triton. Kyla fluids will be processed via Bittern Separation train. Triton Life Extension project looking at 2035 and 2040. Q3 2028 FO allows Kyla mid to high case recovery by 2035.	Host facility mods for tie-in of Kyla alone are not expected to be prohibitive. Gannet A life to 2035 is assumed for this screening exercise.	Host facility mods for tie-in of Kyla alone are not expected to be prohibitive. Catcher life to 2035 is assumed for this screening exercise.	Host facility mods for tie-in of Kyla alone are not expected to be prohibitive. Anasuria Life Extension project looking at life extension to 2040.

Serica Energy Chinook Limited: Kyla Field Development Environmental Statement

Parameter Assessed	Host Facility / Tie-Back Option					
	Direct Tie-In at Triton FPSO Riser Base	Tie-in to Evelyn or Belinda manifolds and Process via Triton FPSO	Tie-in to Bittern manifolds and Process via Triton FPSO	Tie-in to Gannet Alpha Platform	Tie-in to Catcher FPSO	Tie-in to Anasuria FPSO
Key: Red = Score of 0. Indicates the development option performs significantly worse than alternatives for the given criterion. Example: CAPEX is approximately twice that of the least capital-intensive option, or pipeline lengths exceed twice the distance of the shortest option. Amber = Score of 5. Indicates moderate underperformance compared to other options. Example: CAPEX is around 1.5 times higher than the lowest-cost option, or pipeline length is 1.5 to 2 times longer than the shortest development option. Green = Score of 10. Indicates the development option performs optimally against the criterion. Example: It has the lowest CAPEX or shortest pipeline requirement among all options.						
Overall Score	30/50	30/50	50/50	30/50	30/50	20/50
Justification	Not selected due to impact on schedule and extensive CAPEX and moderate subsea environmental impact.	Not selected due to significant back-out of Belinda, Ganne E and Evelyn fields and moderate subsea environmental and CAPEX impact.	Selected as the base case. Delivers Kyla production with minimal back-out of other fields, with least subsea and environmental impact, maximise re-use of existing infrastructure and least CAPEX intensive option.	Not selected due to impact on schedule and extensive CAPEX and moderate subsea environmental impact.	Not selected due to impact on schedule and extensive CAPEX and moderate subsea environmental impact.	Least attractive option – not selected.

2.2.4 Net Zero Considerations

Aligned with the North Sea Future Plan (DESNZ, 2025b) and in accordance with the OGA Strategy and OGA Plan to reduce UKCS GHG emissions from oil and gas extraction, the selection of the development concept for Kyla has been informed by carbon intensity and infrastructure reuse considerations. Key benefits of the chosen concept include:

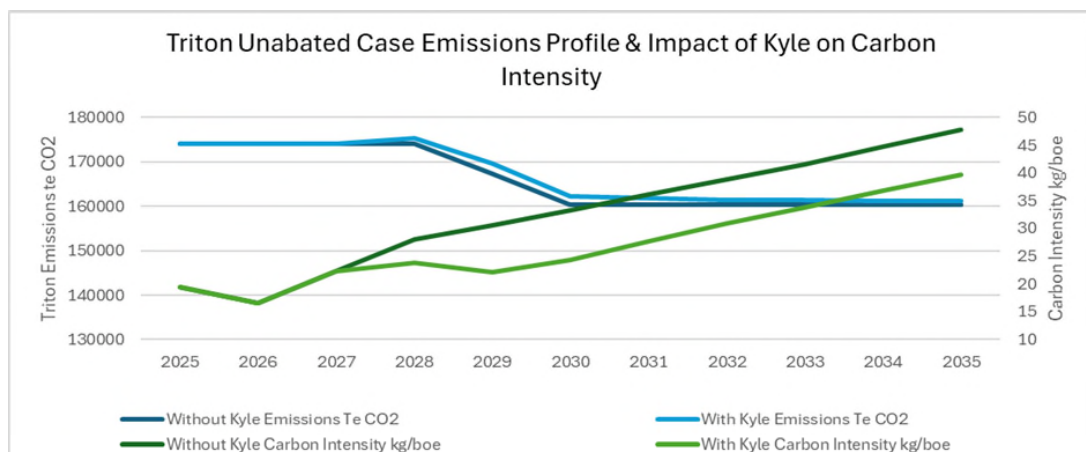
- Reuse of existing subsea and topsides facilities, avoiding the need for new-build processing or export infrastructure;
- Low incremental power requirements, Triton FPSO has sufficient capacity within existing power generation systems;
- Optimisation of gas management, with produced gas used for fuel and lift, and surplus gas exported, minimising flaring;
- Estimated 20% reduction in carbon intensity across Triton FPSO production when Kyla comes onstream, through economies of scale.

Carbon intensity is the total mass of CO₂ emitted per barrel of oil equivalent produced. This metric is a key performance indicator for UKCS installation operators and allows comparison with other installations or country averages.

Figure 2.2 and Figure 2.3 below shows Triton emissions and carbon intensity forecasts for unabated and max value abatement scenario with and without Kyla. This clearly shows the benefit in Triton carbon intensity once Kyla comes online, with a reduction over the remaining field life. It should be noted that unabated Triton FPSO emissions profiles in Figure 2.2, includes for the successful implementation of Triton Zero Routine Flaring Project. Emissions forecast and carbon intensity profiles due to maximum value abatement scopes, which are not all approved as yet (as per Triton Emissions Reduction Action Plan, which is discussed below) are shown in Figure 2.3.

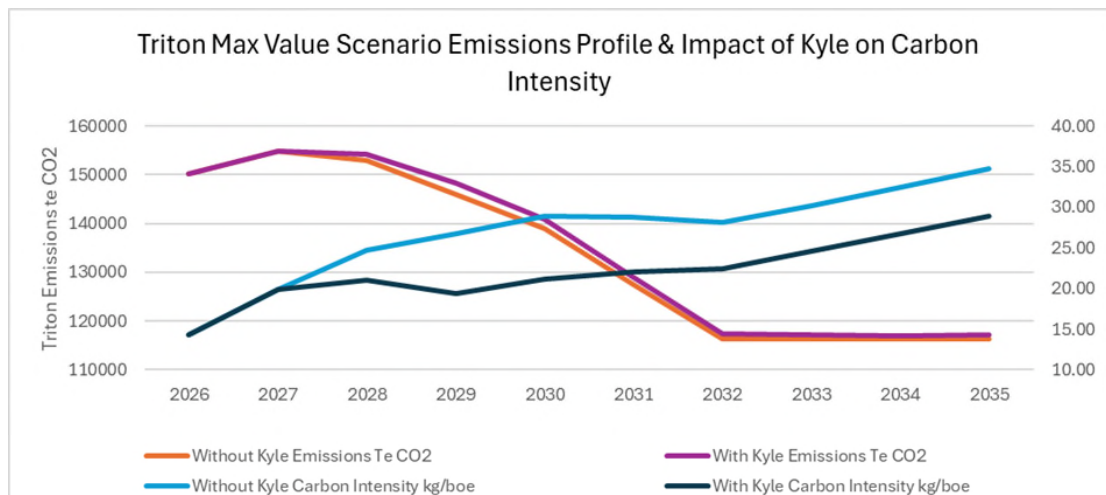
As reported in the NSTA (2025a) Emissions Monitoring Report, the average carbon intensity of UKCS offshore fields in 2024 is expected to have remained at 24 kgCO₂e/boe. The NSTA UKCS Emissions Monitoring Dashboard reports the average carbon intensity for FPSOs in the CNS in 2024 at 30.5 kgCO₂e/boe. When filtering by installation age (>25 years old) this increases to 37.5 kgCO₂e/boe (NSTA, 2025b). In comparison, over the life of the field, the Triton FPSO with Kyla will have an average carbon intensity of 29.9 kgCO₂e/boe in the unabated scenario, decreasing to 23.3 kgCO₂e/boe under the maximum value case over the period from 2028 to 2035.

Figure 2.2: Triton Unabated Case Emissions & Carbon Intensity profile with & without Kyla ¹



¹ The unabated Triton FPSO emissions profiles include for the successful implementation of the Triton Zero Routine Flaring Project.

Figure 2.3: Triton Max Value Case Emissions & Carbon Intensity profile with & without Kyla ¹



¹ The max value case for Triton FPSO emissions profiles include all Net Present Value positive projects detailed in the Triton ERAP.

In its capacity as one of Triton FPSO owners, Serica is fully engaged with the operator of Triton (Dana), on the ERAP for the FPSO. This engagement includes sharing Serica's experience on Bruce (a North Sea production platform operated by Serica) and providing support, especially sharing engineering knowledge and learning related to flare gas and vents recovery systems to meet the World Bank's requirements of zero routine Flaring and Venting by 2030. Dana also has relevant experience implementing a flare gas recovery system, having designed and installed this at their Western Isles operated asset and are utilising this knowledge for Triton.

Prior to implementation of the ERAP, the following emissions reduction initiatives were completed on Triton, resulting in a 21% decrease in CO₂ emissions from 2019 to 2021:

- Focus on plant and production reliability, reducing process upsets and flaring;
- Overhaul of gas compressors to reduce outages and subsequent flaring;
- Tuning of separator and export compressor controls, reducing outages and subsequent flaring;
- Anti-surge logic changes to flash gas compressor, reducing outages and subsequent flaring;
- Adjustment of Compact Flotation Unit (CFU) gas rates to aid flash gas compressor operation, reducing outages and subsequent flaring.
- Pot water maker steam driven unit replacement with electrical driven Restriction Orifice maker.
- Level 2 process trip modification.

Dana submitted the Triton ERAP in Q1 2023 as per Stewardship Expectation 11 to meet NSTD emissions reduction targets. The ERAP is updated on a yearly basis with the latest version issued in July 2025. To date, considerable work has been undertaken to analyse the opportunities for Triton and focus on a single target scenario for emissions reduction. In total, 73 emissions reduction opportunities were reviewed and updated. Of these, 39 remain as "live" opportunities in the hopper, 26 are in the "archived" status and 8 have been implemented.

The main work streams for the FPSO under various project phases are listed below:

- Power generation accounts for the majority of the asset's emissions, as fuel gas or diesel is burned in one of two dual-fuel turbines. An ongoing project is currently reviewing options to replace these turbines with more efficient alternatives.
- Development work is ongoing to assess the feasibility of partially electrifying Triton FPSO (this is not dependent on tie-back of the proposed Kyla field). Full electrification has been ruled out for further study due to technical constraints.

- Flaring emissions are also a key area for reduction. An ongoing Zero Routine Flaring and Venting project aims to meet the Zero Routine Flaring target by 2030, primarily addressing Category A flaring. Additional efforts to minimise non-routine flaring (Categories B and C) are also under investigation.
- The primary source of venting on Triton is from the crude oil tanks. Work is ongoing to evaluate options to change the blanketing medium from an inert gas to hydrocarbon gas to allow recovery, considering both technical feasibility and impacts to the FPSO safety case.

It is widely acknowledged that on the pathway to Net Zero emissions, oil and gas will continue to play an important part of the energy mix for the foreseeable future. Moreover, according to the Climate Change Committee (CCC), the UK will require 13–15 billion barrels of oil and gas equivalent in the period 2025 to 2050 but is currently only forecast to produce 4 billion (CCC, 2025; NSTA, 2025a). In a time of historically low domestic energy production with more than 40% of the UK's energy now imported (DESNZ, 2025), responsible development of UKCS oil and gas fields ensures that the UK meets its energy demand while retaining control over emissions.

The selected development concept for Kyla makes maximum use of existing oil and gas infrastructure and will be a contributor in the life extension of Triton FPSO. While the development represents one of the lowest carbon intensity means of recovering remaining hydrocarbons in the Kyla field. Opportunities for further emissions reductions, including electrification of offshore assets and low-carbon logistics, will be assessed as part of ongoing asset stewardship and future investment planning.

Section 9 of this ES assesses the impact of the upstream and downstream GHG emissions generated from the proposed Kyla Development on the climate and the significance of any likely effects.

2.3 Well Design

A range of conceptual well design options were assessed as part of the concept select process as summarised in Table 2.2.

Table 2.2: Well Design Options Summary

Option	Description	Evaluation
Vertical Well	Simple well geometry, limited reservoir contact	Lower recovery efficiency; not sufficient to meet development objectives
Deviated Well	Inclined trajectory through reservoir	Moderate reservoir contact, higher costs than vertical; less recovery than horizontal
Horizontal Well (ESP)	Horizontal trajectory with ESP artificial lift	Higher productivity, but ESPs less reliable for subsea wells; additional topside requirements
Horizontal Well (Gas Lift) Selected Option	Horizontal trajectory with gas lift completion, tie-back to Triton using existing lift gas facilities	Maximises recovery, proven reliability, integrates with existing infrastructure; selected base case

Vertical and deviated wellbores were ruled out due to limited reservoir contact and reduced recovery efficiency, while a horizontal well with an Electrical Submersible Pump (ESP) lift was discounted due to reliability concerns for subsea tie-backs and the requirement for additional topside modifications.

The selected option 'a single horizontal well with gas lift' offers the optimal balance of reservoir performance, operability, and integration with existing Triton infrastructure. This design maximises recovery of remaining Palaeocene reservoir while minimising technical risks such as well intervention frequency and well underperformance, and the associated environmental risks including additional vessel activity, higher emissions, and increased subsea footprint. By using a single, high-productivity horizontal well with existing lift gas, the development avoids the need for multiple wells reducing

drilling activity, subsea infrastructure, and associated seabed disturbance compared with the alternative designs.

The feasibility of a slimhole design for the well, which would help reduce the volume of drilling mud needed, the quantity of cuttings and other waste material generated, as well as the drilling time, will be evaluated in the detailed well design phase.

2.4 Pipeline / Umbilical Route Selection and Installation

2.4.1 Route Selection

Kyla production fluids will be exported via a new 12 to 13.2 km long 8-inch production carbon steel pipeline to one of the Bittern drill centre manifolds (either DCA or DCB). A direct pipeline route has been selected for both manifold options, minimising seabed disturbances as much as possible. A 3-inch gas lift carbon steel pipeline will be piggybacked to the production pipeline to supply gas lift to the Kyla well. An electro/chemical/hydraulic and control umbilical will be extended from Bittern to Kyla, which will run adjacent to the pipelines, 50 - 75 m apart. The exact separation distance between the lines will be dependent on the chosen trenching solution.

2.4.2 Installation Method

The pipelines and umbilical are likely to be installed by a reel-lay vessel and will be surface laid on the seabed. The lines will then be trenched and buried, similar to the other pipelines which form part of the Triton area. For Kyla, trenching will be carried out using a pipeline plough, jet trenching tool or mechanical cutter. The umbilical will be trenched and buried separately to the pipelines.

Although technically feasible, laying the umbilical within the piggybacked pipeline system trench is currently not considered practical as it precludes the use of jet trenching and mechanical cutting trenching methods. Laying the umbilical in the same trench as the piggybacked production and gas lift pipeline is only possible when a ploughed trenching technique is used whereby the umbilical is laid into a pre-cut trench after this is formed by the plough when trenching the piggyback pipeline into place. The subsequent backfill operation would then cover both the piggyback pipeline and umbilical in the same trench. A combined pipeline and umbilical trench can restrict the use of the backfill plough when redepositing the spoil heaps, created by ploughing, back into the trench depending upon the as laid position of the umbilical within the trench profile. The backfill plough cannot be used in areas where the umbilical is positioned high up the trench side wall and at risk of damage. The net result is that these potential areas leave trench spoil on the seabed and also require rock placement for protection and upheaval buckling mitigation of the pipeline system.

Both ploughing and jetting solutions have been successfully used on previous Triton area pipelines. Evelyn pipelines were trenched and backfilled using a pipeline plough and the Belinda pipelines were installed using a jet trenching tool.

Depending on the soil conditions and based on previous experience in the Triton Area, mechanical ploughing and backfill potentially has a higher likelihood of achieving greater depth of cover thus potentially a reduced requirement for remedial rock. If a jetted or mechanically cut trenching solution is selected additional rock contingency may be required for potential variability in trenching performance to address the risk of achieving less than the planned backfill/depth of cover. However, the mechanical ploughing operation itself has a larger impact on seabed area versus jetting/mechanical cutting.

The final method will be selected by the installation contractor; however, for the purposes of this ES, trenching and backfilling via a plough has been assessed, as this is considered to represent the worst-case scenario for seabed disturbance and fuel consumption by vessels.

2.5 Subsea Structures

As part of the concept select process, the subsea architecture has been defined to include one or two subsea structures: a manifold (valve skid) at the Kyla drill centre and, if required, a tie-in structure at Bittern. The requirement for a structure at Bittern is dependent on the tie-in arrangement and will be confirmed during detailed design.

Two foundation concepts are currently being considered for the structures:

- A piled structure with indicative dimensions of approximately 9 m × 6 m × 3.3 m and a dry weight of ca. 55 tonnes, installed using four x 24-inch diameter steel piles.
- A GBS with indicative dimensions of approximately 16.6 m × 6.5 m × 3.7 m and a dry weight of ca. 124 tonnes. A GBS would be placed directly on the seabed and stabilised by self-weight, avoiding the need for piling.

Both options will result in localised seabed disturbance. The piled structure has a relatively small footprint (ca. 54 m² for the structure itself, plus localised disturbance from piles), whereas the GBS option has a larger footprint (ca. 108 m²) but avoids seabed penetration and piling activity. For assessment purposes, a piled structure has been assessed from an underwater noise perspective and the GBS has been assessed for seabed disturbance.

2.6 Drilling Operations

2.6.1 MODU Type

Drilling of the Kyla development well will be undertaken using a moored semi-submersible drilling rig. A heavy-duty jack-up rig was considered but discounted. The Kyla location lies in approximately 90 m water depth in the CNS, where semi-submersibles provide superior operational reliability and station-keeping compared with jack-ups operating close to their technical depth limits. The development concept requires drilling and completion of a horizontal subsea producer well and installation of a subsea tree and manifold; semi-submersibles are better suited to the deployment of this subsea hardware and to subsequent well testing and completion activities. In addition, seabed geotechnical conditions in the Kyla area are more favourable to moored semi-submersibles than to jack-up spudcan foundations, which carry an increased risk of punch-through. The semi-submersible drilling rig option therefore represents the safest and most technically robust solution, with reduced seabed disturbance, greater flexibility for workover and intervention, and proven application in the Triton area.

2.6.2 Drill Fluids and Cuttings Disposal

For the top two hole sections (36" and 26"), the well will be drilled riserless with seawater and frequent bentonite "sweeps" passed down the well to clean out the hole. Cuttings from these top-hole sections will be discharged directly from the wellbore at the seabed. For the deeper 17½", 12¼" and 9½" sections, a marine riser will be situated between the well and the drilling deck so that cuttings and drilling fluid are circulated back up to the MODU. These sections will be drilled with LTOBM.

Offset well experience within the Triton area has shown that water-based muds can be effective for the 17½" section but have limited performance in the deeper formations. In particular, previous drilling through the Lark formation encountered significant hole stability challenges, including tight hole conditions, gumbo clay build-up, and shaker screen blinding. Based on this operational experience, the Kyla planning design recommends the use of LTOBM for drilling these unstable formations to improve wellbore stability and drilling performance. This approach provides effective inhibition of reactive clays, reduces the risk of stuck pipe and hole collapse, and ensures safe casing installation through problem zones. The use of LTOBM is therefore considered the most suitable and lowest-risk fluid system for the lower hole sections, leveraging proven performance in nearby wells and minimising operational and environmental risk through improved well control and reduced non-productive time.

It is not yet known if the LTOBM contaminated cuttings from the lower sections will be skipped and shipped to shore for disposal or if they would be thermally treated offshore to an acceptable overboard disposal limit (<1% oil on cuttings) and discharged from the MODU. However, for the purposes of this ES, modelling of the discharge of the drill cuttings has been carried out to support the impact assessment, assuming the treatment and discharge of the LTOBM contaminated cuttings.

3 Kyla Development Project Description

3.1 The Kyla Field and Development Overview

The Kyla field was discovered in 1993 and was subsequently appraised in 1994 and 1995. Wells 29/02-12 and -12Z were drilled, tested and suspended as a future producer (termed in K12) in 1998. Field development activities took place from 2000 to 2002 with the drilling of three further production wells (K13, K14 and K15). The field was initially tied back to the Curlew FPSO before being re-tied back to the Banff FPSO in 2005, where it produced oil and gas until the K14 well failed in 2018 following sand control issues which led to decommissioning in 2020. All four production wells were plugged and abandoned.

Two distinct reservoirs are present at Kyla: Cretaceous chalk and the shallower Palaeocene sandstone. Historically, three production wells (K12, K13 and K15) targeted the chalk, with one well (K14) producing from the sandstone. The proposed Kyla Development concept will target the western flank of the reservoir, where historically the Palaeocene sandstone production has come from as the remaining chalk recoverable volumes are interpreted to be very small.

Whilst a small (<1 bscf) free gas cap exists at Kyla, the Kyla fluids are almost entirely in a liquid oil phase, with a 38.1 API and Gas to Oil Ratio (GOR) of 799.

Serica is proposing to develop the Kyla field via a single subsea well tied back via 12 – 13.2 km long 8-inch production and 3-inch piggybacked gas lift rigid pipelines to one of the existing Bittern drill centre manifolds (either DCA or DCB) via a tie-in structure. The Bittern manifolds are in turn tied back to the Triton FPSO, with both assets operated by Dana. An electro/chemical/hydraulic and control umbilical will be extended from Bittern to Kyla, which will run adjacent to the pipelines, 20 - 75 m apart.

Kyla hydrocarbons will be processed on the Triton FPSO. The Triton FPSO has suitable process facilities and spare capacity to support and service Kyla with relatively minor topsides modifications. Kyla oil will be exported as part of the Triton FPSO blend via shuttle tanker and sales gas routed with other Triton area gas to the St Fergus terminal onshore via the Fulmar gas pipeline for onwards transmission to the National Transmission network.

The Kyla Development is expected to produce hydrocarbons for ca. 8 years, until 2035, depending on the reserves, the production rate and the life of the Triton FPSO.

3.2 Project Schedule

A provisional project schedule for the offshore activities associated with the Kyla Development is shown in Figure 3.1. First oil is targeted for Q3 2028.

Figure 3.1: Indicative Timeline for Proposed Kyla Development Project

	2027				2028			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Topside Modifications								
Development Drilling								
Subsea Installation								
First Oil								

The following sections provide a detailed description of the current base-case design for the project. Some design parameters will be further refined during the detailed design phase and may therefore be subject to change. However, the design parameters presented are deemed realistic, yet conservative (i.e. worst-case) with regards to the potential environmental impacts, based on the current project scope and definition.

3.3 Drilling Operations

3.3.1 Overview

Serica proposes to drill and complete one subsea horizontal production well (29/02c-K16) in the Kyla field targeting the Palaeocene sandstone. The proposed tophole location for this well sits within UKCS Block 29/02 at 56° 53' 01.13"N, 01° 13' 50.70"E (ED50 TM 0 N).

The development well will consist of the following sections: 36", 26", 17½", 12¼" and 9½" sections, with contingency for a re-spud scenario and a 17½" sidetrack to account for any unforeseen mechanical issues. The top two well sections will be drilled using a water-based fluid, before being lined with steel well casings that are cemented in place. The deeper well sections will be drilled with a low toxicity oil base mud (LTOBM) system.

On completion of the 17½" section, a 12¼" pilot hole on Kyla will also be drilled and logged to optimise the placement of the horizontal production well. It will be abandoned by pumping two cement plugs. The first plug is planned to be set on bottom and tagged after waiting on cement (WOC) to confirm there is a minimum of 200 ft (ca. 60 m) of good cement above the reservoir. The second plug will be set in open hole, acting as a kick-off plug for the development wellbore. It is currently anticipated that the total depth (TD) of the pilot hole will be 2,407 m true vertical depth subsea (TVDss), and the measured depth (MD) will be up to 2,755 m.

It is currently anticipated that the TD of the development well will be 2,190 m TVDss and the actual well length will be up to 3,603 m MD, assuming no contingent sections are drilled.

In order to prepare the well for production, upper and lower completion equipment will be run. Due to the unstable nature of the sand in the reservoir, the lower completion equipment will include sand exclusion.

Upon completion of the drilling operations, a 'fishing friendly' Xmas tree designed to control flow will be installed on top of the wellhead directly from the MODU. The well will be temporarily suspended through the valves in the tree until it can be connected to the production jumpers.

3.3.2 Drilling Unit, Logistics and Support

A MODU has yet to be contracted for the project, but given the water depth at Kyla (ca. 90 m), it is expected that the subsea well will be drilled and completed from a semi-submersible drilling rig, which will be held in position over the Kyla location by anchors and chains.

For the purpose of this ES, it is assumed that the MODU mooring system will consist of eight anchors and mooring lines, with all anchors laid up to a distance of 1.6 km from the rig centre. Each anchor typically weighs around 15 tonnes, with outer dimensions measuring approximately 7.5 m (W) x 4.5 m (L), equating to a seabed footprint of ca. 34 m². A length of steel chain, typically 750 m in length and 3" (76 mm) in diameter, will be attached to each of the anchors. To complete the mooring lines, pennant wire, typically 200 m in length, will be connected to the inboard end of each ground chain to facilitate subsequent connection to the MODU. Fibre rope inserts may also be added to some of the mooring lines, connecting the anchor ground chain and paid-out rig wire. These inserts allow the central sections of the lines to be buoyed and lifted into the water column, preventing interaction with seabed infrastructure. As such, only part of each mooring line will come into contact with the seabed once the MODU is connected. However, to represent a worst case scenario, it is assumed that the total length of each ground chain (750 m) and pennant wire (200 m) will be in contact with the seabed. Therefore, the combined length of line that may interact with the seabed once the MODU is on location and connected to the mooring system is 7,600 m. In the event there is a requirement to re-spud the well, the anchor pattern arrangement would not change.

To avoid potential delays associated with poor weather conditions or the competitive support vessel market, the anchors and a proportion of the mooring lines will be pre-laid ahead of MODU arrival using two anchor handling vessels (AHVs). The pre-laid elements of the mooring system may therefore sit on the seabed for a number of weeks without the MODU. The process of connecting the MODU to the pre-laid components of the mooring system will be supported by a further two AHVs. When the MODU

moves off site, the same elements of the mooring system may be left on the seabed for a number of weeks, to be collected at a later date by AHVs.

The pre-laid anchors and chains may pose a snagging risk to fishing vessels in the area before the arrival of the MODU at Kyla and once the MODU has moved off location. A guard vessel may therefore be deployed to warn passing vessels of their presence.

Once the MODU is in place at Kyla and connected to the mooring system, a 500 m safety zone will be imposed around it for safety reasons. An Emergency Rescue and Recovery vessel (ERRV) will be stationed in the vicinity of the MODU to enforce the 500 m safety zone and assist in the event of an emergency. The MODU and its associated 500 m safety zone will be in place throughout the proposed drilling operations, which are currently anticipated to last up to 100 days.

The MODU will also be supported by two supply vessels, used to transport drilling equipment, supplies, water, fuel and food to the well location from a supply base in north east Scotland and return waste and surplus equipment to shore.

Personnel will be transferred to the MODU via helicopter from Aberdeen. Typically, up to four scheduled flights will be made to the MODU per week throughout the proposed drilling operations.

A summary of the vessel and helicopter requirements for the proposed Kyla Development drilling operations, along with typical fuel consumption rates are provided in Table 3.1.

Table 3.1: Vessel and Helicopter Requirements for Kyla Development Drilling Campaign

Vessel	Function / Assumptions	Total No. of Vessel Days	Fuel Type	Fuel Consumption Rate	Total Fuel Consumption (tonnes)	GHG Emissions (tonnes of CO ₂ e) ²
2 x AHVs	10 days to lay anchors, 10 days to connect and disconnect rig, 10 days to recover anchors	60	Diesel	30 tonnes/day	1,800	5,841.55
MODU	Transit to / from Kyla	1	Diesel	34 tonnes/day	34	110.34
	Drill and complete the well on location at Kyla	100	Diesel	21 tonnes/day	2,100	6,734.48
ERRV	Assist in the event of an emergency	100	Diesel	2 tonnes/day	200	649.06
Supply vessels	Logistic support and transportation of goods, tools, equipment and LTOBM cuttings ¹	400	Diesel	8 tonnes/day	3,200	10,384.97
Guard vessel	28 days on site with pre-laid mooring system and 28 days after operations	56	Diesel	2 tonnes/day	112	363.47

Vessel	Function / Assumptions	Total No. of Vessel Days	Fuel Type	Fuel Consumption Rate	Total Fuel Consumption (tonnes)	GHG Emissions (tonnes of CO ₂ e) ²
Helicopter	Transfer crew to and from MODU (2.5hr round trip)	4 return flights per week	Aviation fuel	0.655 tonnes/hour	93	300.70
Totals:					7,539	24,384.58

¹ It is assumed that supply vessels will either be on location at the MODU or transiting for the duration of the proposed drilling operations (100 days). It has been assumed, as a worst case scenario in terms of vessel days and fuel consumption, that LTOBM contaminated cuttings will be skipped and shipped to shore for appropriate treatment and disposal. However, the option remains to treat and discharge the cuttings offshore, as detailed in Section 3.3.4.

² Refer to Appendix E for details on the methodology used to calculate the quantity of GHG emissions produced.

3.3.3 Well Design

An indicative profile for the Kyla Development well is detailed in Table 3.2 and illustrated in the well schematic provided in 1 Refer to Section 3.3.1 for pilot hole description and justification.

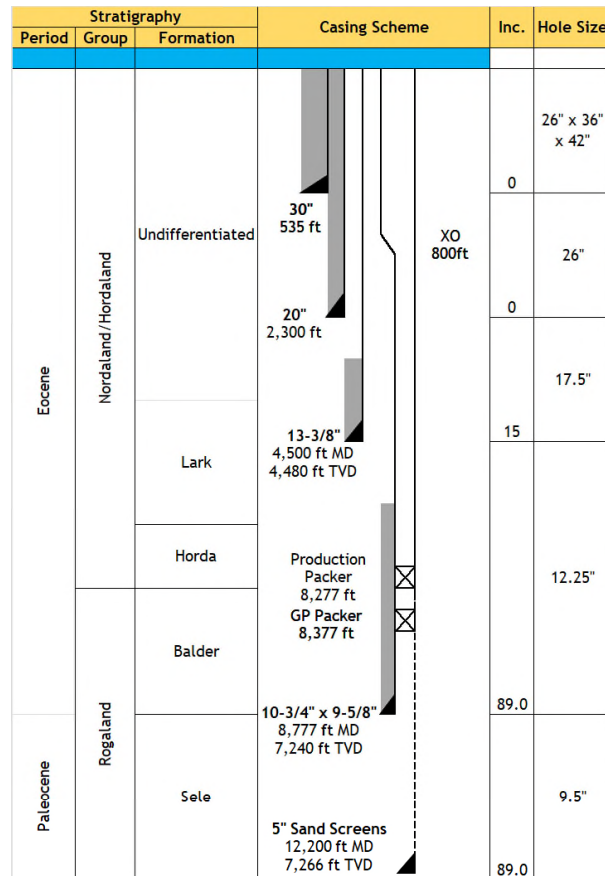
Figure 3.2. A 36" diameter top-hole section will be drilled into the seabed, into which the 30" diameter conductor pipe is cemented. The second (26") section will then be drilled through the conductor and a 20" surface casing installed and cemented into place. The casings of the two top-hole sections, firmly cemented into the borehole, will then provide a firm foundation for the Blowout Preventer (BOP), which will be installed on the drilling riser at the seabed. The drilling riser connects the well to the MODU, therefore providing a conduit to return the mud and cuttings from the deeper sections of the well back up to the MODU. The deeper 17½", 12¼" and 9½" sections of the well will then be drilled with the drilling fluids circulated back to the MODU.

Table 3.2: Indicative Well Profile

Hole Diameter (inches)	Casing Diameter (inches)	Casing Type	Section Length (ft)	Section Length (m)
36	30	Conductor	145	45
26	20	Surface casing	1,765	540
17½	13½	Intermediate casing	2,200	671
12¼ PH	N/A	N/A	4,618	1,408
12¼ Dev	10¾ x 9¾	Production liner	4,277	1,304
9½	-	-	3,423	1,043
Total (Development Well excluding Pilot Hole ¹)			11,810	3,603

¹ Refer to Section 3.3.1 for pilot hole description and justification.

Figure 3.2: Provisional Kyla Development Well Schematic



3.3.4 Mud System, Cuttings Disposal and Chemical Use

During the proposed drilling operations, a variety of chemicals will be used to facilitate the drilling processes and the safe completion of the well including drilling fluid (or mud) chemicals, cementing chemicals, well clean-up and completion chemicals. In addition, a number of chemicals will be used on the MODU for maintenance, such as detergents to wash the rig and lubricants for certain equipment and machinery. The BOP will also require chemicals for control and operation in the form of hydraulic fluids.

The use and discharge of the chemicals in offshore waters is regulated through The Offshore Chemicals Regulations (2002) (as amended). Prior to drilling the well, Serica will therefore seek consent from OPRED for the use and discharge of chemicals during the proposed drilling operations. A Drilling Operations Master Application Template (MAT) and associated Chemical Permit Subsidiary Application Template (SAT) will be submitted via the Portal Environmental Tracking System (PETS) on the UK Energy Portal. All chemicals proposed to be used will be selected based on their technical specifications and environmental performance. Chemicals with substitution (SUB) warnings will be avoided where technically possible.

Drilling Mud and Cuttings

Drilling mud serves a number of functions including maintaining hydrostatic pressure within the wellbore, circulating rock fragments (termed 'cuttings') back to the drilling rig, preservation of the wellbore to facilitate casing / completion installation and cooling and lubrication of the drill bit.

For the top two hole sections (36" and 26"), the well will be drilled riserless with seawater and frequent bentonite "sweeps" passed down the well to clean out the hole. Cuttings from these top-hole sections will be discharged directly from the wellbore at the seabed.

For the deeper 17½, 12¼" and 9½ sections, a marine riser will be situated between the wellhead and MODU so that cuttings and drilling fluid are circulated back up to the MODU. These sections will be

drilled with LTOBM. It is not yet known if the LTOBM contaminated cuttings from the lower sections will be skipped and shipped to shore for disposal or if they would be thermally treated offshore to an acceptable overboard disposal limit (<1% oil on cuttings) and discharged from the MODU. However, for the purposes of this ES, modelling of the discharge of the drill cuttings has been carried out to support the impact assessment, assuming the treatment and discharge of the LTOBM contaminated cuttings.

In the event the LTOBM cuttings are thermally treated offshore, the LTOBM cuttings will be crushed and heated to a temperature which is high enough for oil and water to vaporise and thereby disappear from the cuttings. The liquid is separated from the solids, with oil and water condensed later in the treatment process. Recovered oil will be pumped back into the mud system and recovered water will be disposed overboard if the oil in water content is < 30 mg/l. The resulting rock powder / solids, with a hydrocarbon content of <1%, will be discharged to sea.

Table 3.3 provides an estimate of the quantity of cuttings generated and discharged for the Kyla Development well. To account for any unforeseen mechanical or geological issues, a re-spud scenario and contingency 17½" sidetrack have been added to represent a worst case scenario. The total amount of cuttings discharged in the event all contingent well sections are drilled is 2,387,000 kg (2,387 tonnes).

Table 3.3: Estimated Mass of Cuttings Generated

Hole Diameter (inches)	Fluid Type	Section Length (m)	Section Volume (m³)	Total Muds Volume (m³)	Weight of Cuttings (kg)	Discharge Point
36	Seawater sweeps	45	30	125*	75,500	Seabed
36 (re-spud)		45	30	125*	72,500	
26		540	185	670**	459,900	
26 sidetrack		540	185	670**	459,900	
17½	LTOBM	671	105	341	259,700	Surface (<1% oil on cuttings)³
17½ sidetrack ¹		671	105	341	259,700	
12¼ (PH)		1,408	107	449	361,600	
12¼ (Dev)		1,304	100	441	283,400	
9½ ²		1,043	48	489	154,800	
Total:		6,267	895	3,651	2,387,000	

¹ Considered to be the worst-case mechanical sidetrack for the well as it accommodates the worst case trajectory change from the current planned reservoir target.

² Reservoir hole section likely to be 8.5" under reamed to 9.5" as per previous Triton wells.

³ LTOBM cuttings will be thermally treated offshore to an acceptable overboard disposal limit (<1% oil on cuttings) and discharged.

* 36" hole: this assumes 50 bbl sweeps every half a stand drilled + 200 bbl sweeps for hole cleaning at TD + 1.5 x hole volume displacement at TD

** 26" hole: this assumes 50 bbl sweeps every half a stand drilled + 200 bbl sweeps for hole cleaning at TD + 1.5 x hole volume displacement at TD

Cementing Operations

The casings used to prevent the well from collapsing will be cemented into place inside the borehole. The conductor will be cemented into the top hole section of the well. In this case an allowance will be made to pump up to 300% excess cement to allow for washout and cratering of the wellbore. However, a Remote Operated Vehicle (ROV) will monitor the return flow at the seabed and all attempts will be made to identify returns and reduce the pumped slurry volume when possible and safe to do so. A dye will be added to the cement spacer to assist in visually identifying the returns from the wellhead. At this point the remaining cement in the drill string will have to be circulated out, and it is estimated this may result in a discharge of ca. 48 m³ (300 bbl) of cement being pumped out to the seabed. The cementing of the 20" casing will be very similar to that of the conductor option, using 100% open hole

excess cement, which will amount to a theoretical maximum of ca. 75 m³ (473 bbl) of mixed cement being pumped out to the seabed. Hence, up to ca. 123 m³ (773 bbl) cement slurry may be pumped out to the seabed.

In the event that a problem is encountered when drilling one of top hole sections, and a re-spud scenario is required, 300% and 100% excess cement quantities would again be used for the conductor and surface casing, respectively. Hence, as a worst case, a further 123 m³ (773 bbl) of cement slurry could possibly be discharged to the seabed from the re-spud tophole operations.

The cementing of the 13 $\frac{3}{8}$ " and 9 $\frac{5}{8}$ " casings, as well as the pilot hole abandonment, will be engineered so that the cement will not reach to top of the casing, and thus no cement is expected to be returned to the surface from these sections. Any cement dressed off during the sidetrack kick off will be treated in the same manner as cuttings.

The only potential discharge during this part of the cementing operations, would be from an unplanned event, such as an aborted cement job due to technical or mechanical failures. If for any reason cement is circulated back to the MODU, it would need to be discharged to sea before it solidifies.

No unmixed cement will be discharged overboard. In addition, in between cementing operations, there will be a requirement to discharge small, residual volumes of cement, associated with cleaning of cement tanks between the cementing applications.

3.3.5 Well Clean-up and Completion Operations

Once drilling operations are finished, the well will be completed and readied for production. Before production begins, the well will undergo a thorough clean-up to eliminate any residual LTOBM drilling fluids and debris in the wellbore. The lower completion is then installed and a gravel pack operation is carried out. Once the gravel pack is completed, the area above the lower completion is displaced using a suitable brine (this may be mixed with viscosified pills, solvents, and surfactants; these will be segregated and if contaminated will be transported onshore for disposal). Finally, the upper completion will be installed. Throughout this process, it is estimated that approximately ca. 477 m³ (3,000 bbl) of completion brine will be discharged. Prior to discharge, the brine will be filtered until the fluids are below 30 mg/l LTOBM hydrocarbons, with a maximum total of 14.3 kg of LTOBM hydrocarbon discharged. No well test is planned.

3.3.6 Xmas Tree Installation

Once drilling operations are completed and the production equipment has been installed downhole, a vertical xmas tree will be landed on top of the wellhead, installed directly from the drilling rig (Section 3.4.2). The xmas tree will sit above the seabed, locked onto the wellhead as it emerges from the seabed. This tree will remain on the seabed permanently, providing well control and supporting the production of hydrocarbons. Based on the life of the field, this tree will remain in place for ca. 8 years.

3.4 Subsea Installation Operations

3.4.1 Overview

The new subsea infrastructure proposed to be installed as part of the Kyla Development is summarised in Table 3.4 and discussed in the following subsections.

Table 3.4: Summary of Kyla Development Infrastructure

Subsea Item	Dimensions	Installation Method
Kyla Development Drill Centre (see Figure 3.3)		
Xmas tree	5.1 m (L) x 4.8 m (W) x 6.3 m (H)	Installed directly from the MODU
Valve skid	Piled structure: 9 m (L) × 6 m (W) × 3.3 m (H) or GBS: 16.6 m (L) × 6.5 m (W) × 3.7 m (H)	Installed from CSV
Rigid tie-in spools	Production spools: 100 m (L) Gas lift spools: 100 m (L)	Installed from DSV and mattresses protected
EHC jumpers / EHC control umbilical tie-in loop	EHC jumpers (bundled): 50 m (L) Tie-in loop: 75 m (L)	
Pipelines and Umbilical (see Figure 3.6)		
8" production pipeline	13.2 km in length	Reel laid, trenched and buried. Rock protection required for trench transitions, pipeline crossing and mitigation of upheaval buckling
3" gas lift pipeline	13.2 km in length	
Electro-hydraulic control umbilical	13.2 km in length	
Bittern Tie-in Arrangement (see Figure 3.8; Figure 3.9) ¹		
Tie-in Structure	Piled structure: 9 m (L) × 6 m (W) × 3.3 m (H) or GBS: 16.6 m (L) × 6.5 m (W) × 3.7 m (H)	Installed from CSV
Rigid tie-in spools and pipeline ends	Production: 300 m (L) Gas lift: 150 m (L)	Installed from DSV and mattresses protected
EHC jumpers / EHC control umbilical tie-in loop	EHC jumpers (bundled): 150 m (L) Tie-in loop: 240 m (L)	

¹ The new subsea infrastructure at Bittern will be installed within the existing Bittern 500m safety zone.

3.4.2 Kyla Development Drill Centre

The proposed Kyla Development drill centre layout is illustrated in Figure 3.3.

The subsea infrastructure to be installed at Kyla includes a 'fishing friendly' Xmas tree, which will be placed on top of the wellhead and a 'fishing friendly' valve skid, which would be located ca. 35 m from the proposed Kyla well location.

Serica will apply for a 500 m safety zone to be in place around the Kyla wellhead location before the MODU arrives on location.

Xmas Tree

Upon completion of the proposed drilling operations, a vertical Xmas tree, an arrangement of valves, gauges, chokes and connection pieces used to regulate the flow of produced oil to the surface and lift gas or chemicals into the well, will be installed on top of the wellhead directly from the MODU. The vertical xmas tree is roughly cube shaped, and once landed on top of the wellhead, the highest point of the overall structure will sit approximately 6.3 m above the seabed surface.

Once the tree is secure on top of the wellhead, four telescopic legs will be lowered to the seabed. These are designed to deflect any fishing lines or trawl boards over the tree and prevent any lines or trawl boards getting into the wellhead / conductor area, negating the need for a specific Xmas tree protection structure. Once in position and the legs are lowered, the outermost dimensions of the xmas tree will be 5.1 m long by 4.8 m wide.

Kyla Valve Skid

A 'fishing friendly' valve skid will be installed at Kyla to route gas lift and production fluids to and from the Kyla well and Bittern manifold and act as the connecting point for the Kyla umbilical.

Two foundation concepts, piled versus gravity-based, are currently being considered for the structure. For the purposes of this ES, a piled structure foundation concept has been assumed as worst case for the underwater noise assessment and a gravity-based structure (GBS) has been assumed as worst case for the seabed disturbance assessment (refer to Section 2.5).

The piled structure has approximate dimensions of approximately 9 m (L) × 6 m (W) × 3.3 m (H), a dry weight of ca. 55 tonnes and a seabed footprint of ca. 54 m² for the structure itself, plus localised disturbance from piles (Figure 3.4). It is assumed that the valve skid would be held in place by four tubular piles, one at each corner, each with a diameter of 24-inch and length of up to 24 m. The piles would be secured into the seabed using a maximum hammer blow energy of 90 kJ, with a maximum blow rate of 50 blows per minute. It is expected that the hammering operations for each pile will be ongoing for up to two hours. A soft start is assumed with a ramp up from 30% energy to full energy over 5 minutes, with a reduced blow rate of 6 strikes per minute. Each pile is estimated to take 2 hours to install, giving a total maximum piling duration of 8 hours.

The GBS has dimensions of approximately 16.6 m (L) × 6.5 m (W) × 3.7 m (H) and a dry weight of ca. 124 tonnes. It would be placed directly on the seabed and stabilised by self-weight, avoiding the need for piling. The GBS has a seabed footprint of ca. 108 m².

Regardless of the foundation concept, the valve skid will be installed from a construction support vessel (CSV).

Tie-in Spools and Umbilical Jumpers

The proposed Kyla tie-in line lengths and protection requirements are detailed in Table 3.5.

Rigid tie-in spools will connect the Kyla well to the Kyla valve skid and the Kyla valve skid to the 8-inch production pipeline and 3-inch gas lift pipeline. These tie-in spools will be surface laid installed from a DSV and protected by concrete mattresses, with each concrete mattress having dimensions of 6 m x 3 m x 0.15 m.

The Kyla umbilical will connect directly into the valve skid. The untrenched sections of the umbilical will be protected with concrete mattresses, similar to the tie-in spools. An electro-hydraulic control (EHC) bundled jumper will be DSV installed and connect the Kyla valve skid to the Kyla xmas tree. EHC jumper protection will be via concrete protection mattresses.

Table 3.5: Kyla Development Drill Centre Tie-in Details

Spool Type	Length (m)	From	To	Protection Material ¹	Seabed Footprint (m ²)
8" production pipeline tie in spools	50	8" pipeline	Kyla Valve Skid	16 x concrete mattresses (covering both 8" and 3" spools and pipeline ends)	288
3" gas lift pipeline tie in spools	50	3" pipeline	Kyla Valve Skid		
6" Xmas tree spools	50	Kyla Valve Skid	Kyla Xmas tree	9 x concrete mattresses (covering 8" / 3" spools and EHC jumper)	162
3" Xmas tree spools	50	Kyla Valve Skid	Kyla Xmas Tree		
Xmas tree EHC jumpers (bundled)	50	Kyla Valve Skid	Kyla Xmas Tree		
EHC control umbilical tie-in loop	175	Kyla Valve Skid	Start of Trench	26 x concrete mattresses	468

¹ Mattress dimensions are assumed to be 6 x 3 x 0.15 m.

Seabed Footprint

An estimate of the total area of seabed directly impacted by the installation of subsea infrastructure and associated protection material at the Kyla drill centre is presented in Table 3.6.

Table 3.6: Estimated Seabed Footprint of Subsea Infrastructure at Kyla Development Drill Centre

Subsea Item	Assumptions	Total Seabed Footprint (m ²)
Xmas tree / wellhead ¹	Outermost dimensions of the xmas tree, including telescopic legs will be 5.1 m (L) x 4.8 m (W)	24.5
Kyla valve skid	GBS has dimensions of ca. 16.6 m (L) x 6.5 m (W)	108
Tie-in spools, pipeline ends and control jumpers	Pipeline ends, spools and jumpers will be surface laid and protected with concrete mattresses (see assumptions in Table 3.5)	450
Untrenched Umbilical Section	Umbilical tie-in loop will be surface laid and protected with concrete mattresses (see assumptions in Table 3.5)	468
Total Seabed Footprint at Kyla Drill Centre		1,050.50

¹ Xmas tree will be located on top of the wellhead.

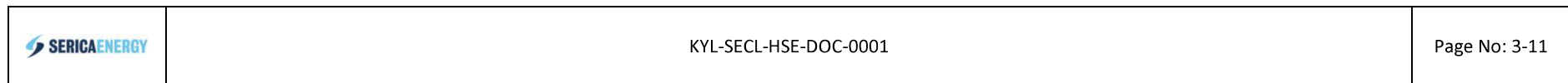
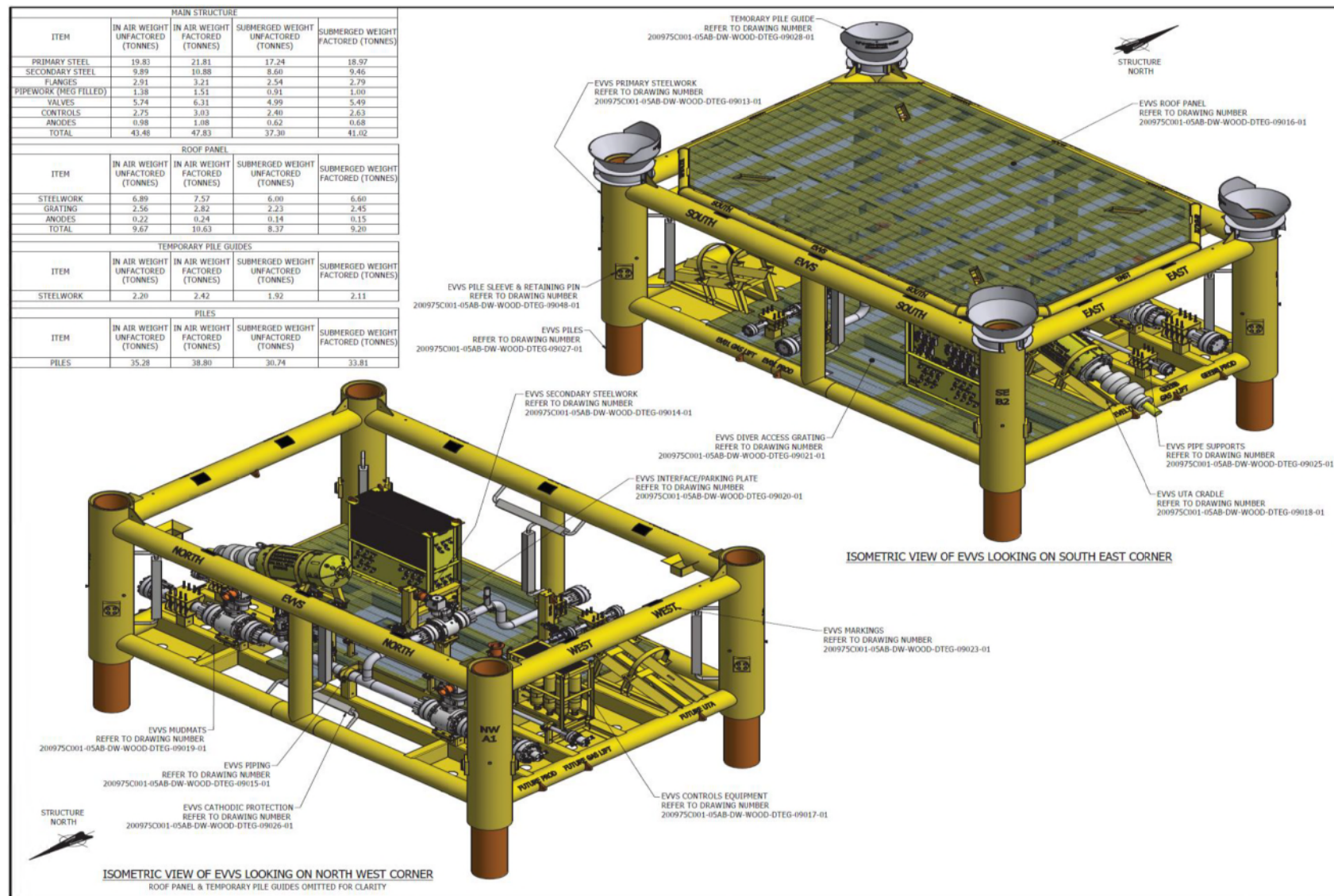


Figure 3.4: Example Piled Valve Skid Structure



3.4.3 Production Pipeline, Gas Lift Pipeline and Control Umbilical

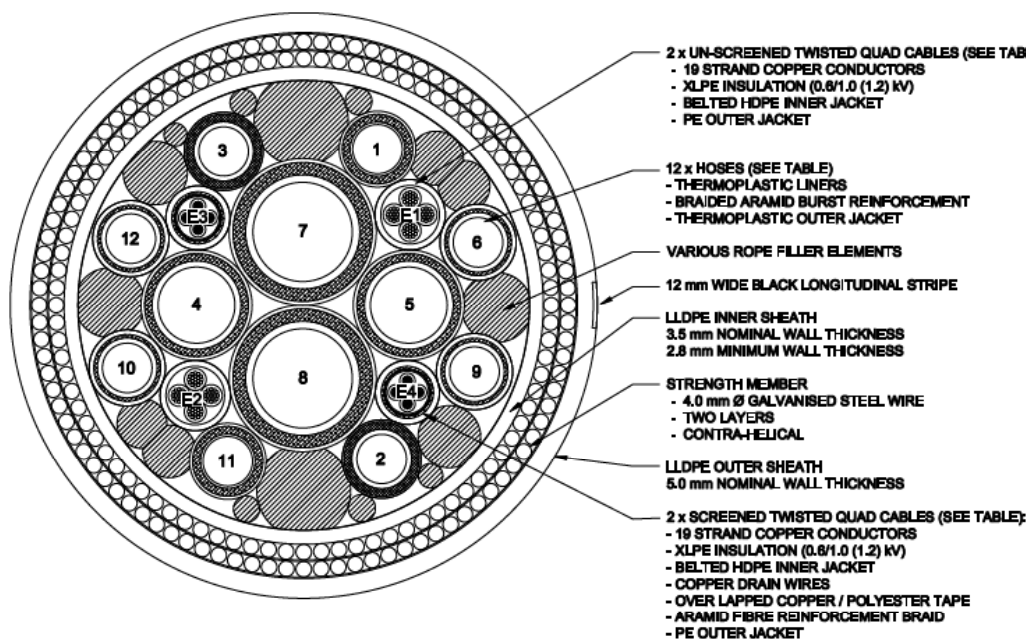
Kyla production fluids will be exported via a new 12 to 13.2 km long 8-inch production carbon steel pipeline to one of the Bittern manifolds (either DCA or DCB). A 3-inch gas lift carbon steel pipeline will be piggybacked to the production pipeline to supply gas lift to the Kyla well. The proposed pipeline details are provided in Table 3.7.

Table 3.7: Pipeline Details

Parameter	Unit	Production Pipeline	Gas Lift Pipeline
Outside diameter	mm	219.1	88.9
Wall thickness	mm	14.3	7.6
Material	-	Carbon steel	Carbon steel
Design pressure	barg	200bar	200bar
External corrosion coating	-	Thermotite ULTRA Insulation	3LPP
External coating thickness	mm	38.0	1.5

A 12 to 13.4 km long umbilical will be extended from Bittern to Kyla, running adjacent to the pipelines, ca. 50 m apart. The umbilical will provide electrical power/signal functions, hydraulic functions and chemicals (scale inhibitor, corrosion inhibitor, methanol and provision for wax inhibitor) to the Kyla well. A preliminary cross section of the umbilical is depicted in Figure 3.5.

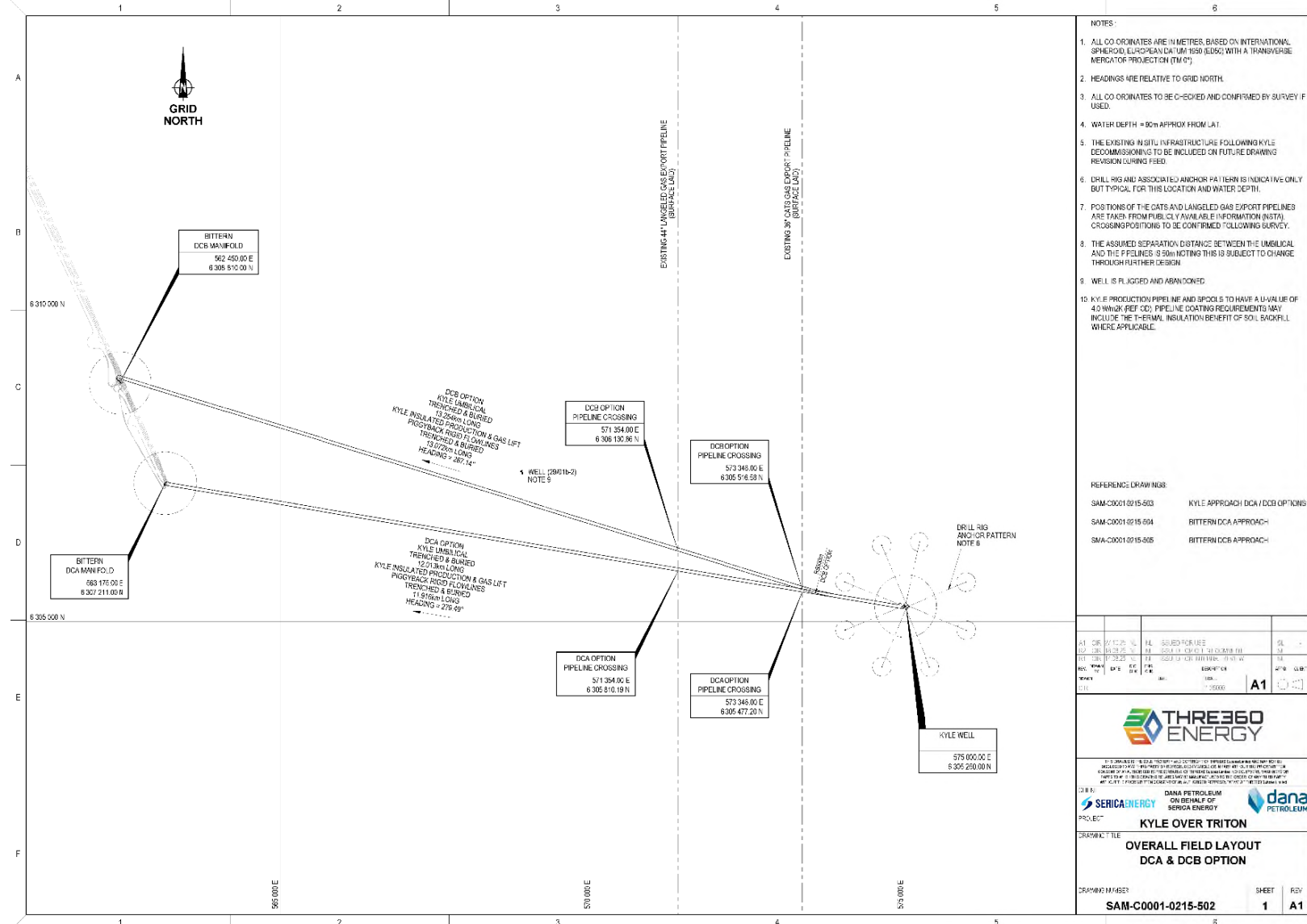
Figure 3.5: Kyla Umbilical Provisional Cross Section



The proposed pipeline and umbilical routes between Kyla and Bittern DCA or Bittern DCB are illustrated in Figure 3.6. The routes cross the existing 44-inch Langeled and the 36-inch CATS gas export pipelines, both of which are surface laid.

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Figure 3.6: Pipeline Route from Kyla to Bitten DCA or DCB Manifold



The Kyla pipelines and umbilical are likely to be installed by a reel-lay vessel and will be surface laid on the seabed prior to trenching. For reel-lay installation, long pipe segments are welded, tested and coated onshore and then spooled onto a large, usually vertically oriented pipe reel, in one continuous length. Once the reel-lay vessel is in position, the pipe is unspooled, straightened and then lowered to the seabed as the vessel moves forward. As-laid surveys would be performed by the vessel to confirm the lines have been installed in the correct position.

In order to initiate pipelaying, temporary laydown areas will be required for initiation anchors (as a worst case it is assumed that drag embedment anchors would be used) and initiation wire, the length of which is assumed to be up to 100 m. Following installation of the pipelines, the anchors and wire will be recovered. There may also be a requirement to temporarily wet store subsea facilities and protection materials, as well as ROV tooling and baskets. The dimensions of any temporary laydown area are unlikely to exceed 20 m x 10 m based on maximum tie-in spool dimensions. It is assumed up to six temporary laydown areas will be required for the Kyla Development, impacting a total seabed area of 1200 m² (0.0012 km²). No turning bollards are anticipated to be required along the route.

Once surface laid, the lines will be trenched and buried, similar to the other pipelines which form part of the Triton area. The umbilical will be trenched and buried separately to the pipelines as it is not considered feasible to install the umbilical in the same trench as the piggybacked production and gas lift pipelines.

Seabed sediments along the proposed pipeline/umbilical route are mainly poorly sorted muddy sand and are considered suitable for all three trenching techniques. Both ploughing and jetting solutions have been successfully used on previous Triton area pipelines. Depending on the soil conditions, ploughing potentially has a higher likelihood of achieving greater depth of cover thus potentially a reduced requirement for remedial rock versus jetting. If a jetted or mechanically cut trenching solution is selected additional rock contingency may be required to address the risk of achieving less than planned depth of cover (variability in trenching performance) the following will be considered:

- Not all subsea installation contractors have access to conventional plough equipment;
- The high bollard pull (>300Te) vessels required to pull a conventional plough are now in short supply in the North Sea and may attract a significant premium depending on market conditions;
- Recent project experience of a jetted trenching solution in the Triton Area required significant additional rock since it achieved less than planned depth of backfill cover;
- Note that a surface laid pipeline with blanket rock placement only (i.e. no trenching) would require significantly more rock than any of the trenched solutions.

The final trenching method will be selected by the subsea installation contractor. However, for the purposes of this ES, trenching and backfilling via a plough has been assessed, as this represents the worst-case scenario for seabed disturbance and fuel consumption by vessels. If a jetted or mechanically cut trenching solution is selected, the items listed above will also apply; therefore, additional rock contingency has been included in the assessment to allow for this.

A pipeline plough creates an open V shaped trench in the seabed and spoil heaps either side. Backfilling is subsequently carried out using a mechanical backfill plough to redeposit the spoil heaps above the trenched pipe. If ploughed, the trench for the pipelines will have a width of ca. 5.0 m and depth of 1.8 m, with a target cover depth of 1 m. The backfilling equipment is expected to disturb up to 11 m of seabed on each side of the pipelines. A similar disturbance corridor is assumed for the umbilical. As a worst case, it is therefore anticipated that, as a maximum, 0.616 km² of seabed would be directly impacted, assuming a line length of ca. 14 km and two 22 m wide corridors.

Boulders of different sizes have previously been recorded during surveys conducted for Bittern and Belinda. Sidescan sonar data has not yet been collected along the route of proposed pipelines and umbilical and, therefore, the number and location of boulders in the Kyla Development area is not known. Boulders inhibit the use of the trenching equipment, and boulder clearance may therefore be required prior to trenching. Boulder clearance will be minimised as far as practical via pipeline routing exercises as part of the design process and potentially local the pipeline micro routing prior to pipe or umbilical lay. However, the need for boulder relocation cannot currently be ruled out. If required,

boulder clearance will be achieved through use of a grab or bumper bar. All boulders greater than 0.5m would typically be removed from the lay corridors for the pipelines and umbilical and relocated to the edges of the installation corridor, ideally within a 5 m corridor downstream of the prevailing current to minimise likelihood of scour developing on the route. The as-left position of each boulder will be recorded. In the event that up to ten boulders may need to be removed from the lay corridors a conservative estimate of the seabed impact resulting from this would be 10 m².

Burial of the pipelines will assist in protection against upheaval buckling, where temperature changes cause the pipeline to move to relieve the expansion forces. The potential for upheaval buckling is directly related to the as-trenched shape of the pipeline where deviations in height away from a perfectly straight pipe are susceptible to upheaval buckling. The target pipeline burial depth should be sufficient to prevent upheaval buckling for the majority of deviations in height. However, for larger imperfections, the backfill cover height provided by the backfilled sediment may not, on its own, be sufficient to resist upheaval buckling and at these locations placement of rock may be required.

Rock is considered the most appropriate mitigation measure for upheaval buckling. Based on experience from the wider Triton area, it has been calculated that up to 25,000 tonnes of rock may be needed to mitigate for upheaval buckling along the pipeline. This allows for contingency to account for the fact that data from the detailed engineering surveys is still pending. Any rock required for upheaval buckling will be sited within a ca. 10m wide corridor centred above the pipeline.

The requirement for rock to be deposited along the pipelines will be determined by reviewing as-trenched and as-backfilled survey data against the critical trench imperfection criteria defined during detailed design. As a contingency it is assumed up to 65,000 tonnes of rock may be deposited on the pipelines if target trenching is not achieved.

The umbilical will not require any rock placement provided it is suitably trenched below mean seabed level. However, as a contingency it is assumed up to 10,000 tonnes of rock may be deposited on the umbilical if target trenching is not achieved.

Additional rock will also need to be deposited where the pipelines and umbilical exit the trenches at Kyla and Bittern (50 m sections for the pipelines and 25 m sections for the umbilical). It is estimated that up to 2,000 tonnes of rock may need to be deposited over the lines for protection at these locations.

In addition, as shown in Figure 3.6, the proposed route of the Kyla pipelines and umbilical cross the existing 44-inch Langeled and the 36-inch CATS gas export pipelines, both of which are surface laid and exposed. Crossing designs are not yet matured, but are likely to entail concrete mattresses/plinths and rock placement. The impact assessment presented in this ES is based on the worst case assumption of 34,100 tonnes of rock required for the pipeline and umbilical crossings, including trench transition, and up to 54 concrete mattresses to accommodate both the Kyla pipelines and Kyla umbilical crossing Langeled and CATS. Where concrete mattresses are used as part of the crossings design, or in other open water relocations outside the 500m safety zones at Bittern and Kyla, rock cover will be provided over the mattresses to minimise risk of snagging with fishing gear.

Figure 3.7 shows a schematic of this type of pipeline crossing arrangement.

Any rock required will be deposited by a rock placement vessel. The vessel will survey the seabed as the rock placement installation progresses to determine the exact location of the rock material and to confirm that the design requirements have been met. The spread of rock placement will be restricted through the use of a fall pipe system held a few metres above the seabed to accurately place rock material. The rock material deposited will comprise inert rock material, containing minimal fines.

Table 3.8 provides a worst case estimate of the total quantity of rock which will be required to be deposited on the seabed to install the Kyla pipelines and umbilical. As detailed design work has not yet commenced, the quantity of rock detailed in Table 3.8 is subject to change but is based on information from previous rock placement campaigns in the area undertaken for the Evelyn, Belinda and Bittern projects, with credible worst case contingencies applied.

Table 3.8: Rock Quantity Estimate (worst case)

Requirement	Quantity of rock to be deposited (tonnes)		Seabed Footprint (m ²)	Justification
	Pipelines	Umbilical		
Upheaval buckling (UHB) mitigation ¹	25,000	N/A	32,500	<p>Rock placement requirements for UHB mitigation assume:</p> <ul style="list-style-type: none"> 66 imperfections requiring additional rock for UHB mitigation (5 per km); 250 tonnes of rock used per imperfection (with 50% contingency applied); Footprint based on 5 tonnes per m placed giving a length of 5,000 m. Total berm height of 0.75 m with 2.0 m crown and 1:3 side slopes giving a total width of berm of 6.5 m and area of 32,500m².
Trenching performance contingency	65,000	10,000	66,450	<p>Rock placement requirements for pipeline UHB mitigation and protection assume:</p> <ul style="list-style-type: none"> Blanket rock required over full length based on mitigating pipeline imperfections less than 0.1m; Allowing for rock dumping tolerances 6.2 tonnes per m assumed as upper bound giving 74,400 tonnes. Upper bound rock placement tolerances assumed to mitigate 0.2 m imperfections and less. Thus 74,400 tonnes reduced by 9,400 tonnes of spot rock which is included in the 25,000 tonnes allocated to UHB mitigation, giving 65,000 tonnes for the pipeline; Footprint based on 8 tonnes giving a berm height of 0.85 m with 2.0 m crown and 1:3 side slopes giving a total width of berm of 7.1 m and area of 85,200m² over the full pipeline length of 12,000m. To avoid inclusion of the footprint allocated to upheaval buckling mitigation twice, where blanket rock placement is used, the total 85,200m² has been reduced by 90% of 32,500m² (UHB mitigation total) giving a total of 55,950m². <p>Rock placement requirements for umbilical protection assume:</p> <ul style="list-style-type: none"> Rock required over 2,500 m where target trenching isn't achieved; 4 tonnes of rock per metre assumed, thus a total of 10,000 tonnes. Footprint based on berm height of 0.6 m with 1.0 m crown and 1:3 side slopes giving a total width of berm of 4.2 m and area of 10,500m².

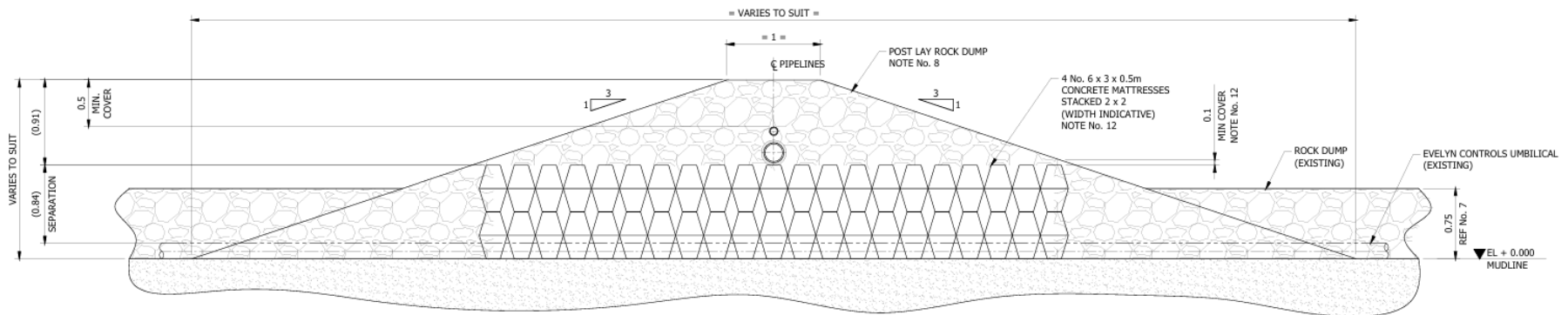
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Requirement	Quantity of rock to be deposited (tonnes)		Seabed Footprint (m ²)	Justification
	Pipelines	Umbilical		
Pipeline crossings ²	24,600	9,500	11,300	Rock placement requirements for pipeline crossings assume: <ul style="list-style-type: none"> Total length of 2 crossings plus transitions is 600 m with an average of 20.5 tonnes per metre over the crossing length. Rock placement requirements for umbilical crossings assumes: <ul style="list-style-type: none"> Total length of 2 crossings plus transitions is 450 m with an average of 10.6 tonnes per metre over the crossing length.
Trench transition ¹	1,200	800	1,500	Rock placement requirements for trench transition assume: <ul style="list-style-type: none"> Pipelines: total length of transition is 150 m with a footprint width of 6 m. Umbilical: total length of transition is 100 m with a footprint width of 6 m.
Total:	136,100		111,750	

¹ As a worst case, includes for a contingency of 100% to account for the fact that data from the detailed engineering surveys is still pending.

² As a worst case, includes for a contingency of 100% to account for the fact the crossing design is not yet matured

Figure 3.7: Typical (Example) Pipeline Crossing Design



3.4.4 Bittern Tie-in Arrangement

The proposed tie-in arrangement options at Bittern are illustrated in Figure 3.8 (DCA) and Figure 3.9 (DCB). The tie-in arrangement to the DCB manifold requires a separate ‘fishing friendly’ tie-in structure to be installed, which would be located within the existing Bittern 500 safety zone.

Tie-in Structure

If tie-back to the Bittern DCB manifold is selected over the DCA manifold, a separate ‘fishing friendly’ tie-in structure will be installed, ca. 60 m north of the DCB manifold. The purpose of the tie-in structure is to provide valve and piping arrangements at DCB for pipeline isolation and routing selection such that Kyla flow can be routed to any of the existing Bittern pipelines. The DCA tie-in option does not require this facility as it already exists as part of the spare tie-in slot on the DCA manifold.

Two foundation concepts, piled versus gravity-based, are currently being considered for the tie-in structure. For the purposes of this ES, a piled structure foundation concept has been assumed as worst case for the underwater noise assessment and a GBS has been assumed as worst case for the seabed disturbance assessment (refer to Section 2.5).

The piled structure has approximate dimensions of approximately 9 m (L) × 6 m (W) × 3.3 m (H), a dry weight of ca. 55 tonnes and a seabed footprint of ca. 54 m² for the structure itself, plus localised disturbance from piles (Figure 3.4). It is assumed that the valve skid would be held in place by four tubular piles, one at each corner, each with a diameter of 24-inch and length of up to 24 m. The piles would be secured into the seabed using a maximum hammer blow energy of 90 kJ, with a maximum blow rate of 50 blows per minute. It is expected that the hammering operations for each pile will be ongoing for up to two hours. A soft start is assumed with a ramp up from 30% energy to full energy over 5 minutes, with a reduced blow rate of 6 strikes per minute. Each pile is estimated to take 2 hours to install, giving a total maximum piling duration of 8 hours.

The GBS has dimensions of approximately 16.6 m (L) × 6.5 m (W) × 3.7 m (H) and a dry weight of ca. 124 tonnes. It would be placed directly on the seabed and stabilised by self-weight, avoiding the need for piling. The GBS has a seabed footprint of ca. 108 m².

Regardless of the foundation concept, the tie-in structure will be installed from a CSV.

Tie-in Spools and Jumpers

The proposed Bittern tie-in line lengths and protection requirements are detailed in Table 3.9.

Rigid tie-in spools will connect the 8-inch production pipeline and 3-inch gas lift pipeline either directly into the Bittern DCA manifold or into the new Bittern tie-in structure, which in turn will be connected by tie-in spools to the DCB manifold.

The Kyla umbilical will either connect directly into the Bittern DCA manifold or into the new Bittern tie-in structure. Jumpers will connect the Bittern tie-in structure to the DCB manifold.

These lines will be surface laid, installed from a DSV, and protected by concrete mattresses, assumed to have dimensions of 6 m x 3 m x 0.15 m.

Table 3.9: Bittern Manifold Tie-in Details

Spool Type	Length (m)	From	To	Protection Material ¹	Seabed Footprint (m ²)
Bittern DCA Manifold					
8" production pipeline tie in spools	100	8" pipeline	Bittern DCA	27 x concrete mattresses (covering both 8" and 3" spools and pipeline ends)	486
3" gas lift pipeline tie in spools and pipeline end	100	3" pipeline	Kyla Valve Skid		
EHC control umbilical tie-in loop	100	DCA Manifold	Start of Trench	15 x concrete mattresses	270
Bittern DCB Manifold					
8" production pipeline tie in spools and pipeline end	300	Tie In Valve Skid	DCB manifold	58 x concrete mattresses (covering both 8" and 3" spools, pipeline ends and EHC jumper bundle)	1,044
3" gas lift pipeline tie in spools and pipeline end	150	Tie In Valve Skid	DCB manifold		
EHC jumper bundle	150	Tie In Valve Skid	DCB manifold		
EHC control umbilical tie-in loop	240	Bittern Tie-in Structure	Start of Trench	40 x concrete mattresses	720

¹ Mattress dimensions are assumed to be 6 x 3 x 0.15 m.

Seabed Footprint

An estimate of the total area of seabed directly impacted by the installation of new subsea infrastructure and associated protection material at Bittern is presented in Table 3.10.

Table 3.10: Estimated Seabed Footprint of New Subsea Infrastructure at Bittern ¹

Subsea Item	Assumptions	Total Seabed Footprint (m ²)
Bittern tie-in structure	GBS has dimensions of ca. 16.6 m (L) × 6.5 m (W)	108
Tie-in spools, pipeline ends and control jumpers	Lines will be surface laid and protected with concrete mattresses (see assumptions in Table 3.9)	1,044
Untrenched umbilical section	Umbilical tie-in loop will be surface laid and protected with concrete mattresses (see assumptions in Table 3.9)	720
Total Seabed Footprint at Bittern		1,872

¹ Seabed footprint is worst case, based on the tie-in arrangement at Bittern DCB manifold.

Figure 3.8: Approach to Bittern DCA Manifold

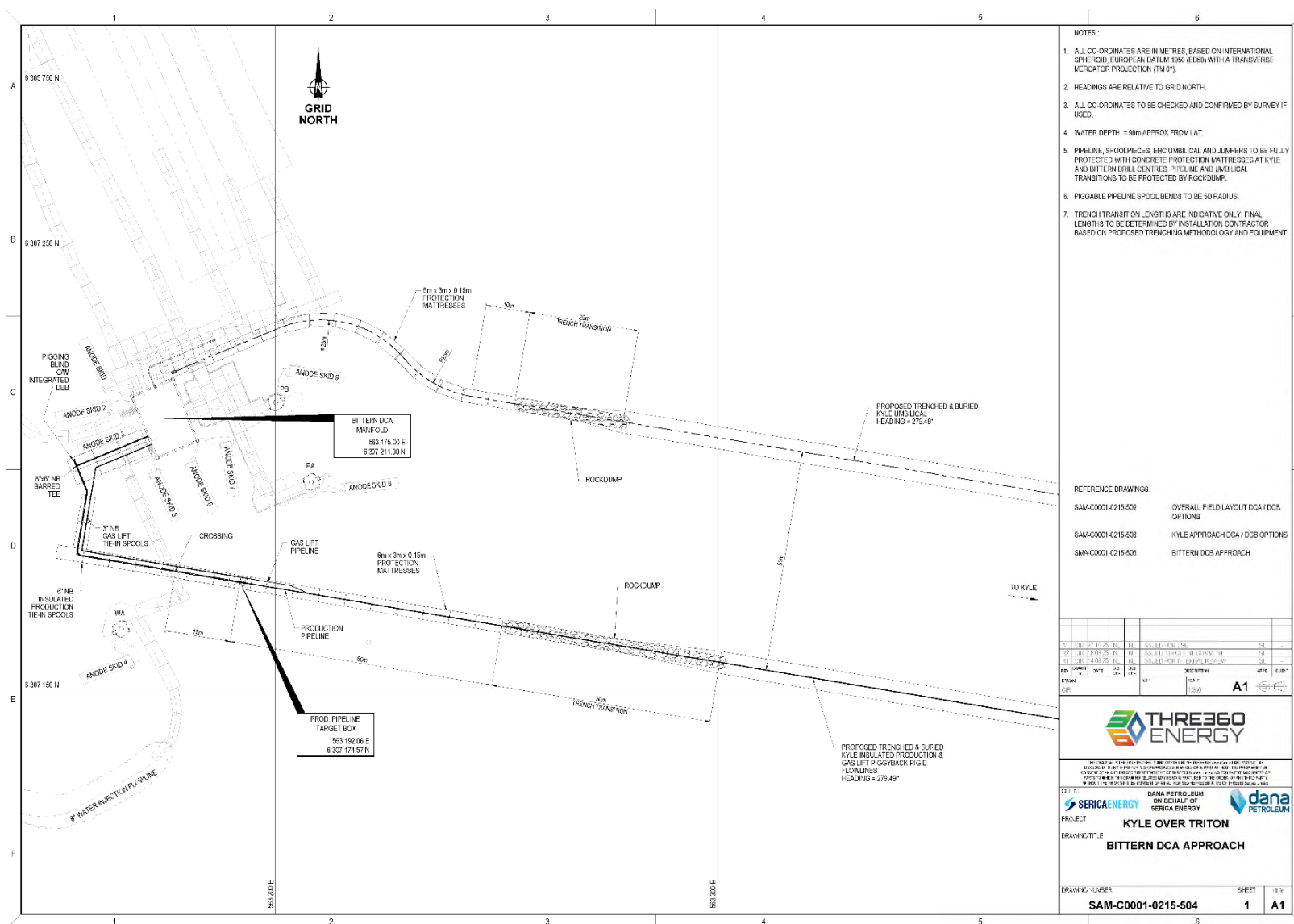
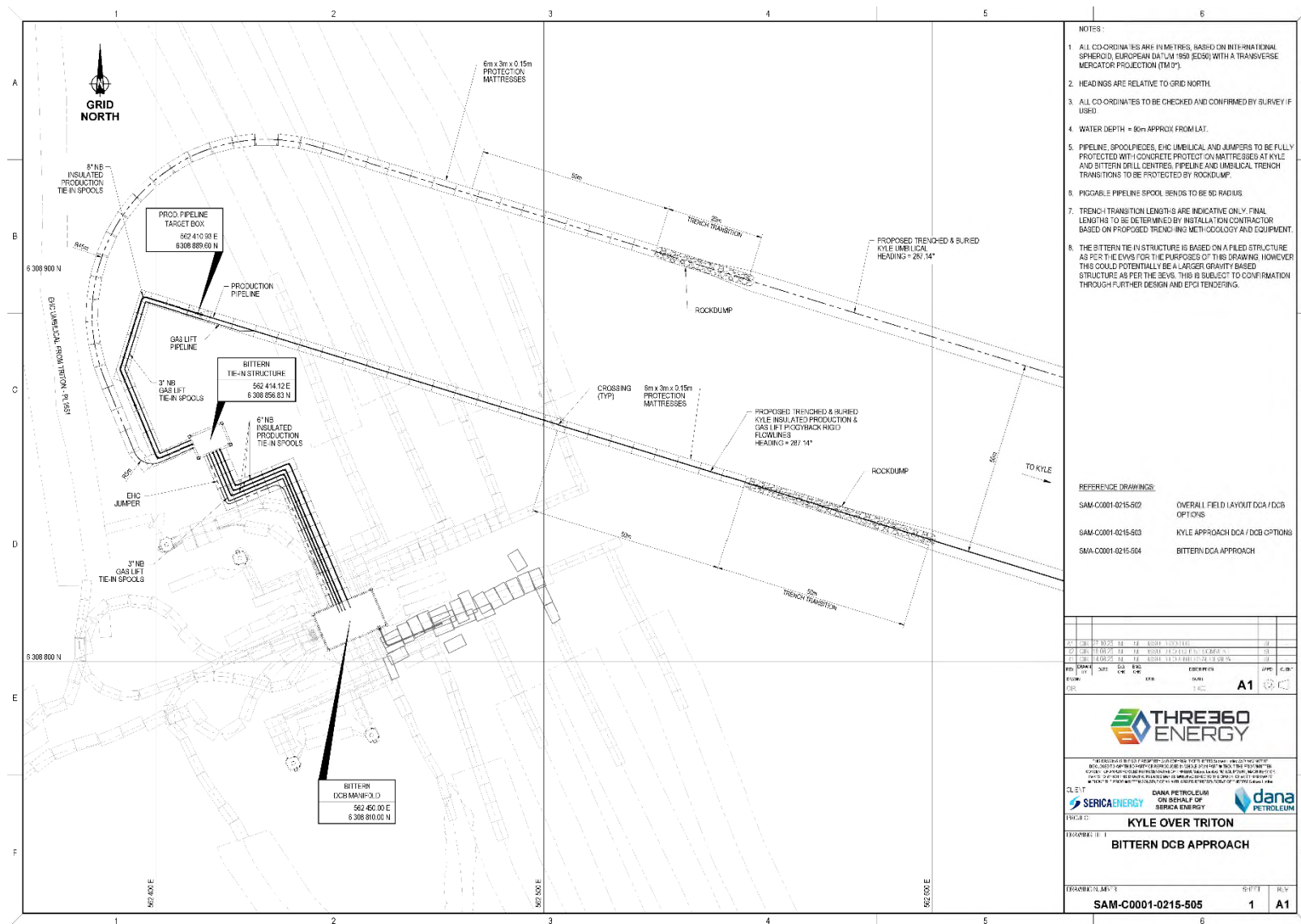


Figure 3.9: Approach to Bittern DCB Manifold



3.4.5 Pre-Commissioning

Where feasible, as much equipment as possible will be pre-commissioned onshore. It is anticipated that the spool pieces will be hydrotested onshore and will be installed, pre-filled with chemicals to protect the infrastructure integrity typically MEG gel and potentially also dye, to facilitate leak testing. The control umbilical will be pressure tested on completion of manufacture and will be installed, pre-filled with the control lines filled with the appropriate hydraulic fluid and the chemical injection lines will be filled with MEG/Water or a suitable spacer chemical.

The production and gas lift pipelines will be installed air filled or allowed to free flood during installation. For the former case, the air will be displaced by flooding with chemically treated fresh water (e.g., oxygen scavenger (to prevent oxygen induced corrosion), biocide (to prevent bacterial growth), corrosion inhibitor and dye (which would be visible in the water column if the production pipeline leaked). A pipeline integrity gauge (PIG) will be pushed through the lines to detect any dents or defects in the pipeline surface that might have been caused during installation (called 'gauging') and to clean the inside of the lines as part of the flooding process.

Once the pipelines are water filled, the pressure within the pipelines will be slowly raised to help confirm that the pipeline structure is intact (hydrotesting/strength testing). Once the pressure has been raised to the intended pressure, it will be held for a period sufficient to determine that the pipeline demonstrates the required strength and integrity in accordance with the pipeline design Codes and Standards.

Following testing and installation of all the spool pieces, jumpers, etc., the gas lift pipeline will be dewatered into the production pipeline driven by lift gas from the Triton FPSO and the production pipeline is expected to be subsequently dewatered back to Triton, driven by production fluids upon start-up of the Kyla well. It is anticipated that up to a maximum of 400 m³ of treated seawater will be discharged to the marine environment at the Triton FPSO during the de-watering phase.

The use and discharge of chemicals during pre-commissioning operations will be detailed and assessed in the Pipeline Operations MAT and associated Chemical Permit SAT in accordance with the Offshore Chemicals Regulations 2002 (as amended). Chemicals will be subject to an environmental risk assessment, where applicable and products with an improved environmental profile will be preferentially selected for use.

3.4.6 Vessel Requirements

A summary of the vessel requirements and durations associated with the Kyla subsea installation operations, along with typical fuel consumption rates, are provided in Table 3.11. All installation vessels will use DP to maintain position and will not be anchored.

Table 3.11: Vessel Requirements for Kyla Subsea Installation Operations

Operation	Vessel Type	Total No. of Vessel Days ¹	Typical Fuel Consumption (tonnes per day)	Total Fuel Consumption (tonnes)	GHG Emissions (tonnes of CO ₂ e) ²
Survey Work (pre-execution and preparatory works)	Remotely Operated Vehicle Survey Vessel	83	8	664	2,154.88
Pipelay activities	Reel Lay Vessel	20	35	700	2,271.71
Trenching and backfill operations	Trenching Support Vessel	32	50	1,600	5,131.04
Installation of subsea structures	CSV	30	16	480	1,557.75

Operation	Vessel Type	Total No. of Vessel Days ¹	Typical Fuel Consumption (tonnes per day)	Total Fuel Consumption (tonnes)	GHG Emissions (tonnes of CO ₂ e) ²
Tie-in activities	DSV	35	16	560	1,817.37
Rock placement operations	Rock Placement Vessel	14	25	350	1,135.86
Guard vessel	Guard vessel for pipeline / umbilical installation	50	3	150	486.80
Totals:		264	153	4,504	14,555.40

¹ Includes an allowance for vessel mobilisation, transit and demobilisation.

² Refer to Appendix E for details on the methodology used to calculate the quantity of GHG emissions produced.

3.5 Production

This section provides an overview of the oil and gas production expected from the Kyla Development and any associated effects this will have on the Triton FPSO host facility, including produced water and chemical usage, incremental power demand and associated atmospheric emissions.

3.5.1 Triton FPSO

It is proposed that Kyla production fluids will be routed to the Triton FPSO (Figure 3.10) via Bittern and enter the FPSO via the Bittern risers for processing via the Bittern separation train. Production from Kyla will require artificial lift, i.e. gas lift, with gas lift supplied from Triton via Bittern.

Minor modification of the chemical injection systems (i.e. new control panels for Corrosion Inhibitor, Scale Inhibitor and Wax Inhibitor injection, tubing installation and re-instatement of existing Wax Inhibitor pumps and tanks), existing Triton controls and shutdown systems software and logic updates for inclusion of Kyla will be required at Triton to accommodate Kyla. These will be undertaken by Dana, as the operator of Triton. Changes to the Triton main process systems are not required for inclusion of Kyla.

By utilising the existing Bittern process train located at Triton, the incremental emissions arising from Kyla production will be minimal and consistent with the targets of the NSTD. In comparison with current levels of CO₂ emissions, average Kyla incremental emissions from the combustion of fuel gas in the turbines is estimated to be ca. 2.5% relative to current Triton (unabated) emissions of ca. 85,000 tonnes per year. This drops to less than 1% in the later years. There will also be low level incremental emissions from cold vented gas from Kyla oil stored in the cargo tanks (refer to Section 3.5.5).

There will be no measurable increase in flaring or diesel use at Triton as a result of the Kyla Development coming online.

Figure 3.10: Triton FPSO



3.5.2 Kyla Development Oil and Gas Production

The oil, gas and water production figures for the Kyla Development are presented in Table 3.12 and illustrated in Figure 3.11 (P10, High case), with high, mid and low case production figures provided for comparison in Appendix G.

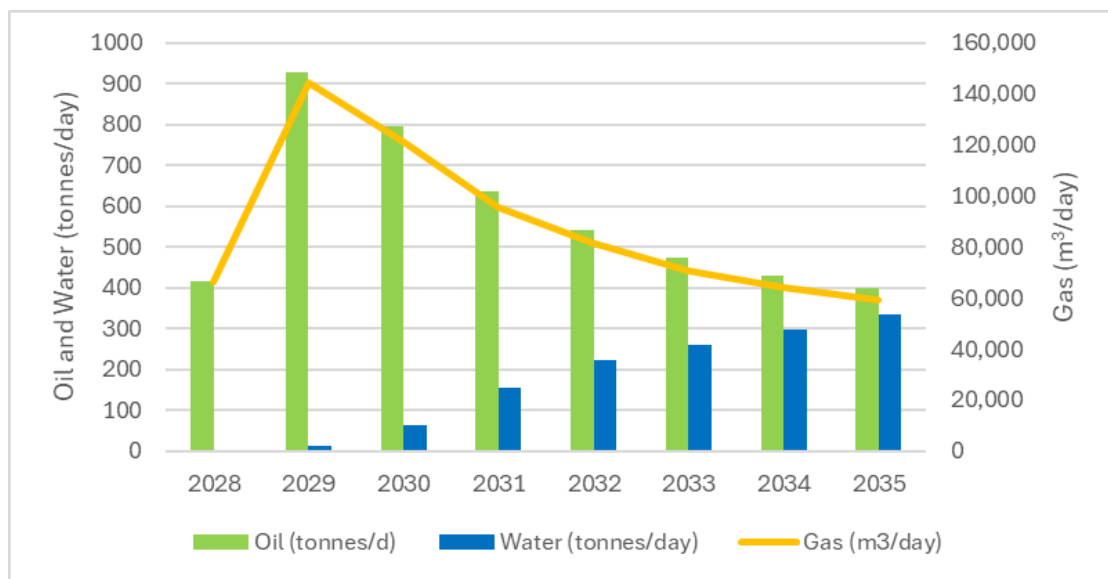
The P10, High case presents the highest estimate of recoverable and/or potentially recoverable volumes from the Kyla Development. There is a 10% probability that recovered volumes will meet or exceed the high case estimate. The impact assessment presented in this ES (and all associated calculations for emissions and discharges) has therefore been carried out using the High case. The production predictions are based on an ensemble of reservoir models which reflect the identified range of uncertainty in reservoir parameters and align with the application for development and production consent which will be submitted to the NSTA.

First oil is currently targeted for Q3 2028, with rates anticipated to peak in 2029, the first full year of production, at 928.2 tonnes (1,112.5 m³) of oil per day and 144,720 m³ (5.1 million cubic feet (MMscf)) of gas per day (High case). Post 2029, there is a steady decline over the life of the field. The field is expected to produce hydrocarbons for circa eight years, until 2035, depending on the reserves, the production rate and the life of the Triton FPSO.

Table 3.12: Kyla Gas, Oil and Water Production Volumes, High case ¹

Year	Oil (tonnes/d)	Oil (m ³ /d)	Gas (m ³ /d)	Gas (MMscf/d)	Water (m ³ /day)	Water (bbl/d)
2028	415.6	498.1	66,564	2.4	2.3	14.5
2029	928.2	1,112.5	144,720	5.1	11.0	69.0
2030	795.5	953.5	120,940	4.3	64.1	403.2
2031	635.9	762.1	95,705	3.4	154.6	972.5
2032	541.2	648.6	81,265	2.9	224.0	1,409.0
2033	472.5	566.3	70,684	2.5	261.4	1,643.9
2034	431.0	516.6	64,194	2.3	296.1	1,862.3
2035	400.3	479.8	59,288	2.1	333.4	2,097.2

Figure 3.11: Kyla Development Production Profile (P10 – High case)



3.5.3 Produced Water

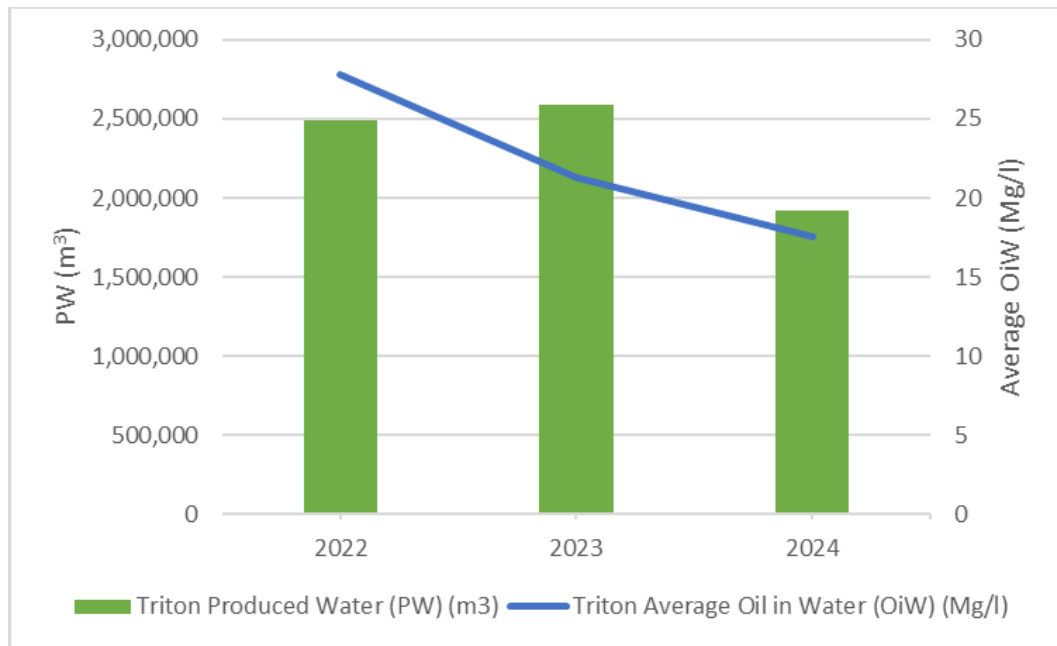
There is no produced water reinjection on the Triton FPSO, so produced water from the Kyla Development shall be treated by the existing Triton produced water system where it will be discharged to sea, provided the monthly average oil concentration does not exceed 30 mg/l in accordance with the OPRED OPPC Guidance Notes (February, 2022).

The Triton inlet facilities consist of a dedicated inlet heater and a 1st stage separator arrangement for each of the Bittern and the Guillemot West fields. The oil from each 1st stage separator co-mingles downstream of the respective oil side level control valves and is routed via the Crude Oil Heaters to the 2nd stage separator. The separated water from each 1st stage separator is routed to dedicated Bittern and Greater Guillemot Area produced water treatment trains. The 2nd stage separator removes the remaining bulk water from the oil. The oil is then routed to the 3rd stage separator which operates close to atmospheric pressure to ensure the final flashing of the light-ends from the bulk oil to meet the oil Reid Vapour Pressure (RVP) specification. The stabilised oil is pumped through the Coalescer where the oil base sediment and water specification is met. The dry oil is then routed via the crude oil coolers to the crude oil storage tanks in the hull.

Produced water from the Bittern 1st stage separator is routed through a single dedicated hydrocyclone unit to the Bittern de-gasser where dissolved gases in the produced water are flashed-off to flare. The water from the Bittern de-gasser is routed to the Bittern OSPAR system. This system consists of two CFUs configured series and two Polishing Units also in series located downstream of the CFU units.

During 2024, the total volume of produced water discharged from Triton was ca. 1,919,234 m³, which resulted in approximately 33.6 tonnes of oil being discharged to sea. Figure 3.12 shows the downward trend of the total amount of oil in produced water discharged at Triton since 2022.

Figure 3.12: Average oil in produced water discharged and Volume of produced water discharged for 2022 – 2024 for Triton



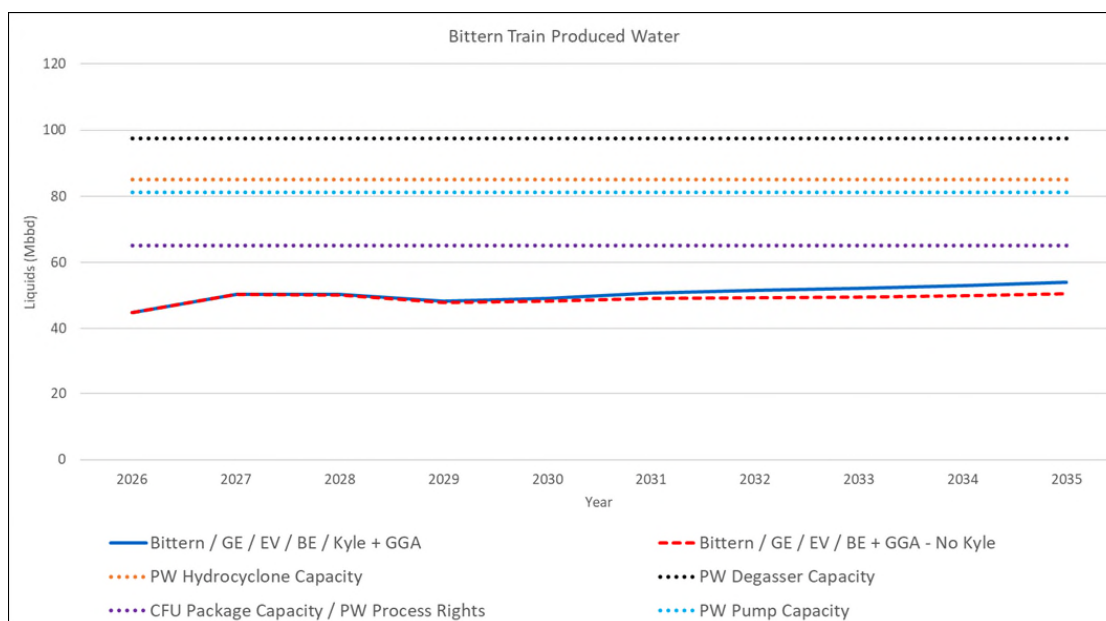
Kyla Development produced water in the high case is initially low for the first years of production but reaches 154.6 m³ per day (972.5 bbl per day) in 2031 and gradually increases to reach a peak of 333.4 m³ per day (2,097.2 bbl per day) in 2035 at the end of field life.

Assuming an oil concentration of 30 mg/l, the amount of additional oil that would be discharged per day at the Triton FPSO due to the Kyla Development is detailed in Table 3.13. This equates to a total of ca. 14.75 tonnes of oil being discharged over the life of the field.

Table 3.13: Kyla Development Incremental Estimated Oil Discharged at Triton FPSO

Year	Water (m³/day)	Average OiW (mg/l)	Kyla Incremental Estimated Oil Discharged	
			(tonnes per day)	(tonnes per year)
2028	2.3	30	0.0001	0.03
2029	11	30	0.0003	0.12
2030	64.1	30	0.0019	0.70
2031	154.6	30	0.0046	1.69
2032	224	30	0.0067	2.45
2033	261.4	30	0.0078	2.86
2034	296.1	30	0.0089	3.24
2035	333.4	30	0.0100	3.65
Total:				14.75

Processing of Kyla fluids will not exceed Triton's current produced water processing capacity, as illustrated in Figure 3.13, which shows life of field Triton produced water rates to be processed via the Bittern produced water system with and without Kyla. As such, no modification or upgrades are required to the Bittern produced water facilities on Triton to accommodate Kyla Development produced water.

Figure 3.13: Bittern Train Produced Water ¹

¹ 2026 includes all field operating assets, first oil from Kyla Development is expected to start in Q3 2028.

3.5.4 Flaring, Venting and Fugitive Emissions

It is projected that the flaring load of current Triton Scope 1 emissions without Kyla is approximately 27,000 tonnes per year of CO₂. No change to flaring on Triton is expected, as Kyla fluids are to be processed through the existing Bittern process and therefore will not change demand on current and future, routine flaring, operational up-sets or emergency flaring. However, it should be noted that if the Kyla Development is consented, Kyla would pick up an allocated share of the existing Triton flare in terms of any flare consent.

The primary source of venting on Triton is from the crude oil tanks. The Triton FPSO has a segregated cargo storage which offloads approximately twice per month via shuttle tanker. Some additional gas will therefore be cold vented from the oil storage tanks as a result of Kyla production, as detailed in Table 3.14. This would be reduced, if Triton achieves zero venting by 2030.

At Triton, the ongoing Zero Routine Flaring and Venting project aims to meet the World Bank's requirements of zero routine flaring and venting by 2030, primarily by addressing Category A (routine) flaring. Additional efforts to minimise non-routine flaring (Categories B (operational upset) and C (safety)) are also under investigation. Flare gas recovery technologies are well established and therefore options at Triton that are currently under consideration include a gas ejector or compression option. An additional option is to combine the new flare gas recovery compressor with the flash gas compressor on Triton. All of these will require shutting in the flare and converting it into a closed system and therefore impacts on the FPSO safety case need to be considered.

The crude oil tanks on Triton are blanketed with inert gas, which is post combustion gas generated by a diesel burning boiler. Some hydrocarbon gas is evaporated off of the oil in the tanks during the filling and is mixed with the inert gas and vented. The combined vented gas is therefore of a very low quality for repurposing as a fuel. Most technologies for recovering this vented gas are applicable when a hydrocarbon gas is used for blanketing, resulting in a richer gas which can be recovered and burned. Work is currently ongoing to evaluate options to change the blanketing medium from an inert gas to hydrocarbon gas to allow recovery, considering both technical feasibility and impacts to the FPSO safety case.

Table 3.14: Kyla Development Incremental Vented Gas at Triton FPSO ¹

Year ²	Triton Vented Gas - Without Kyla (tonnes per year)	Kyla Incremental Vented Gas at Triton	
		(tonnes per day)	(tonnes per year)
2028	607	0.37	45.10
2029	543	0.83	301.58
2030	482	0.71	258.47
2031	446	0.57	206.61
2032	416	0.48	175.83
2033	388	0.42	153.52
2034	362	0.38	140.04
2035	337	0.36	130.08
Total:	3,581	-	1,411.24

¹ Values based on Triton EEMS records, which indicate 0.000118 tonnes of gas are vented per barrel of oil stored. Values shown are based on Kyla high case (P10).

² Assumes Kyla production starting in September 2028 and cessation of production in December 2035.

No impact on fugitive emissions from Triton is envisaged, as Kyla fluids will be processed through existing Bittern process equipment and pipework and therefore Kyla processing will not change or add to fugitive leak paths.

3.5.5 Power Generation

Power generation on Triton supports operations of major seawater pumps, compressors, accommodation, utilities, and various other pumping systems. Once online, Kyla will only impact export compressors operational loads and will not impact on power increase for other requirements.

Power generation on Triton is provided by dual (42MW each) fuel turbines. The existing maximum Triton power requirements are in the range of 22 to 34 MW, depending upon single or dual export compressor operation. Dual export compressor mode of operation is the base case for Triton (without Kyla) for the foreseeable future due to high gas production rates. Kyla will add ca. 0.6MW to this load (peak Kyla gas 2029). This represents a 1.8% increase over the peak Triton power requirement and is well within the existing power turbine limit of 42 MW per power turbine.

The incremental fuel gas requirements on Triton once the Kyla Development is online are detailed in Table 3.15.

Table 3.15: Kyla Development Incremental Fuel Gas Usage at Triton FPSO ¹

Year ²	Kyla Incremental Fuel Gas Usage at Triton	
	(tonnes per day)	(tonnes per year)
2028	1.39	169.56
2029	3.02	1103.69
2030	2.53	922.33
2031	2.00	729.88
2032	1.70	619.75
2033	1.48	539.06
2034	1.34	489.56
2035	1.24	452.15
Total	-	5,025.98

¹ Incremental Triton Export gas compressors power increase for processing of Kyla gas is estimated as ca. 0.115MWh (2.75MWh/d) for processing of 1 MMSCFD of Kyla gas. Associated fuel gas requirement is based on ca. 0.215te/MWh of incremental power required for Triton Export Gas Compressors for processing Kyla gas. Values shown are based on Kyla high case (P10).

² Assumes Kyla production starting in September 2028 and cessation of production in December 2035.

No change to diesel usage on Triton is expected as a result of the Kyla Development. Diesel is used as a back-up fuel for power generation in case of operational up-sets and use for steam generation in the boilers. These uses do not change due to the processing of Kyla fluids through existing Bittern process.

3.5.6 Production Chemical Requirements

Chemicals are used during the production of hydrocarbons to maintain process efficiency, for example: demulsifiers improve the separation of oil and water; scale inhibitors slow down the build-up of scale in pipework and valves and biocides reduce microbial growth.

Chemical usage and discharge will be captured in an update to the Triton Production Chemical Permit prior to production commencing from the Kyla Development. It is anticipated that chemicals required for the production of hydrocarbons from the Kyla Development will be the same as those being used at Triton at the time of first oil, although quantities used are likely to increase. The following chemicals are therefore expected to be utilised:

- Corrosion inhibitor to be injected at Kyla wellhead to form a protective layer on metal surfaces;
- Scale inhibitor to be injected at Kyla valve Skid to prevent the formation of scale;
- Wax inhibitor to be injected at Kyla Valve Skid to mitigate risk of operational issues due to wax formation and build up;
- Methanol required for hydrate control during well start-ups;
- Demulsifier to be injected at Bittern 1st Stage Separator to assist in the oil water separation by breaking up emulsions;
- Deoiler to be injected at Bittern 1st Stage Separator to help in the efficient removal of oil from produced water;
- Antifoam injected at Bittern 1st Stage Separator to prevent the formation of excessive foam bubbles.

The proposed chemical injection design basis for Kyla is provided in Table 3.16.

Those chemicals which partition to the oil phase will be exported along with the oil, whereas aqueous phase chemicals will partition into the produced water and discharged to sea.

Table 3.16: Kyla Chemical Injection Requirements

Chemical Function	Proposed Product	Dosage Rate	Injection Point
Corrosion Inhibitor	CRW88015	ca. 211 parts per million (ppm) - dosed into produced water	Kyla wellhead
Scale Inhibitor	SCW88002	ca. 70ppm - dosed into total fluids	Kyla valve skid
Wax Inhibitor	-	ca. 500ppm - dosed into oil	Kyla valve skid
Methanol	-	1m ³ per start-up	Kyla wellhead
Demulsifier	DM086101	ca. 15ppm - dosed into total fluids	Bittern 1st Stage Separator
Deoiler	RBW88077	ca. 30ppm - dosed into produced water	Bittern 1st Stage Separator
Antifoam	DFO85853	ca. 30ppm - dosed into total fluids	Bittern 1st Stage Separator

3.5.7 Inspection and Maintenance

An integrity management system will be developed and inspection programmes implemented for the Kyla subsea system. However, in general, the subsea equipment is designed for the field life time such that no maintenance is required.

External inspection will take place through a combination of ROV/ Autonomous Underwater Vehicle (AUV) and towed sonar. The frequency of such maintenance will be determined by ongoing risk assessment. In terms of internal maintenance, the pipelines will be designed to accommodate intelligent pigging inspection, if necessary, whereby a remote sensing PIG will be conveyed through the pipelines to undertake checks on and confirm pipeline integrity and condition.

It is anticipated that 5 vessel days per year will be required for inspection and maintenance of the subsea infrastructure over the life of the Kyla Development as detailed in Table 3.17.

Table 3.17: Vessel Requirements for Maintenance of Subsea Infrastructure (over life of the field)

Vessel	Function	Total No. of Vessel Days ¹	Fuel Type	Fuel Consumption Rate (tonnes per day) ¹	Total Fuel Consumption (tonnes)	GHG Emissions (tonnes of CO ₂ e) ²
ROVSV	Inspection and maintenance of subsea infrastructure	40	Diesel	25	1,000	3,245.30

¹ Includes an allowance for vessel mobilisation, transit and demobilisation

² Refer to Appendix E for details on the methodology used to calculate the quantity of GHG emissions produced.

3.6 Decommissioning of the Kyla Development

On CoP, the Kyla Development will be decommissioned in accordance with the requirements of the prevailing UK and international law.

The main obligations for decommissioning offshore oil and gas operations are set out in OSPAR decision 98/3 (the "Decision 98/3") which specifically prohibits the dumping or leaving in place of installations in the marine environment. However, the OSPAR provisions do not directly apply to pipelines and there are no international guidelines on the decommissioning of disused pipelines. Therefore, pipeline and umbilical decommissioning options will be subject to comparative assessment and assessed in accordance with UK legislation and policy in place at the time of decommissioning, noting the UK's policy objective of aiming to achieve a clear seabed.

It is currently anticipated that the well will be disconnected from its subsea architecture and will be plugged and abandoned, as per regulatory guidelines at the time, using an anchored MODU or vessel with well intervention capabilities. The conductor and wellhead would then be cut at a depth of 3 m below the mudline and removed.

All subsea infrastructure will be depressurised and flushed to remove residual hydrocarbons and chemicals and left flooded with seawater prior to abandonment. The Kyla Development subsea structures (Kyla xmas tree, valve skid and Bittern tie-in structure) will be designed to be capable of being removed at the end of their service life, leaving no obstructions above the mud line.

Note, as the pipelines and umbilical will be trenched and buried it currently assumed these would remain *in situ*, along with any rock deposited on the seabed as part of the Kyla Development. The pipelines and umbilical would be isolated and flushed and any above seabed sections will be removed including protection mattresses and grout bags. The proposed Kyla pipelines will be of standard reel lay design with wet insulation and are not of a bundle design. OPRED's expectation that pipeline bundles must be removed at end of field life is therefore not applicable.

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Serica's final decommissioning programme (under section 29 of the Petroleum Act 1998) for the Kyla infrastructure will take account of the following:

- Applicable regulations
- Environmental appraisal
- Specialist vendor services
- Re-use and re-purposing
- Use of industry specific decommissioning experiences and lessons learnt, especially related to CNS facilities
- New technology and innovations available at the time

Typical vessels likely to be required to decommission the Kyla Development subsea infrastructure are detailed in Table 3.18.

Table 3.18: Vessel Requirements for Decommissioning the Subsea Infrastructure

Vessel	Function	Duration (days)	Fuel Type	Fuel Consumption Rate	Total Fuel Consumption (tonnes)	GHG Emissions (tonnes of CO ₂ e) ¹
Well Plug & Abandonment						
AHVs	10 days to lay anchors, 20 days to connect and disconnect rig, 10 days to recover anchors	40	Diesel	30 tonnes/day	1,200	3,894.37
MODU	Transit to / from Kyla	3	Diesel	34 tonnes/day	102	331.02
	P&A Well	40	Diesel	21 tonnes/day	840	2,693.79
ERRV	Patrol 500 m zone during P&A activities	40	Diesel	2 tonnes/day	80	259.62
Supply vessels	Logistic support and transportation of goods, tools, equipment ¹	24	Diesel	8 tonnes/day	192	623.10
Survey vessel	Rig site survey	15	Diesel	15 tonnes/day	225	730.19
Helicopter	Transfer crew to and from MODU	4 return flights per week	Aviation fuel	0.655 tonnes/hour	22	71.13
Subsea Infrastructure Removal						
CSV	Pipeline flushing, remove subsea infrastructure, cutting and removal of spool pieces, jumpers and protective material, pipeline / umbilical end removal and remediation	35	Diesel	16 tonnes per day	560	1,817.37
Pre and Post-decommissioning Surveys						
Survey Vessel	Decommissioning surveys (multiple campaigns)	12	Diesel	15 tonnes/day	180	584.15

¹ Refer to Appendix E for details on the methodology used to calculate the quantity of GHG emissions produced.

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When designing the Kyla Development, consideration was given to the future re-use and/or repurposing of the reservoir. However, Serica understand that there are no plans for Triton to be repurposed for Carbon Capture, Usage, and Storage, hydrogen or renewables and, hence, Kyla also has no opportunity in these areas either.

4 The Existing Environment

4.1 Introduction

This section describes the current environment at the proposed Kyla Development location, which encompasses the proposed Kyla drill centre and Kyla to Bittern pipeline route situated within UKCS Blocks 29/1 and 29/2. The description is largely based on data provided in the OPRED OESEA Reports (2003-2022), as well as other published data sources, supported by site-specific survey data as detailed below. The proposed Kyla Development is located within CNS region of the OESEA Regional Sea 1 (DESNZ, 2022).

4.1.1 Kyla Site-Specific Data

To inform this ES, a HA (Gardline, 2025a) and EBS (Gardline, 2025b) was carried out within the proposed Kyla Development area by Gardline, on behalf of Serica, between the 15th and 20th July 2025.

The scope of the survey included a total of 18 sampling stations, co-located with camera transects ranging in length from 80 to 100 m, arranged as follows:

- 12 x stations arranged in tidally aligned cruciform pattern centred on a proposed Kyla well location,
- 2 x stations along the proposed Kyla to Bittern pipeline route at 5 km intervals;
- 4 x stations situated along a now discounted route between Kyla to Triton, again at 5 km intervals.

The location of the Kyla sampling stations and camera transects are illustrated in Figure 4.1. Note, since the survey was conducted by Gardline, the proposed Kyla well location has moved ca. 267 m south of the well location used to centre the cruciform sampling points.

A full suite of faunal and physico-chemical samples was retrieved from all 18 sampling stations using a grab sampler, with:

- 1 x 0.00024 m³ physico-chemical replicate subsampled for particle size distribution (PSD), heavy and trace metals (HM), and hydrocarbons (HC) at a single surface depth of 0-2 cm;
- 3 x 0.001 m³ macro-invertebrate replicate samples processed over a 0.5 mm aperture sieve in the field.

The results of the analysis have been compared to a variety of reference values relating to regional background levels and threshold effect levels to aid in the interpretation of the data, including data from the UK Offshore Operators Association (UKOOA, 2001), Long et al. (1995) effect range low (ERL) and effect range median (ERM) levels, and apparent effect thresholds (AETs) as detailed by Buchman (2008).

The data collected from the stations along the discounted Kyla to Triton route have, where relevant, been included in this baseline description as it is representative of the wider region.

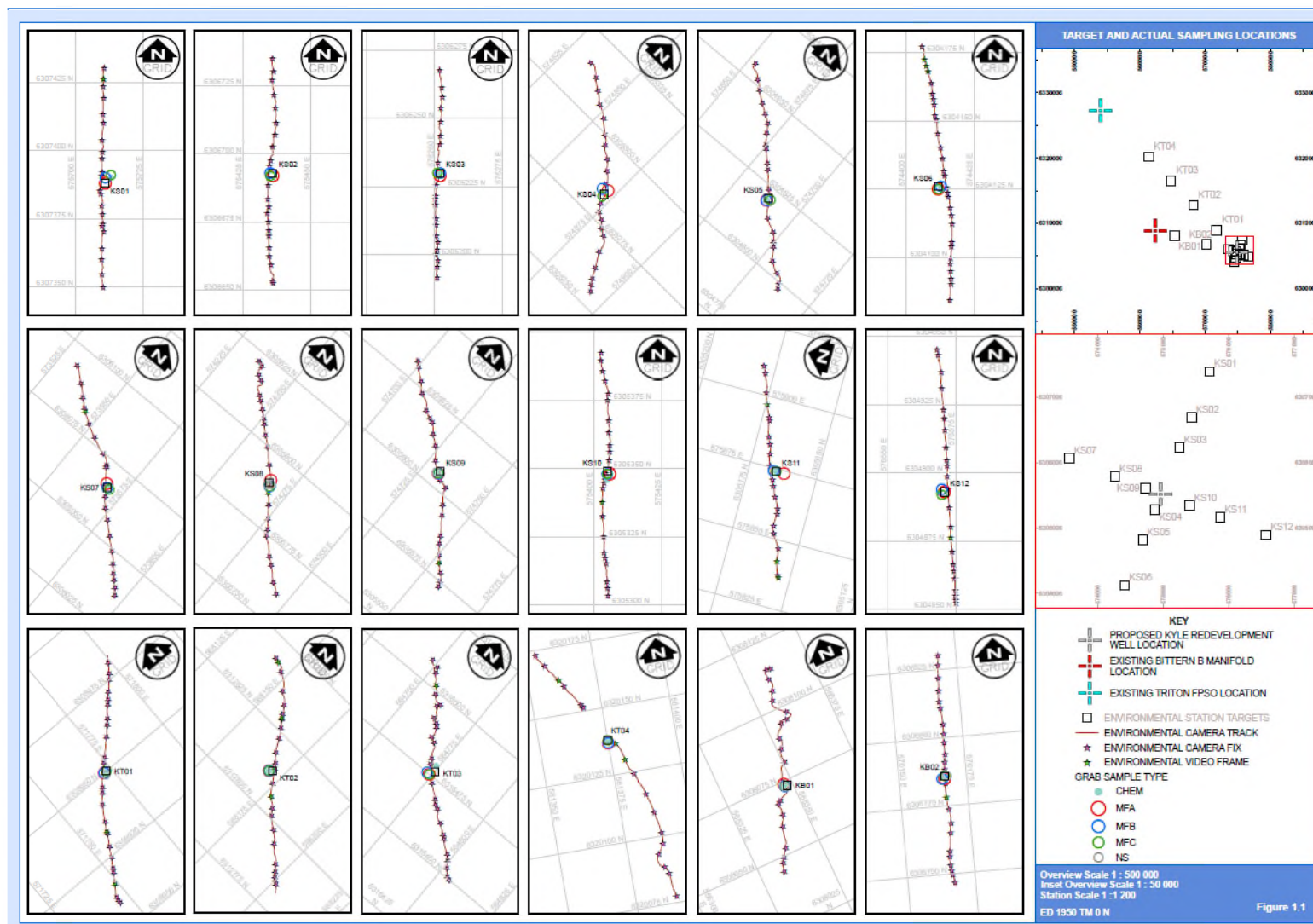
In addition, a pre-decommissioning survey involving geotechnical, geophysical and environmental operations was undertaken at the historic Kyle field in 2020 (Fugro, 2020; CNRI, 2021). Twenty-four stations were sampled across the Kyle survey area. Twelve sites were arranged in a cruciform pattern around both the Kyle North and Kyle South drill centres. A total of three survey transects were undertaken; one at Kyle North and a further two at Kyle South. The Kyle development consisted of the K12, K13, K14 and K15 development wells. The proposed Kyla well is located ca. 0.30 km southwest of the K12 well, 0.33 km southwest of the K15 well and over 3 km south southeast of the K13 and K14 wells (NSTA, 2025c).

4.1.2 Environmental Surveys in the Wider Area

The results of the Kyla site specific surveys described above are supported by the environmental survey work conducted in 2017 and 2023 around the Bittern Manifolds and Wells (Fugro, 2017; Fugro, 2023). These surveys consisted of grab samplings and seabed imagery operations. These operations were

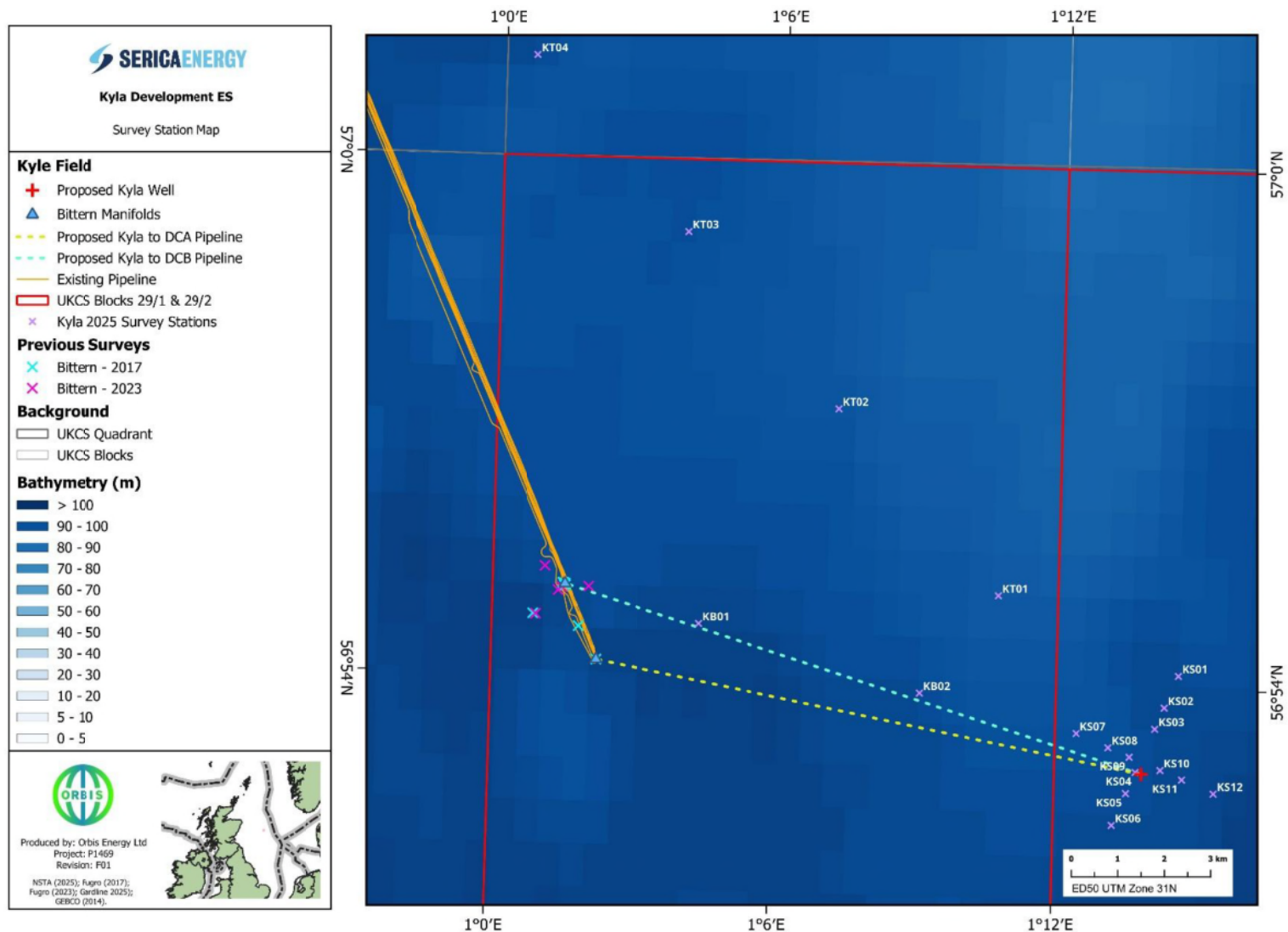
performed at 9 locations in 2017 and 5 locations in 2023. In addition, the stations along the discounted Kyla to Triton route (KT01, KT02, KT03, KT04) in the 2025 Gardline survey provide data for the wider region (Gardline, 2025a; 2025b). The locations of these sampling stations in relation to the proposed Kyla Development are presented in Figure 4.2.

Figure 4.1: Environmental Sampling Strategy for the Kyla Development Survey Area (Gardline, 2025a) ¹



¹ The 'Proposed Kyle Redevelopment Well Location' is a previous proposed well location for the Kyla Development located ca. 267 m north of the confirmed proposed Kyla well location

Figure 4.2: Location of 2025 Kyla Survey Stations and Bittern Survey Stations in relation to the Proposed Kyla Development (Gardline, 2025a; 2025b; Fugro, 2017; Fugro, 2023)



4.2 Physical Environment

4.2.1 Bathymetry and Seabed Features

The proposed Kyla Development is located within the shallower waters of Regional Sea 1, referred to as the CNS, which are generally deeper compared to the Southern North Sea (SNS) (DESNZ, 2022). The North Sea in general is a large shallow water body with a surface area of around 750,000 km².

The bathymetry at both Kyla and Bittern and along the proposed pipeline route is relatively flat with depths in the range of 90-95 m (CNRI, 2021; Fugro, 2017; Fugro, 2023; Gardline, 2025a).

4.2.2 Seabed Sediments

The nature of the local seabed sediments is a determining factor in the benthic communities present in the area (Kostylev, 2012).

British Geological Survey (BGS) seabed sediment data indicates that the seabed within the proposed Kyla Development area is comprised of sand and muddy sand (BGS, 2015).

The seabed imagery collected during the 2025 survey indicates that the seabed habitat in the proposed development area predominantly consists of a homogeneous sediment type, characterised by silty fine sand with varying proportions of shell fragments (Gardline, 2025a). Given the relative proportions of sand, fines and gravel, sediments were classified as poorly sorted muddy sand at all stations, except Station KB01 which was classified as poorly sorted slightly gravelly muddy sand (Gardline, 2025a).

This is similar to surveys of Bittern which found the seabed sediment to be poorly to very poorly sorted fine to very fine sand (Fugro, 2017; Fugro, 2023). Boulders have been observed at Bittern, but as sidescan sonar was not part of the Bittern survey operations, the number and location of these in the wider field area was not recorded. In addition, sidescan sonar was not carried out as part of the 2025 Kyla survey operations, therefore the number and location of any boulders present has not been quantified.

Particle Size Analysis

Most benthic organisms exhibit preferences for sediment with particular grain size characteristics. In addition, many contaminants, particularly metals and hydrocarbons, are strongly associated with finer fractions in sediment. Determination of sediment particle size across an area is therefore important to understanding the benthic community.

Sediment samples gathered from the proposed Kyla Development area were subjected to particle size analysis (PSA). The results of the PSA indicated that in the vicinity of both the proposed well location and along the proposed Kyla to Bittern pipeline route the sediment types were generally homogenous; the stations (KS01 to KS12; KB01 to KB02) were likely to be dominated by sand (mean 78.72%) with fines content also contributing significantly (mean 21.16%), this value is higher than the CNS mean background value (17.38%); gravel was absent at the majority of stations, except for station KB01 (1.6%; mean 0.11%). Sand content ranged from 71.4% to 84.1%, fines content ranged from 15.9% to 27.0%, and gravel content ranged from 0.0% to 1.6% (see Table 4.1; Gardline, 2025a, 2025b; UKOOA, 2001).

The mean particle size within the vicinity of the proposed well location and along the proposed pipeline route (KS01 to KS12; KB01 to KB02) ranged from 77 micrometre (µm) to 141 µm (very fine sand to fine sand; Wentworth, 1922), with a mean of 95.86 µm and low variability (SD 17.55) (Table 4.1; Gardline, 2025a, 2025b).

The samples collected within the vicinity of the proposed well location (KS01 to KS12) were all represented by the Folk Classification 'Muddy sand' (Folk, 1954). The samples collected along the proposed pipeline route were represented by two Folk classifications with station KB01 classified as 'Slightly gravelly muddy sand', and station KB02 is classified as 'Muddy sand' (See Table 4.1; Gardline, 2025a, 2025b). This is consistent with the sediment of the wider area that includes Kyla and Bittern.

Within the stations sampled in the wider region (KT01 to KT04), the results of the PSA also indicated that the sediment types were generally homogenous; the stations were also likely to be dominated by

sand (mean 82.04%) with fines content contributing significantly (mean 17.95%), this value is marginally higher than the CNS mean background value (17.38%); gravel was absent at all stations. Sand content ranged from 77.1% to 84.1%, and fines content ranged from 15.9% to 22.9%. The mean particle size at these stations ranged from 89 µm to 148 µm (very fine sand to fine sand; Wentworth, 1922); and all stations were represented by the Folk classification 'Muddy sand' (Folk, 1954; Gardline, 2025a, 2025b).

Previous surveys confirm that the samples taken from proposed Kyla Development area are broadly consistent with the seabed sediment types previously found. The sediments at Kyle North were found to be fine to very fine sands (average 88.33% sand, 11.59% fines and <1% coarse), with those at Kyle South being similar in composition (average 84.31% sand, 15.51% fines and <1% coarse), with fines in most samples not exceeding the CNS mean of 17.38% (Fugro, 2020; CNRI 2021). The proposed Kyla well will be located near to the Kyle South Well cluster. At Bittern, the sediments have been found to be very fine sand (mean 78.75% sand; 20.78% fines; <1.64% gravel); these values are comparable to those found at stations KB01 and KB02 along the proposed Kyla to Bittern pipeline route (Fugro, 2017; 2023; Gardline 2025a, 2025b).

Organic Matter and Organic Carbon

Determining the organic content of sediments is also important to understanding benthic communities. Organic matter is a food source for suspension and deposit feeders and its availability in the sediments can therefore influence benthic communities. An overabundance may lead to reductions in species richness, abundance and biomass (Hyland *et al.*, 2005). In addition, many contaminants are strongly associated with organic carbon.

TOM content within the vicinity of the proposed well location and along the pipeline route (KS01 to KS12; KB01 to KB02) ranged from 2.9% to 4.7% at Stations KS05 and KB01, which were identified as high outliers. With a mean TOM content of 3.8% ($\pm 0.5SD$), these concentrations were comparable to those reported by UKOOA (2001) for CNS sediment, with all but the two high outliers recording a TOM content below the 95th percentile of 4.5% (see Table 4.1; Gardline, 2025b).

TOC content within the vicinity of the Kyla Development ranged from 0.17% at Station KS03 to 0.33% at Station KS10, with a mean concentration of 0.25% ($\pm 0.04SD$) (see Table 4.1; Gardline, 2025b). These TOC concentrations were lower than the comparison survey (Fugro, 2020; CNRI, 2021).

In addition, within the stations sampled in the wider region (KT01 to KT04), the TOM ranged from 3.3% to 3.9%, with a mean of 3.6%; and the TOC ranged from 0.17% to 0.24%, with a mean of 0.21% (see Table 4.1; Gardline, 2025b). These concentrations are similar to those within the vicinity of the proposed Kyla Development area.

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Table 4.1: Summary of Sediment Characteristics (Gardline, 2025a; 2025b)

Station	Water Depth (m)	Mean Particle Diameter		TOM (%)	TOC (%)	Fractional Composition			Folk Classification
		µm	Wentworth Classification			Fines (%)	Sand (%)	Gravel (%)	
Cruciform Stations									
KS01	93	92	Very fine sand	4.0	0.23	21.8	78.2	0.0	Muddy sand
KS02	93	90	Very fine sand	3.4	0.22	21.3	78.7	0.0	Muddy sand
KS03	92	80	Very fine sand	3.3	0.17	24.3	75.7	0.0	Muddy sand
KS04	92	96	Very fine sand	2.9	0.21	22.1	77.9	0.0	Muddy sand
KS05	93	96	Very fine sand	4.7	0.26	19.9	80.1	0.0	Muddy sand
KS06	93	89	Very fine sand	3.9	0.29	20.3	79.7	0.0	Muddy sand
KS07	91	141	Fine sand	3.8	0.31	15.9	84.1	0.0	Muddy sand
KS08	92	123	Very fine sand	3.6	0.26	17.6	82.4	0.0	Muddy sand
KS09	92	108	Very fine sand	3.8	0.27	18.9	81.1	0.0	Muddy sand
KS10	93	86	Very fine sand	3.8	0.33	22.6	77.4	0.0	Muddy sand
KS11	93	93	Very fine sand	3.7	0.24	21.0	79.0	0.0	Muddy sand
KS12	94	80	Very fine sand	3.9	0.23	22.2	77.8	0.0	Muddy sand
Pipeline Routes									
KB01	93	77	Very fine sand	4.7	0.23	27.0	71.4	1.6	Slightly gravelly muddy sand
KB02	92	91	Very fine sand	3.9	0.29	21.4	78.6	0.0	Muddy sand
Stations in the Wider Region									
KT01	89	148	Fine sand	3.3	0.19	15.9	84.1	0.0	Muddy sand
KT02	89	147	Fine sand	3.5	0.17	16.2	83.8	0.0	Muddy sand
KT03	93	89	Very fine sand	3.5	0.22	22.9	77.1	0.0	Muddy sand

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Station	Water Depth (m)	Mean Particle Diameter		TOM (%)	TOC (%)	Fractional Composition			Folk Classification
		µm	Wentworth Classification			Fines (%)	Sand (%)	Gravel (%)	
KT04	91	127	Fine sand	3.9	0.24	16.8	83.2	0.0	Muddy sand
Mean		103	Very fine sand and fine sand	3.8	0.24	20.5	79.5	0.1	Muddy sand and slightly gravelly muddy sand
SD		24		0.4	0.04	3.1	3.3	0.4	
Minimum		77		2.9	0.17	15.9	71.4	0.0	
Maximum		148		4.7	0.33	27.0	84.1	1.6	
Historic Survey Data (Fugro, 2020; CNRI, 2021)									
Mean		181	Very fine to medium sand	-	0.33	13.5	86.3	0.1	Muddy sand to sand
SD		54		-	0.06	3.1	3.1	0.2	
Minimum		93		-	0.24	9.1	78.9	0.0	
Maximum		285		-	0.43	21.0	90.9	0.7	
Key:									
Above UKOOA (2001) 50 th percentile		-	-	1.63	-	17.38	-	-	-
Above UKOOA (2001) 95 th percentile		-	-	4.48	-	77.56	-	-	-

Sediment Hydrocarbons

Marine sediments can contain hydrocarbons derived from both natural (geochemical processes and biosynthesis) and anthropogenic sources (e.g. oil spills). The exceedance of background hydrocarbons levels in marine sediments can indicate past and/or present anthropogenic sources. Crude oil is a complex mixture of compounds, including n-alkanes and aromatics (e.g. polycyclic aromatic hydrocarbons; PAHs). These groups can be determined individually, but they may also be analysed as total hydrocarbons (Cefas, 2001a). A summary of the sediment hydrocarbon concentrations recorded in the proposed Kyla Development area are presented in Table 4.2.

Within the vicinity of the proposed Kyla well location and along the pipeline route the THC levels ranged from 7.5 micrograms per gram ($\mu\text{g.g}^{-1}$) to $11.4 \mu\text{g.g}^{-1}$. Overall, the mean THC concentration was $8.86 \mu\text{g.g}^{-1}$. Concentrations of THC in the Gardline (2025b) survey were higher than those recorded in the previous Kyla surveys (see Table 4.2; Fugro, 2020; CNRI, 2021) and there were no significant correlations with the analysed sediment characteristics. Within the wider region (KT01 to KT04), the THC concentrations ranged from $5.87 \mu\text{g.g}^{-1}$ at KT01 to $8.77 \mu\text{g.g}^{-1}$ at KT04, with a mean of $7.27 \mu\text{g.g}^{-1}$ (see Table 4.2; Gardline, 2025b). These concentrations are similar to those within the vicinity of the proposed Kyla Development area (Gardline, 2025b).

To put these results into a wider context, UKOOA (2001) reported a mean THC concentration of $9.51 \mu\text{g.g}^{-1}$ (n=159 stations) and a 95th percentile of $40.10 \mu\text{g.g}^{-1}$ for CNS stations. Further, a subset of stations with sandy sediments (n=115 stations) recorded a mean THC concentration of $11.13 \mu\text{g.g}^{-1}$. All stations in the current survey recorded THC concentrations below the 95th percentile and can therefore be considered consistent with background concentrations.

It has previously been shown that benthic macrofauna suffer adverse effects when THC is in excess of $50 \mu\text{g.g}^{-1}$ (Kjeilen-Eilertsen et al., 2004; UKOOA, 2002; 2005) and as such, this concentration represents the threshold above which hydrocarbons are expected to have a significant environmental impact. Kingston (1992) also previously reported that benthic macrofauna suffer adverse effects, namely reduced biodiversity, when THC is more than 50 to $60 \mu\text{g.g}^{-1}$ and that specific sensitive species may be impacted at levels greater than $10 \mu\text{g.g}^{-1}$. Mair et al. (1987) observed a noticeable increase in the dominance of opportunistic species at THC levels greater than $291.4 \mu\text{g.g}^{-1}$. The THC concentrations across the survey area were well below thresholds expected to significantly impact faunal communities but were sufficient at Stations KS01, KS03 and KS05 (located 2.3 km northeast, 1 km northeast and 531 m southwest from the proposed Kyla well respectively) to potentially affect specific sensitive species (Gardline, 2025b).

Total n-alkane concentrations within the vicinity of the proposed Kyla Development area (KS01 to KS12; KB01 to KB02) ranged from $0.205 \mu\text{g.g}^{-1}$ to $0.399 \mu\text{g.g}^{-1}$. The overall mean concentration within the vicinity of the proposed Kyla well location and pipeline route was $0.307 \mu\text{g.g}^{-1}$. Within the wider region (KT01 to KT04), total n-alkane concentrations ranged from $0.189 \mu\text{g.g}^{-1}$ to $0.254 \mu\text{g.g}^{-1}$, with an overall mean concentration of $0.213 \mu\text{g.g}^{-1}$ (see Table 4.2; Gardline, 2025b).

To put these results into a wider context, UKOOA (2001) recorded a mean total n-alkane concentration of $0.40 \mu\text{g.g}^{-1}$ (n=307 stations) and a 95th percentile of $1.18 \mu\text{g.g}^{-1}$ for CNS stations. Further, a sub-group of stations (n=206) with sandy sediments recorded a mean total n-alkane concentration of $0.38 \mu\text{g.g}^{-1}$. As all concentrations were below the UKOOA (2001) CNS 95th percentile, they can be considered consistent with the wider area.

The ratio of odd to even numbered n-alkanes within the High Molecular Weight (HMW) range nC₂₆-nC₃₀, commonly referred to as the carbon preference index (CPI; Farrington & Tripp, 1977), can provide further insight into the origins of alkanes in marine sediments. Marine sediments containing high levels of biogenic (odd carbon number) n-alkanes are known to have CPI values of ≥ 2.0 , with values ≥ 4.0 suggesting a virtual absence of petrogenic hydrocarbons (McDougall, 2000). CPI values close to 0 indicate a predominance of petrogenic hydrocarbons.

Within the vicinity of the proposed Kyla Development area (KS01 to KS12; KB01 to KB02) and the wider region (KT01 to KT04), stations were dominated by odd-numbered HMW n-alkanes and presented the highest peaks at nC₂₉ and nC₃₁. This profile is characteristic of low-level sedimentary biogenic hydrocarbons from a higher terrestrial plant waxes and marine macrophytes (Bouloubassi et al., 2001;

Zhang et al., 2024; Gardline, 2025b). The Low Molecular Weight (LMW) n-alkanes (n_{C10-20}) accounted for 6 to 16% of the total n-alkanes with peaks observed at n_{C15} , n_{C17} and n_{C19} , which is consistent with phytoplankton (Zhang et al., 2024; Gardline, 2025b). Within this area, CPI values ranged from 1.8 to 2.9 and suggested a biogenic input with some presence of petrogenic hydrocarbons. Within the wider region (KT01 to KT04) CPI values were similar to those within the proposed Kyla Development area, ranging from 1.8 to 2.4 (see Table 4.2; Gardline, 2025b).

Pristane to phytane (types of n-alkane) ratios can also provide information on the relative contribution of biogenic hydrocarbon sources. Pristane is primarily biogenic in origin, whilst phytane is rarely produced biogenically and, in the natural environment, it is generally absent or only present at low concentrations (McDougall, 2000). A lower pristane to phytane ratio indicates both biogenic and petrogenic sources of n-alkanes, whilst high ratios indicate a dominance of biogenic sources for the n-alkanes.

Pristane to phytane ratios within the proposed Kyla Development area ranged from 2.0 to 8.8, which is significantly lower than those recorded in the pre-decommissioning survey at the historic Kyle field (see Table 4.2; Gardline, 2025b; Fugro, 2020; CNRI, 2021), due to lower pristane concentrations. Ratios at all stations were ≥ 2.0 , indicating the presence of primarily biogenic hydrocarbons. Within the wider region (KT01 to KT04), pristane to phytane ratios ranged from 1.2 to 18.7, which is also lower than those recorded in the comparison survey (see Table 4.2; Gardline, 2025b; Fugro, 2020; CNRI, 2021), due to lower pristane concentrations. Ratios at all of these stations excluding Station KT02 were ≥ 2.0 , indicating the presence of primarily biogenic hydrocarbons, with a greater petrogenic input at Station KT02 (Gardline, 2025b).

PAHs are largely formed by the incomplete combustion of organic matter. This includes the combustion of organic material such as forest fires (Youngblood and Blumer, 1975), the burning of fossil fuels and, in the case of offshore oil fields, flare stacks. Within the vicinity of the proposed Kyla well location and pipeline route (KS01 to KS12; KB01 to KB02), total PAH concentrations ranged from $0.151 \mu\text{g.g}^{-1}$ to $0.418 \mu\text{g.g}^{-1}$, with a mean of $0.218 \mu\text{g.g}^{-1}$. Total naphthalenes, phenanthrenes and dibenzothiophenes (NPDs) concentrations ranged from $0.017 \mu\text{g.g}^{-1}$ to $0.052 \mu\text{g.g}^{-1}$ with a mean of $0.027 \mu\text{g.g}^{-1}$ (see Table 4.2; Gardline, 2025b). Within the wider region (KT01 to KT04), total PAH concentrations ranged from $0.087 \mu\text{g.g}^{-1}$ to $0.141 \mu\text{g.g}^{-1}$, with a mean of $0.115 \mu\text{g.g}^{-1}$. Total NPD concentrations ranged from $0.013 \mu\text{g.g}^{-1}$ to $0.021 \mu\text{g.g}^{-1}$ with a mean of $0.018 \mu\text{g.g}^{-1}$ (see Table 4.2; Gardline, 2025b).

In a wider context, UKOOA (2001) reported a mean total PAH concentration of $0.287 \mu\text{g.g}^{-1}$ for CNS stations with a 95th percentile of $0.899 \mu\text{g.g}^{-1}$, whilst the average NPD concentration was $0.105 \mu\text{g.g}^{-1}$ with a 95th percentile of $0.316 \mu\text{g.g}^{-1}$. Concentrations of total PAHs and NPD at all stations were consistent with their respective UKOOA (2001) means.

Available data also suggests that there is limited hydrocarbon contamination at Bittern, with values similar to those within the proposed Kyla Development area (Fugro, 2017; Fugro 2023).

Table 4.2: Summary of Seabed Sediment Hydrocarbon (Gardline, 2025b)

Station	Water Depth (m)	THC ($\mu\text{g}\cdot\text{g}^{-1}$)	Total n-alkanes ($\mu\text{g}\cdot\text{kg}^{-1}$)	CPI	Pristane/Phytane Ratio	Total PAHs ($\mu\text{g}\cdot\text{g}^{-1}$)	NPD ($\mu\text{g}\cdot\text{g}^{-1}$)
Cruciform Stations							
KS01	93	10.02	0.348	2.3	5.5	0.182	0.028
KS02	93	9.9	0.297	2	4.7	0.191	0.03
KS03	92	11.02	0.385	2.3	4.8	0.219	0.034
KS04	92	9.88	0.318	2	5	0.191	0.028
KS05	93	11.4	0.399	2.9	3.6	0.248	0.036
KS06	93	7.8	0.205	2.4	4.3	0.15	0.021
KS07	91	7.84	0.303	2	3.8	0.156	0.019
KS08	92	8.62	0.247	2.7	5.3	0.153	0.023
KS09	92	9.12	0.282	2	6.4	0.286	0.052
KS10	93	9.76	0.305	2.4	7.4	0.418	0.025
KS11	93	8.93	0.309	1.8	2	0.384	0.021
KS12	94	7.5	0.264	2.8	6.3	0.155	0.017
Pipeline Routes							
KB01	93	9.57	0.333	2.5	4.7	0.167	0.026
KB02	92	9.09	0.303	2	8.8	0.151	0.022
Stations in the Wider Region							
KT01	89	5.87	0.189	2.1	4.7	0.087	0.013
KT02	89	6.21	0.201	2.4	1.2	0.141	0.021
KT03	93	8.22	0.207	1.8	18.7	0.105	0.016
KT04	91	8.77	0.254	1.8	12	0.125	0.02
Mean		8.86	0.286	2.2	6.1	0.195	0.025
SD		1.47	0.061	0.3	4.0	0.089	0.009
Minimum		5.87	0.189	1.8	1.2	0.087	0.013
Maximum		11.40	0.399	2.9	18.7	0.418	0.052
Historic Survey Data (Fugro, 2020)							
Mean		4.22	-	-	14.0	-	-
SD		2.48	-	-	6.8	-	-
Minimum		2.3	-	-	3.0	-	-
Maximum		13.0	-	-	31.0	0.23	0.045
Key:							
Above UKOOA (2001) Mean		9.51	0.4	2.0	-	0.287	0.105
Above UKOOA (2001) 95 th percentile		40.10	1.18	2.79	-	0.899	0.316

Heavy and Trace Metals

Heavy metals such as copper (Cu), Pb and Zn, are generally persistent and have a tendency to bioaccumulate in the tissues of exposed organisms, particularly species living on or within the seabed sediments, where they can have toxicity impacts on the receptor and subsequently become concentrated through higher levels of the food web. Metal concentrations in uncontaminated marine sediments generally exceed those found in overlying seawater by three to five orders of magnitude, since the buffering effects of saline water cause many metals to be rapidly precipitated out of seawater (Bryan and Langston, 1992).

Ba can be an important element in the detection of localised anthropogenic sediment pollution. It is often used in the form of barite (barium sulphate) as a weighting agent in drilling fluids. Barite is predominantly insoluble in oxic seawater, although it may be mobilised under anoxic conditions and therefore can provide a useful indication of drilling mud dispersion since discharge. Table 4.3 presents a summary of total heavy and trace metal analysis from the Kyla environmental baseline survey.

Within the vicinity of the proposed Kyla well location and pipeline route (KS01 to KS12; KB01 to KB02), concentrations of Ba following Hydrofluoric acid (HF) digest ranged from $421 \mu\text{g.g}^{-1}$ to $8,190 \mu\text{g.g}^{-1}$, with a mean of $1,773 \mu\text{g.g}^{-1}$ (see Table 4.3; Gardline, 2025b). Within the wider region (KT01 to KT04), concentrations of Ba ranged from $111 \mu\text{g.g}^{-1}$ to $6,510 \mu\text{g.g}^{-1}$ with a mean concentration of $2,419 \mu\text{g.g}^{-1}$ (see Table 4.3; Gardline, 2025b). These concentrations were similar to those previously recorded within the Kyla Development area (decommissioned Kyle field) (Fugro, 2020).

To put these results into a wider context, the Kyla Development area mean for Ba was above that of the CNS UKOOA (2001) background stations ($348 \mu\text{g.g}^{-1}$; $n=164$ stations), and above the 95th percentile ($720 \mu\text{g.g}^{-1}$) with individual values below the 95th percentile only recorded at Stations KS02, KS06 and KS07. Concentrations of Ba can therefore be considered above the background levels for the area. Furthermore, Neff (2004) suggested that sediments not contaminated by drilling cuttings may contain Ba concentrations of up to $2,000 \mu\text{g.g}^{-1}$, a concentration that was exceeded at Station KS08 (located 935 m from the closest historic well), but most notably at Stations KS10 and KS12 (located 287 m and 1,489 m from the closest historic wells respectively) (Gardline, 2025b). There were no significant correlations with the analysed sediment characteristics or hydrocarbon concentrations.

The Kyla Development is a redevelopment of the decommissioned Kyle field. Drilling history at the Kyla field suggests that discharges of oil-based drilling muds and synthetic based drilling muds occurred during the 1990s and 2000s, with the cuttings pile at the field previously estimated to cover ca. 0.0043 km^2 (Fugro, 2020). As concentrations of Ba are known to remain elevated for long periods after the discharge of drilling fluids (Ellis et al., 2012a), this may explain the high concentrations recorded at Stations KS10 and KS12. The Fugro (2020) comparison survey also reported that total barium concentrations indicated some dispersion of drilling muds around two drill centres surveyed within the Kyla field. However, the cuttings piles were not observed in camera footage during the Kyle pre-decommissioning survey (Fugro, 2020).

Of the eight other analytes, within the vicinity of the proposed well location and pipeline route (KS01 to KS12; KB01 to KB02), four (As, Cr, Pb, and Ni) also recorded the highest concentrations at Station KS10 and Pb concentrations at Station KS10 were identified as a high outlier and Cd at Station KS12 (Gardline, 2025b). Within the wider region (KT01 to KT04), high outlier concentrations of Cu were identified at Station KT01.

More widely, concentrations of these eight metals were below their respective UKOOA (2001) 95th percentile for CNS background stations other than Pb at Stations KS10, KS12 and KT01 and Zn at Stations KS08, KS12, KT01, KT02 and KT03. This suggests that the metal concentrations can be considered consistent with background for sediments in the wider area with some localised elevation in Pb and Zn.

With the exception of Ba, concentrations of all analytes were higher than those recorded in the comparison survey (Fugro, 2020). This is likely due to the differing extraction methods used; the comparison survey (Fugro, 2020) used aqua regia extraction which is a weaker solvent than hydrofluoric acid used in the current survey. Cd, Cu, Hg, Pb and Zn exceeded their respective Background Concentration (BC) values at several stations, with the survey average for Pb also above Background

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Assessment Criteria (BAC). This further suggests that concentrations of Pb across the survey area are above background.

All metal concentrations were below their respective ERL (Long et al., 1995), except Pb at Station KS10, located 417 m southeast of the proposed Kyla well, and KT01 which is located 2.7 km northeast of the proposed Kyla Development, which exceeded the ERL but were below the ERM. All other concentrations were below their respective AETs, indicating that adverse effects on fauna were unlikely to occur (see Table 4.3; Gardline, 2025b).

At Bittern higher levels of barium were recorded along with higher concentrations of chromium and zinc, reflecting the localised influence of drilling (Fugro, 2023). Elevated barium levels were also recorded at the historic Kyle North and South drill centres during the pre-decommissioning survey, consistent with the drilling of wells at these locations (Fugro, 2020; CNRI, 2021).

Table 4.3: Total Heavy and Trace Metal Concentrations ($\mu\text{g.g}^{-1}$) (Gardline, 2025b)

Station	Depth (m)	Al	As	Ba	Cd	Cr	Cu	Pb	Hg	Ni	Li	Zn
Cruciform Stations												
KS01	93	25300	6	650	0.05	24.8	4.4	14.1	<0.01	8.6	15.9	28.5
KS02	93	25300	5.3	548	0.05	23.9	3.9	12.5	<0.01	7.7	15.4	21.4
KS03	92	27600	5.3	782	0.06	26.9	4.5	13.9	<0.01	8.6	17.6	23.8
KS04	92	27700	4.7	749	0.05	24.3	4.6	13	<0.01	8.3	17.8	22
KS05	93	29500	4.4	886	0.07	27.2	4.7	15.6	<0.01	8.8	18.6	23.9
KS06	93	26400	4.2	431	0.06	24.2	5.3	12.9	<0.01	8.5	15.8	40.8
KS07	91	23900	5.2	421	0.04	20.6	3.7	11.9	<0.01	7	14.1	19.2
KS08	92	27200	6.5	1980	0.08	20.4	4.6	19.6	<0.01	7.5	15.9	70.3
KS09	92	26000	6.2	1620	0.06	26.1	5.7	22.2	0.05	8.8	16.3	25.1
KS10	93	26300	7.8	8190	0.12	27.8	7.6	64.8	0.04	9.7	17.5	42.8
KS11	93	28300	4.8	840	0.06	25.2	4.3	13.9	<0.01	8.2	17.6	23.2
KS12	94	23900	5.3	5940	0.19	25.9	5.8	38.2	<0.01	9	14.9	49
Pipeline Route												
KB01	93	25300	5.4	805	0.07	24.6	5.5	14.5	<0.01	9.2	16.4	27.1
KB02	92	24400	4.3	975	0.05	23.9	4.6	14.1	<0.01	8.2	15.6	24.9
Stations in the Wider Region												
KT01	89	25100	7.1	6510	0.12	24.5	17	48.9	0.05	8.9	15.8	74.5
KT02	89	21900	5.3	2700	0.07	22	10.2	19.7	0.04	6.9	12.1	46.5
KT03	93	24600	4.4	111	0.07	22	4.3	13.5	0.02	7.2	14.8	65.5
KT04	91	21300	4.4	356	0.05	18.8	3.3	11.6	<0.01	6.6	11.4	19.2
Mean		25556	5.4	1916	0.07	24.1	5.8	20.8	-	8.2	15.8	36.0
Standard Deviation		2109	1.0	2400	0.04	2.5	3.2	14.7	-	0.9	1.9	18.3
Minimum		21300	4.2	111	0.04	18.8	3.3	11.6	<0.01	6.6	11.4	19.2
Maximum		29500	7.8	8190	0.19	27.8	17.0	64.8	0.05	9.7	18.6	74.5
Historic Survey Data (Fugro, 2020)												
Mean		4179	4.0	690	-	14.7	1.7	7.8	-	4.7	5.2	12.6
Standard Deviation		985	0.6	971	-	1.8	0.6	1.4	-	1.0	1.3	2.8

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Station	Depth (m)	Al	As	Ba	Cd	Cr	Cu	Pb	Hg	Ni	Li	Zn
Minimum		2420	3.1	74	<0.08	11.8	1.0	6.2	<0.04	3.3	3.2	8.4
Maximum		6660	5.7	3600	<0.08	19.4	3.8	11.8	0.05	7.2	8.4	20.1
Reference Values												
UKOOA (2001) CNS 50th %ile		-	-	348	0.76	23.9	6.3	12.6	0.17	11.5	-	21.3
Above UKOOA (2001) CNS 95 th percentile		-	-	720	1.0	54.0	18.0	26.8	0.58	21.8	-	43.4
OSPAR ERL (Long et al., 1995)		-	8.2	-	1.2	81	34	46.7	0.15	20.9	-	150
OSPAR ERM (Long et al., 1995)		-	70	-	9.6	370	270	218	0.71	51.6	-	410
AET (Buchman, 2008)		18000	35.0	-	3.0	62.0	390.0	400.0	0.41	110.0	-	410.0

¹ Values in **Bold** are greater than Long et al. (1995) ERL values

Note: Al = Aluminium, As = Arsenic, Cd = Cadmium, Cr = Chromium, Hg = Mercury, Ni = Nickel, Li = Lithium.

4.2.3 Hydrography and Metocean Conditions

Currents and Tides

The CNS is influenced by the NAC, which transports warm subtropical water into the wider North Sea (DESNZ, 2022). The currents broadly follow the 200 m depth contour to the north of the Shetland Islands after which they travel southwards along the western shelf edge. The tidal currents in the CNS area are generally weak and are readily influenced by other factors such as winds and density driven circulation. This results in a relatively atypical pattern to the tidal currents. Modelled data indicates tidal rates are 0.007 metres per second (ms^{-1}) and 0.054 ms^{-1} for neap and spring peak flows respectively (ABPMer 2008).

Significant Wave Height

Wave conditions in the North Sea are strongly influenced by seasonal changes, with maximum wave heights peaking around January, although extreme waves may also be encountered at other times, most notably between November and March. The North Sea is generally more sheltered than the Western Isles, however, localised North Sea storms and swells can result in relatively large wave heights (DESNZ, 2022). Wave direction is predominantly from the west and south-west. Annual mean significant wave height in the vicinity of the proposed development area is approximately 2.11 m to 2.4 m (NMPI, 2025).

Wind Regime

Wind speed and direction directly impacts the transport and dispersion of atmospheric emissions, and indirectly marine discharges through wind effects on surface currents. It can also influence vessel and helicopter support requirements to offshore operations. In this region of the CNS, prevailing winds are from the south-west and north-north-east. South and south-easterly winds may become established for as long as several weeks if an anticyclone develops over Europe (DESNZ, 2022; UKHO 2013). Wind strengths in winter are typically in the range of Beaufort scale 4-6 ($6\text{--}11 \text{ ms}^{-1}$) with higher winds of force 8-12 ($17\text{--}32 \text{ ms}^{-1}$) being much less frequent. Winds of force 5 (8 ms^{-1}) and greater are recorded 60-65% of the time in winter and 22-27% of the time in summer. In April and July, winds in the open, central to northern North Sea, are highly variable and there is a greater incidence of north-westerly winds (DESNZ, 2022).

Temperature and Salinity

The CNS is more saline than the SNS due to the absence of receiving significant freshwater input from rivers along its eastern boundary unlike the SNS. Annual mean surface salinity in the vicinity of the proposed Kyla Development area ranges from 35.1 parts per thousand (‰) to 34.8 ‰, while annual mean near seabed salinity ranges from 35.1‰ and 34.9‰ (NMPI, 2025). Monthly mean surface temperatures in the vicinity of the proposed Kyla Development area range from 5.8 Degrees Celsius (°C) to 14.7°C, while Monthly mean near seabed temperatures range from 6.0°C to 9.3°C (NMPI, 2025).

4.2.4 Climate Change and GHG Emissions

The DESNZ supplementary guidance for assessing the effects of downstream scope 3 emissions on climate from offshore oil and gas projects (DESNZ, 2025c), requires a global baseline scenario of greenhouse gases to be presented in the ES.

Over recent decades, scientific consensus has confirmed that the Earth's climate is undergoing significant change, largely driven by anthropogenic (human induced) GHG emissions (IPCC, 2023; IPCC, 2019a; WMO, 2023; WMO, 2019; UNEP; 2024).

A variety of robust up-to-date data sources have been examined for this section of the ES to characterise the current state of global GHG emissions in the atmosphere (expressed in carbon dioxide equivalent (CO₂e)¹ where available), analyse historical trends, review effects and look at future projections, including:

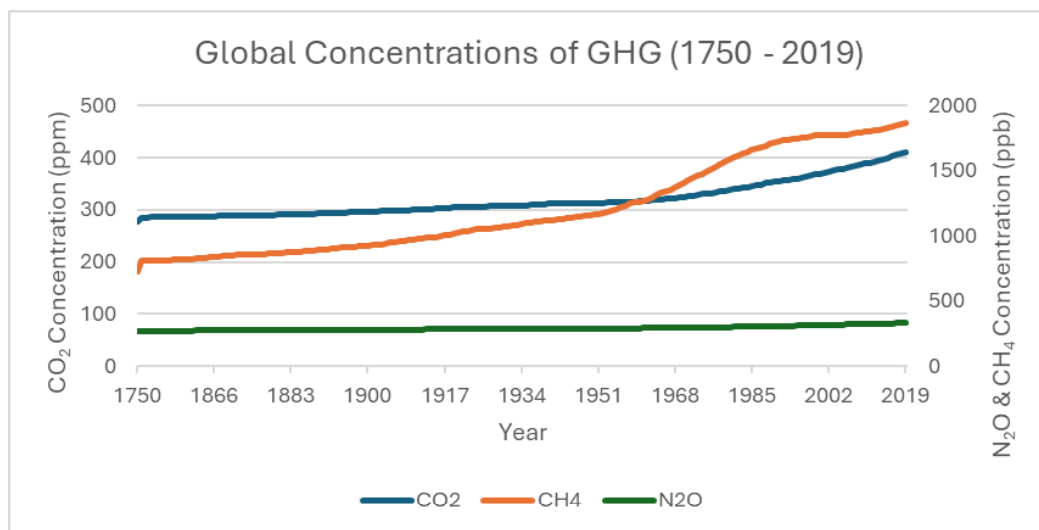
- The Intergovernmental Panel on Climate Change (IPCC) – Sixth Assessment Report 'AR6' (IPCC, 2023)
- United Nations Environment Programme (UNEP) – Emissions Gap Report 2024 (UNEP, 2024)
- Emissions Database for Global Atmospheric Research (EDGAR) (EDGAR, 2025)
- World Meteorological Organization (WMO) – WMO Greenhouse Gas Bulletin (WMO, 2023)
- National Oceanic and Atmospheric Administration (NOAA) – Global Monitoring Laboratory measurements (Lan et al., 2025)
- *Indicators of Global Climate Change 2024* (Forster et al., 2025)

Global GHG Emissions - Current Status, Trends and Effects

Since 1850, human activities, including the combustion of fossil fuels, land-use change, and industrial activity have resulted in rapidly increasing concentrations of GHGs in the atmosphere, most notably CO₂, CH₄ and N₂O (Figure 4.3). Global mean concentrations for well-mixed GHGs (CO₂, CH₄ and N₂O) in 2019 correspond to increases of about 47%, 156%, and 23%, respectively, above the levels in 1750 (representative of the pre-industrial era) (high confidence) (IPCC, 2023). This has unequivocally caused global warming.

¹ CO₂e is a metric used to express the impact of different greenhouse gases in terms of the amount of carbon dioxide that would produce the same global warming effect.

Figure 4.3: Global GHG Emissions from 1750 to 2019 ^{N1}



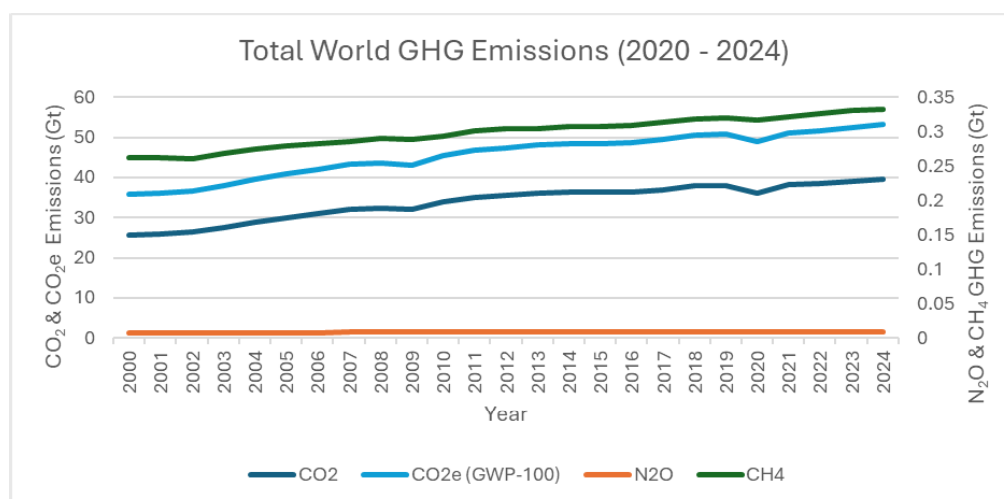
^{N1} Data obtained from IPCC (2023) Working Group 1 (WG1) Sixth Assessment Report (AR6) Annex III Extended Data

Over the past two decades (2000–2020), CO₂ emissions to the atmosphere from the burning of fossil fuels generally have risen year-on-year, starting at 6.8 petagrams (Pg) of carbon² per year in 2000 and reaching a maximum of 10.1 Pg of carbon in 2019 (Jacobson, 2023).

Over the period 2014–2023, it is estimated that the annual release rate of GHG emissions into the atmosphere averaged 53.6 ± 5.2 Gigatons (Gt)³ CO₂e per year (Forster et al., 2025), with the latest data from EDGAR (2025) indicating that 53.2 Gt CO₂e was released in 2024 (Figure 4.4; EDGAR, 2025). In 2024, global energy-related GHG emissions reached 42.6 Gt CO₂e (IEA, 2025).

In 2023, global GHG emissions set a new record of ca. 57.1 Gt CO₂e (UNEP, 2024), a 1.3% increase (0.7 GtCO₂e) from 2022 levels, with the power sector (i.e. fossil fuel combustion to generate electricity and heat in power plants) the largest global contributor to emissions at 15.1 GtCO₂e, followed by transport (8.4 GtCO₂e), agriculture (6.5 GtCO₂e) and industry (i.e. fossil fuel combustion to drive on-site industrial processes, such as heating furnaces) (6.5 GtCO₂e). The 1.3% increase in emissions above 2022 levels, is higher than the average rate in the decade preceding the COVID-19 pandemic (2010–2019), when GHG emissions growth averaged 0.8% per year (UNEP, 2024).

Figure 4.4: Total Global GHG Emissions by CO₂, N₂O, CH₄ and CO₂e (GWP-100 'AR5') ^{N1}



^{N1} Data obtained from EDGAR (2025) GHG total datasets (1974 – 2024), represented to show Gt of GHG, manipulated from base unit of Gg, to show period 2000 – 2024 (the past two decades).

² One petagram of carbon is equal to one billion metric ton of carbon or 3.67 billion metric ton of CO₂.

³ One gigaton is equivalent to one billion metric tons (1,000,000,000 tons)

The effects of climate change have been observed both quantitatively, i.e. global mean surface temperature rise, sea level rise, ocean heat content, sea ice extent; and qualitatively, i.e. coral bleaching, extreme weather patterns, seasonal shifting, and migratory species changes (IPCC, 2023; 2019a; 2019b). Global surface temperature averaged over the decade 2011-2020 was 1.1°C warmer than the 1850-1900 average and the past ten years (2015-2024) were the warmest ten years on record (Met Office, 2025). Over the past two decades, the rate of ocean warming has increased to 0.66 ± 0.10 watts per square metre (W/m^2), with global mean sea level increasing by 0.20 m between 1901 and 2018 (IPCC, 2023; IOC-UNESCO, 2024). The ocean has also absorbed enough CO_2 to lower its pH by 0.1 units, a 30% increase in acidity (Lindsey, 2025).

Projected Global GHG Emissions and Possible Future Climate Scenarios

Over the life of the Kyla Development (2028 up to 2035), the quantity of global GHGs affecting climate will be subject to both natural and anthropogenic change. In nearly all considered scenarios and modelled pathways, global warming is predicted to continue to increase in the near term (2021–2040) mainly due to increased cumulative CO_2 emissions (IPCC, 2023).

The UNFCCC is an international agreement that commits countries to efforts to stabilise GHG concentrations to prevent dangerous, human-induced climate change. The COP is the main decision-making body of the UNFCCC. In 2015, COP21 created the Paris Agreement, a global treaty that commits countries to limit global average temperature to well below 2°C above preindustrial levels and pursuing efforts to limit temperature increase to 1.5°C above preindustrial levels. At the heart of the Paris Agreement are NDCs, which embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. Each country must submit a NDC to the UNFCCC secretariat every five years.

The Paris Agreement's GST process is designed to evaluate progress on climate action at the global level every five years. The first-ever GST, which concluded at COP28 in December 2023, highlighted that whilst progress has been made since the Paris Agreement — global temperatures are now expected to rise by 2.4-2.6°C by the end of the century, compared to 3.7-4.8°C in 2010 — the world is still not on track to limit global warming to 1.5°C (CCC, 2024). It concluded that to keep 1.5°C in reach, deep rapid and sustained reductions in global GHG emissions are required (43% by 2030 and 60% by 2035 from 2019 levels, aiming for net zero CO_2 by 2050). Following this at COP29 in November 2024, the global community acknowledged that the world is already crossing critical temperature thresholds — 2024 is expected to mark the first year that the global average temperature exceeds 1.5 °C above pre-industrial levels. (CCC, 2024).

The GST process was informed by the IPCC AR6 cycle, completed in July 2023. AR6 defines a core set of five illustrative Shared Socio-economic Pathways (SSP) scenarios combined with Representative Concentration Pathways (RCP) scenarios — SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5. The SSP-RCP scenarios combine baseline socio-economic narratives (the SSPs; SSP1 to SSP5⁴), which incorporate assumptions about future socioeconomic developments (e.g. population growth, economic trends, and technological advancements), with different emissions trajectories informed by the RCP scenarios⁵ which impose a level of radiative forcing in 2100, corresponding to a related level of global warming (refer to Table 4.4).

⁴ Five pathways have been developed by the international scientific community — sustainable development (SSP1), middle-of-the-road development (SSP2), regional rivalry (SSP3), inequality (SSP4) and fossil-fuelled development (SSP5).

⁵ RCP scenarios were defined in the IPCC's fifth assessment reporting cycle (AR5) and show how GHG concentrations can affect global temperatures. For example, RCP 8.5 represents a high-emissions pathway, while RCP 2.6 assumes strong mitigation efforts.

Table 4.4: Shared Socioeconomic Pathways and Changes in Global Surface Temperatures (IPCC, 2023)

GHG Emissions Scenario ^{N1}	Description	Change in Global Surface Temperature (°C) ^{N2}			Key Assumptions
		Best Estimate [and very likely range]			
		Near term (2021 – 2040)	Mid-term (2041 – 2060)	Long-term (2081 – 2100)	
SSP1-1.9 (Very Low)	limit warming to 1.5°C (>50%) with no or limited overshoot	1.5 [1.2 to 1.7]	1.6 [1.2 to 2.0]	1.4 [1.0 to 1.8]	Rapid decarbonisation, societies switch to more sustainable practices, inequality falls. Net zero CO ₂ achieved in ca. 2050.
SSP1-2.6 (Low)	limit warming to 2°C (>67%)	1.5 [1.2 to 1.8]	1.7 [1.3 to 2.2]	1.8 [1.3 to 2.4]	Socioeconomic shifts towards sustainability, but reduction in CO ₂ emissions is slower than SSP1-1.9. Net zero CO ₂ achieved in ca. 2070.
SSP2-4.5 (Intermediate)	limit warming to 3°C (>50%)	1.5 [1.2 to 1.8]	2.0 [1.6 to 2.5]	2-7 [2.1 to 3.5]	Current policies continue. Slow progress toward sustainability and development and income grow unevenly. CO ₂ emissions hover around current levels before starting to fall mid-century. Net zero CO ₂ is not achieved by 2100.
SSP3-7.0 (High)	limit warming to 4°C (>50%)	1.5 [1.2 to 1.8]	2.1 [1.7 to 2.6]	3.6 [2.8 to 4.6]	Fragmented, high fossil use, inequality. CO ₂ emissions roughly double from current levels by 2100
SSP5-8.5 (Very High)	exceed warming of 4°C (>50%)	1.6 [1.3 to 1.9]	2.4 [1.9 to 3.0]	4.4 [3.3 to 5.7]	Rapid economic growth without mitigation, fuelled by exploiting fossil fuels and energy-intensive lifestyles. Current CO ₂ emissions roughly double by 2050.

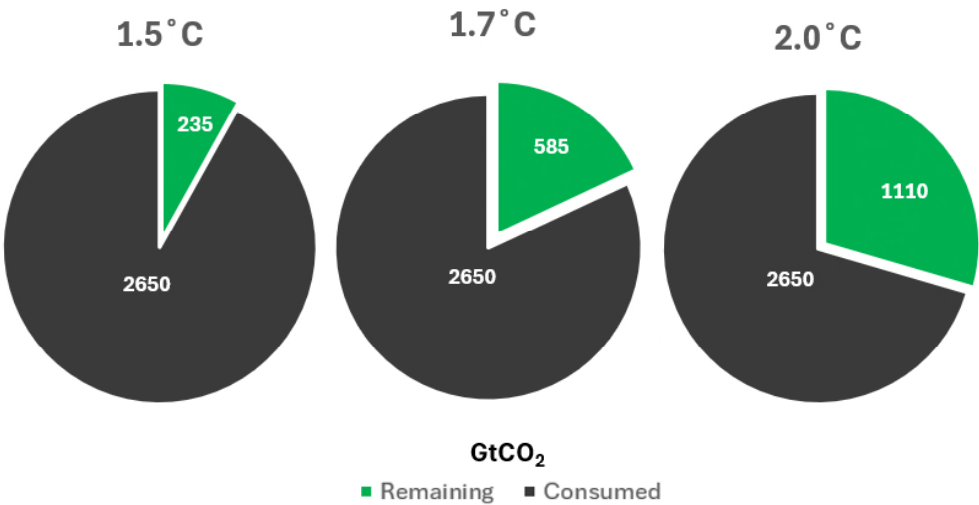
^{N1} Scenarios relate to SSPs + “forcing”, where the number refers to the radiative forcing level in W/m² in the year 2100. For example, ‘SSP1-1.9’ is a scenario that combines SSP1 with 1.9 W/m² radiative forcing in 2100 (RCP1.9)

^{N2} Temperature differences relative to the average global surface temperature of the period 1850-1900.

Remaining Global Carbon Budget

The Global Carbon Project produces an annual Global Carbon Budget (GCB), which tracks the trends in global carbon emissions and sinks and is a key measure of the progress towards the goals of the Paris Agreement. The 2024 GCB projects fossil CO₂ emissions of 37.4 Gt CO₂⁶, up 0.8% from 2023 and concludes that there are no clear signs that the world has reached a peak in fossil CO₂ emissions. If current trends continue, from January 2025, the remaining carbon budget for a 50% likelihood to limit global warming to 1.5°C, 1.7°C and 2°C has respectively been estimated at 235 Gt CO₂ (which would be exceeded in 6 years at 2024 emissions levels), 585 Gt CO₂ (14 years) and 1,110 Gt CO₂ (27 years) (Figure 4.5; GCP, 2024). For comparison, for the period 1850–2019, a total of 2,390 ± 240 Gt CO₂ has been emitted (IPCC, 2021).

Figure 4.5: Remaining Carbon Budget (GCP, 2024) ¹



¹ Data represented from GCP (2024). Data represents 50% likelihood to achieve SSP.

4.3 Biodiversity

4.3.1 Plankton

The collective term plankton describes the plants (phytoplankton) and animals (zooplankton) that live freely in the water column and drift passively with the water currents. Plankton form the base of the food chain, therefore changes in the abundance and composition of the planktonic community can have impacts on higher consumers. Typically, on the Scottish continental shelf, a phytoplankton bloom occurs every spring, generally followed by a smaller peak in the autumn (DESNZ, 2022).

This region is influenced by the warm waters of the continental shelf current and the currents entering the North Sea from the north-east Atlantic and the Norwegian Sea (JNCC, 2004). The phytoplankton community in these waters is dominated by the dinoflagellate genus *Tripos* (mainly *T. fusus*, *T. furca* and *T. muelleri*), with diatoms such as *Thalassiosira* spp. and *Chaetoceros* spp. also abundant to the west of Scotland, diatoms such as *Rhizosolenia* spp. and *Fragillariopsis* spp. and coccolithophores increase in abundance towards the shelf edge, while dinoflagellates such as *Prorocentrum*, *Gymnodinium* and *Scyriopsis* are also abundant in late summer (DESNZ, 2022).

The zooplankton communities are dominated in terms of biomass and productivity by calanoid copepods, particularly *Calanus* spp. (*finmarchicus* and *helgolandicus*), *Paracalanus* spp. and *Pseudocalanus* spp. Meroplanktonic echinoderm larvae and decapod larvae are also abundant. Other

⁶ Global fossil CO₂ emissions include the cement carbonation sink.

important taxa in the region include *Acartia spp.*, *Evadne spp.*, *Oithona spp.* and *Metridia lucens* (DESNZ, 2022).

4.3.2 Seabed Communities

The benthos refers to the animals (and plants where light levels are sufficient) that live on or within the seabed. Animal communities are divided at a basic level into infauna and epifauna. Infauna consists of mainly of animals that burrow into the sediment or form tubes in it, generally representing the larger component of benthic communities. Those species which live on, as opposed to in, the seabed including those attached to rocks or other animals are known as epifauna.

Habitat Classification

Data from the European Marine Observation and Data Network (EMODnet) broad-scale seabed habitat map for Europe (EUSeaMap2), indicates that the proposed Kyla Development area is located within the following European Nature Information System (EUNIS) habitat classifications (see Figure 4.6 and EMODnet, 2021; EEA, 2022):

- Offshore circalittoral sand (MD5) – these habitats are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms;
- Offshore circalittoral mud (MD6) – these habitats are quite diverse featuring a variety of faunal communities depending upon the level of silt/clay and organic matter in the sediment. Communities are typically dominated by polychaetes but often with high numbers of bivalves such as *Thyasira spp.*, echinoderms and foraminifera.

The habitat investigation undertaken for Kyla used a combination of field observations, detailed review of photographic data and analysis of sediment samples to identify the habitat types across the survey area (Gardline, 2025a).

Biotope classification following the EUNIS hierarchy was primarily based on seabed imagery, depth and PSA. All stations, including those in the wider region (KT01 to KT04) were classified to the level four EUNIS biotope complex MD621: Faunal communities of Atlantic circalittoral mud. Additionally, Stations KS01, KS04 and KS08 were classified further to level five as EUNIS biotope MD6216: Seapens and burrowing megafauna in Atlantic circalittoral fine mud, reflecting the presence of sea pens and/or faunal burrows in the majority of the images at these stations (Gardline, 2025a).

Faunal communities of Atlantic circalittoral mud (MD621)

Example seabed images of the EUNIS habitat type ‘Faunal communities of Atlantic circalittoral mud’ (MD621); which were observed on all transects within the Kyla Development survey area, including stations in the wider region (KT01 to KT04); are presented in Figure 4.8 and Figure 4.9. Generally, the seapens *Virgularia mirabilis* and *Pennatula phosphorea* are characteristic of this habitat type together with the burrowing anemone *Cerianthus lloydii* and the ophiuroid *Amphiura* spp. The relatively stable conditions often lead to the establishment of communities of burrowing megafaunal species, such as *Nephrops norvegicus* (EEA, 2022).

The most commonly observed fauna on the seabed photographs and video were the seapens *Pennatula phosphorea*. Fauna including crabs and shrimp (*Paguroidea* spp. and *Caridea* spp.), faunal turf (Hydrozoa/Bryozoa), *Pleuronectiforme* spp., molluscs (*Naticidae* spp., *Nudibranchia* spp.), hermit crab fur (*Hydractinia echinata*) and sea pens (*Funiculina quadrangularis*, *Virgularia* spp.) were also widely seen. Other, less regularly observed fauna included fish species (*Actinopterygii* spp., *Glyptocephalus cynoglossus*, *Callionymus lyra*, *Myxine glutinosa*, *Microstomus kitt*), mollusc species (*Pseudamussium peslutrae*, Scaphopoda spp., Anomiidae spp., *Buccinum undatum*), cnidaria (*Alcyonium digitatum*, *Lytocarpia myriophyllum*, *Hormanthia digitata*, Anthozoa spp.), arthropods (*Atelecyclus rotundatus*, Galatheididae spp., *Nephrops norvegicus*), sponges (*Porifera* spp.) and annelids (*Annelida* spp.). Faunal turf and burrows were also present at the majority of stations (Gardline, 2025a).

Seapens and burrowing megafauna in Atlantic circalittoral fine mud (MD6216)

Example seabed images of the EUNIS habitat type 'Seapens and burrowing megafauna in Atlantic circalittoral fine mud' (MD6216), which were observed at stations KS01, KS04 and KS08 within the Kyla Development survey area, are presented in Figure 4.7.

This habitat type consists of plains of fine mud at depths greater than about 15 m which may be heavily bioturbated by burrowing megafauna. Burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of seapens, typically *Virgularia mirabilis* and *Pennatula phosphorea*. The burrowing crustacea present typically include *Nephrops norvegicus*, which is frequently recorded from surface observations although grab sampling may fail to sample this species. The burrowing anemone *Cerianthus lloydii* and the epibenthic scavengers *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator* are present in low numbers in this biotope whilst the brittlestars *Ophiura albida* and *Ophiura ophiura* are sometimes present, but are much more common in slightly coarser sediments. The infauna may contain significant populations of the polychaetes *Pholoe* spp., *Glycera* spp., *Nephtys* spp.; spionids *Pectinaria belgica* and *Terebellides stroemi*; the bivalves *Nucula sulcata*, *Corbula gibba* and *Thyasira flexuosa*; and the echinoderm *Brissopsis lyrifera* (EEA, 2022).

The most commonly observed fauna on the seabed photographs and video were the seapens *Pennatula phosphorea*. Fauna including crabs and shrimp (*Paguroidea* spp. and *Caridea* spp.), faunal turf (Hydrozoa/Bryozoa), molluscs (*Nudibranchia* spp.), and sponges (*Porifera* spp.) were also widely seen. Other, less regularly observed fauna included fish species (*Actinopterygii* spp., *Callionymus lyra*), mollusc species (*Anomiidae* spp., *Buccinum undatum*), cnidaria (*Hormanthia digitata*), arthropods (*Polybius depurator*), and annelids (*Serpulidae* spp.). Faunal turf and burrows were present at the majority of stations (Gardline, 2025a).

Figure 4.6: Predicted Seabed Habitats in the Vicinity of the Kyla Development (EMODnet, 2021)

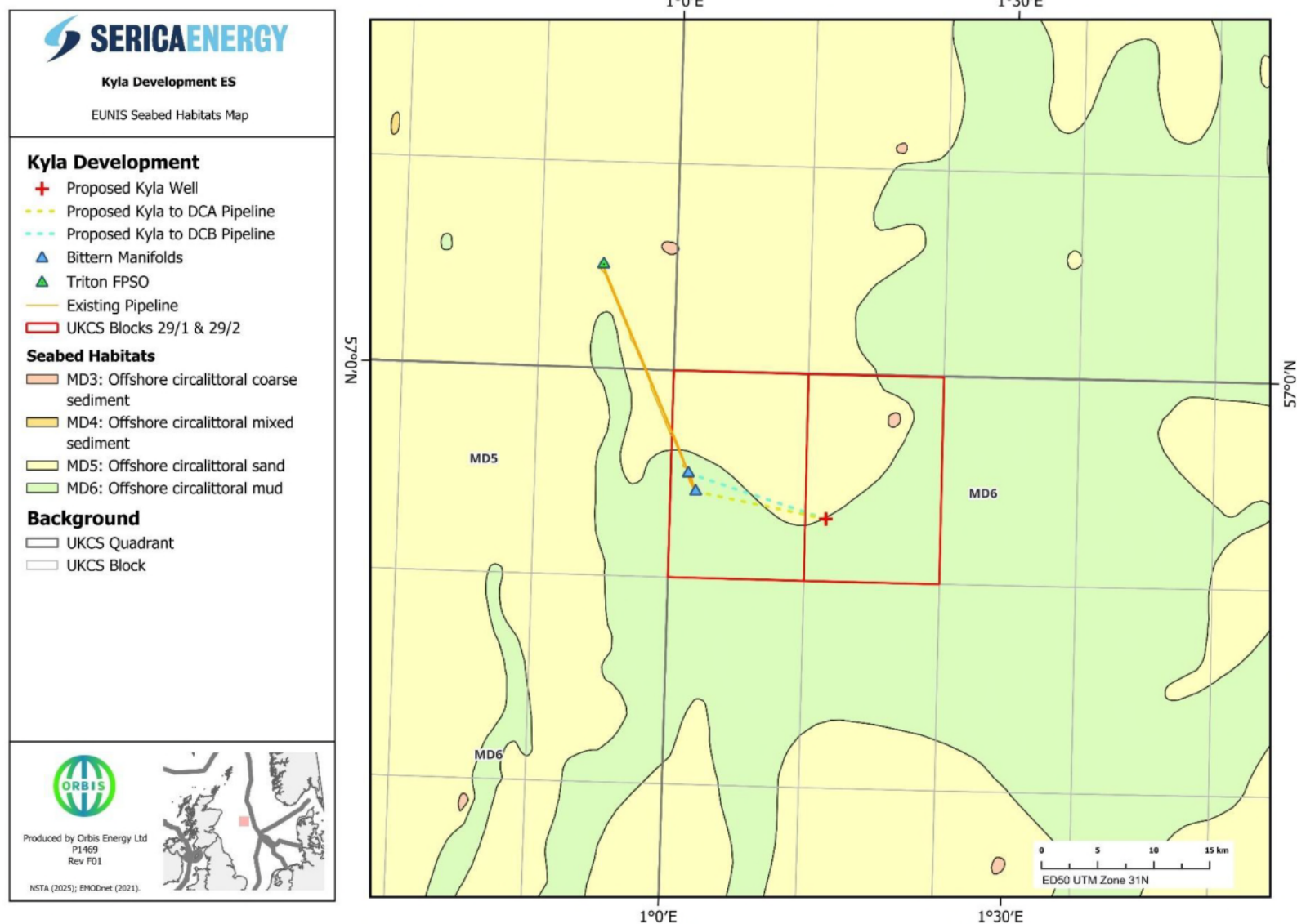
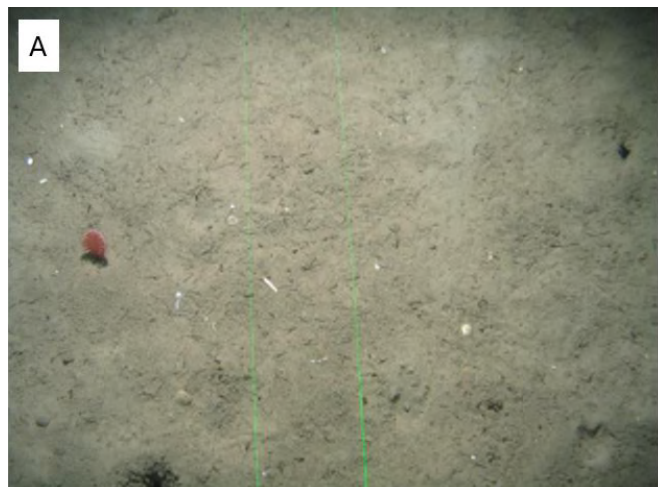
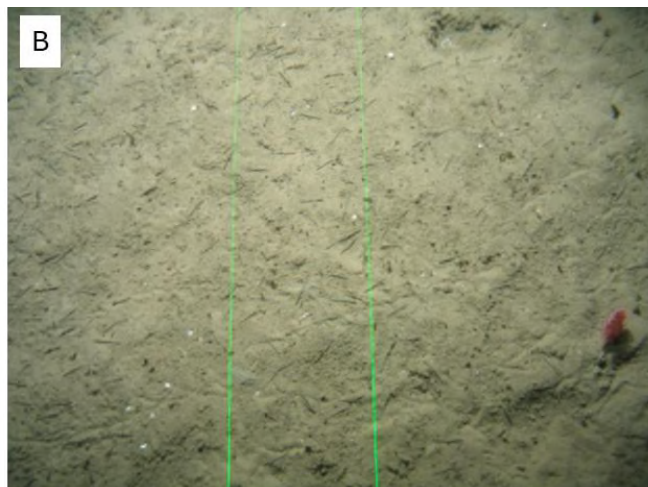


Figure 4.7: Example Seabed Images of the 'Seapens and burrowing megafauna in Atlantic circalittoral fine mud (MD2616)' habitat type within the vicinity of the proposed Kyla well location (Gardline, 2025a)

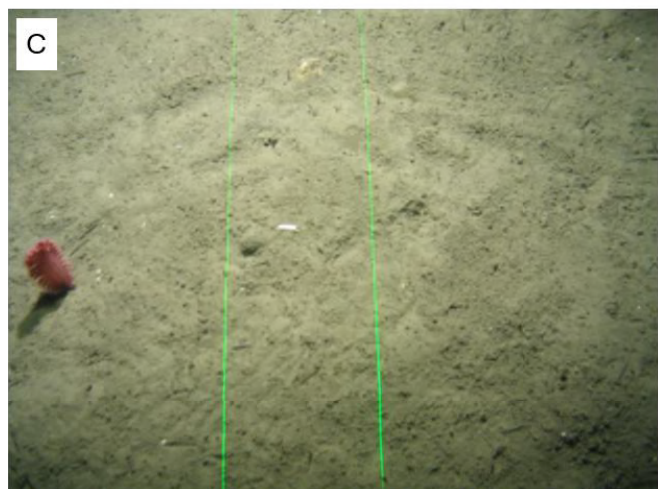
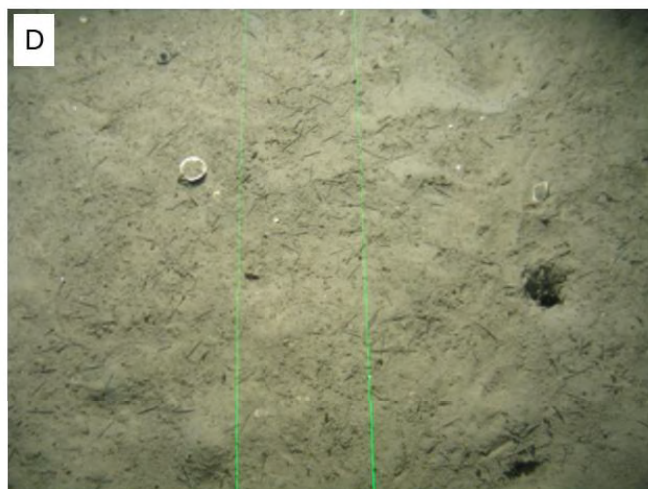


A: Photograph KS01 (Fix 397)

Muddy fine sand with shell fragments
Cnidaria (*Pennatula phosphorea*)

B: Photograph KS04 (Fix 202)

Muddy fine sand with shell fragments.
Cnidaria (*P. phosphorea*)



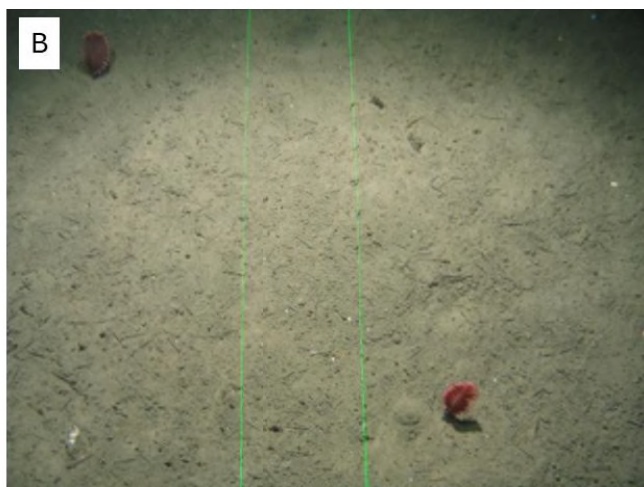
C: Photograph KS04 (Fix 209)

Muddy fine sand with shell fragments
Cnidaria (*P. phosphorea*)

D: Photograph KS08 (Fix 164)

Muddy fine sand with shell fragments
No visible fauna

Figure 4.8: Example Seabed Images of the 'Faunal communities of Atlantic circalittoral mud (MD621)' habitat type within the vicinity of the proposed Kyla well location (Gardline, 2025a)

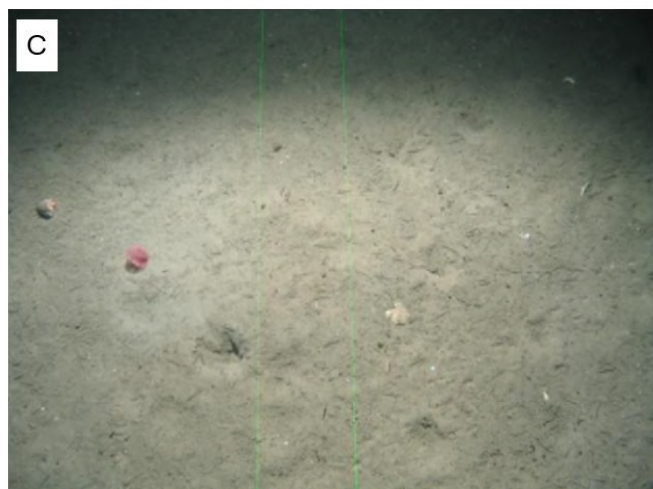


A: Photograph KS07 (Fix 137)

Muddy fine sand with shell fragments
Arthropoda (*Nephrops norvegicus*)

B: Photograph KS07 (Fix 145)

Muddy fine sand with shell fragments.
Cnidaria (*P. phosphorea*), Faunal Turf



C: Photograph KS09 (Fix 182)

Muddy fine sand with shell fragments
Arthropoda (Paguroidea spp.),
Cnidaria (*P. phosphorea*)

D: Photograph KS09 (Fix 190)

Muddy fine sand with shell fragments
Mollusca (Naticidae spp.)

Figure 4.9: Example Seabed Images of the 'Faunal communities of Atlantic circalittoral mud (MD621)' habitat type along the proposed Kyla to Bittern pipeline route (Gardline, 2025a)

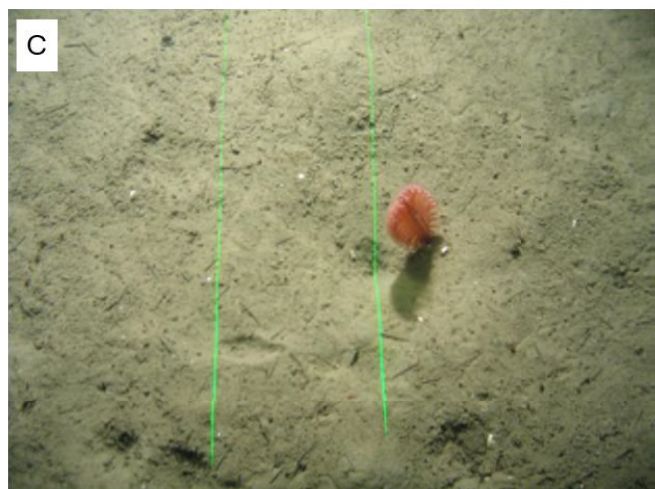


A: Photograph KB01 (Fix 74)

Muddy fine sand with shell fragments
Cnidaria (*P. phosphorea*)

B: Photograph KB01 (Fix 86)

Muddy fine sand with shell fragments.
Chordata (*Myxine glutinosa*)



C: Photograph KB02 (Fix 94)

Muddy fine sand with shell fragments
Cnidaria (*P. phosphorea*)

D: Photograph KB02 (Fix 96)

Muddy fine sand with shell fragments
No visible fauna

Potential Sensitive Habitats and Species

The following potential sensitive habitats and species are known to occur in the wider region (CNS) (See Section 4.3.6), including:

- Seapen and burrowing megafauna communities (Burrowed mud);
- Ocean quahog (*Arctica islandica*);
- Herring Spawning Grounds;
- Sandeel Spawning Grounds.

The Kyla HA and EBS paid particular attention to establishing whether or not any of the above habitats and/or species occurred within the survey area, as discussed below.

No other sensitive habitat or species of conservation interest was observed during the Kyla Development survey.

Seapen and burrowing megafauna communities;

A seapen and burrowing megafauna communities habitat is classified as a threatened and/or declining habitat (OSPAR, 2008). It is defined by OSPAR (2010) as plains of fine mud, extending over an area of at least 25 m² and at water depths ranging from 15 m to 200 m or more. These areas are defined as being heavily bioturbated by burrowing megafauna including *Nephrops norvegicus*, *Calocaris macandreae* or *Callinassa subterranea*, with burrows and mounds typically forming a prominent feature of the sediment surface, and which may include conspicuous populations of seapens (Pennatuloidae); typically, *Virgularia mirabilis* and *Pennatula phosphorea*. Despite its classification as a threatened and/or declining habitat (OSPAR, 2008); this habitat is widespread throughout the CNS, around the south and west coasts of Norway and around the north of the British Isles (OSPAR, 2010).

Within Scottish waters, the PMF broad habitat burrowed mud is defined as areas of finer sediment with burrows and mounds forming a prominent component of the habitat (Tyler-Walters et al., 2016). In some areas burrowed mud may support conspicuous populations of seapens; typically, *V. mirabilis* and *P. phosphorea*. This habitat is typically found in environments of fine mud, sandy mud and muddy sand in water depths ranging from 10 m to greater than 500 m. The burrowed mud PMF supports the component biotope seapens and burrowing megafauna in circalittoral fine mud. This is defined as stable circalittoral mud with populations of distinctive seapens, which occurs in relatively shallow but sheltered muddy bottoms at depths from 500 m in full or variable salinities.

Seabed imagery revealed that burrows were present in 5 and 39% of analysed images at all stations and three species of sea pens (*F. quadrangularis*, *P. phosphorea* and *Virgularia*) were present in 13 to 60% of analysed images from all stations. Therefore, a detailed assessment of the sea pen and burrowing megafauna community habitat as defined by OSPAR (2010) was conducted, referring to the Marine Nature Conservation Review (MNCR) SACFOR abundance scale (JNCC, 2013; Gardline, 2025a). The results of the assessment are summarised in Table 4.5.

A total of four *F. quadrangularis*, 127 *P. phosphorea* and two *Virgularia* individuals were recorded across all stations. Total Pennatuloidae densities ranged from 0.6 to 2.8 individuals per m² with observed specimens measuring between 0.4 and 12.6 cm. When categorised using the SACFOR scale, all stations recorded abundances reaching or encompassing the frequent category, with six stations surrounding the around the proposed Kyla well location (Stations KS02 to KS05, KS07 and KS12) recording categories of frequent or above (Table 4.5; Gardline, 2025a).

A total of 96 burrows were observed across all stations, with diameters ranging from 0.8 to 10.8 cm. Burrow densities varied between 0.2 burrows per m² at Station KS04, to 1.8 burrows per m² at Station KS12. These densities correspond to SACFOR categories reaching frequent at all stations except Station KS01 (Table 4.5; Gardline, 2025a).

The Joint Nature Conservation Committee (JNCC) (2014) clarification report states that to be considered a sea pen and burrowing megafauna communities habitat, densities of burrows and/or mounds, together with sea pens, if present, should be classified as frequent or above on the SACFOR scale. Therefore, across the survey area, some similarity to this habitat was observed at all stations

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except Station KS01 and when considering the survey data overall, burrows were classified as rare to frequent, suggesting that there is some similarity to a sea pen and burrowing megafauna communities habitat, as per OSPAR (2010). Although burrows were present, burrowing fauna were rarely sighted with only a single individual of *N. norvegicus* observed across the survey area to confirm the burrow inhabitants, therefore burrows could not confidently be attributed to any of the classified megafauna species within the seapen and burrowing megafauna community habitat classification (Gardline, 2025a).

The sea pen and burrowing megafauna communities habitat has also been found to likely be present within the Bittern Field Development area (Fugro, 2017; 2023).

Table 4.5: Sea Pen and Faunal Burrow SACFOR Assessment (Gardline, 2025a)

Station	Number of Images	Total Area Assessed	Number of F. quadrangularis	Number of P. phosphorea	Number of Virgularia	Total Pennatuloidae			Faunal Burrows			
						Density (individuals m ²)	Size Range (cm)	SACFOR Range ¹	Number of Burrows	Density (individuals m ²)	Size Range (cm)	SACFOR Range ¹
Kyla Cruciform Stations												
KS01	22	4.9	0	3	0	0.6	1.5 to 3.6	O to F	3	0.6	1.1 to 2.7	O to O
KS02	23	5.5	0	11	0	2	2.9 to 6.7	F to C	8	1.5	0.8 to 4.0	O to C
KS03	22	5.8	0	8	1	1.5	1.9 to 4.9	F to C	2	0.3	2.3 to 3.0	O to F
KS04	20	4.3	0	5	0	1.2	2.1 to 4.0	F to C	1	0.2	5	F
KS05	21	6	0	6	0	1	2.4 to 6.5	F to C	10	1.7	1.1 to 4.2	F to C
KS06	28	8.3	0	11	0	1.3	0.9 to 5.9	O to C	5	0.6	2.6 to 3.5	O to F
KS07	21	5.1	0	7	0	1.4	3.5 to 5.5	C to C	4	0.8	2.2 to 10.8	O to F
KS08	22	4.8	0	4	0	0.8	1.3 to 4.6	O to F	5	1	2.7 to 5.7	F to C
KS09	21	5.8	0	4	0	0.7	1.5 to 4.6	O to F	4	0.7	1.8 to 4.9	O to F
KS10	24	4.7	0	3	0	0.6	0.9 to 4.1	R to F	2	0.4	2.3 to 3.2	O to F
KS11	21	7.1	0	5	1	0.8	2.8 to 5.1	O to F	6	0.8	1.2 to 4.3	O to F
KS12	23	5	0	13	0	2.6	1.4 to 6.1	F to C	9	1.8	1.4 to 7.4	F to C
Kyla to Bittern Pipeline Route												
KB01	20	5.6	0	16	0	2.8	0.5 to 5.0	O to C	7	1.2	0.9 to 4.8	O to C
KB02	23	6.4	0	4	0	0.6	2 to 3.7	O to F	11	1.7	1.3 to 6.7	F to C
Key: (Application of SACFOR Abundance Ranges to OSPAR (2010) Sea Pen and Burrowing Megafauna Communities Habitat)												
< Frequent = No similarity			≤ Frequent = Some similarity			< and > Frequent = Some Similarity			≥ Frequent = Greatest similarity			

¹ SACFOR classification scale S = superabundant, A = abundant, C = common, F = frequent, O = occasional and R = rare. Classification is based on minimum and maximum estimated size of seapen and burrows and the respective mean density at each station and transect.

The sea pen and burrowing megafauna communities habitat is also listed as a key component biotope within the broader Burrowed mud habitat, which is designated as a PMF (NatureScot, 2022). This is defined by Scottish Natural Heritage (2016) as fine mud, sandy mud and muddy sand in water depths ranging from 10 m to greater than 500 m, characterised by a range of burrowing crustaceans. Burrows and mounds are a prominent feature of this habitat, while sea pens and anemones may also be present. Sediments across the survey area were classified as muddy sand to slightly gravelly muddy sand, suggesting some ecological similarities to the Burrowed mud PMF.

Whilst this habitat is on the list of threatened and/or declining species and habitats, it is widespread throughout the CNS, around the south and west coasts of Norway and around the north of the British Isles (OSPAR, 2010; Hill et al., 2022).

Ocean quahog (*Arctica islandica*)

Ocean quahog (*A. islandica*) is listed as a PMF in Scottish waters and is listed as an OSPAR Threatened and/or Declining species. This species of bivalve mollusc is long-lived with a slow growth rate and is generally found partially buried in sandy and muddy sediments. Thirty-one juvenile *A. islandica* individuals were recorded across the survey area, with no adults observed within samples (Gardline, 2025b).

In addition, during a historic survey at the Kyla field, no adult *A. islandica* (> 1 cm) were recovered from the grab stations. However juvenile *A. islandica* were found within all but one of the macrofaunal samples ranging between 1 and 22 juveniles per 0.1 m² (mean 8 per 0.1 m²) (Fugro, 2020). Furthermore, during historic surveys at Bittern, no adult individuals of *A. islandica* were present, but juvenile individuals were recorded (Fugro, 2017; 2023).

Herring Spawning Grounds

The proposed Kyla Development area coincided with a potential herring nursery ground area according to Cefas (2010). Water depths across the survey area ranged from 89 to 94m which is deeper than the suitable depth range (15 to 40 m) though within the maximum depth (200 m) for herring spawning according to the International Council for the Exploration of the Sea (ICES) (2024). Consequently, all stations were reviewed for the spawning potential of each relevant aspect, using the Reach et al. (2013) criteria, with results displayed in Table 4.8 (Table 4.7; Gardline, 2025a).

Table 4.6: Herring Spawning ground assessment categories specified by Reach et al. (2013)

Percent Contribution of Mud & Gravel	Folk (1954) Descriptions	Habitat Sediment Preference
<5% mud, >50% gravel	Gravel and part of Sandy Gravel	Prime
<5% mud, >25% gravel	Part of Sandy Gravel and part of Gravelly Sand	Sub-prime
<5% mud, >10% gravel	Part of Gravelly Sand	Suitable
>5% mud, <10% gravel	All other Folk sediment categories	Unsuitable

Table 4.7: Herring Spawning Ground Assessment results using Reach et al. (2013) (Gardline, 2025a)

Station	Coarse Sand to Gravel (%)	Fines (%)	Gravel (%)	Modified Folk Scale	Habitat Sediment Preference	Habitat Sediment Classification
Kyla Cruciform Stations						
KS01	1	21.8	0	Muddy Sand	Unsuitable	Unsuitable
KS02	0.1	21.3	0	Muddy Sand	Unsuitable	Unsuitable
KS03	0.01	24.3	0	Muddy Sand	Unsuitable	Unsuitable
KS04	0.4	22.1	0	Muddy Sand	Unsuitable	Unsuitable
KS05	0.8	19.9	0	Muddy Sand	Unsuitable	Unsuitable
KS06	0.2	20.3	0	Muddy Sand	Unsuitable	Unsuitable
KS07	0.3	15.9	0	Muddy Sand	Unsuitable	Unsuitable
KS08	1.3	17.6	0	Muddy Sand	Unsuitable	Unsuitable
KS09	0.5	18.9	0	Muddy Sand	Unsuitable	Unsuitable
KS10	0.01	22.6	0	Muddy Sand	Unsuitable	Unsuitable
KS11	0.2	21	0	Muddy Sand	Unsuitable	Unsuitable
KS12	0.03	22.2	0	Muddy Sand	Unsuitable	Unsuitable
Kyla to Bittern Pipeline Route						
KB01	3.3	27	1.6	Slightly gravelly muddy sand	Unsuitable	Unsuitable
KB02	0.2	21.4	0	Muddy Sand	Unsuitable	Unsuitable

Although all stations (KS01 to KS12, KB01 to KB02) were of a suitable Wentworth classification (1922)(Table 4.1), the near ubiquitous absence of gravel, excepting the minimal contribution at Station KB01, was below the 10% threshold and therefore the stations were deemed unsuitable for herring spawning in terms of habitat sediment preference. Furthermore, the modified Folk (1954) classifications of muddy sand and slightly gravelly muddy sand also indicated the habitat to be unsuitable for herring spawning based on habitat sediment classification (Gardline, 2025a).

As acknowledged by Reach et al. (2013 in; MarineSpace Ltd et al., 2013) and as previously defined by Cefas (2001b), use of the modified Folk classification alone may over-estimate the suitability of an area in terms of its herring spawning potential as further consideration should be given to other environmental (physical, chemical and abiotic) parameters such as oxygenation, siltation, micro-scale morphological features (e.g. ripples and ridges). Furthermore, the area must be exposed to the main flow of water and the sediments wells sorted to ensure maximum oxygenation of the sediment and hence the lower layers of herring eggs; the area should be elevated with respect to the surrounding seabed. Therefore, the proposed Kyla Development area can be considered unsuitable as a herring spawning ground (Gardline, 2025a).

Sandeel Spawning Grounds

The proposed Kyla Development area coincides with a potential low intensity sandeel spawning and nursery ground (Cefas, 2010). Water depths across the survey area ranged from 89 to 94 m, overlapping the 15 to 120 m depth range which is within which sandeels are frequently encountered (Wright et al., 2000). Therefore, PSA results from all stations have been reviewed for their spawning ground potential based on criteria defined by Latto et al. (2013) (Table 4.8), with results displayed in Table 4.9 (Gardline, 2025a).

Table 4.8: Sandeel Spawning Potential Criteria adapted from Latto et al. (2013) (Gardline, 2025a)

Habitat Sediment Preference	Prime	Sub	Suitable	Unsuitable
% Particle contribution preference	<1% muds, >85% sand, <15% gravel (inferred)	<4% muds, >70% sand, <35% gravel	<10% muds, >50% sand, <35% gravel	>10% muds, <50% sand, >35% gravel
Folk classification based on % particle contribution preferences above	Part S, part (g)S, and part gS	Part S, part (g)S, and part gS	Part S, part (g)S, part gS, part sG, part mS, part (g)mS, part gmS and part msG.	All others (including mS, (g)mS, part gmS, part msG and part sG)
Habitat Sediment Class	Preferred	Marginal	Unsuitable	
Folk classification generalised	Sand, slightly gravelly sand and gravelly sand	Sandy gravel	All others	

Table 4.9: Sandeel Spawning Ground Assessment Results using Latto et al. (2013) (Gardline, 2025a)

Station	Habitat Sediment Preference			Habitat Sediment Classification	
	Fines (%)	Sand (%)	Suitability	Modified Folk Classification	Suitability
Kyla Cruciform Stations					
KS01	21.8	78.2	Unsuitable	Muddy sand	Unsuitable
KS02	21.3	78.7	Unsuitable	Muddy sand	Unsuitable
KS03	24.3	75.7	Unsuitable	Muddy sand	Unsuitable
KS04	22.1	77.9	Unsuitable	Muddy sand	Unsuitable
KS05	19.9	80.1	Unsuitable	Muddy sand	Unsuitable
KS06	20.3	79.7	Unsuitable	Muddy sand	Unsuitable
KS07	15.9	84.1	Unsuitable	Muddy sand	Unsuitable
KS08	17.6	82.4	Unsuitable	Muddy sand	Unsuitable
KS09	18.9	81.1	Unsuitable	Muddy sand	Unsuitable
KS10	22.6	77.4	Unsuitable	Muddy sand	Unsuitable
KS11	21	79	Unsuitable	Muddy sand	Unsuitable
KS12	22.2	77.8	Unsuitable	Muddy sand	Unsuitable
Kyla to Bittern Pipeline Route					
KB01	27	71.4	Unsuitable	Slightly gravelly muddy sand	Unsuitable
KB02	21.4	78.6	Unsuitable	Muddy sand	Unsuitable

Although the dominance of sand was consistent with sub-prime conditions, the prevalence of fines (>10%) rendered all stations unsuitable in terms of both habitat sediment preference and classifications

with modified Folk (1954) of muddy sand or slightly gravelly muddy sand. Sandeels were found by Holland et al. (2005) to prefer medium to coarse sand (250 to 1000 µm), which constituted 3.5 to 25 % of the sampled sediment within the 2025 Gardline survey. Latto et al. (2013) bases its categorisation of the sediment on the modified Folk (1954) classification for comparison to the pre-existing BGS charts to allow a broadscale assessment of potential sandeel spawning suitability and this method is likely to overstate the suitability of sediment to support populations of sandeel.

No sandeels or eggs were observed within seabed imagery during the 2025 Gardline survey, however this was conducted in July which falls outside the typical sandeel spawning period of November and February making the low observations of sandeels expected (Gardline, 2025a).

Other Potential Sensitive Habitats and Species

The Kyla habitat assessment survey surrounding the proposed well location and along the proposed pipeline route (KS01 to KS12; KB01 to KB02) found that the EUNIS level 5 habitat type 'Seapens and burrowing megafauna in Atlantic circalittoral fine mud' (MD6216) and EUNIS level 4 habitat type 'Faunal communities of Atlantic circalittoral mud' (MD621) are present (Gardline, 2025a). These are component biotopes of 'Burrowed Mud', which is a designated priority habitat within Scottish waters, and 'Mud habitats in Deep Water', which is a designated United Kingdom Biodiversity Action Plan (UK BAP) priority habitat (Tyler-Walters et al., 2016; BRIG, 2011).

No other Annex I habitats, Annex II species, OSPAR listed as threatened and/or declining habitats or species, UK Biodiversity Action Plan (BAP) priority habitats and species or PMF habitats or species were observed within the Kyla survey area (Gardline, 2025a; 2025b).

Benthic Infaunal Communities

Both within the vicinity of the proposed Kyla well location and pipeline route (KS01 to KS12; KB01 to KB02), and within the wider region (KT01 to KT04), there was a high species richness, with similar species dominating throughout. Macrofaunal analysis was carried out on 36 grab samples obtained at twelve environmental stations within the proposed Kyla Development area and the wider region (see Figure 4.1 and Figure 4.2 in Section 4.1.1).

A total of 22,861 individuals from the samples taken from within the vicinity of the proposed Kyla Development area (KS01 to KS12; KB01 to KB02) were analysed. Overall, 257 taxa were recorded; the taxa consisted of 111 annelid species, which dominated the community, accounting for 66.97 % of the total individuals. There were 70 species of arthropods recorded (4.08 % of the total individuals), 54 species of molluscs (10.05 % of the total individuals), 13 species of echinoderms (17.69 % of total individuals), and one species of nemerteans (0.89 % of total individuals). The other phyla (Phoronida, Foraminifera, Hemichordata, Platyhelminthes, Actinaria and Chordata) were represented by eight species, accounting for 0.32 % of the total individuals. The most abundant phyla from the Kyla Development area are listed in Table 4.10 (Gardline, 2025b).

Within the wider region (KT01 to KT04), a total of 5,783 individuals from the samples taken were analysed. Overall, 179 taxa were recorded; the taxa consisted of 85 annelid species, which dominated the community, accounting for 82.03 % of the total individuals. There were 38 species of arthropods recorded (4.7 % of the total individuals), 36 species of molluscs (4.53 % of the total individuals), nine species of echinoderms (6.74 % of total individuals), and one species of nemerteans (1.07 % of total individuals). The other phyla (Phoronida, Foraminifera, Hemichordata, Platyhelminthes, Actinaria and Chordata) were represented by ten species, accounting for 0.92 % of the total individuals. The most abundant phyla from the wider region are listed in Table 4.11 (Gardline, 2025b).

Table 4.10: Summary of Macrofaunal Analysis within the vicinity of the proposed Kyla Development area (KS01 to KS12; KB01 to KB02) (Gardline, 2025b)

Phylum	Kyla Development Survey ¹			
	Number of Taxa	Composition of Taxa (%)	Abundance	Composition of Individuals (%)
Annelida	111	43.19	15,309	66.97
Echinodermata	13	5.06	4,044	17.69
Mollusca	54	21.01	2,297	10.05
Arthropoda	70	27.24	932	4.08
Nemertea	1	0.39	205	0.89
Other ²	8	3.11	74	0.32
Total	257	100	22,861	100

¹ Kyla Development area survey sampled using a 0.5 mm mesh sieve;

² Other phyla included Phoronida, Foraminifera, Hemichordata, Platyhelminthes, Actinaria and Chordata.

Table 4.11: Summary of Macrofaunal Analysis within the wider region surrounding the Kyla Development area (KT01 to KT04) (Gardline, 2025b)

Phylum	Wider Region Survey ¹			
	Number of Taxa	Composition of Taxa (%)	Abundance	Composition of Individuals (%)
Annelida	85	47.49	4,744	82.03
Echinodermata	9	5.03	390	6.74
Arthropoda	38	21.23	272	4.70
Mollusca	36	20.11	262	4.53
Nemertea	1	0.55	62	1.07
Other ²	10	5.59	53	0.92
Total	179	100	5,783	100

¹ Kyla Development wider region sampled using a 0.5 mm mesh sieve;

² Other phyla included Phoronida, Foraminifera, Hemichordata, Platyhelminthes, Actinaria and Chordata.

The species identified during the Kyla Development survey, both within the vicinity of the development area (KS01 to KS12; KB01 to KB02) and in the wider region (KT01 to KT04) were ranked in terms of dominance, ranking the taxa has made it possible to examine which were consistently dominant throughout the survey area. The ranking of taxa in terms of abundance and dominance is presented in Table 4.12 (Gardline, 2025b).

Of the top ranked adult taxa, seven were Annelida, two were Mollusca and one each were Echinodermata, Arthropoda and Others (Nemertea). *Paramphinome jeffreysii* was the dominant taxon in both the adult only and full fauna datasets. When including juvenile taxa there were two (Echinoidea and Ophiuroidea) among the top ranking, displacing *Notomastus*, Nemertea and *Lumbrineris aniana* (Gardline, 2025b). The top-ranking adult taxa were broadly aligned with those previously recorded within the decommissioned Kyla field, (proposed Kyla field) (Fugro, 2020; CNRI, 2021), indicating that the faunal community remained relatively consistent over time.

Table 4.12: Species Ranking across the Kyla Development Area and the Wider Region (Gardline, 2025b)

Species / Taxon	Phylum	Kyla Development Survey ¹		
		Rank Dominance	Present at No. of Stations (Frequency %)	Rank Abundance
<i>Paramphinoe jeffreysii</i>	Annelida	1	18	1
<i>Ampharete falcata</i>	Annelida	2	18	2
Ophiuroidea (juv.)	Echinodermata	3	18	4
Echinoidea (juv.)	Echinodermata	4	18	3
<i>Eclysiptis vanelli</i>	Annelida	5	18	6
<i>Axinulus croulinensis</i>	Mollusca	6	18	5
<i>Galathowenia</i>	Annelida	7	16	7
<i>Adontorhina similis</i>	Mollusca	8	18	8
<i>Aricidea (Acmira) catherinae</i>	Annelida	9	18	9
<i>Urothoe elegans</i>	Arthropoda	10	18	13
<i>Ophiocten affinis</i>	Echinodermata	12	16	10

¹ Kyla Development area sampled using a 0.5 mm mesh sieve

Primary and Univariate Analyses

Stations both within the vicinity of the proposed Kyla Development (KS01 to KS12; KB01 to KB02) and within the wider region (KT01 to KT04) presented relatively consistent diversity, dominance and evenness values. Shannon-Wiener diversity values ranged from 2.56 to 4.69, with a mean of 3.60 (Gardline, 2025b). This is slightly lower than the mean value of 4.36 (n=111 replicates) for fauna retained using a 0.5mm sieve in the CNS (UKOOA, 2001) and lower than the mean previously recorded in the Kyla region (Fugro, 2020; CNRI, 2021).

Pielou's evenness suggested the adult community was more even than uneven at most stations, with values ranging from 0.38 to 0.70 with a mean of 0.55 (Gardline, 2025b). The least even communities were recorded at Stations KS07, KT02 to KT04 and KB02, where Pielou's evenness was <0.5 and *P. jeffreysii* accounted for at least 57% of the community. The overall lack of dominance, aside from *P. jeffreysii*, was further supported by the low Simpson's dominance values, which ranged from 0.10 to 0.52, with only Stations KS07, KT02 to KT04 and KB02 recording Simpson's dominance ≥ 0.3 (Gardline, 2025b). Samples in the current Kyla survey generally exhibited an adult faunal community that was less even and more dominated than the previous surveys at Kyla (Fugro, 2020; CNRI, 2021), and that was reported for the CNS (UKOOA, 2001), reflecting the increased dominance of *P. jeffreysii*.

The number of taxa both within the vicinity of the Kyla Development and within the wider region ranged from 21 to 35 for the adult only dataset, which was lower than the previous survey at Kyla (Fugro, 2020; CNRI, 2021).

Multivariate Analyses

Multivariate analyses were performed on the rationalised data taken from stations both in the Kyla Development area (KS01 to KS12; KB01 to KB02) and within the wider region (KT01 to KT04) using PRIMER v7.

The CLUSTER analysis identified six similarity profile (SIMRPOF) groups comprising one outlier (Station KB01), three closely associated pairs (SIMPROF Groups b, c and d) and two clusters (SIMPROF Groups e and f). All stations joined at a similarity of 59%, showing that stations were more similar than dissimilar. Much of the separation can be attributed to variations within the top ten most dominant taxa, mostly *P. jeffreysii*, *A. falcata* and *Galathowenia* (Gardline, 2025b). With the inclusion of juveniles,

all stations were identically grouped and all stations joined together at a similarity of 59%. The clusters and the stations they encompass are summarised below:

- Cluster A – KB01;
- Cluster B – KS06 and KS12;
- Cluster C – KS01 and KS05;
- Cluster D – KS07 and KB02;
- Cluster E – KS02 to KS04, KS08 to KS11;
- Cluster F – KT01 to KT04 (wider region).

When comparing the adult only macrofaunal community dataset to the physico-chemical data a 70% correlation was identified between the percentage of fines and concentrations of LMW alkanes, pristane, Cu and Li. This result supports the interpretation that the faunal community across the survey area (the Kyla Development area and wider region) varied naturally with physical sediment characteristics and there was no evidence of any anthropogenic impacts associated with chemical variables (Gardline, 2025b).

4.3.3 Fish and Shellfish

Distribution of Adult Populations

Fish are separated into pelagic species, which occur in shoals swimming in mid-levels of the water, typically making extensive seasonal movements or migrations between sea areas and demersal species, which live on or near the seabed.

Although the distribution of adult fish populations is highly fluid, analysis of recent fisheries landings and effort data suggests that adult populations of demersal species such as haddock (*Melanogrammus aeglefinus*) and whiting (*Merlangius merlangus*) make up a large proportion of catches in the vicinity of the proposed Kyla Development (SG-MD, 2025). Species diversity within the fish community is not as great in the CNS and northern North Sea as in the SNS, with the exception of some areas of the Scottish coast (Callaway et al. 2002; DESNZ, 2022).

The highest richness of northerly species is found in waters off the north-east of Scotland, including Orkney and Shetland (Daan 2006). Statistical analyses of North Sea fish assemblages using data collected in groundfish surveys (Callaway et al. 2002, Reiss et al. 2010) found that the 50 m depth contour that separates the SNS from the CNS and northern North Sea acts as a boundary between different fish assemblages. Within the CNS, a number of assemblages were identified, with divisions typically occurring at the 100 m depth contour. At depths between 50-100 m, the benthic community was dominated by dab (*Limanda limanda*) and long rough dab (*Hippoglossoides platessoides*). Of species more loosely associated with the seabed, haddock, whiting, herring (*Clupea harengus*) and plaice (*Pleuronectes platessa*) were dominant. At depths of between 100-200m, the community was characterised by long rough dab, hagfish (*Myxine glutinosa*) and Norway pout (*Trisopterus esmarkii*) (DESNZ, 2022).

Spawning and Nursery Grounds

The North-East Atlantic and North Sea is split into statistical grids called ICES Rectangles in order to map statistical information about the area. The proposed development area is located within ICES Rectangle 42F1.

Spawning Grounds

Data from Coull *et al.*, 1998 and Ellis *et al.*, 2012 indicates that fish species that use ICES Rectangle 42F1 as spawning grounds include cod (*Gadus morhua*), lemon sole (*Microstomus kitt*), mackerel (high intensity) (*Scomber scombrus*), Norway pout (high intensity), and sandeel (*Ammodytes* spp.) (Table 4.13; Coull *et al.*, 1998; Ellis *et al.*, 2012b).

However, the Marine Scotland National Marine Plan Interactive (NMPi) Map (2025) illustrates the likely spawning grounds of Atlantic cod, as predicted by González-Irusta and Wright (2016), taking account

of certain environmental influences. This indicates that the proposed Kyla Development area is located in an area which is 'Unfavourable' for spawning cod.

The Marine Scotland NMPI (2025) also illustrates the probability of presence and predicted density of buried sandeels modelled by Langton *et al.* (2021). The proposed Kyla Development area contains habitat that is not suitable for sandeels, with low densities predicted. This was confirmed by analysis carried out following the Kyla survey operations stating that all sediment was 'unsuitable' (Latto *et al.*, 2013; Gardline, 2025a; Gardline, 2025b).

Nursery Grounds

Fish species utilising ICES Rectangle 42F1 for nursery grounds include anglerfish (*Lophius piscatorius*), blue whiting (*Micromesistius potassou*), cod (high intensity), European hake (*Merluccius merluccius*), haddock, herring, ling (*Molva molva*), mackerel, Norway pout, plaice, sandeel, spurdog (also known as spiny dogfish; *Squalus acanthias*), and whiting (*Merlangius merlangus*) (Table 4.13; Coull *et al.*, 1998; Ellis *et al.*, 2012b).

Juvenile Fish

In addition to the mapping of spawning and nursery grounds of key commercial fish species, more recent spatial modelling of the probability of the occurrence of aggregations of 0 group fish species (i.e. fish in the first year of their life) and / or larval stages has been undertaken. This has provisionally identified the spatial distribution of sensitive life stages of commercial fish species (in line with mapping from Coull *et al.*, 1998 and Ellis *et al.*, 2012b) that could be affected by offshore oil and gas operations (Aires *et al.*, 2014). 0 group fish are considered to be most sensitive to physical damage from oil and gas operations (particularly through seismic surveying and piling). In general, the juvenile stages of many commercial fish species remain within coastal areas for a year or two before moving offshore.

Based on spatial modelling of 0 group fish the proposed Kyla Development area is not considered to be of high importance to 0 group fish, being within an area of moderate probability of 0 group aggregations of anglerfish, European hake, haddock, cod, herring, Norway pout, and whiting and low probability of 0 group aggregations of blue whiting, horse mackerel (*Trachurus trachurus*), mackerel, plaice, sole (*Solea solea*), sprat (*Sprattus sprattus*), and whiting (Figure 4.11 and Figure 4.12; Aires *et al.*, 2014). However, It is important to note however that the specific locations of these sites of fish sensitivity are dynamic and may shrink or expand or move over time as maps are updated (Figure 4.11 and Figure 4.12; Aires *et al.*, 2014).

Table 4.13: Fish Spawning and Nursery Species within the Proposed Kyla Development Area (ICES Rectangles 42F1) (Coull *et al.*, 1998; Ellis *et al.*, 2012; Aires *et al.*, 2014)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Anglerfish	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Blue Whiting	N	N	N	N	N	N	N	N	N	N	N	N
Cod	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
European Hake	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Haddock	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Herring	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Lemon Sole												
Ling	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	N	N	N	N	N	N	N	N
Norway Pout	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Plaice	N	N	N	N	N	N	N	N	N	N	N	N
Sandeel	N	N	N	N	N	N	N	N	N	N	N	N
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
Whiting	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ	NJ
Key												
N = High intensity nursery as per Ellis <i>et al.</i> , 2012												
Species = High intensity spawning as per Ellis <i>et al.</i> , 2012												
J = Moderate or higher probability of juvenile fish species as per Aires <i>et al.</i> , 2014												
	Peak Spawning	Spawning	N	Nursery		No Activity						

A number of the fish species identified above are listed as Scottish PMFs, including anglerfish, blue whiting, cod, herring, ling, mackerel, Norway pout, sandeels, spurdog and whiting (NatureScot, 2022). Cod and spurdog are on the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR, 2024). In addition, cod, spurdog and haddock is listed as 'Vulnerable' globally on the International Union for the Conservation of Nature (IUCN) Red List and European populations of spurdog are listed as 'Endangered'. These species should therefore be considered as priorities for protection. All other species identified in Table 4.13 are listed as Least Concern (IUCN, 2025). Of note, in UK waters there has been significant recent declines of sandeel, cod, haddock and whiting as a result of warming waters over the last 30 years (DESNZ, 2022).

Figure 4.10: Fish Spawning and Nursery Areas across the Proposed Kyla Development Area (Coull et al., 1998; Ellis et al., 2012)

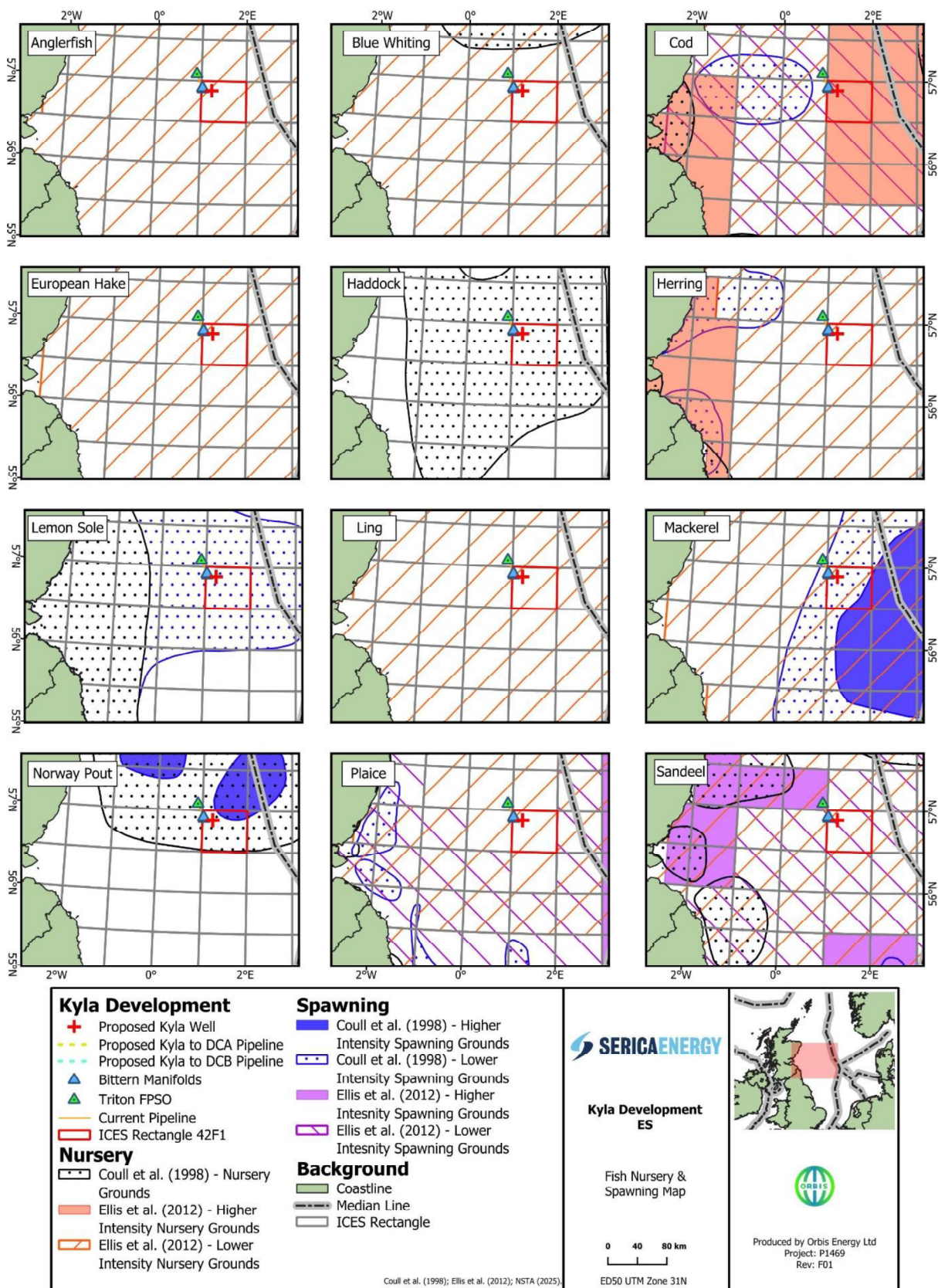


Figure 4.11: Fish Spawning and Nursery Areas across the Proposed Kyla Development Area (Coull et al., 1998; Ellis et al., 2012)

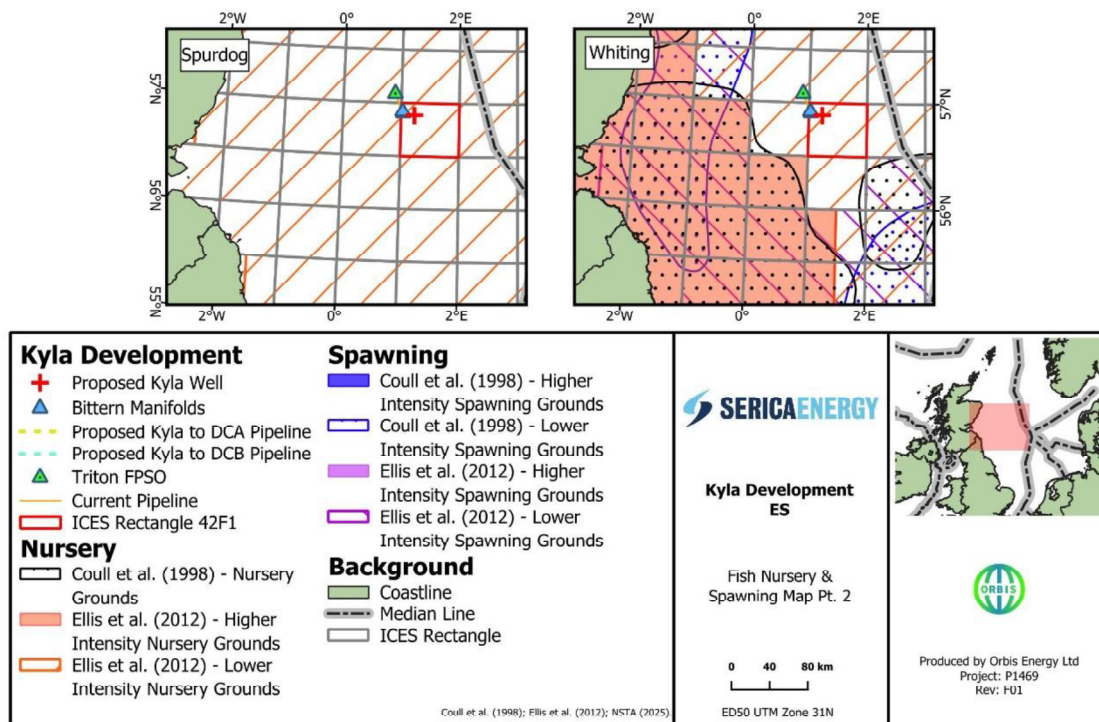
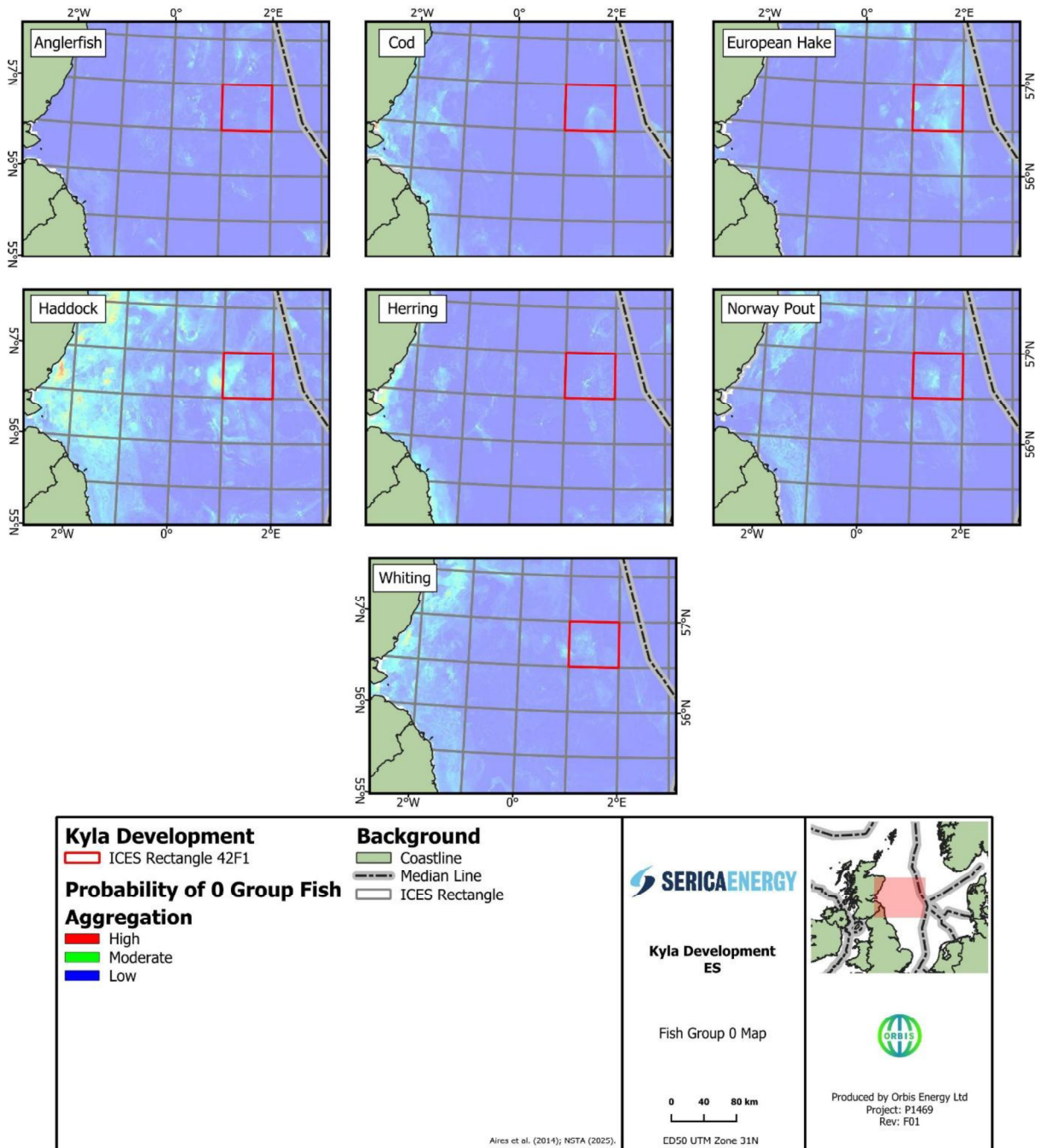


Figure 4.12: Probability of 0 Group Fish Aggregations in the Vicinity of the Kyla Development Area (Aires et al., 2014)



Elasmobranchs

Elasmobranch species (sharks, skates, and rays) are also an important component of the North Sea ecosystem. Elasmobranchs have a low fecundity and slow growth rate, leaving them vulnerable to over-fishing pressures and pollution events, and subsequent recovery of populations in response to disturbance events is low.

A survey of the distribution of elasmobranchs in UK waters was undertaken by Ellis *et al.* in 2004. A total of 26 elasmobranch species were recorded throughout the North Sea and surrounding waters. Species which have been recorded in the CNS at various times throughout the year and may therefore be present in the vicinity of the proposed Kyla Development, are listed in Table 4.14 (Ellis *et al.*, 2004).

Table 4.14: List of Elasmobranch Species Likely to be found in the Vicinity of the Kyla Development (Ellis *et al.*, 2004; IUCN, 2025)

Common Name	Latin Name	Depth Range (m)	Global IUCN Status ^{N1}	European IUCN Status ^{N1}
Cuckoo skate	<i>Leucoraja naevus</i>	12 - 290	Least Concern	Least Concern
Lesser-spotted dogfish / Small spotted catshark	<i>Scyliorhinus canicula</i>	6 - 308	Least Concern	Least Concern
Spurdog / Spiny dogfish	<i>Squalus acanthias</i>	15 - 528	Vulnerable	Endangered
Starry ray / Thorny skate	<i>Amblyraja radiata</i>	32 - 209	Vulnerable	Least Concern

^{N1} Status as of September 2025

Of these species, the spurdog / spiny dogfish is listed as a PMF (NatureScot, 2022). In addition, spurdog / spiny dogfish is also listed on the OSPAR List of Threatened and/or Declining species and habitats (OSPAR, 2024). All the species listed in Table 4.14, excluding starry ray / thorny skate, spurdog / spiny dogfish and European populations of spurdog / spiny dogfish, are of least concern (IUCN, 2025). Spurdog / spiny dogfish and starry ray / thorny skate are of most concern, due to their unfavourable conservation status (IUCN, 2025).

4.3.4 Seabirds

Offshore Distribution and Abundance

Seabird presence and abundance is often used as an indicator for assessing the state of the marine environment as their populations and distribution varies with changes in prey abundance, weather, predation, and pollution. The offshore waters of the SNS are visited by seabirds mainly for feeding purposes in and around the shallow sandbanks (DESNZ, 2022). Individuals may originate from the onshore colonies, particularly around the Firth of Forth, or may be migrants through the area.

The European Seabirds at Sea (ESAS) database is the most complete and longstanding dataset detailing the distribution of seabirds at sea, compiling a range of boat and transect data over a period of 29 years. The proposed development area is not located within a hotspot area for seabirds. The predicted at-sea seabird density in the proposed development area is shown in Table 4.16. The data predicts a density of less than two seabirds per km² during the breeding season (March – September), increasing to less than four seabirds per km² in winter (November – March). The most abundant species present are Fulmar, and Gannet in the breeding season; Fulmar, Guillemot and Kittiwake over winter and Guillemot during the post-breeding dispersal period (JNCC, 2019; Kober *et al.*, 2010). Of these species, kittiwake surface feed and shallow dive for fish and shrimp; fulmar surface feed in flocks on fish waste, crustaceans and sand eels; gannets fly high and circle before plunging into the sea to feed on fish (RSPB, 2025). Guillemots are excellent diving seabirds, they can dive to depth of a few hundred metres and feed on fish and crustaceans (RSPB, 2025).

The proposed development area is located approximately 182 km from the nearest UK coast and is therefore remote from sensitive seabird breeding areas. However, based on mean max +1SD foraging ranges reported by Woodward *et al.* (2019), the following species may forage within the proposed development area during the breeding season, which coincides with the proposed development operations: Northern fulmar (*Fulmarus glacialis*) and black-legged kittiwake (*Rissa tridactyla*) (see Table 4.15). Following the breeding season, large numbers of moulting auks, including common guillemot, razorbill (*Alca torda*) and Atlantic puffin disperse from their coastal colonies and into the offshore waters. Kittiwake, Gannet, and Fulmar are also present in sizable numbers during the post breeding season (DESNZ, 2022).

Table 4.15: Seabirds Potentially Foraging in the Proposed Kyla Development Area during the Breeding Bird Season (JNCC, 2025; Woodward *et al.*, 2019; Woodward *et al.*, 2024; RSPB, 2025)

Species	Mean Maximum +1SD Foraging Range (km)	Potential Originating Special Protection Area (SPA) / Ramsar	Type of Feeder
Northern Fulmar	542.3±657.9	Fowlsheugh SPA, Buchan Ness to Collieston Coast SPA	Surface
Black-legged kittiwake	156.1±144.5	Fowlsheugh SPA, Buchan Ness to Collieston Coast SPA	Surface

Table 4.16: Predicted At-Sea Seabird Density in the Vicinity of the Proposed Kyla Development Area (UKCS Blocks 29/1 and 29/2) (Number of Individuals per km²) (JNCC, 2019; Kober et al., 2010)

Species	Season	Predicted Density in the Blocks of Interest ¹												Predicted Density Range Across UK Waters ^{N1}
		J	F	M	A	M	J	J	A	S	O	N	D	
Fulmar	Breeding					1.12								0 - 582.6
	Winter	3.37								3.37				0 - 239.2
Storm petrel	Breeding								< 0.01					0 - 24.9
Gannet	Breeding							0.50						0 - 110.5
	Winter		0.06									0.06		0 - 24.9
Great skua	Breeding							< 0.01						0 - 1.6
Kittiwake	Breeding							0.26						0 - 185.0
	Winter		1.22									1.22		0 - 306.8
Common gull	Breeding							<0.01						0 - 2.6
Great black-backed gull	Breeding					0.02								0 - 4.8
	Winter		0.19								0.19			0 - 19.5
Herring gull	Winter		0.19								0.19			0 - 101.9
Guillemot	Breeding					0.03								0 - 713.4
	Winter		1.79									1.79		0 - 62.7
	Other								1.02					0 - 254.8
Little auk	Winter		0.10									0.10		0 - 13.4
Razorbill	Winter		0.01									0.01		0 - 15.8
Atlantic Puffin	Breeding					0.23								0 - 162.4
	Winter		0.31							0.31				0 - 0.14
Key (Number of individuals per km²)														
		1.0 - ≤ 4.0		0.2 - < 1.0		0.01 - < 0.2				< 0.01				No Occurrence

^{N1}: The predicted at-sea seabird density for each seabird species/season was calculated from ESAS transect data using the spatial interpolation technique Poisson kriging (Kober et al., 2010)

The JNCC prepares the latest analysed trends in abundance, productivity, demographic parameters, and diet of breeding seabirds, from the Seabird Monitoring Programme (JNCC, 2023). This data provides at-a-glance UK population trends as a percentage of change in breeding numbers from complete censuses. From the year 2015 to 2021, 25 species were monitored, and there is confidence in the trends of 21 of these species, with 11 of these 21 having declined in population since the 1998-2002 census. Species with declining population trends include Arctic skua (-66%), common gull (-49%), black- legged kittiwake (-42%), northern fulmar (-35%), and great black- backed gull (-40%). Breeding seabird numbers of some species have shown a long-term decline, probably as a result of a shortage of key prey species such as sandeel associated with changes in oceanographic conditions (DESNZ, 2022). This is further exacerbated by fish stock depletion by commercial fisheries, meaning there's not enough food to go around during the important breeding season.

The trend in declining UK seabird populations is also seen in the research comparing the Seabird 2000 consensus with the 2015 - 2021 UK Seabirds Count (Burnell et al., 2023). Britain and Ireland account for 64% to 67% of the global population of great skuas. However, the outbreak of Highly Pathogenic Avian Influenza (HPAI) caused a substantial mortality of great skua during the 2021 and 2022 breeding seasons, with Tremlett et al. (2024) finding a 76% decline in 2023 great skua colony counts, which represents 83% of the UK Seabirds Count population. This resulted in the reclassification of great skuas

from the UK Birds of Conservation Concern (BoCC) 'Amber' to 'Red' list. The effects of HPAI have also contributed to a 7% and 25% decline in the breeding populations of herring gulls and lesser black-backed gulls, respectively, at selected natural nesting sites, based on pre- and post-HPAI counts (Tremlett et al., 2024). The impact of HPAI on their winter populations, however, remains uncertain. Other noteworthy decreases include a 52% drop in common gulls, a 79% decline in Leach's storm-petrels, and a 43% reduction in great black-backed gulls. As a result, five new species have been added to the UK BoCC 'Red' list, indicating they are now at significant risk of local extinction. These species include great skuas, Leach's storm-petrels, common gulls, great black-backed gulls, and Arctic terns. They join the previously listed kittiwakes, herring gulls, roseate terns, Arctic skuas, and puffins, all of which are also highly threatened.

In contrast, the Seabird Monitoring Programme indicates that some species have increasing population trends, including razorbill (+18%) and northern gannet (+38%). Species that remained stable (change within +/- 10%) include common guillemot, common tern, and sandwich tern (JNCC, 2023).

Seabird Sensitivity to Oiling

Seabird populations are particularly vulnerable to surface pollution. The sensitivity of bird species to oil pollution varies considerably throughout the year and is dependent on a variety of factors, including time spent on the water, total biogeographical population, reliance on the marine environment and potential rate of population recovery. Species considered most sensitive to sea surface pollution are those which spend a great deal of time on the sea surface, for example puffin, guillemot, and razorbill. Species considered to be at lower risk, due to spending less time on the sea surface, include gannet and kittiwake.

The Seabird Oil Sensitivity Index (SOSI) (Webb *et al.*, 2016) combines seabird data collected between 1995 and 2015 and individual seabird species index values to create a single measure of seabird sensitivity to oil pollution. The SOSI score for each UKCS Block is ranked into sensitivity categories, from 1 (extremely high sensitivity) to 5 (low sensitivity). An assessment of the median SOSI scores for the proposed Kyla Development and the surrounding blocks indicates that the sensitivity of seabirds to oil pollution is generally low year-round (Table 4.17; Webb *et al.*, 2016). For the UKCS Blocks 29/1 and 29/2 where infrastructure is proposed to be installed, sensitivity is low all year round, bar November, where no data was available for any block.

Table 4.17: Seabird Sensitivity to Oiling within the Proposed Kyla Development Area (Webb et al., 2016)

UKCS Blocks	J	F	M	A	M	J	J	A	S	O	N	D
21/30	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
22/26	5	<u>5</u>	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
22/27	5	<u>5</u>	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
22/28	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
28/5	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
29/1	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
29/2	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
29/3	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
28/10	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
29/6	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
29/7	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>
29/8	5	5	5	<u>5</u>	<u>5</u>	5	5	5	5	<u>5</u>	N	<u>5</u>

Key: 1 = Extremely High; 2 = Very High; 3 = High; 4 = Medium; 5 = Low; N = No Data.
SOSI sensitivity category in red and underlined indicates an indirect assessment of SOSI scores, in light of coverage gaps.
Rows in bold and dark grey indicate the Kyla Development area

4.3.5 Marine Mammals

Cetaceans

Cetacean abundance in the CNS is relatively high compared to the SNS, and broadly in line with the northern North Sea. Twenty-three species of cetacean have been recorded in Scottish waters over the last 25 years. Harbour porpoise (*Phocoena phocoena*) and white-beaked dolphin (*Lagenorhynchus albirostris*) are the most widespread and frequently encountered species, occurring regularly throughout most of the year. Minke whales (*Balaenoptera acutorostrata*) are regularly recorded as frequent seasonal visitors. The coastal waters of the Moray Firth and the east coast of Scotland also support an important population of bottlenose dolphins (*Tursiops truncatus*), while killer whales (*Orcinus orca*) are sighted with increasing frequency towards the north of the area. Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Risso's dolphin (*Grampus griseus*) and long-finned pilot whale (*Globicephala melas*) can be considered occasional visitors, particularly in the north of the area (DESNZ, 2022).

The UK Statutory Nature Conservation Bodies (SNCBs) have published Marine Mammal Management Units (MMMUs) for the seven most common cetacean species in UK waters (bottlenose dolphin, common dolphin, harbour porpoise, minke whale, Risso's dolphin, white-beaked dolphin, and white-sided dolphin). The boundaries of the Management Units (MUs) for each species are primarily defined by the presence of known populations, with divisions proposed on the basis of ecological evidence and / or divisions used for the management of human activities. MUs provide an indication of the spatial scales at which impacts of plans and projects need to be assessed for the key cetacean species in UK waters (IAMMWG, 2022). The MUs within which the proposed Kyla Development area is located, along with the corresponding abundance of animals within these units, are presented in Table 4.18 below and Figure 4.13 (IAMMWG, 2022).

Table 4.18: Estimates of Cetacean Abundance in the Relevant MMMUs (IAMMWG, 2022)

Species	Management Unit	Abundance of Animals	95 % Confidence interval	Density ^{N1}
Bottlenose dolphin	Greater North Sea (639,886 km ²)	2,022	548 – 7,543	0.003
Harbour porpoise	North Sea (678,206 km ²)	346,601	289,498 – 419,967	0.511
Risso's dolphin	Celtic and Greater North Seas (1,560,875 km ²)	12,262	5,227	0.007
Common dolphin		102,656	58,932 – 178,822	0.065
Minke whale		20,118	14,061 – 28,786	0.012
White-beaked dolphin		43,951	28,439 – 67,924	0.028
White-sided dolphin		18,128	6,049 – 54,323	0.011

^{N1} Density (individuals per km) was calculated using the total area of the MU and the abundance of animals within that MU

It is evident that harbour porpoise are the most abundant species in the North Sea compared to other species identified in Table 4.18, despite its MMMU being smaller in area than all species, apart from bottlenose dolphin.

The relative abundance and density of cetaceans in the vicinity of the Kyla Development can also be derived from data obtained during the Small Cetacean Abundance of the North Sea (SCANS-IV) aerial and ship-based surveys. This project identified the abundance and density of cetacean species within predefined sectors of the North Sea and North-East Atlantic. The proposed Kyla Development is situated within SCANS-IV Block NS-D in which harbour porpoise, minke whale, fin whale (*Balaenoptera physalus*) and white-beaked dolphin have been recorded (Table 4.19; Gilles et al., 2023).

Table 4.19: Estimated Abundance and Density of Cetaceans in UK Waters from the SCANS IV Aerial Survey Area Block NS-D (Gilles et al., 2023)

Species	SCANS-IV Block 'NS-D'		Total (Aerial Survey Blocks)	
	Abundance	Density ^{N1}	Abundance	Density ^{N1}
Harbour Porpoise	38,577	0.5985	409,244	0.279
White-beaked Dolphin	5,149	0.0799	67,138	0.046
Minke Whale	2,702	0.0419	12,417	0.009
Fin Whale	57	0.0009	2,515	0.0017

^{N1} Density is the number of animals per km²

As the SCANS-IV survey area encompasses a relatively large geographical area and is therefore unlikely to accurately reflect the abundance and densities of cetaceans which may be present within the vicinity of the proposed development area, data from the JNCC Atlas of Cetacean Distribution in northwest European Waters has been used to give a more localised indication of the seasonal distribution of cetaceans. The seasonal sightings data for ICES Rectangle 42F1 are summarised in Table 4.20, which indicates that harbour porpoise, common dolphin, minke whale, white beaked dolphin and Atlantic white-sided dolphin have been observed in the area (Reid *et al.*, 2003). However, it is important to note that the lack of recorded sightings does not necessarily preclude the presence of a species at a certain time of year. In addition, the highly mobile nature of cetaceans means that species that are found within the area in general may be present at other times of the year.

Table 4.20: Cetacean Sightings in ICES Rectangles 42F1 (Reid *et al.*, 2003)

Species	J	F	M	A	M	J	J	A	S	O	N	D
Common Dolphin												
Harbour Porpoise												
Minke Whale												
White Beaked Dolphin												
White Sided Dolphin												
Key (Number of individuals per hour of sightings effort)												
	High (>100)	Medium (10 – 100)	Low (1 – 10)				Very Low (0 – 1)					No sightings

All cetaceans (whales, dolphins, and porpoises) are listed as European Protected Species (EPS) under Annex IV of the Habitats Directive. Harbour porpoise is also listed on the OSPAR List of Threatened and/or Declining Species (OSPAR, 2024) and harbour porpoise is listed under Annex II of the Habitats Directive. In addition, harbour porpoise, minke whale and white beaked dolphin are listed as PMFs (NatureScot, 2022). All species mentioned are regarded as being of Least Concern in terms of their population threats (IUCN, 2025).

Of note is that there has been a change in the overall conservation status of cetaceans in UK waters from favourable to unknown since 2013. This is due to the implementation of a more robust assessment methodology, supported by updated European Union (EU) Commission guidance, which requires consideration of population trends in setting the Favourable Reference Population (FRP) value. However, this requires a higher number of UK population estimates over time than are currently available, resulting in the unknown conclusion (DESNZ, 2022).

Multiple studies have been undertaken that aim to predict the future distributions, behaviours and health of cetacean populations (DEFRA, 2024). In general, they note that, in the UK and wider north-west European waters, the main effects of climate change on cetaceans will be:

- Geographical range shifts appear to be occurring, with northward extensions of the range of warmer water species, such as striped dolphin, short-beaked common dolphin, and possible range contractions of cold-water species such as white-beaked dolphin.

- Continued rises in sea temperature could result in a shift in the species composition for cetaceans around the British Isles, with increased biodiversity particularly of subtropical and warm temperate pelagic species.
- Species that traditionally make long-distance seasonal migrations (e.g. most baleen whales) will likely arrive earlier or remain in high latitudes for longer, with increased breeding attempts.
- Ecosystem regime shifts in UK waters may result in lower food availability for a number of marine mammal species, and lead to re-distribution of some regional populations.
- In low latitude, warm water regions, some species have experienced occasional mass die-offs linked to the presence of algal toxins. These may now also be affecting marine mammal species in mid-latitudes, including harbour seals.
- Responses of marine mammals to climate change, both at individual and population levels, remain poorly understood. Predicting future impacts is challenging, and it is currently unrealistic to assess these for specific time horizons beyond the likely continuations of range shifts which are already being observed.

Pinnipeds

Two species of seals; grey seal (*Halichoerus grypus*) and the harbour (or common) seal (*Phoca vitulina*) live and breed in the UK. Grey and harbour seals are both listed under Annex II of the EU Habitats Directive, requiring the designation of Special Areas of Conservation (SACs) in order to protect these species. In addition, harbour and grey seals are protected under the Conservation of Seals Act 1970 (DTI, 2004), and are listed as Scottish PMFs (NatureScot, 2022).

In the UK, recent demographic changes (increases in most grey seal populations and declines in some harbour seal populations) could potentially be linked in some way to climate-mediated changes in food supply, however, other factors (depletion of food resources from fishing, recovery from epizootics, interspecific competition, density dependent effects) may be more important (DESNZ, 2022).

Grey Seals

Approximately 70% of the UK population breeds in Scotland, largely in the Western Isles and Orkney (SCOS, 2024). Major colonies are also present on Shetland and along the east coast of Scotland including the Isle of May and Fast Castle. Breeding takes place in the autumn between September and November. Pup production has continued to increase exponentially at colonies in the North Sea; elsewhere, it is stable or increasing (DESNZ, 2022).

Most of the grey seal population will be on land for several weeks from October to December during the pupping and breeding season, and again in February and March during the annual moult. Densities at sea are likely to be lower during this period than at other times of the year. They also haul-out and rest throughout the year between foraging trips to sea (DESNZ, 2022). Studies have shown some mature seals to return year after year to particular breeding sites and foraging season haul-outs (Pomeroy *et al.*, 2000; Vincent *et al.*, 2005).

Grey seal are generalist feeders, foraging mainly on the seabed at depths up to 100 m, although likely capable to feed at all depths found across the continental shelf (SCOS, 2024). Their foraging movements are on two geographical scales: long and distant trips from one haul-out site to another; and local repeated trips to discrete foraging areas (McConnell *et al.*, 1999). Foraging areas can be up to 100 km offshore and connected to haul-out sites by prominent high-usage corridors (Jones *et al.*, 2015). As such, the distribution of grey seals in the proposed Kyla Development area is predicted as very low with less than 0.001% of the total seal population present at any given time per 25 km² (Figure 4.15; Carter *et al.*, 2022)

Harbour Seals

The UK is home to approximately 30% of the European population of harbour seals, with Scotland holding approximately 85% of the UK harbour seal population (SCOS, 2024). Harbour seals are widespread around the west coast of Scotland, throughout the Hebrides and around Shetland and Orkney (SCOS, 2024), although major declines have been documented in many harbour seal

populations around Scotland, with declines of 85% between 1993 and 2019 seen in Shetland (Morris *et al.*, 2021).

Harbour seal haul out, breeding and moulting sites are typically situated in sheltered estuaries and on sandbanks, but they also utilise rocky areas. Harbour seals spend a high proportion of time ashore during the pupping and moulting seasons from June to August. Satellite tagging studies have observed that foraging trips around Orkney and Shetland are generally within 40 – 50 km of haul out sites; although some foraging trips of over 100 km were recorded (SCOS, 2005; SCOS, 2014). Longer trips (further than 200 km) were also observed, but these were between haul out sites on Orkney and Shetland rather than to offshore foraging areas. Tracking studies indicate the at-sea distribution of harbour seals in the vicinity of the proposed Kyla Development area is very low with less than 0.001% of the total seal population present at any given time per 25 km² (Figure 4.15; Carter *et al.*, 2022).

Management Units

The UK SNCBs have defined MUs for grey and harbour seals in inshore UK waters in order to provide an understanding of their geographical range, and abundance of their populations, and subpopulations, to aid conservation and management purposes. The proposed Kyla Development is not located within a MU for seals as these are specific to inshore waters (IAMMWG, 2013). However, it is noted that the seaward extent of these MUs is illustrative and not definitive, as seals will cross MU boundaries on a regular basis. Table 4.21 therefore lists the MU for seals which is adjacent to the proposed Kyla Development, along with the corresponding abundance of animals within this unit.

Table 4.21: Population Sizes of Seals in MUs relevant to the Kyla Development Area defined by SCOS (2024)

Species	Management Unit	Seal Count	Estimated UK Population Size	Survey Year
Harbour Seal	East Coast Scotland	276	40,525	2021, 2023
Grey Seal		1,584	168,400	2021, 2023

In the UK, recent demographic changes (increases in most grey seal populations and declines in some harbour seal populations) could potentially be linked in some way to climate-mediated changes in food supply, however, other factors (depletion of food resources from fishing, recovery from epizootics, interspecific competition, density dependent effects) may be more important (DESNZ, 2022).

Figure 4.13: Marine Mammal Management Units in the Vicinity of the Proposed Kyla Development (IAMMWG, 2022)

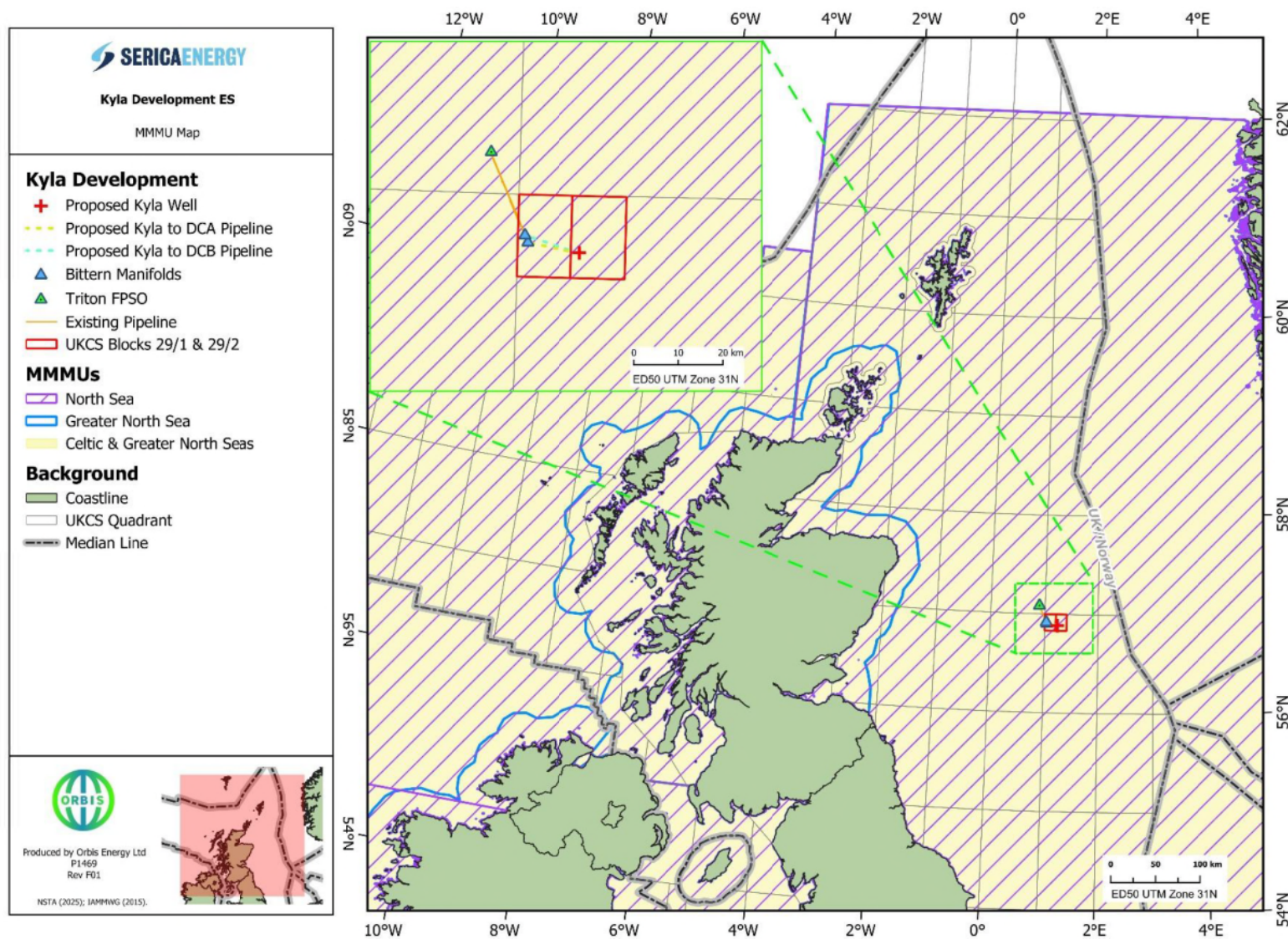


Figure 4.14: SCANS IV Blocks in the Vicinity of the Proposed Kyla Development (Gilles et al., 2023)

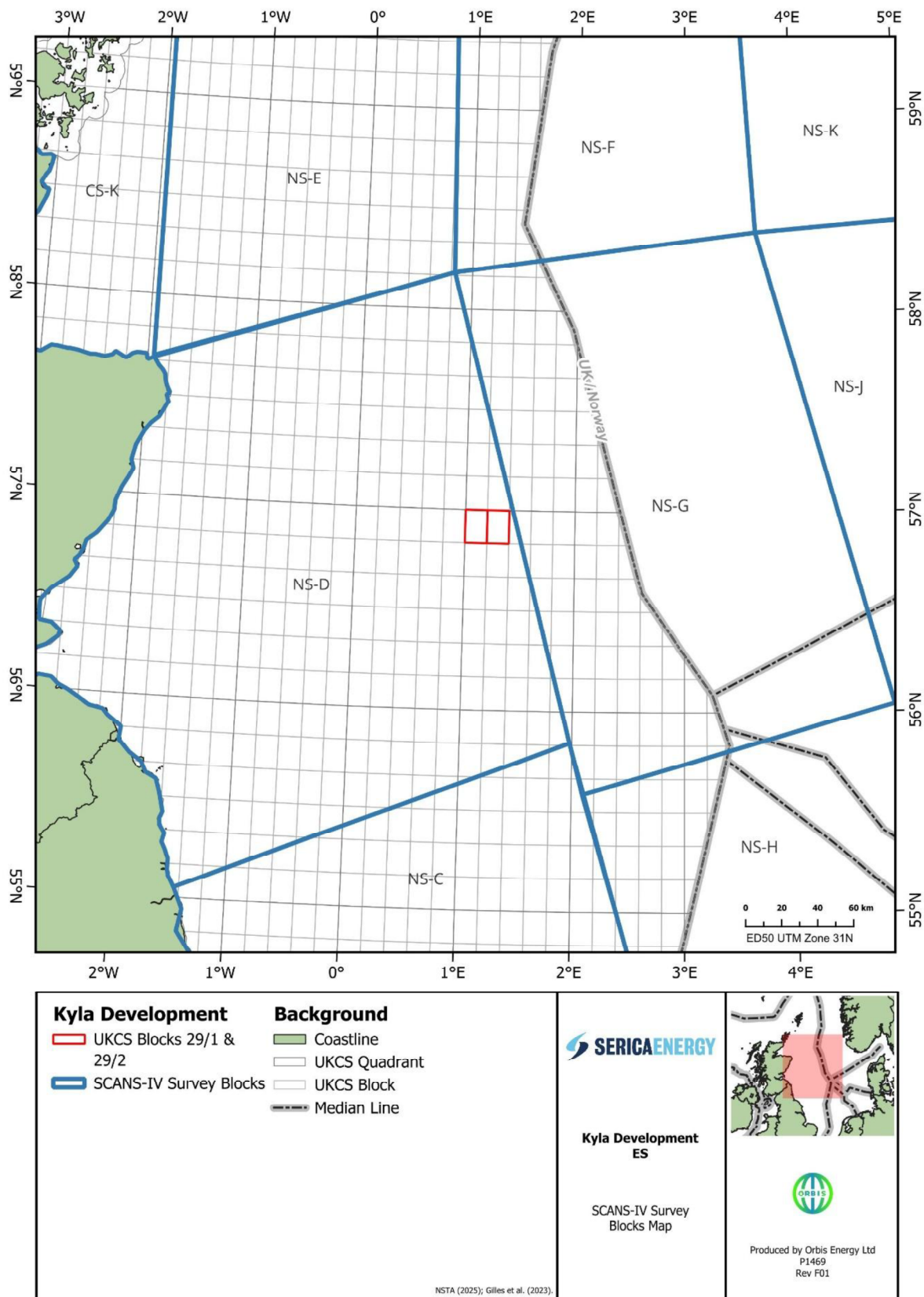
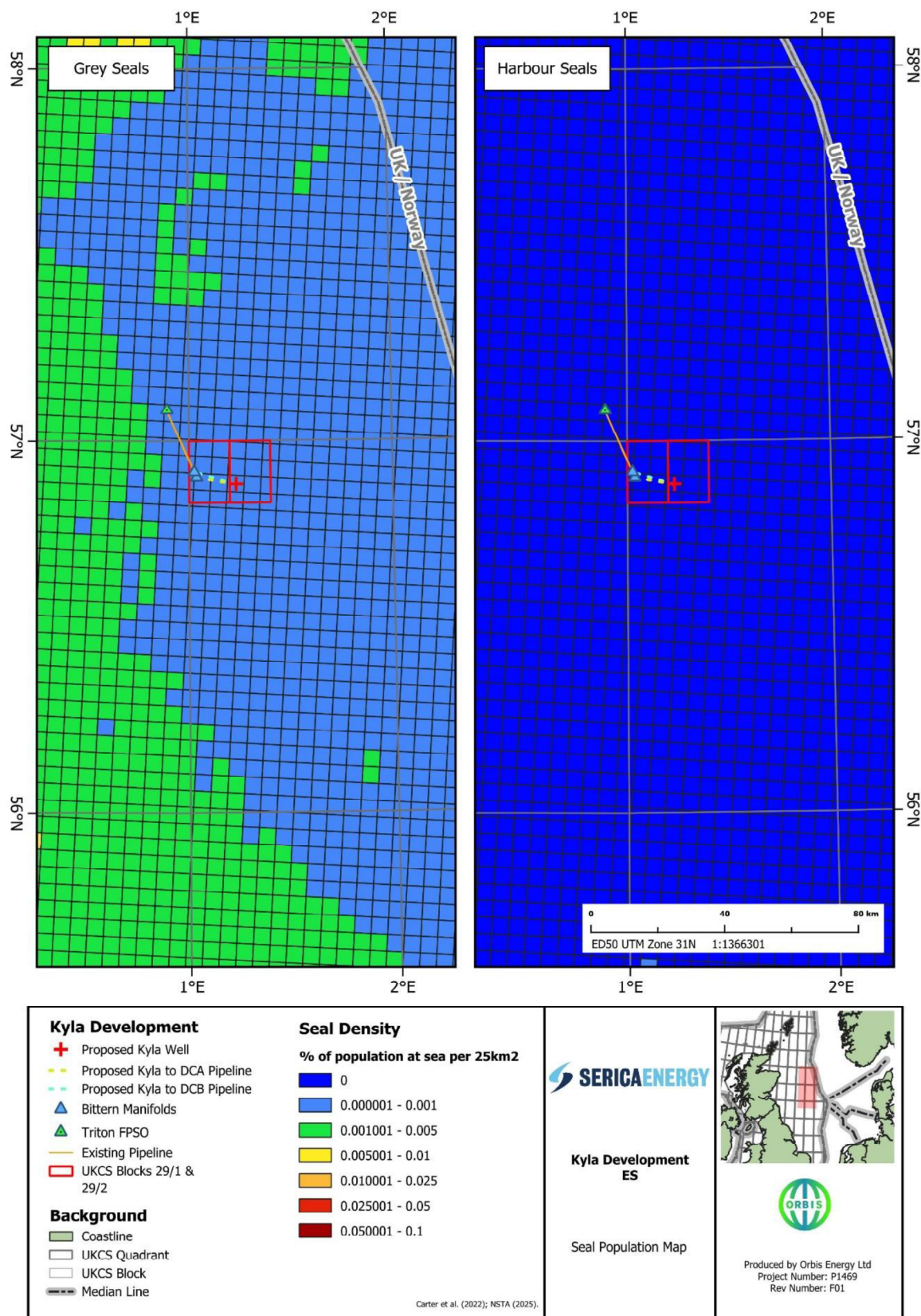


Figure 4.15: Seal Density in the vicinity of the Kyla Development (Carter *et al.*, 2022)



4.3.6 Marine Protected Areas

The proposed Kyla Development area is located 13.4 km south of the East of Gannet and Montrose Fields NC MPA, designated for the protection of ocean quahog (*Arctica islandica*) aggregations (JNCC, 2024a). No other MPAs are located within 40 km of the proposed Kyla Development area (Refer to Figure 4.16).

East of Gannet and Montrose Fields NC MPA

The East of Gannet and Montrose Fields NC MPA lies within a relatively shallow sediment plain comprised mainly of sand and gravel habitats that support a range of benthic species. One such species is the ocean quahog (*Arctica islandica*), which is considered Threatened and/or Declining across the North-east Atlantic by the OSPAR Commission. This species of clam is typically found beneath the surface of sandy sediments, in water depths from 4 m to over 400 m. Ocean quahog filter food from passing currents and use their shovel-like 'foot' to bury into the sediment. Ocean quahog are an important food source for several species of fish, including cod, and can live buried deep in the sand for long periods of time without food or oxygen to escape predators. They can live for more than 400 years and are one of the longest living creatures on Earth. The Norwegian Boundary Sediment Plain NC MPA and Firth of Forth Banks Complex NC MPA are also located within the CNS biogeographic region and designated for ocean quahog aggregations, increasing the replication and, therefore, the resilience of this protected feature in the MPA network (JNCC, 2024b).

The MPA also protects the full extent of an area of offshore deep-sea mud. By protecting the full extent of the deep-sea mud in this area, the MPA protects a coherent, rather than fragmented, example of this habitat. This is one of the few examples of Atlantic-influenced offshore deep sea mud habitats on the continental shelf in the region. Furthermore, East of Gannet and Montrose Fields NC MPA is the only MPA designated in the CNS region for the protection of offshore deep-sea muds. The deep-sea muds occur across the south-east half of the MPA, approximately 100 m deep. Ocean quahogs are distributed across the entire site, with the supporting habitat for this feature occurring across the north-west half of the MPA. There is limited evidence of the composition and diversity of the biological communities present in this habitat, but evidence from the monitoring survey in 2015 showed this to be colonised by animals such as seapens.

The conservation objectives of The East of Gannet and Montrose Fields NC MPA are to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining both the Favourable Conservation Status (FCS) of the NC MPA site (JNCC, 2024b).

In the context of the sites change, this will be achieved by ensuring that:

- so far as already in favourable condition, remain in such condition; and
- so far as not already in favourable condition, be brought into such condition, and remain in such condition.

With respect to the Offshore deep-sea muds within the NC MPA, this means that:

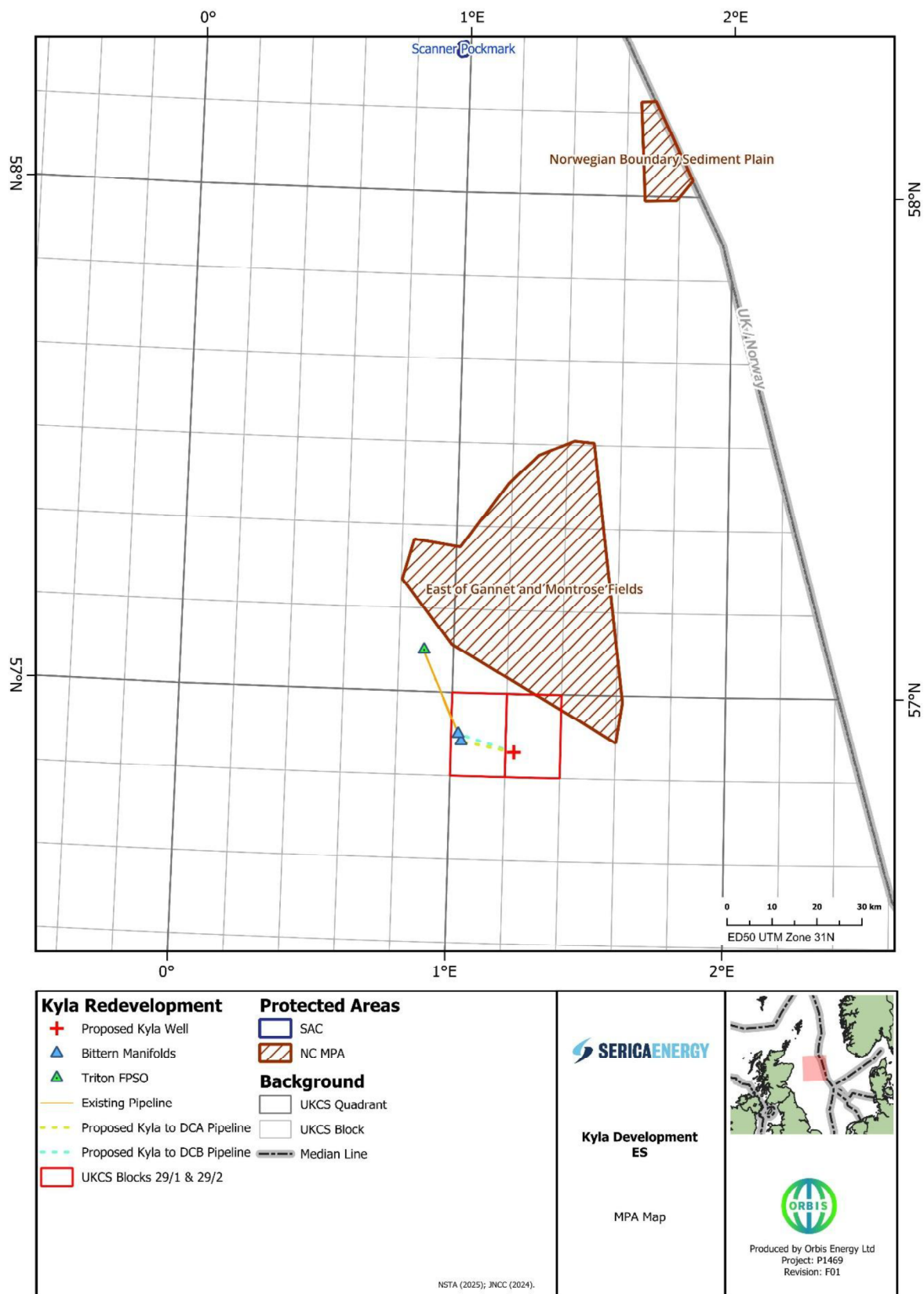
- extent is stable or increasing; and
- structures and functions, quality, and the composition of characteristic biological communities (which includes a reference to the diversity and abundance of species forming part of or living within the habitat) are such as to ensure that they remain in a condition which is healthy and not deteriorating;

With respect to the Ocean quahog aggregations (including supporting sedimentary habitats) within the NC MPA:

- This means that the quality and quantity of its habitat and the composition of its population in terms of number, age and sex ratio are such as to ensure that the population is maintained in numbers which enable it to thrive.

Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery from such deterioration. Any alteration to that feature brought about entirely by natural processes is to be disregarded.

Figure 4.16: MPAs within the Vicinity of the Kyla Development (JNCC, 2024; NSTA, 2025c)



4.4 Human Environment

4.4.1 Commercial Fisheries

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

As previously noted, the proposed development area is located within ICES Rectangle 42F1. The SG-MD provides landings data, including the live weight (tonnes) and value of sea fish by UK vessels into the UK and abroad, and landings into the UK by foreign vessels with a primary focus on Scottish waters. The data for ICES Rectangle 42F1 is shown in Table 4.24, Table 4.25, Table 4.26 and Table 4.27 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025).

Fishing Landings

Table 4.24 and Table 4.26 summarise monthly fisheries landings data (live weight and sales value, respectively) from ICES Rectangle 42F1 over a ten year period from 2015 to 2024. Across the ten year period, the live weight landings fluctuate, but, on average were highest in January at 56.92 tonnes and lowest in April at 7.78 tonnes. The most commonly fished months were January and June, landings were reported in these months for 7 out of the 10 years in Table 4.24. The mean sales value also fluctuates, but were highest in January at £188,955.46, and lowest in April at £18,041.93.

Table 4.25 and Table 4.27 summarise the fisheries landings data (live weight and sales value, respectively), from ICES Rectangle 42F1 for a ten year period from 2015 to 2024 by species type. It can be seen from this that shellfish fisheries dominate the landings data from ICES Rectangle 42F1, with *Nephrops norvegicus* the first greatest component in terms of value and in terms of weight (tonnes) of the fishery (see Table 4.22 and Table 4.23). The total live weight and sales value fluctuates over the ten year period, with the highest value recorded in terms of weight in 2016 at 604.14 tonnes and in terms of value in 2023 at £1,505,781.44. The lowest values recorded in terms of weight in 2015 at 149.55 tonnes and in terms of value in 2015 at £391,673.89 respectively.

Table 4.22: Catch Composition by Weight (tonnes) between 2015 and 2024 within ICES Rectangle 42F1 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025)

Number	Average Quantity (tonnes)	Species
1	208.23	<i>Nephrops</i> (Norway Lobster)
2	75.43	Herring
3	33.39	Haddock
4	23.57	Whiting
5	16.19	Monks or Anglers
6	9.74	Gurnards - Grey
7	6.78	Witch
8	6.23	Plaice
9	6.07	Lemon Sole
10	3.28	Squid

Table 4.23: Catch Composition by Value (£) between 2015 and 2024 within ICES Rectangle 42F1 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025)

Number	Average Value (£)	Species
1	820,563.48	<i>Nephrops</i> (Norway Lobster)
2	44,644.64	Monks or Anglers
3	36,731.25	Herring
4	18,917.69	Halibut
5	17,932.60	Haddock
6	16,909.69	Whiting
7	14,545.78	Lemon Sole

Number	Average Value (£)	Species
8	10,726.58	Squid
9	7,180.15	Witch
10	5,051.07	Plaice

Fishing Effort

Table 4.28 summarises the fishing effort (days) in ICES Rectangle 42F1 during the 2015-2024 period. It can be seen that fishing effort within ICES Rectangle 42F1 is low, with an average annual effort of 304 days recorded per year. January is the month with the highest effort on average for any given year, and January, May and August are the most consistent months within the period an average effort of 55, 32 and 30 days respectively. There is a net increase since 2015 in terms of days fished within 42F1. The data features a lot of disclosive identifiers 'D', which further indicates a low level of fishing activity where data has been disclosed (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025; Table 4.28).

Within ICES Rectangle 42F1 the most popular gear used to target fisheries is trawls, these accounted for 100% of the effort within the period between 2015-2024 records. Traps are also recorded as being utilised in 42F1, however the data is disclosive for all years, which further indicates a low level of fishing activity using this gear type (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025).

In addition, fishing vessel density data shows that within the Kyla Development area the annual average hours per km² is very low (< 0.3) (EMODnet, 2024; Figure 4.18).

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Table 4.24: Total Monthly Fishing Landings (by live weight) by Vessels between 2015 and 2024 within ICES Rectangle 42F1 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025)

Month	42F1 - Fishing Landings (tonnes)										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Mean
Jan	D	D	32.05	84.32	52.07	35.62	D	136.69	191.64	36.83	56.92
Feb	-	D	D	4.18	27.42	11.04	16.11	D	13.48	26.02	9.82
Mar	D	67.24	-	D	46.08	D	D	D	D	3.34	11.67
Apr	12.78	D	D	D	18.98	D	36.74	D	-	9.32	7.78
May	15.25	87.38	D	D	D	D	D	142.96	21.13	5.8	27.25
Jun	14.43	73.19	43.14	4.44	D	D	159.97	43.97	14.21	D	35.33
Jul	-	D	D	D	11.51	D	D	D	93.96	24.51	13.0
Aug	-	D	93.64	53.7	25.63	201.03	D	D	14.03	1.94	39.0
Sept	34.57	111.98	D	D	30.77	-	D	D	3.02	45.6	22.59
Oct	31.0	D	D	D	D	D	27.7	D	39.33	70.75	16.88
Nov	29.29	10.62	D	D	69.04	20.46	D	D	74.2	122.0	32.56
Dec	D	91.07	D	D	25.44	19.55	18.28	38.06	33.78	D	22.62

Note: '-' = no data, 'D' = Disclosive data (indicating very low effort).

Table 4.25: Weight of landings (by species type) for ICES Rectangle 42F1 between 2015 and 2024 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025)

Species	42F1 - Fishing Landings (tonnes)									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Demersal	66.48	153.27	67.32	53.24	99.69	71.04	77.98	110.17	230.9	175.42
Pelagic	0.33	214.99	1.34	26.55	0.42	5.22	0.21	0.13	0.11	0.03
Shellfish	82.73	235.88	140.28	115.12	242.47	281.17	284.35	308.16	267.83	175.65
Total	149.55	604.14	208.93	194.91	342.57	357.43	362.54	418.46	498.84	351.09

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Table 4.26: Total Monthly Fishing Landings (by value) by Vessels between 2015 and 2024 within ICES Rectangle 42F1 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025)

Month	42F1 - Fishing Landings (value in £)										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Mean
Jan	D	D	104,921.57	303,565	150,217.21	91,357.59	D	479,796.82	653,588.02	106,108.35	188,955.46
Feb	-	D	D	6,798.52	64,107.80	33,153.11	42,873.48	D	36,196.30	100,810.53	28,393.97
Mar	D	174,218.84	-	D	121,988.87	D	D	D	D	10,099.48	30,360.72
Apr	20,653.03	D	D	D	58,170.28	D	81,305.19	D	-	20,290.77	18,041.93
May	36,098.75	244,807.22	D	D	D	D	D	555,811.18	71,541.04	14,482.92	92,274.11
Jun	28,626.28	42,450.29	143,022.75	13,072.01	D	D	450,188.80	173,067.40	67,000.36	D	91,742.79
Jul	-	D	D	D	36,585.05	D	D	D	252,455.39	83,552.79	37,259.32
Aug	-	D	331,044.66	93,270.51	80,157.27	432,963.49	D	D	47,931.85	5,623.01	99,099.08
Sept	101,735.30	371,298.29	D	D	77,574.27	-	D	D	2,958.61	128,530.20	68,209.67
Oct	88,463.38	D	D	D	D	D	75,945.40	D	117,396.21	257,847.81	53,965.28
Nov	86,449.73	45,621.06	D	D	214,341.51	46,602.09	D	D	196,053.54	323,857.00	91,292.49
Dec	D	369,974.52	D	D	78,004.36	46,904.79	56,197.91	105,718.02	60,631.68	D	71,743.13

Note: '-' = no data, 'D' = Disclosive data (indicating very low effort).

Table 4.27: Value of landings (by species type) for ICES Rectangle 42F1 between 2015 and 2024 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025)

Species	42F1 - Fishing Landings (value in £)									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Demersal	70,310.57	202,600.63	112,475.13	75,048.65	121,310.86	90,698.83	113,785.69	168,681.63	255,694.95	168,839.08
Pelagic	361.60	104,582.01	1,301.12	10,620.06	349.20	2,916.63	255.86	197.00	128.95	0.14
Shellfish	321,001.72	1,080,619.90	602,734.50	484,343.95	842,305.49	689,308.50	857,272.56	1,319,680.57	1,249,957.54	890,962.60
Total	391,673.89	1,387,802.54	716,510.75	570,012.66	963,965.55	782,923.96	971,314.11	1,488,559.20	1,505,781.44	1,059,801.82

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Table 4.28: Number of Days Fished per Month (All Gears) in ICES Rectangles 42F1 from 2015-2024 (Marine Scotland, 2015; Marine Scotland, 2020; SG-MD, 2025)

ICES Rectangle 42F1													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total ^{N1}
2024	41	33	7	10	4	D	26	4	29	65	65	D	287
2023	160	6	D	D	31	18	93	11	7	47	61	20	456
2022	102	D	D	D	139	23	17	D	D	9	D	23	352
2021	22	6		28	14	126	D	9	34	24	10	11	289
2020	27	18	16	D	D	D	D	129		D	25	9	265
2019	45	9	42	24	D	D	23	D	18	23	42	17	251
2018	98	11	D	D	D	D	D	42	D	D	D	31	210
2017	51	D	D	D	D	43	34	72	D	D	D	D	222
2016	D	D	100	15	94	10	14	47	101	8	18	99	512
2015	D		D	D	14	20			39	37	51	D	195
Note: Monthly fishing effort by UK vessels landing into Scotland: Blank = no data, D = Disclosive data (indicating very low e ffort), ^{N1} Includes any days that cannot be disclosed in the monthly figures green = 0-100 days fished, yellow = 101-200, orange =201-300, red = ≥301													

An analysis of fishing activity has also been undertaken by Kafas *et al.* (2012) using the Vessel Monitoring Systems (VMS). The VMS provides information on the locations and identity of all UK fishing vessels greater than 15 metres in length from 2009 to 2013. Fishing activity data from the VMS were combined with landings data to identify spatial patterns of fishing intensity. It is important to note that the data does not provide an absolute quantitative representation of the amount of fishing in an area but can be used to qualitatively describe relative fishing intensity. Fishing intensity information was gathered for demersal mobile and demersal static gears, as well as pelagic fisheries (mackerel and herring) and shellfish fisheries (crab, lobster, scallops and squid). For the proposed Kyla Development area, Figure 4.17 shows that there is a low intensity of demersal fisheries (mobile and static gears), crab fisheries, lobster fisheries, mackerel fisheries, scallop fisheries and squid fisheries; and a moderate intensity of *Nephrops norvegicus* fisheries (mobile gears) and herring fisheries in the vicinity of the proposed Kyla Development (Kafas *et al.*, 2012).

Figure 4.17: Fishing Intensity in the Vicinity of the Proposed Kyla Development (Kafas et al., 2012)

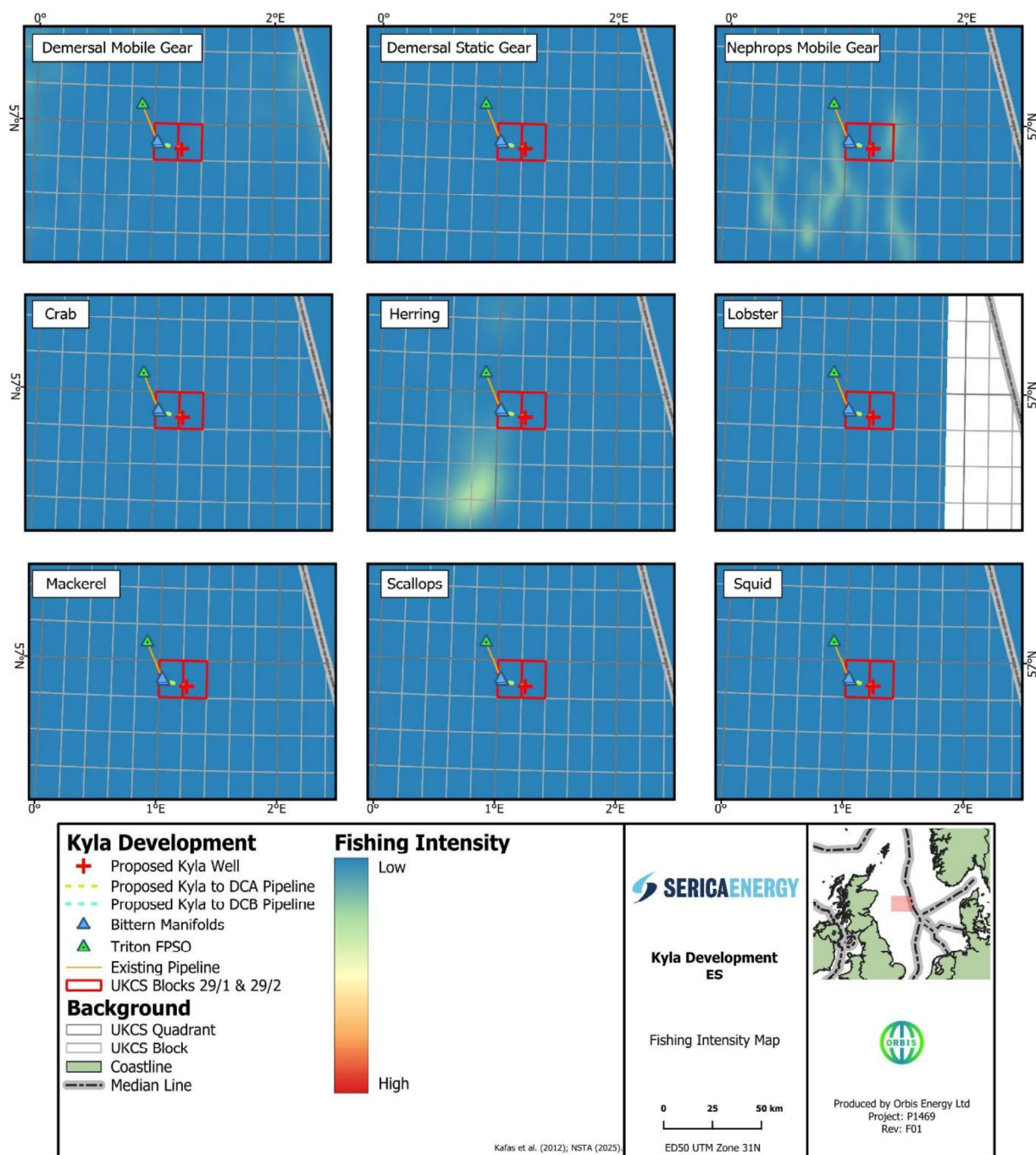
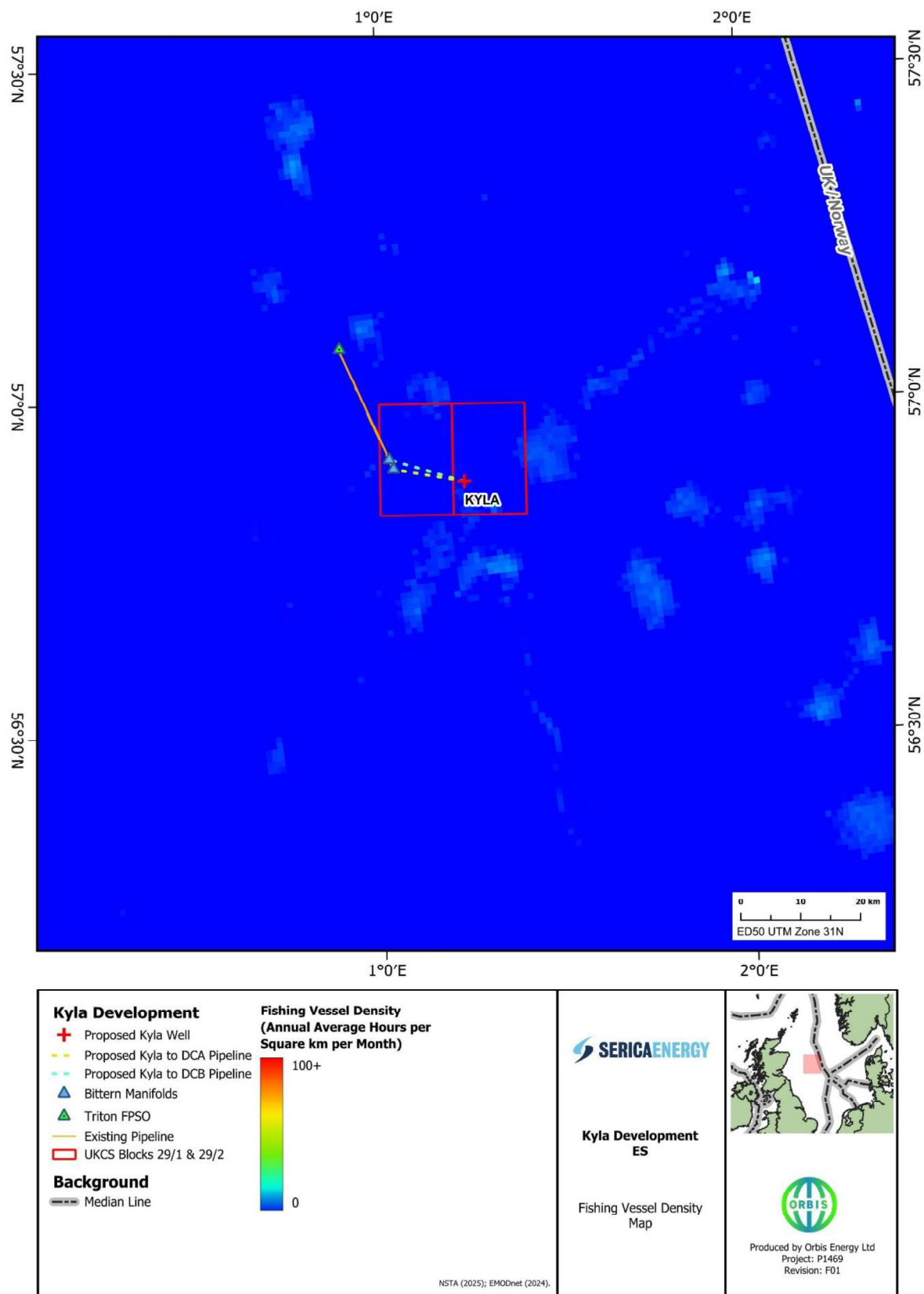


Figure 4.18: Fishing Vessel Density in the Vicinity of the Proposed Kyla Development (EMODnet, 2024)



Regional Fishing Intensity Study

A vessel traffic survey focused on the Bittern to Triton FPSO pipeline was previously conducted; this study is focussed on a 10 nautical mile (NM) radius zone around the pipeline (Xodus, 2025). As the proposed Kyla well location and proposed pipeline route sit within this 10 NM boundary from Bittern (the proposed Kyla well is ca. 6.4 NM from the Bittern manifolds and pipeline), the results of this survey are applicable to the proposed Kyla Development.

Figure 4.19 shows vessel tracks from all fishing vessels identified within the 10 NM study area. It should be noted that the presence of fishing vessels does not necessarily indicate the presence of fishing activity in the study area and may represent vessels in transit.

There were 262 tracks associated with fishing vessels in the study area. Figure 4.19 shows the distribution of fishing tracks in the area. Fishing activity is relatively low across the study area, although fishing patterns are visible on both sides of the Bittern pipeline and across it. There is evidence of active fishing along two main routes: one north of the Triton FPSO (located ca. 20 km from the proposed Kyla Development), running west to east, and another originating in the southern part of the study area, moving northward to intersect the Bittern to Triton FPSO pipeline approximately 5.5 km south of the Triton FPSO (Xodus, 2025).



4.4.2 Aquaculture and Shellfish Water Protected Areas

There are no aquaculture sites or shellfish protected areas within the vicinity of the proposed Kyla Development due to the large distance from the nearest coastline at Peterhead (184 km) (NMPI, 2025).

4.4.3 Shipping

The density of shipping traffic in the CNS is relatively high due to the presence of fishing vessels, some ferries between the UK and the rest of Europe and cargo and offshore support vessels (DESNZ, 2022). Within UKCS Blocks 29/1 and 29/2 (i.e. the Blocks encompassing the proposed Kyla drill centre and Kyla to Bittern pipeline route) shipping activity is considered to be low, with EMODnet (2024) showing a generally low vessel density, with discrete higher densities areas associated with existing oil and gas infrastructure (OGA, 2016; EMODnet, 2024).

A vessel traffic survey has recently been conducted for the Bittern development project (Xodus, 2025). This study focussed on a 10 NM radius zone surrounding the proposed Bittern to Triton pipeline route. As the proposed Kyla Development infrastructure sits within this 10 NM boundary (the proposed Kyla well is ca. 6.4 NM from the Bittern manifolds and pipeline), the results of this survey are applicable to this assessment.

Figure 4.20 illustrates the shipping lanes identified within 10 NM of the Bittern to Triton pipeline. It should be noted that vessels within a given lane may have different ports of origin / destination, while sharing a common routing pattern within the study area, and as such, behave as a single conceptual lane at the closest point of approach to the asset (Xodus, 2025).

There were 21 shipping lanes in total identified within 10 NM of the Bittern pipeline. Across all shipping lanes within 10 NM of the Bittern pipeline, the most frequent port of origin was Aberdeen (Scotland) with 1,390 tracks (67.9% of all shipping lane tracks) marking this as their previous port. The most frequent destination port was also Aberdeen, with 1,405 tracks (68.6% of all shipping lane tracks) with this as their next port (Xodus, 2025). Within the combined 10 NM study area, the AIS vessel tracks data was filtered to routine traffic only. Routine traffic typically includes cargo vessels, tankers and other vessels but excludes fishing vessels, military operations, tugs, dredgers, pleasure craft and sailing vessels. The study area contains a total of 4,058 routine vessel tracks associated with 440 different vessels, which corresponds to an estimated 11.1 vessel transits per day. These indicate moderate, consistent traffic, with a clear west–east transit pattern across the area. Additionally, there are clusters of activity around the Bittern infrastructure, Triton FPSO, and just west of the Gannet A platform (see Figure 4.21; Xodus, 2025).

Shipping lane and in-field traffic (defined as vessels operating within the hydrocarbon field complex) contribute almost equally to the routine traffic in the study area, with shipping lane traffic accounting for 50.4% and in-field traffic for 49.6% of the total. This similar proportion of in-field and shipping lane traffic suggests that the region has a moderate level of both active surface infrastructure and international shipping activity. Amongst shipping lane traffic, cargo vessel traffic accounts for 6.8% of all routine vessel tracks while tanker vessel traffic in the study area were significantly lower, at 0.8% (Xodus, 2025).

Figure 4.20: Theoretical centre lines of shipping lanes within 10 NM of the Bittern pipeline (Xodus, 2025)

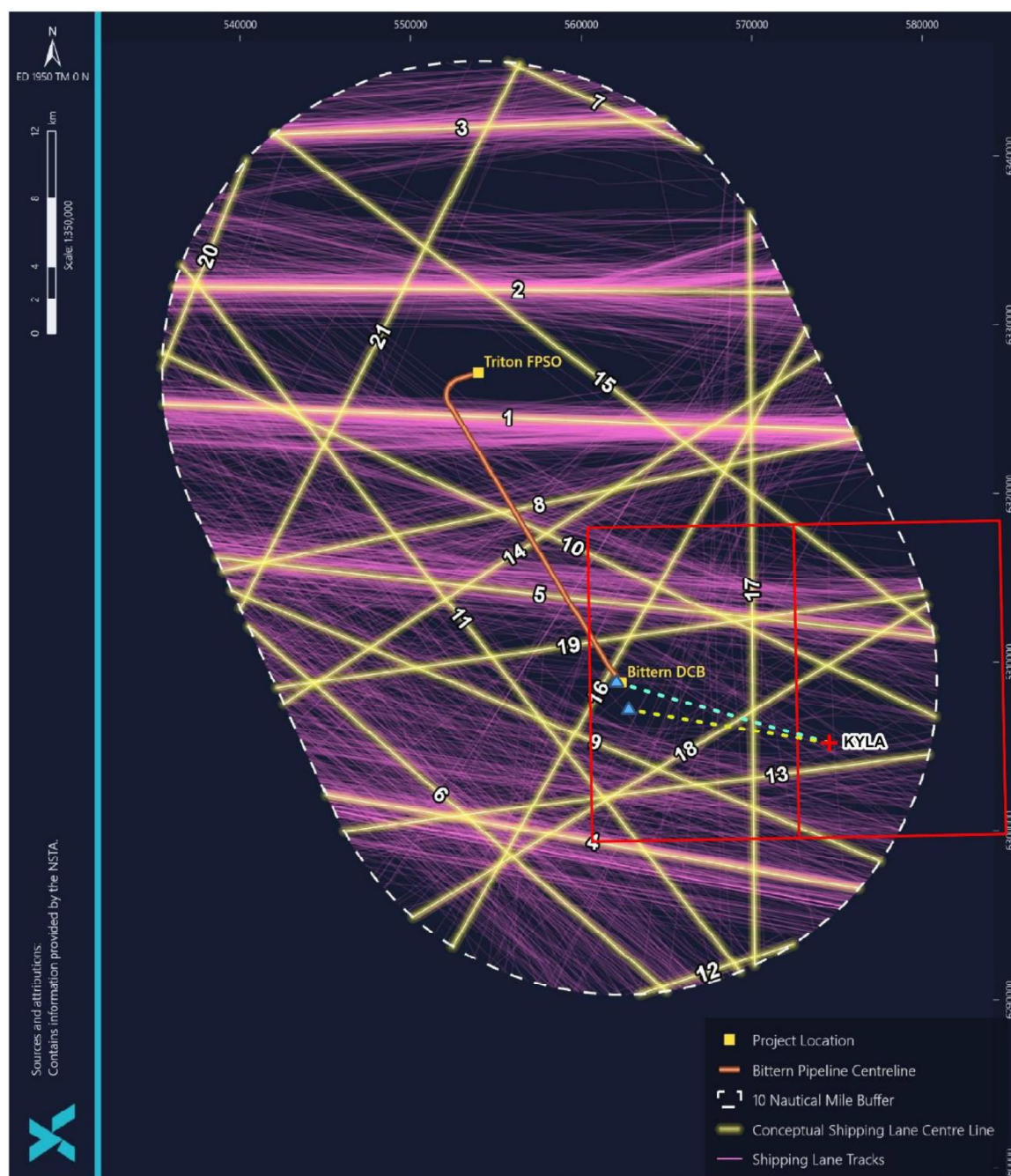
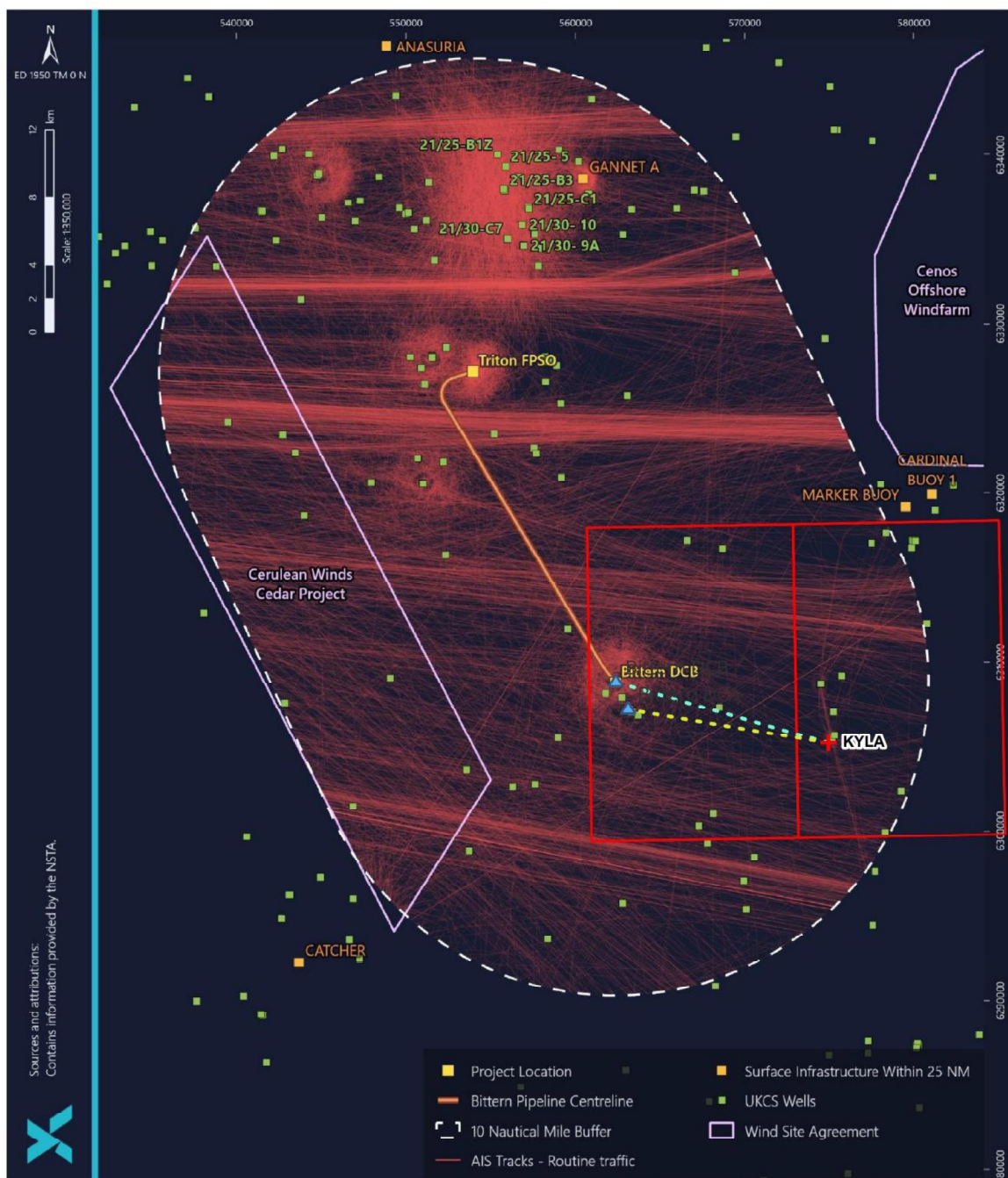


Figure 4.21: Routine vessel tracks within 10 NM of the Bittern pipeline (Xodus, 2025)



4.4.4 Offshore Oil and Gas Activity

The proposed Kyla Development will tie-back to the Bittern Manifold (DCA or DCB) located approximately 12 to 14 km west of the proposed Kyla well location, which produces to the Triton FPSO. Dana operates the subsea and surface infrastructure relating to this export route.

As discussed in Section 1.1, the original Kyle field development was decommissioned in 2020. A multibeam echosounder geophysical survey of the Kyle field undertaken as part of the pre-decommissioning survey scope did not identify a discernible physical cuttings pile. The historic cuttings piles are believed to have dispersed and now lie flush with the seabed. However, seabed samples taken during the survey of the area show a chemical footprint (elevated THC levels) covering an area of 1,432 m² (CNRI, 2021). The proposed Kyla well is located ca. 0.30 km southwest of the K12 well, 0.33 km southwest of the K15 well and over 3 km south southeast of the K13 and K14 wells (NSTA, 2025c). All stations sampled during the 2025 Kyla survey display THC concentrations consistent with the wider area (background concentrations), however, concentrations of Ba can were found to be above the background levels for the area (refer to Section 4.2.2) (Gardline, 2025b).

Apart from Bittern, the closest producing field to Kyla is the Starling subsea gas field (operated by Shell UK), located in UKCS Block 29/3a approximately 12 km to the northeast, which is tied back to the Shearwater platform (NSTA, 2025c).

The nearest FPSO is the Triton FPSO (operated by Dana) which is located approximately 20 km northwest of the Bittern DCB manifold and 30 km northwest of the proposed Kyla well. The next nearest FPSO is the Catcher FPSO (operated by BW Offshore) which is located approximately 24 km southwest of the Bittern DCA manifold (NSTA, 2025c).

The nearest platform to the Bittern DCB manifold is the Gannet A platform (operated by Adura) located approximately 30 km north. The nearest platform to the proposed Kyla well is the West Franklin WHP (operated by Total Energies) which is located approximately 36 km northeast (NSTA, 2025).

The Belinda field is located approximately 14 km north of the Bittern DCB manifold and 24 km northwest of the proposed Kyla well (NSTA, 2025c).

Two active pipelines cross with the proposed Kyla pipeline route, the CATS pipeline (PL774) operated by the Wood Group and the Langed pipeline (PL2071) operated by GASSCO AS (NSTA, 2025).

There are 30 wells within 5 km of the proposed Kyla Development infrastructure. Of these, 9 are appraisal wells, 17 are development and 4 are exploration. Of the 30 wells, 22 are Abandoned (4 Abandoned Phase 1; 18 Abandoned Phase 3), 7 are Completed (Operating) and 1 is plugged (NSTA, 2025c).

Table 4.29: Well Information for wells within 1 km from the Kyla Development (NSTA, 2025c)

Operator	OGA Well Origin Wellbore Name	Well Origin Spud Date	Spud Completion Date	Original Well Intent	Current Status	Water Depth (m)	Distance to Proposed Kyla Development (km)
CNR International (U.K.) Limited	29/02c- 12	21/07/1998	13/08/1998	Appraisal	Abandoned Phase 3	91.14	0.30
CNR International (U.K.) Limited	29/02c- 12J	17/07/1998	21/07/1998	Appraisal	Abandoned Phase 3	91.14	0.30
CNR International (U.K.) Limited	29/02c- 12Z	13/08/1998	04/10/1998	Appraisal	Abandoned Phase 3	91.14	0.30
CNR International (U.K.) Limited	29/02c- 15	19/04/2002	03/07/2002	Development	Abandoned Phase 3	91.14	0.33
CNR International (U.K.) Limited	29/02c- 8	04/07/1993	29/08/1993	Exploration	Abandoned Phase 3	92.05	0.53
CNR International (U.K.) Limited	29/02c- 8Z	06/09/1993	11/11/1993	Appraisal	Abandoned Phase 3	92.05	0.53
Dana Petroleum (E&P) Limited	29/01b- B6	12/05/2024	16/07/2024	Development	Completed (Operating)	92.66	0.01
Dana Petroleum (E&P) Limited	29/01b- B5	18/09/2020	13/10/2020	Development	Completed (Operating)	92.96	0.01
Dana Petroleum (E&P) Limited	29/01b- B4Z	26/09/2006	20/01/2010	Development	Abandoned Phase 1	92.66	0.07
Dana Petroleum (E&P) Limited	29/01b- B4Y	20/01/2010	15/02/2010	Development	Completed (Operating)	92.66	0.07
Dana Petroleum (E&P) Limited	29/01b- B4	02/09/2006	26/09/2006	Development	Abandoned Phase 1	92.66	0.07
Dana Petroleum (E&P) Limited	29/01b- B3	28/04/1998	12/07/1999	Development	Completed (Operating)	92.66	0.05
Dana Petroleum (E&P) Limited	29/01b- B2	24/04/1998	02/07/1999	Development	Abandoned Phase 1	92.96	0.01
Dana Petroleum (E&P) Limited	29/01b- B1	20/04/1998	17/06/1999	Development	Plugged	92.66	0.02

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Operator	OGA Well Origin Wellbore Name	Well Origin Spud Date	Spud Completion Date	Original Well Intent	Current Status	Water Depth (m)	Distance to Proposed Kyla Development (km)
Dana Petroleum (E&P) Limited	29/01b- 5	14/05/1996	14/07/1996	Exploration	Abandoned Phase 3	92.96	0.89
Hess Limited	29/01b- 2	03/04/1986	22/04/1986	Exploration	Abandoned Phase 3	89.31	0.22
Serica Energy Mistral Limited	29/01a-A3Z	02/12/2010	19/12/2010	Development	Completed (Operating)	92.66	0.02
Serica Energy Mistral Limited	29/01a-A3	07/09/1998	02/12/2010	Development	Abandoned Phase 1	92.66	0.02
Serica Energy Mistral Limited	29/01a-A2	03/09/1998	11/01/1999	Development	Completed (Operating)	92.66	0.1
Serica Energy Mistral Limited	29/01a-A1	29/08/1998	03/03/1999	Development	Completed (Operating)	92.96	0.1
Serica Energy Mistral Limited	29/01a- 8	31/07/1997	05/09/1997	Appraisal	Abandoned Phase 3	92.96	0.11
Serica Energy Mistral Limited	29/01a- 7	01/10/1996	04/11/1996	Appraisal	Abandoned Phase 3	92.35	0.25

4.4.5 Renewable Energy, Carbon Capture & Storage and Subsea Cables

The nearest submarine cable to the proposed Kyla Development is the North Sea Link North power cable, operated by the National Grid, located approximately 7.28 km south east from the proposed Kyla Development at its nearest point (see Figure 4.23; KIS-ORCA, 2025).

There are currently no carbon storage licensing blocks or carbon storage licensing round blocks on offer in the vicinity of the proposed development area (Crown Estate Scotland, 2025; NMPI, 2025). The nearest site is CNS Area 2, located approximately 135 km north of the Kyla Development area.

There are no operational, under construction or consented offshore windfarms in the vicinity of the proposed Kyla Development area. The closest offshore windfarm is the Cerulean Winds Cedar Project, currently in the pre-planning stage, located approximately 9.5 km southwest of the Kyla Development (Crown Estate Scotland, 2025). The next closest windfarm is the Cenos Offshore Wind Farm, currently in the planning stage, which would be located approximately 15.5 km northeast of the Kyla Development. Both of these proposed wind farm projects are Innovation and Targeted Oil and Gas (INTOG) offshore wind projects (Crown Estates Scotland, 2025).

4.4.6 Aggregate Dredging and Disposal Activity

There are no dredging or aggregate activities in the vicinity of the proposed Kyla Development area (Crown Estate Scotland, 2025).

Figure 4.22: Oil and Gas Infrastructure in the Vicinity of the Proposed Kyla Development (NSTA, 2025c)

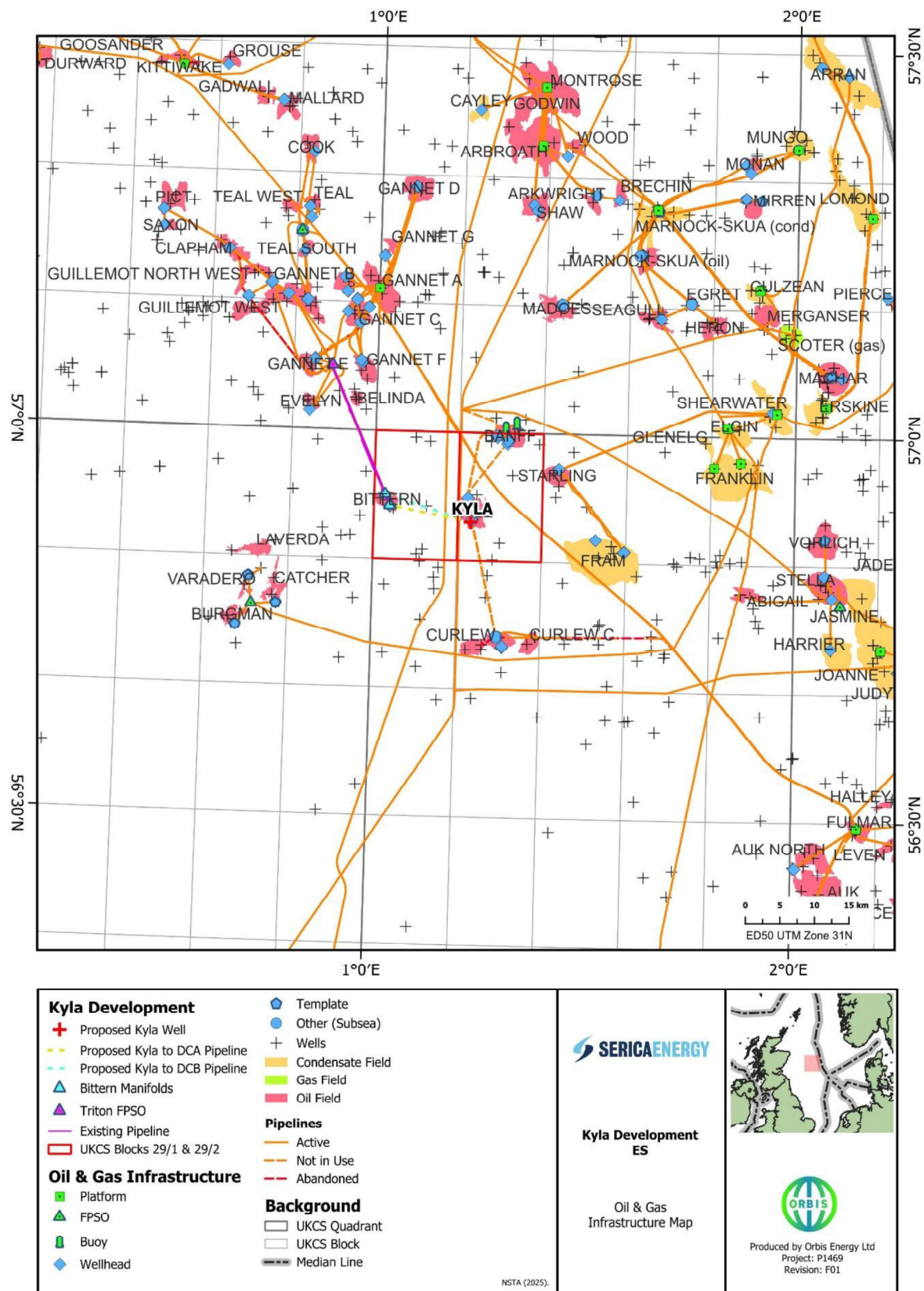
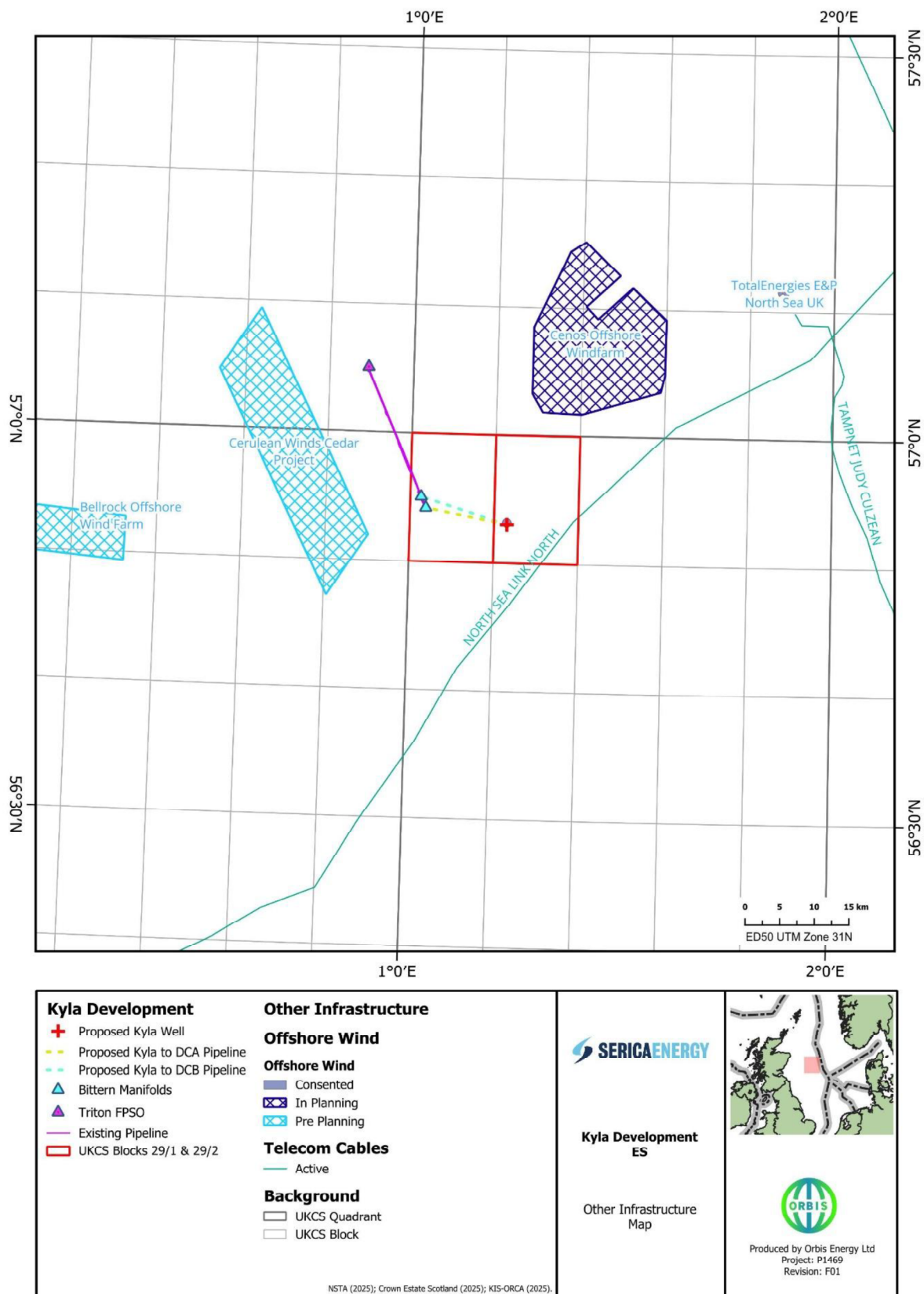


Figure 4.23: Other Infrastructure in the Vicinity of the Proposed Kyla Development (Crown Estate Scotland, 2025; KIS-ORCA, 2025)



4.4.7 Military Activity

There are no military practise and exercise areas in the vicinity of the proposed Kyla Development area and there are no licence conditions applied to UKCS Blocks 29/1 and 29/2 on behalf of the Ministry of Defence (OGA, 2019; NMPI, 2025).

4.4.8 Wrecks

There are no wrecks designated as historic Marine Protected Areas (hMPAs), scheduled monuments (including wrecks) or war graves within the vicinity of the proposed Kyla Development area (NMPI, 2025), nor are there any charted wrecks (UKHO, 2024). In addition, no wrecks were observed during either the 2025 Kyla survey camera footage or the Kyle pre-decommissioning survey camera footage (Gardline, 2025a; Gardline, 2025b; Fugro, 2020; CNRI, 2021).

4.4.9 Tourism and Leisure

The risk of interaction with tourism and leisure-based activities is extremely low given the far offshore location of the proposed Kyla Development (ca. 182 km from Peterhead on the eastern Scottish coastline), however, these activities could be threatened in the event of a major accidental spill approaching the coast.

4.4.10 Natural Disasters

Due to the very low likelihood of occurrence of natural disasters in the North Sea, such as earthquakes of major magnitude, tsunamis or tornados, this event has been scoped out for this assessment.

5 Assessment Methodology

5.1 Introduction

The method used in this ES to determine if the proposed Kyla Development (the Project) is likely to have any significant effects on the environment is described in this section and follows EIA good practice guidance (e.g. EC, 2017; CIEEM, 2018; SNH and HES, 2018; IEMA, 2016).

The process commences with the identification of Project activities (or aspects) that could impact environmental and socio-economic receptors, with consideration given to both planned (routine) activities and unplanned (accidental) events.

The terms “impact” and “effect” have different definitions in EIA and one drives the other. Impacts are defined as changes to the environment as result of Project activities. Effects are defined as the consequences of those impacts upon receptors.

The type of impacts which could occur from the Project are categorised as follows:

- **Direct:** resulting from a direct interaction between a planned or unplanned Project activity and a receptor;
- **Indirect:** occurring as a consequence of a direct impact and may arise as a result of a complex pathway and be experienced at a later time or spatially removed from the direct impact;
- **In-combination:** arising from different activities within the Project resulting in several impacts on the same receptor or where different receptors are adversely affected to the detriment of the entire ecosystem;
- **Cumulative:** resulting from incremental changes caused by other past, present or reasonably foreseeable projects/proposals together with the Project itself.
- **Transboundary:** extending beyond the boundaries of the UKCS (i.e. impacting on other countries).

The nature, duration, scale and frequency of these impacts can be described as adverse or positive, short, medium- or long-term, temporary or permanent, localised or widespread, one-off, intermittent or continuous.

Impacts that could potentially result in significant effects have been subject to detailed assessment based on best available scientific evidence and professional judgement so that, where possible, measures can be taken to prevent, reduce or offset what might otherwise be significant adverse effects on the environment through design evolution or operational mitigation measures.

Residual effects are those that are predicted to remain assuming the successful implementation of the identified mitigation measures and have been reviewed by Serica to confirm that the Project complies with environmental regulations and does not adversely impact Marine Planning policies and objectives (refer to Appendix A).

5.2 Identification of Environmental Impacts

In order to identify the environmental impacts which could arise from the Kyla Development, an ENVironmental and socio-economic impact IDentification (ENVID) workshop was undertaken by Serica and the EIA team on 22nd September 2025. The purpose of the ENVID was to identify potentially significant aspects requiring detailed assessment in the ES, along with any project specific mitigation measures for consideration. The results of the ENVID workshop are documented in the ENVID Registers provided in Appendix B.

5.2.1 Aspects Subject to Further Assessment

Serica has determined that the aspects listed in Table 5.1 could potentially result in significant environmental effects. A comprehensive assessment has therefore been undertaken for these aspects, using the significance criteria defined in Section 5.3, the results of which are documented in Sections 6 to 12 of the ES.

Table 5.1: Aspects Subject to Further Assessment

Assessment Topic	Potentially Significant Aspects	Receptors	ES Section
Physical Presence	<ul style="list-style-type: none"> • Presence of semi-submersible MODU (including pre-laid anchors and ground chains) and support vessels during drilling operations • Presence of vessels during installation, inspection, maintenance and decommissioning activities • Ongoing presence of subsea infrastructure and protection / stabilisation material (rock and mattresses) 	Shipping, Commercial Fisheries	Section 6
Seabed Disturbance	<ul style="list-style-type: none"> • Mooring of semi-submersible MODU (anchors and ground chains) • Deposit of drill cuttings, muds and cement on the seabed • Installation of 'fishing friendly' xmas tree and valve skid at Kyla and tie-in structure at Bittern • Laying of pipelines and umbilical on the seabed, including pre-lay boulder clearance • Trenching and burial / protection of pipelines and control umbilical • Installation of tie-in spools and jumpers at Kyla and Bittern • Laying of rock and concrete mattresses for protection / stability / trench transitions • Construction of pipeline crossings (Langeled and CATS pipelines) 	Water Quality, Seabed Sediments, Benthic Communities, Fish	Section 7
Underwater Noise Emissions	<ul style="list-style-type: none"> • Piling operations to install valve skid at Kyla and tie-in structure at Bittern 	Fish, Marine Mammals, Seabirds	Section 8

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Assessment Topic	Potentially Significant Aspects	Receptors	ES Section
Atmospheric Emissions	<ul style="list-style-type: none"> Fuel consumed for power generation on the MODU, vessels and helicopters during drilling, installation, inspection, maintenance and decommissioning activities Incremental atmospheric emissions at the Triton FPSO as a result of Kyla coming online Further refining, transportation and distribution of Kyla hydrocarbons after Triton, but prior to end use of sold products; End use emissions from burning the extracted hydrocarbons 	Air Quality, Climate	Section 9
Marine Discharges	<ul style="list-style-type: none"> Discharge of LTOBM cuttings at the sea surface Discharge of drilling, cementing, completion and rig chemicals during drilling operations Discharge of chemicals during hook-up and commissioning of subsea infrastructure, including commissioning and preservation fluids Incremental increase in production chemicals and produced water discharges at the Triton FPSO as a result of Kyla coming online Discharge of chemical or hydrocarbons during subsea intervention activities and decommissioning operations 	Water Quality, Plankton, Fish, Benthic Communities	Section 10
Accidental Releases	<ul style="list-style-type: none"> Well blowout (releasing large quantities of oil) in the event of a loss of well control MODU or vessel collision (loss of diesel inventory) Production pipeline rupture and subsequent release of hydrocarbons to sea Large release of gas due to rupture of gas lift pipeline 	Water Quality, Seabed Sediments, Plankton, Benthic Communities, Fish and Shellfish, Seabirds, Marine Mammals, Marine Protected Areas, Shipping, Commercial Fishing, Tourism and Leisure, Air Quality, Climate	Section 11
Waste Management	<ul style="list-style-type: none"> Onshore disposal of general operational solid waste (non-hazardous & hazardous). 	Population and Human Health	Section 12

5.2.2 Aspects Scoped Out of Assessment

A number of aspects were not considered to result in significant environmental effects and were scoped out from further assessment. A justification for this is provided in Table 5.2.

Table 5.2: Aspects Scoped out of Further Assessment

Topic	Aspect	Receptors	Justification / Control Measures
Physical Presence	Presence of AHVs during the pre-lay, hookup and removal of MODU anchors and ground chains	Commercial Fishing, Shipping	Main operators of vessels passing in proximity to Kyla will be provided with advanced notice of the proposed operations; Notification to Kingfisher Bulletin.
	Presence of MODU and vessels	Marine Mammals, Seabirds	The physical presence of the semi-submersible MODU and vessels has the potential to disturb or displace seabirds. However, the temporary presence of a small number of vessels is unlikely to result in significant disturbance or displacement of seabirds from the area and alternative foraging habitat is available in the surrounding area. The risk of injury to marine mammals from collision with the MODU or a vessel is low as they will be travelling below the speed threshold where most lethal and serious injuries occur (Laist et al., 2001; Neilson et al., 2012).
	Artificial light emitted from the MODU and vessels	Seabirds	Kyla is remote from sensitive seabed breeding areas on the coast.
Seabed Disturbance	Inspection, maintenance and repair of subsea infrastructure	Water Quality, Seabed Sediments, Benthic Communities, Fish	The subsea equipment is designed for the field life time such that no maintenance is required. Any disturbance to the seabed resulting from the repair of subsea infrastructure, if required, would be small scale and localised.
Underwater Noise Emissions	Use of propellers / Dynamically Positioned (DP) thrusters on MODU and vessels including general noise and vibration of equipment whilst operating	Fish, Marine Mammals, Seabirds	Noise and vibration may cause localised, temporary changes in the distribution of sensitive marine fauna in the immediate vicinity of the MODU / vessel. However, the limited temporal scale of vessel use during the Kyla Development means any changes would be small-scale and would not result in population level effects (refer to Section 8 for further justification).

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Topic	Aspect	Receptors	Justification / Control Measures
	Operation of equipment on MODU (e.g. rotating machinery)		Scheduling will minimise MODU / vessel offshore durations. Operational and maintenance procedures will aim to optimise the efficiency of equipment.
Airborne Noise Emissions	Use of helicopters	Seabirds	Helicopter movements will be optimised by careful planning. Any impacts to seabirds from airborne noise emissions will therefore be short term, limited to temporary disturbance and/or displacement from foraging areas. Alternative foraging habitat is available to seabirds in the wider area.
Marine Discharges	Routine discharges to sea (grey/blackwater, food waste) from MODU and vessels	Water Quality, Plankton, Fish, Seabirds, Marine Mammals	Waste water and food waste will be disposed of in accordance with the requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL) convention and UK regulations.
	Discharge of ballast water (potential for introduction of alien species) from MODU and vessels		MODU and vessels will comply with the IMO Ballast Water Management Convention.
	Oily water discharges from deck drainage on MODU		Deck drainage water will be sampled prior to discharge to ensure the oil in water concentration is <40 mg/l. An Oil Discharge Permit will also be in place.
Accidental Events	Subsea control system failure resulting in a minor release of hydraulic / control fluid to sea	Water Quality, Plankton, Fish & Shellfish, Seabirds, Marine Mammals	Any impacts on water quality and marine fauna will be localised and temporary. Appropriate maintenance, and pre-use checks on hydraulic equipment and ROVs will be undertaken.
	Small release of hydrocarbons / chemicals to sea (e.g. from drains, bunkering operations etc.) during drilling, installation and commissioning activities		Any impacts on water quality and marine fauna from a small release of hydrocarbons / chemicals to sea will be localised and temporary. MODU / vessels are designed and will be managed and maintained to prevent spills. Crews will be adequately trained, and regular exercises will be held. Bunkering procedures will be put in place. All releases to sea of oil and offshore chemicals that occur during offshore oil and gas activities will be immediately reported to the regulator (via a PON1).
Accidental Events	Dropped objects resulting in unplanned disturbance to seabed	Oil and Gas, Commercial Fishing	Dropped objects may pose a risk to subsea infrastructure or present a snagging risk to trawlers. However, any dropped objects will be immediately

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Topic	Aspect	Receptors	Justification / Control Measures
			reported to the regulator (via a PON2) and procedures will be in place to recover objects, where possible. Debris will be identified during post work surveys and anything that cannot be recovered will be reported to the relevant authorities to be included on navigation charts. Subsea infrastructure will be designed for dropped objects as applicable.
Use of Resources	Resource use during drilling, installation, inspection, maintenance and decommissioning activities	Population and Human Health	The use of natural resources will be minimised, as far as practicable. Subsea structures will be designed with consideration to decommissioning. Decommissioned structures will be recovered and recycled onshore.
Natural Disasters	Some natural disasters could increase the risk of a major pollution event occurring at the Kyla field. For example, an earthquake could lead to damage to the subsea infrastructure and potential loss of well control	Water Quality, Seabed Sediments, Plankton, Benthic Communities, Fish and Shellfish, Seabirds, Marine Mammals, Marine Protected Areas, Shipping, Commercial Fishing, Tourism and Leisure, Air Quality, Climate, Population and Human Health	The probability of an earthquake of sufficient magnitude occurring on the UKCS impacting seabed infrastructure is extremely rare. Climate change effects, such as sea level change and extreme weather events, are not considered to significantly alter the range of effects considered.

5.3 Significance Evaluation

This section describes the criteria used in this ES for determining the likely significance of effects on the environment to ensure the assessment process is as transparent and consistent as possible. Where uncertainty exists, this has been acknowledged in the assessment text in Sections 6 to 12.

5.3.1 Planned Events

For planned activities, the significance of environmental effects has been evaluated by considering the **sensitivity** of the receptor affected in combination with the **magnitude** of impact that is likely to arise, having regard to:

- The magnitude and spatial extent of the impact (geographical area and size of the population likely to be affected)
- The nature of the impact
- The transboundary nature of the impact
- The intensity and complexity of the impact
- The probability of the impact
- The expected onset, duration, frequency and reversibility of the impact
- The cumulation of the impact with the impact of other existing and / or approved projects and / or projects not yet approved, but that Serica is aware of
- The possibility of effectively reducing the impact

Sensitivity Criteria

Sensitivity is a function of the value of the receptor (a measure of its importance, rarity and worth), its capacity to accommodate change when a pressure is applied (resistance or tolerance), and its subsequent recoverability (resilience). The criteria presented in Table 5.3 has been used as a guide to determine the sensitivity of receptors.

Table 5.3: Determining Sensitivity

		Resistance and Resilience			
		Very High	High	Medium	Low
Value	Low	Low	Low	Medium	Medium
	Medium	Low	Medium	Medium	High
	High	Low	Medium	High	Very High
	Very High	Medium	High	Very High	Very High
Definitions:					
Resistance (Tolerance) and Resilience (Recovery)					
Very High:		Highly adaptive and resilient to pressure. High recoverability in the short-term.			
High:		Some tolerance / capacity to accommodate pressure. High recoverability in the medium-term.			
Medium:		Limited tolerance / capacity to accommodate pressure. Recoverability is slow and/or costly.			
Low:		Very limited or no tolerance / capacity to accommodate pressure. Recovery is unlikely or not possible.			
Value					
Very High:		Very high value and/or of international importance.			
High:		High value and/or of national importance.			
Medium:		Moderate value and/or of regional importance.			
Low:		Low value and/or of local importance.			

Magnitude of Impact Criteria

The magnitude of impact considers the characteristics of the change that is likely to arise (e.g. a function of the spatial extent, duration, reversibility and likelihood of occurrence of the impact) and can be adverse or positive. Where it is not possible to quantify impacts, a qualitative assessment has been carried out, based on best available scientific evidence and professional judgement. The criteria presented in Table 5.4 has been used as a guide to define the magnitude of impact.

Table 5.4: Determining Magnitude of Impact

Magnitude	Definition
Substantial	<p>Widespread long-term change in baseline environmental conditions, with poor potential for recovery.</p> <p>Impact may be one-off, intermittent or continuous and/or experienced over a very wide area (i.e. international in nature).</p> <p>Impact will result in environmental quality standards or threshold criteria being routinely exceeded.</p> <p>The Project's GHG emissions are not compatible with international climate agreements and emissions reduction pathways that aim to hold the global average temperature to well under 2°C. The Project is not aligned with UK sector-specific Net Zero strategies and reduction trajectories.</p>
Major	<p>Widespread medium to long-term, but reversible change in baseline environmental conditions.</p> <p>Impact may be one-off, intermittent or continuous and/or experienced over a wide area (i.e. national in scale).</p> <p>Impact is likely to result in exceedance of environmental quality standards or threshold criteria.</p> <p>The Project's GHG emissions are not compatible with international climate agreements and emission reduction pathways that aim to hold the global average temperature to well under 2°C. The Project is only partially aligned with the requirements of UK sector-specific Net Zero strategies and reduction trajectories.</p>
Moderate	<p>Medium-term, temporary change in baseline environmental conditions or longer-term changes in areas surrounding the immediate footprint of the Project.</p> <p>Impact may be one-off, intermittent or continuous and/or regional in scale (i.e. beyond the area surrounding the Project site to the wider region).</p> <p>Impact could result in one-off exceedance of environmental quality standards or threshold criteria.</p> <p>The Project's GHG emissions are consistent with international climate agreements and emission reduction pathways that aim to hold the global average temperature to well under 2°C. The Project is not fully aligned with the requirements of UK sector-specific Net Zero strategies and reduction trajectories.</p>
Minor	<p>Short-term, temporary change in baseline environmental conditions or localised longer-term changes within the footprint of the Project.</p> <p>Impact may be one-off, intermittent and/or localised in scale.</p> <p>Impact would not result in exceedance of environmental quality standards or threshold criteria.</p> <p>The Project's GHG emissions are consistent with international climate agreements and emission reduction pathways that aim to hold the global average temperature to well under 2°C. The Project is aligned with the requirements of UK sector-specific Net Zero strategies and reduction trajectories.</p>

Magnitude	Definition
Negligible	<p>Immeasurable or undetectable changes (i.e. within the range of normal natural variation).</p> <p>The Project's GHG emissions are consistent with international climate agreements and emissions reduction pathways, which aim to restrict global temperature to under 1.5°C above pre-industrial levels. The Project goes beyond the requirements of UK sector-specific Net Zero strategies and reduction trajectories.</p>

¹ Further detail on how the magnitude of impact of the proposed Kyla Development's GHG emissions on the global climate has been determined in this Assessment is provided in Section 9.5.2.

Significance of Effects

The overall significance of an effect has been determined by cross referencing the sensitivity of the receptor with the magnitude of impact, using the matrix shown in Table 5.5.

Table 5.5: Significance Evaluation Matrix (Planned Activities)

		Magnitude of Impact				
		Negligible	Minor	Moderate	Major	Substantial
Receptor Sensitivity	Low	Negligible	Minor	Minor	Minor	Minor/ Moderate ¹
	Medium	Negligible	Minor	Minor	Moderate	Moderate/ Major ¹
	High	Negligible	Minor	Moderate	Major	Major
	Very High	Negligible	Minor/ Moderate ¹	Moderate/ Major ¹	Major	Major

¹ The choice of significance level is based upon professional judgement and has been justified in the assessment text.

Effects classed as **Major** or **Moderate** are considered to be "significant" in EIA terms and therefore mitigation measures are required to be identified in order to prevent, reduce or offset adverse significant effects or enhance positive effects. The overall significance of the effect is then re-evaluated, taking the mitigation measures into consideration, to determine the residual effect utilising the methodology outlined above.

Effects classed as **Minor** are not considered to be significant and are usually controlled through good industry practice.

Effects classed as **Negligible** are also not considered to be significant.

5.3.2 Unplanned Events

For unplanned events, such as accidental hydrocarbon releases, significance has been determined using a risk assessment approach, where the likelihood (probability) of the unplanned event occurring is considered against the consequence (significance of effect) if the event was to occur.

The consequence (significance of effect) has been determined using the methodology for planned events as described in Section 5.3.1 above. The likelihood of an unplanned event occurring has been determined using the criteria presented in Table 5.6 as a guide.

Table 5.6: Determining Likelihood of Occurrence

Likelihood	Definition
Extremely Rare	Event is extremely unlikely to occur during the Project, given good industry practice. Frequency of event: 1×10^{-4} .
Rare	Event is very unlikely to occur during the Project, given good industry practice. Frequency of event: 1×10^{-3} .
Unlikely	Event is unlikely to occur during the Project, given good industry practice. Frequency of event: 1×10^{-2} .
Possible	Event could occur during the Project, based on industry data. Frequency of event: 1×10^{-1} .
Likely	Event is likely to occur at least once during the Project. Frequency of event: > 1

A risk category (low, medium or high) has then been assigned to the unplanned event using the matrix shown in Table 5.7.

Table 5.7: Significance Evaluation Matrix (Unplanned Events)

		Consequence (Significance of Effect) ¹			
		Negligible	Minor	Moderate	Major
Likelihood of Event	Extremely Rare	LOW	LOW	MEDIUM	MEDIUM
	Rare	LOW	LOW	MEDIUM	MEDIUM
	Unlikely	LOW	LOW	MEDIUM	HIGH
	Possible	LOW	MEDIUM	MEDIUM	HIGH
	Likely	LOW	MEDIUM	HIGH	HIGH

¹ The consequence (significance of effect) has been determined using the methodology for planned events as described in Section 5.3.1.

High risk events are considered to be “significant” in EIA terms and are unacceptable.

Medium risk events are also considered to be “significant” in EIA terms, unless it can be demonstrated that the risk has been reduced to as low as reasonably practicable (ALARP) through mitigation, control measures and good industry practice.

Low risk events are not considered to be “significant” in EIA terms, but should still be controlled through good industry practice.

6 Physical Presence

6.1 Introduction

The temporary presence of the MODU (including pre-laid anchors and ground chains) and vessels and the long-term presence of the Kyla subsea infrastructure once installed have the potential to obstruct or exclude other sea users. This section therefore assesses the potentially significant impacts on other sea users, namely shipping and commercial fisheries, which could arise from:

- Presence of semi-submersible MODU (including pre-laid anchors and ground chains) and support vessels during drilling operations;
- Presence of vessels during installation, inspection, maintenance and decommissioning activities;
- Ongoing presence of subsea infrastructure and protection / stabilisation material (rock and mattresses).

6.2 Assessment of Impacts

6.2.1 Shipping

The density of shipping traffic in the CNS is relatively high due to the presence of fishing vessels, some ferries between the UK and the rest of Europe and cargo and offshore support vessels (refer to Section 4.4.3) (DESNZ, 2022). A Vessel Traffic Survey and Collision Risk Assessment (CRA) Report (Xodus, 2025) was undertaken for the Bittern Development project (pipeline and Bittern Drill Centre B manifold). The Bittern development is located ca. 13 km north west of Kyla. The report indicates that Kyla is located within an area which experiences moderate volumes of routine traffic compared to the other North Sea areas (refer to Section 4.4.3).

The Kyla Development has the potential to interact with shipping through the temporary presence of the MODU and vessels resulting in increased vessel traffic and collision risk. Shipping may also be excluded from areas of sea, potentially resulting in increased steaming times.

The greatest increase in vessel presence in the Development area will be before and during drilling operations, during installation of the subsea infrastructure and, following cessation of production, during decommissioning operations. However, any discernible increase in vessel presence in the area will be temporary in nature.

The proposed Kyla Development drilling phase will involve the use of a MODU, which will be on location at Kyla for a period of up to 100 days. A number of support vessels will also be on location or transiting to / from the Kyla location during this period, including AHVs, Emergency Rescue and Recovery Vessel (ERRV) and supply/support vessels. In addition, to avoid potential delays associated with poor weather conditions or the competitive support vessel market, the anchors and a proportion of the mooring lines will be pre-laid ahead of MODU arrival using two AHVs. When the MODU moves off site, the same elements of the mooring system will be collected at a later date by AHVs (refer to Section 3.3.2).

A 500 m safety zone, patrolled by an ERV equipped with an AIS and/or ARPA, will be in place around the MODU for the duration of the proposed drilling operations (up to 100 days), which will minimise the potential for collision risk between the MODU and third-party vessels. Notwithstanding this, a Vessel Traffic Survey will be undertaken to inform the Consent to Locate (Ctl) permit application, required under Part 4a of the Energy Act 2008 to site the MODU at Kyla. If necessary, a Collision Risk Assessment may also be undertaken if vessels pass within 3.7 km of the site. In addition, notifications to other sea users will be issued via Notices to Mariners and Kingfisher Bulletin to communicate the location of the pre-lay works.

During installation of the Kyla Development subsea infrastructure, a number of DP vessels will be on location for a period of around six months, with metocean conditions likely to drive operations to be conducted in the summer weather window. The main navigational hazard during this phase will be associated with the installation of the pipelines and control umbilical. However, vessels will be moving along the pipeline route, and therefore, will not be in any one area for any significant length of time.

Notifications to other sea users will be issued via Notices to Mariners and Kingfisher Bulletin to communicate the location of the works. Following installation, the pipelines and control umbilical will be subject to routine inspections and maintenance, although vessel requirements for this will be minimal.

During decommissioning, it is anticipated that DP vessels will be used to either fully or partially remove the subsea infrastructure (excluding the pipeline and umbilical which will be subject to a comparative assessment), with the wells plugged and abandoned using a MODU. Any potential impacts to shipping as a result of decommissioning operations will therefore be similar to those described above for drilling and installation operations.

The sensitivity of shipping to displacement as result of the Kyla Development is therefore considered to be **Low**. The receptor is of regional importance, classed as Medium value, but resistance and resilience is Very High as, based on the results of the Bittern Vessel Traffic Survey (Xodus, 2025), there is sufficient sea room for shipping to re-route or avoid the Kyla Development location, as necessary, particularly as the area experiences moderate volumes of routine vessel traffic compared to other North Sea areas (refer to Section 4.4.3). The magnitude of impact is predicted to be **Minor** as any impact will be localised and temporary in nature. Effects on shipping from the physical presence of the MODU and vessels during drilling, installation, inspection and maintenance and decommissioning activities, are therefore assessed as **Minor** and not significant. Mitigation measures are proposed in Section 6.3 to ensure that good industry practice is followed.

6.2.2 Commercial Fishing

The proposed Kyla Development is located with ICES Rectangle 42F1, which is subject to relatively low levels of fishing activity. The main fishing method (gear type) is trawls. Traps are also recorded as being used, however the data for this gear type is disclosive, indicating very low levels of activity. Species targeted include *Nephrops*, herring, halibut, haddock, monk fish and whiting (refer to Section 4.4.1).

During the proposed drilling operations, the presence of the MODU and support vessels has the potential to interact with commercial fishing vessels through displacement. As described above, while the MODU is on location, a 500 m safety zone will be in place, which will be patrolled by an ERRV. Although the 500 m safety zone around the MODU will be temporary, Serica will apply for a 500 m safety zone to be in place around the subsea infrastructure at Kyla prior to installation. Fishing vessels will therefore be excluded from an area of 0.8 km² throughout the life of the field i.e. Q3 2028 to 2035. To further reduce the risk of snagging; the Kyla xmas tree and valve skid will be designed to be 'fishing friendly'.

Notwithstanding the above, fishing vessels (particularly benthic trawlers and those with pelagic mobile gear) may be temporarily displaced from a larger area as a result of the MODU anchors and ground chains, which will extend outside the 500 m safety zone. For the purpose of this ES, it is assumed that the MODU mooring system will consist of eight anchors and mooring lines, with all anchors laid up to a distance of 1,600 m from the rig centre.

As noted above, all eight anchors and up to 750m (100%) of the mooring lines will be pre-laid on the seabed for a number of weeks ahead of MODU arrival and will remain in place for a number of weeks following the MODU departure. As a result, fishing vessels may be displaced from a larger area during the drilling phase, in the region of ca. 8 km². This is a conservative figure as it assumes loss of access to a radius equal to the length of the anchors around the MODU, which is unlikely to be the case. For example, pelagic fishing vessels are more capable of operating close to the mooring system, as their fishing gear is suspended in the water column.

To reduce the snagging risk, before the MODU moves onto location and after it departs, if required a guard vessel will be used to deter vessels from the area, thereby preventing potential interaction with the mooring lines while the MODU is not on location. In addition, information on the location of the MODU and associated anchor pattern and 500 m safety zone will also be communicated to other sea users (via the United Kingdom Hydrographic Office) through the standard communication channels including Kingfisher, Notice to Mariners and Radio Navigation Warnings. Note, the formation of anchor mounds is considered unlikely for this development, given the sandy nature of the sediments at the Kyla location (see Section 4.2.2).

The presence of installation vessels for the pipelines and control umbilical may also temporarily displace fishing vessels from the proposed development area. This would be in the immediate vicinity of the installation vessels that will be travelling along the proposed pipeline route. Therefore, the nature of displacement will be transient and highly localised.

Prior to pipelay activities commencing, there may be a requirement to remove boulders (>0.5 m) from the lay corridors for each line and relocate these to the edges of the installation corridor (refer to Section 3.4.3). In the event this is required, the as-left position of any relocated boulders would be recorded, with the data provided to SFF.

Once installed the pipelines and control umbilical may pose a snagging risk to fishing gear, such as nets. Fishing gear can become trapped on subsea infrastructure, resulting in loss of fishing gear or potentially posing a threat to the safety of the fishing vessel and crew, or damage the asset. The main risk of snagging will be after pipe lay, pending trenching and burial. To minimise this risk, whilst installation activities are ongoing, a guard vessel will be used to patrol the length of the lines.

In the event the lines are trenched using a pipeline plough, trenching berms could be formed by cohesive clay sediments, which are most likely to generate resistance to fishing gear (Rouse et al., 2020). However, sandy sediments such as those present at the Kyla location (refer to Section 4.2.2) are expected to provide little resistance to demersal towed gear which is likely to be able to pull through the sediment and wash out. Nevertheless, Serica will liaise with the SFF following the results of post lay surveys to ensure that if mud berms are present, they do not represent a safety risk for fishermen.

Rock will need to be deposited on the seabed where the pipelines and umbilical exit the trenches at Kyle and Bittern (50 m sections for the pipelines and 25 m sections for the umbilical) and will also be required for upheaval buckling mitigation along the pipelines. The umbilical will not require any rock mitigation provided it is suitably trenched below mean seabed level. However, to account for the possibility that suitable trenching is not achieved over the full umbilical length a contingency length of 2,500 m requiring additional rock for protection purposes has been assumed. The berm profile of any rock deposited on the seabed will be overtrawable.

In addition, the proposed route of the Kyla pipelines and umbilical cross the existing 44-inch Langeled and the 36-inch CATS gas export pipelines, both of which are surface laid and exposed. Crossing designs are not yet matured, but are likely to entail concrete mattresses and rock placement (refer to Section 3.4.3). Where concrete mattresses are used as part of the crossings design, or in other open water relocations outside the 500m safety zones at Bittern and Kyla, rock cover will be provided to minimise risk of snagging with fishing gear.

At the tie-in to Bittern, the DP vessels used to install the Kyla subsea structures will be operating within an existing 500 m safety zone. Therefore, there will be no additional loss of access to fishing grounds as a result of the Kyla Development. The existing safety zone also minimises any potential snagging risk, however, the tie-in structure, if required, will be designed to be 'fishing friendly'.

During the life of the field external inspection of the lines will take place at a frequency determined by ongoing risk assessment. Any free spans recorded that present a potential hazard to fishing will be rectified by rock placement.

Given the above, the sensitivity of commercial fishing to displacement is considered to be **Low**. The Kyla Development area is subject to relatively low levels of fishing activity (refer to Section 4.4.1). The receptor is of regional importance, classed as Medium value, but resistance and resilience is Very High as fishing vessels are able to switch to alternative fishing grounds. The magnitude of impact is predicted to be **Minor**, restricted to the Kyla drill centre location, with the risk of snagging considered to be low. In the long term, fishing vessels will only be prevented from entering an area of 0.8 km² at the Kyla well location. Effects on commercial fishing from physical presence are therefore **Minor** and not significant. Mitigation measures are proposed in Section 6.3 to ensure that good industry practice is followed.

6.3 Mitigation Measures

Impacts to other sea users from the physical presence of the MODU (including pre-laid anchors and ground chains) and vessels and the long term presence of the Kyla Development subsea infrastructure will be minimised by the implementation of the following mitigation measures:

- If required, a guard vessel will be implemented to protect the pre-laid anchors and mooring chains from interaction with fishing vessels.
- 500 m safety zone will be designated around the MODU and a dedicated ERRV, equipped with AIS and/or ARPA will be present during the drilling operations to monitor movements of other vessels in the area and prevent them entering the safety zone.
- A Vessel Traffic Survey and, if necessary, a Collision Risk Assessment, will be prepared to support the Ctl permit applications required to site the pre-laid anchors and mooring chains, MODU and subsea infrastructure at the Kyla Development location and all vessels will comply with the International Regulations for Preventing Collisions at Sea (COLREG).
- Information on the location of the MODU, MODU anchor positions, 500m safety zone, subsea infrastructure (i.e. wellhead/tree, valve skid and pipelines) and vessel operations will be communicated to other sea users via the UKHO, Maritime and Coastguard Agency (MCA), FishSAFE, Kingfisher Information Services, Notices to Mariners and Radio Navigation Warnings.
- Serica will continue to consult with SFF during the detailed design phase and planning process for the subsea infrastructure installation activities. A Fisheries Liaison Officer (FLO) will be appointed to maintain good communication with local fisheries and co-ordinate activities, particularly during installation of the pipelines and umbilical.
- Through careful planning, the number of vessels and length of time they are required on site for installation operations, will be reduced as far as practicably possible.
- Where boulders (>0.5 m) are required to be removed from the pipeline lay corridors, the as-left position of any relocated boulders will be recorded and reported via Kingfisher.
- Vessels involved in subsea infrastructure installation operations will update their marks, lights and navigational status broadcast on AIS to indicate when they are restricted in manoeuvrability. This will assist any passing vessels that encounter the installation vessels.
- Pipeline working corridors will be minimised, as far as possible.
- Prior to installation, Serica will apply for a 500 m safety zone to be in place around the subsea infrastructure at the Kyla well location. The subsea infrastructure at the Kyla well location will be designed to be 'fishing friendly'.
- Following pipeline trenching and burial operations, Serica will liaise with the SFF to ameliorate any safety risks for the fishermen from mud berms being left behind.
- During the life of the field, external inspection of the pipelines and control umbilical will take place at a frequency determined by ongoing risk assessment. Any free spans recorded that present a potential hazard to fishing will be rectified by rock placement.

6.4 Residual Effects

No significant residual effects on other sea users are predicted as a result of the physical presence of the semi-submersible MODU (including pre-laid anchors and ground chains) and / or vessels during drilling, installation, inspection and maintenance and decommissioning activities or the long-term presence of the Kyla subsea infrastructure and associated protection / stabilisation material. There is adequate sea room for shipping to re-route or avoid the Kyla location, as necessary, particularly given that Kyla is subject to only moderate volumes of routine vessel traffic compared to other North Sea areas. Fishing vessels will be temporarily displaced from the Kyla Development area for several months in 2027 and 2028 during the drilling and installation phases, with an area of 0.8 km² at the Kyla well location lost for the life of the field development. This is considered to be a very small area in comparison to the alternative fishing grounds available in the wider CNS area.

6.5 Transboundary Impacts

The Kyla field is located approximately 72 km to the south west of the UK/Norway median line. Although fishing activity in the Kyla Development area is generally low, foreign vessels are known to fish in the wider region (refer to Section 4.4.1). Information on the location of the MODU (including anchor positions), 500m safety zone, subsea infrastructure and vessel operations will be communicated to international fishing organisations, with known vessels working in the area. The area which will be lost to fisheries for the life of the Kyla field (0.8 km² at the well location) represents a small fraction of the total sea available. Furthermore, non-UK fishing vessels will be made aware of the Kyla Development through adequate charting of infrastructure. On this basis it is considered that there will be no significant transboundary impacts on other sea users.

6.6 Cumulative Impacts

Currently there is an existing 500 m safety zone around each of the Kyle South and Kyle North Drill Centres, initiated by CNRI when they were the licence field Operator. CNRI have some remaining decommissioning scope within these areas, which includes debris clearance, removal of debris mats and spools, work on pipeline ends, post decommissioning survey and over trawlable seabed clearance (note: debris is located approx. 150 m north of the proposed Kyla well location). CNRI intend to execute their decommissioning activities in Q2 2028. Serica is in consultation with CNRI regarding the timing of this work, which is currently scheduled to take place following completion of the Kyla development drilling operations. Serica will apply for a 500 m safety zone at Kyla which will be partly over the 500 m safety zone around the Kyle South Drill Centre. This will temporarily exclude fishing vessels from a slightly larger area, estimated to be ca. 1.1 km², until CNRI have completed their decommissioning activities and the safety zones are removed.

Apart from Bittern, the closest producing field to Kyla is the Starling subsea gas field (operated by Adura), located in UKCS Block 29/3a approximately 12 km to the northeast, which is tied back to the Shearwater platform. The nearest FPSO is the Triton FPSO (operated by Dana) which is located approximately 20 km northwest of the Bittern DCB manifold and 30 km northwest of the proposed Kyla well. The next nearest FPSO is the Catcher FPSO (operated by BW Offshore) which is located approximately 25 km southwest of the Bittern DCB manifold 34km southwest of the proposed Kyla well. The nearest platform to the proposed Kyla well is the West Franklin WHP (operated by Total Energies) which is located approximately 36 km northeast. The West Franklin WHP is located approximately 48 km east of the Bittern DCB manifold. The nearest platform to the Bittern DCB manifold is the Gannet A platform (operated by Adura) located approximately 30 km north. The Gannet A platform is located approximately 36 km north-northwest of the proposed Kyla well. The Belinda field which is currently in development (expected to be producing in Q1 2026) is located approximately 14 km north of the Bittern DCB manifold and 24 km northwest of the proposed Kyla well (refer to Section 4.4.4).

There are no operational, under construction or consented offshore windfarms in the vicinity of the proposed Kyla Development area. The closest offshore windfarm is the Cerulean Winds Cedar Project, currently in the pre-planning stage, located approximately 9.5 km southwest of the Kyla Development (refer to Section 4.4.5). The next closest windfarm is the Cenos Offshore Wind Farm, currently in the planning stage, which would be located approximately 15.5 km northeast of the Kyla Development. Construction at this wind farm is not scheduled to begin until 2030.

The other oil and gas developments in the area will also utilise vessels which have the potential to act cumulatively in increasing vessel collision risk. However, given the mitigation measures which will be in place for the Kyla Development and other oil and gas operations, increased vessel presence should not act in combination with any other development to increase collision risk.

Given the low levels of fishing effort recorded in the vicinity of the proposed Kyla Development and the temporary nature of the drilling, installation, inspection and maintenance and decommissioning activities, it is considered that there will be no significant cumulative impact on commercial fishing. Long-term loss of access is restricted to an area totalling 0.8 km² at the proposed Kyla well location for the life of the field development, although vessels will temporarily be restricted from a slightly larger (ca. 1.1 km²) until the 500 m subsea safety exclusion zone around the Kyle South Drill Centre has been

removed. This is very small in comparison to the fishing grounds available in the wider CNS area. In addition, the Kyla subsea infrastructure will be designed to be 'fishing friendly'; the pipelines and umbilical will be trenched and buried, and the berm profile of any rock placement will be designed to be overtrawlable. A significant cumulative increase in snagging risk with other oil and gas development in the area is therefore not anticipated.

7 Seabed Disturbance

7.1 Introduction

This section discusses the potentially significant environmental impacts on water quality, seabed sediments, seabed communities and fish arising from:

- Mooring of semi-submersible MODU (anchors and ground chains)
- Deposit of drill cuttings, muds and cement on the seabed
- Installation of 'fishing friendly' xmas tree and valve skid at Kyla and tie-in structure at Bittern
- Laying of pipelines and umbilical on the seabed, including pre-lay boulder clearance
- Trenching and burial / protection of pipelines and control umbilical
- Installation of tie-in spools and jumpers at Kyla and Bittern
- Laying of rock and concrete mattresses for protection / stability / trench transitions
- Construction of pipeline crossings (Langeled and CATS pipelines)

7.2 Quantification of Impact Area

7.2.1 Mooring of Semi-submersible MODU (Anchors and Ground Chains)

The Kyla well will be drilled from a semi-submersible drilling rig, which will be held in position over the Kyla location using anchors and mooring chains. It is assumed that the MODU mooring system will consist of eight anchors and mooring lines, with all anchors laid up to a distance of ca. 1.6 km from the rig centre.

The dimensions of each anchor are approximately 7.5 m Width (W) x 4.5 m Length (L), equating to a seabed footprint of circa 34 m². Therefore, the deployment of eight anchors will disturb an area of seabed equal to 272 m² (0.0003 km²). To represent a highest impact scenario, it is assumed that the total length of each ground chain connected to each anchor (750 m) and pennant wire (200 m), which is connected to the inboard end of each ground chain to facilitate subsequent connection to the MODU, will be in contact with the seabed. Therefore, the maximum length of mooring line to touchdown on the seabed once the MODU is on location and connected to the mooring system is 7,600 m. It has been assumed that a 10 m wide corridor of seabed will be disturbed per mooring chain. This is a highest impact estimate and allows for the lateral movement of the mooring lines on the seabed during installation and retrieval. Therefore, the deployment of eight mooring lines will disturb an area of seabed equal to 76,000 m² (0.076 km²).

The total seabed disturbance area from MODU anchor and mooring lines is equal to circa. 76,272 m² (0.0763 km²). In the event there is a requirement to re-spud the well, the anchor pattern arrangement would not change.

7.2.2 Deposit of Drill Cuttings, Muds and Cement on the Seabed

For the purpose of the ES, it is assumed that all cuttings will be discharged from the drilling operations. For the two top-hole sections (36" and 26"), the well will be drilled riserless with seawater and frequent bentonite "sweeps" passed down the well to clean out the hole. Cuttings from these top-hole sections (535.4 tonnes) will be discharged directly from the wellbore at the seabed and will form a cuttings pile in the immediate vicinity of the proposed Kyla well location.

For the deeper 17½", 12¼" (pilot hole), 12¼" (development) and 9½" sections, a marine riser will be situated between the wellhead and MODU so that cuttings and drilling fluid are circulated back up to the MODU. These sections will be drilled with LTOBM, and in the highest impact scenario for seabed disturbance, the LTOBM contaminated cuttings from the lower sections will be thermally treated

offshore to an acceptable overboard disposal limit (<1% oil on cuttings) and discharged from the MODU.

In the case of any unforeseen mechanical or geological issues, a re-spud scenario (36" and 26" sections) and contingency 17½" sidetrack have been added to the well profile to represent a highest impact scenario. The overall combined amount of drill cuttings discharged in the event the well is drilled with the re-spud and contingency sidetrack is 2,387,000 kilograms (kg) (2,387 tonnes).

Simulations of the drilling releases in relation to the Kyla site have been completed using the three-dimensional dispersion model (MUDMAP) by RPS on behalf of Serica. Ten years (2010 to 2019 (inclusive)) of Hybrid Coordinate Ocean Model (HYCOM) current data and HYDROMAP tidal data was generated. The current data is suitably long enough to be indicative of interannual variability in ocean currents. As the spud date may vary, 100 simulations were modelled for the release location with varying start dates to assess a range of current conditions. Results from these simulations were overlaid to identify the maximum thicknesses on the seabed in each grid cell.

A conservative low exposure threshold of 10 milligrams per centimetre squared per day (mg/cm²/day) has been applied for this study. Accordingly, moderate and high exposure thresholds are set at ≥30 mg/cm²/day and ≥100 mg/cm²/day, respectively. Equivalent sediment thicknesses were calculated based on the anticipated total discharge period of 26.4 days and an assumed in-situ bulk density of 2,600 kilograms per cubic metre (kg/m³). The low exposure threshold of 10 mg/cm²/day corresponds to approximately 1.0 millimetres (mm) of sediment accumulation (sediment thickness) over this period (RPS, 2025).

Thresholds of 3.0 mm and above 10.2 mm were then used to define moderate and high exposure levels, respectively. These thresholds align with literature findings such as Gilmour (2002), who observed that older corals suffer injury from 2 mm sediment layers applied every two days, with larger polyps showing damage at 5 mm and 10 mm sediment layers. Mesocosm experiments by Trannum et al. (2010) showed that cuttings layers as thin as 3 mm cause gradual community declines over six months in soft-sediment communities.

Figure 7.1 presents the maximum thicknesses in each grid cell from all 100 simulations to define the potential exposure from the discharge of cuttings and muds during the modelled operational period. The drill cuttings and muds predominantly settled along the south-west to north-east, coinciding with the dominant current directions at the release location.

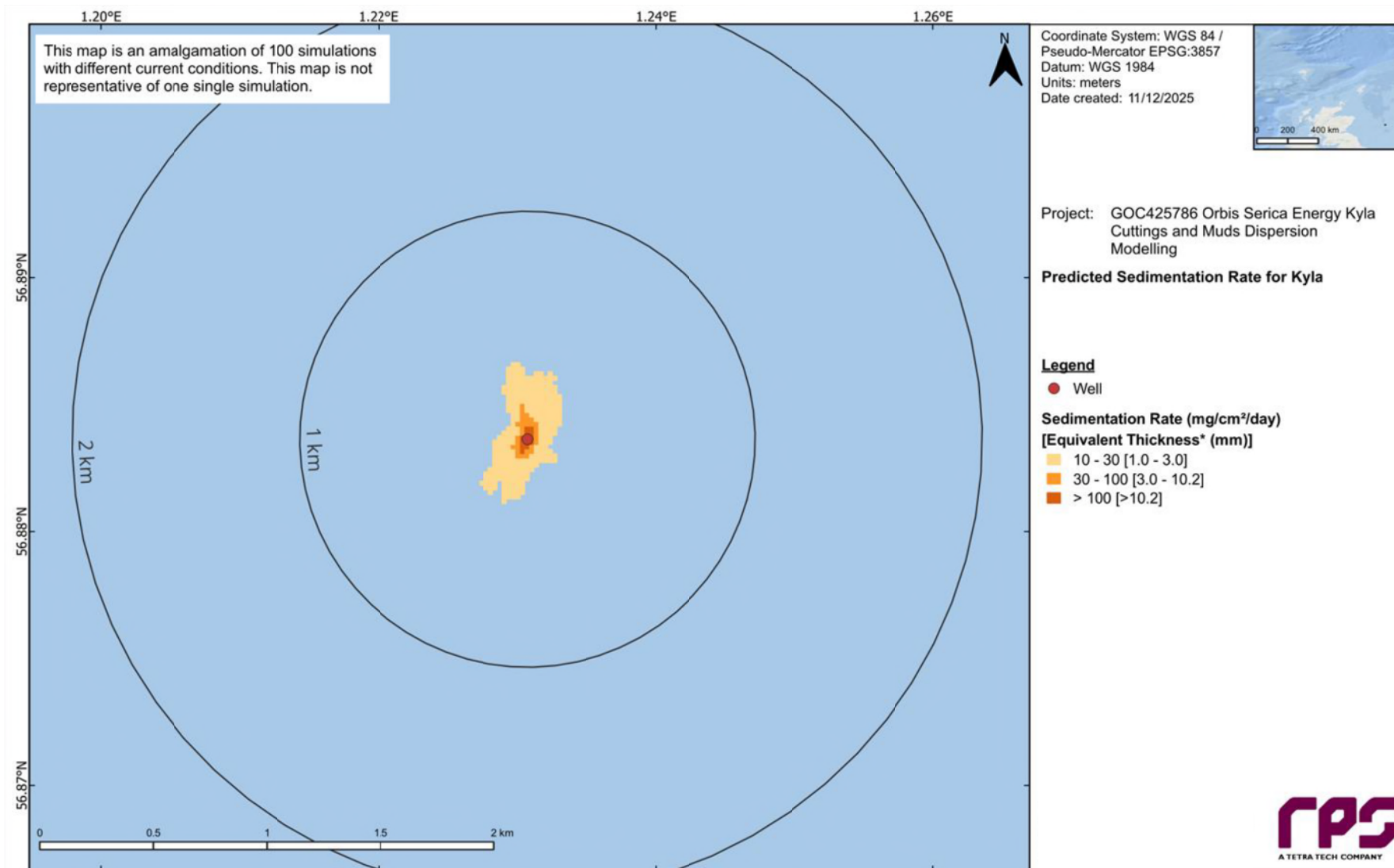
The maximum predicted thickness of deposited cuttings and muds was predominantly associated with the drilling of the 36" and 26" sections, which were returned directly to seafloor from a discharge height of 2 m above the seafloor. A maximum thickness of 0.57 m was predicted within 50 m of the discharge location (RPS, 2025).

Table 7.1 summarises the total area of coverage and the maximum distances from the release location for each sedimentation rate (and equivalent total bottom thickness) of 10 mg/cm²/day (1.0 mm), 30 mg/cm²/day (3.0 mm) and ≥100 mg/cm²/day (≥10.2 mm) for the modelled 26.4 day discharge programme. It can be seen from this that based on the assessment of 100 simulations the maximum distances from the Kyla release location to the edge of the low exposure, moderate exposure and high exposure thresholds were 0.33 km, 0.15 km and 0.06 km, respectively. The total area of coverage for the low exposure threshold, or greater, was 0.12 km² (Table 7.1). Of note, any cement that is pumped to the seabed (refer to Section 3.3.4) will remain within the area impacted by the cuttings pile.

Table 7.1: Predicted areas of coverage and maximum distances from the release location for each reporting threshold based on the results of all 100 simulations. (RPS, 2025)

Reporting Criteria	Total area of coverage (km ²)	Maximum distance (km) from the release locations
1.0 mm (low exposure)	0.12	0.33
3.0 mm (moderate exposure)	0.02	0.15
≥10.2 mm (high exposure)	0.01	0.06

Figure 7.1: Combined predicted maximum sedimentation rate and equivalent thickness from the discharge of drill cuttings and muds at the Kyla location. Results are based on 100 simulations (RPS, 2025)



7.2.3 Installation of the Pipelines and Umbilical

Table 7.2 summarises the total area of seabed that may be disturbed during installation of the pipelines and umbilical (based on the project description in Section 3.4.3).

Table 7.2: Estimated Extent of Disturbed Seabed from Pipelines and Umbilical Installation Operations

Activity	Estimated Area of Seabed Disturbance				Total Area of seabed Impacted	
	Temporary Impact		Long Term Impact			
	m ²	km ²	m ²	km ²	m ²	km ²
Boulder Clearance Operations ¹	-	-	10	0.00001	10	0.00001
Laying and Trench and Burial of Production Pipeline, Gas Lift Pipeline and Umbilical ²	616,000	0.616	-	-	616,000	0.616
UHB mitigation / umbilical protection ³	-	-	32,500	0.0325	32,500	0.0325
Trenching performance contingency	-	-	66,450	0.0665	66,450	0.0665
Pipeline Crossings ³	-	-	11,300	0.0113	11,300	0.0113
Trench Transition ³	-	-	1,500	0.0015	1,500	0.0015
Temporary Initiation Anchors, Wire and Temporary Laydown Areas ⁴	1,672	0.0017	-	-	1,672	0.0017
Total	617,672	0.62	111,760	0.11	729,432	0.73

¹ Assumes up to ten boulders may need to be removed from the lay corridors.

² Assumes two separate trenches with a width of 22 m each and a line length of ca. 14 km.

³ See assumptions in Table 3.8 of Section 3.4.3.

⁴ Assumes anchor dimensions of ca. 6 m by 6 m, impacting an area of 72 m² for the pipelines and umbilical, an initiation wire length for the pipelines and umbilical of 100 m with a 2 m wide disturbance corridor, impacting an area of ca. 400 m² and six temporary laydown areas (20 m x 10 m) impacting an area of 1,200 m².

Although the majority of the impact from pipeline installation operations is temporary, there is potential for long term seabed disturbance. Boulder clearance will be minimised as far as practical via pipeline routing exercises as part of the design process and potentially local pipeline micro routing prior to pipe or umbilical lay. However, the need for boulder relocation cannot currently be ruled out. If required, boulder clearance will be achieved through use of a grab or bumper bar. All boulders greater than 0.5 m would typically be removed from the lay corridors for the pipelines and umbilical and relocated to the edges of the installation corridor, ideally within a 5 m corridor downstream of the prevailing current to minimise likelihood of scour developing on the route. The as-left position of each boulder will be recorded. In the event that up to ten boulders may need to be removed from the lay corridors, the seabed disturbance from these operations has been estimated to total to approximately 10 m² (0.00001 km²).

It is also estimated that 25,000 tonnes of rock berm may need to be deposited in order to mitigate upheaval buckling. The assumption is that 66 imperfections along the pipelines will require additional rock for UHB mitigation (5 imperfections per km), approximately 250 tonnes of rock will be used per imperfection (with 50% contingency applied). Any rock required for upheaval buckling will be sited within a ca. 10 m wide corridor centred above the pipelines.

As a contingency it is assumed that up to 65,000 tonnes of additional rock may be deposited on the pipelines if target trenching isn't achieved. The estimated total additional disturbance arising from this rock is 55,950 m² (0.056 km²).

The umbilical will not require any rock placement provided it is suitably trenched below mean seabed level. However, as a contingency it is assumed up to 10,000 tonnes of rock may be deposited if target trenching isn't achieved. The estimated total disturbance arising from the rock contingency is 10,500 m² (0.0105 km²).

Additional rock will also need to be deposited where the pipelines and umbilical exit the trenches at Kyla and Bittern (50 m sections for the pipelines and 25 m sections for the umbilical). It is estimated that up to 2,000 tonnes of rock may need to be deposited over the lines for protection at these locations. The total length of the pipelines transition will be 150 m and the total length of the umbilical transition will be 100 m. Each trench transition rock placement will have a width of 6 m. The estimated total disturbance arising from these trench transitions is 1,500 m² (0.0015 km²).

In addition, the proposed route of the Kyla pipelines and umbilical cross the existing 44-inch Langeled and the 36-inch CATS gas export pipelines, both of which are surface laid and exposed. Using the highest impact assumption of 34,100 tonnes of rock being required for both crossings, including trench transition, and up to 54 concrete mattresses to accommodate both the Kyla pipelines and Kyla umbilical crossing Langeled and CATS. The estimated total disturbance arising from the pipeline crossings is 11,300 m² (0.0113 km²).

Finally, the initiation of the pipelines and umbilical will require the installation of a temporary initiation anchor (drag embedment anchors would be used as a highest impact, assumed to have dimensions of ca. 6 m by 6 m) and the use of an initiation wire, which will connect between the anchor and the end of the pipelines / umbilical. The anchor is estimated to impact 36 m² of seabed for the two pipelines and umbilical respectively. The initiation wire for both the pipelines and umbilical is expected to be no longer than 100 m in length. To allow for the lateral movement of the wire on the seabed during installation and retrieval, a 2 m wide disturbance corridor has been assumed, with ca. 200 m² of seabed impacted per pipeline. In total, therefore, deployment and retrieval of the initiation anchor and wire will temporarily disturb an area of approximately 472 m². Following the installation of the pipelines/umbilical the anchor and wire will be recovered.

There may also be a requirement to temporary wet store subsea facilities and concrete mattresses, as well as ROV tooling and baskets. The dimensions of any temporary laydown area are unlikely to exceed 20 m x 10 m based on maximum tie-in spool dimensions. It is assumed up to six temporary laydown areas will be required for the Kyla Development, impacting a total seabed area of 1,200 m² (0.0012 km²).

The total seabed disturbance area from boulder clearance; laying and trenching and burial of the pipelines and umbilical; installation of protection for UHB mitigation and trench transition; the construction of pipeline crossings; and the use of temporary initiation anchors and wires, and temporary laydown areas is equal to circa. 729,432 m² (0.73 km²); with 111,760 m² (0.112 km²) of this disturbance causing a long term impact and remaining 617,672 m² (0.62 km²) a temporary impact (see Table 7.2).

7.2.4 Installation of Subsea Infrastructure at the Kyla Drill Centre

The total seabed footprint caused by the installation of seabed infrastructure at the proposed Kyla drill centre is summarised in Table 7.3 (based on the project description in Section 3.4.2). In total, the seabed disturbance associated with the installation of infrastructure at the Kyla drill centre is estimated to be 2,246.5 m² (0.00225 km²), with the long term loss of available seabed estimated to be 1,050.5 m² (0.0011 km²) and the temporary area of seabed impacted estimated to be 2,246.5 m² (0.0022 km²).

Table 7.3: Estimated Area of Seabed Occupied by Subsea Infrastructure at Kyla Drill Centre

Subsea Item	Assumptions	Temporary Disturbance Area (m ²) ³	Long Term Disturbance Area (m ²)	Total Seabed Footprint (m ²)
Xmas tree / wellhead ¹	Outermost dimensions of the xmas tree, including telescopic legs will be 5.1 m (L) x 4.8 m (W)	23.8	24.5	48.3
Kyla valve skid	GBS (highest impact) has dimensions of ca. 16.6 m (L) x 6.5 m (W)	50.2	108	158.2
Tie-in spools, pipeline ends and control jumpers	Pipeline ends, spools and jumpers will be surface laid and protected with concrete mattresses ²	550	450	1,000.0
Untrenched Umbilical Section	Umbilical tie-in loop will be surface laid and protected with concrete mattresses ²	572	468	1,040.0
Total Seabed Footprint at Kyla Drill Centre		1,196.0	1,050.5	2,246.5

¹ Xmas tree will be located on top of the wellhead.

² See assumptions in Table 3.5 of Section 3.4.2

³ A 1 m corridor of temporary disturbance surrounding each item is assumed when the infrastructure is initially placed on the seabed.

7.2.5 Installation of Subsea Infrastructure at the Bittern Manifold

The highest impact total seabed footprint caused by the installation of seabed infrastructure at the Bittern manifold is summarised in Table 7.4 (based on the project description in Section 3.4.4). In total, the installation of subsea infrastructure at Bittern is estimated to impact an area of seabed of 4,078.2 m² (0.0041 km²), with the long term loss of available seabed estimated to be 1,872 m² (0.0019 km²) and the temporary area of seabed impacted estimated to be 2,206.2 m² (0.0022 km²).

Table 7.4: Estimated Area of Seabed Occupied by Subsea Infrastructure at Bittern Manifold ¹

Subsea Item	Assumptions	Temporary Disturbance Area (m ²) ³	Long Term Disturbance Area (m ²)	Total Seabed Footprint (m ²)
Bittern tie-in structure	GBS (highest impact) has dimensions of ca. 16.6 m (L) x 6.5 m (W)	50.2	108	158.2
Tie-in spools, pipeline ends and control jumpers	Lines will be surface laid and protected with concrete mattresses ²	1,276	1,044	2,320
Untrenched umbilical section	Umbilical tie-in loop will be surface laid and protected with concrete mattresses ²	880	720	1,600
Total Seabed Footprint at Bittern		2,206.2	1,872	4,078.2

¹ Seabed footprint is highest impact, based on the tie-in arrangement at Bittern DCB manifold

² See assumptions in Table 3.9 of Section 3.4.4

³ A 1 m corridor of temporary disturbance surrounding each item is assumed when the infrastructure is initially placed on the seabed.

7.2.6 Estimated Total Seabed Disturbance Area

Table 7.5 summarises the highest impact total area of seabed that could be disturbed as a result of the Kyla Development. The estimated highest impact total temporary area of seabed disturbed from the Kyla Development is 817,346 m² (0.819 km²). The highest impact total area of seabed disturbed in the long term by the subsea infrastructure, rock protection and concrete mattresses for the life of the Kyla Development is estimated to be 114,683 m² (0.115 km²).

Areas of seabed subject to temporary disturbance will begin to recover on completion of the operations as discussed in Section 7.3. In contrast long term impacts to the seabed are associated with infrastructure that will be in place for the duration of the Kyla Development (ca. 8 years). Long term impacts may extend beyond the field life of the Kyla Development, depending on the methods and options available at the time of decommissioning.

Table 7.5: Estimated Extent of Seabed Disturbed from the Kyla Development (Assessing the Highest impact Options)

Aspect	Assumptions	Estimated Area of Seabed Disturbance (Highest impact)			
		Temporary Impacts		Long Term Impacts	
		m ²	km ²	m ²	km ²
Mooring of the MODU (Section 7.2.1)	<ul style="list-style-type: none"> MODU mooring system will consist of eight anchors and mooring lines, with all anchors laid up to a distance of 1,600 m from the rig centre. Each anchor: 7.5 m (W) x 4.5 m (L) = 34 m². Maximum length of mooring line on the seabed = 7,600 m. 10 m wide corridor of mooring chain lateral movement. 	76,272	0.076	-	-
Drill Cuttings, Muds and Cement (Section 7.2.2)	<ul style="list-style-type: none"> The majority of drill cuttings, as well as the cement, will be deposited out to a maximum distance of 0.54 km from the release location, aligned with the direction of the current 	120,000	0.12	-	-
Installation of the Pipelines and Umbilical (Section 7.2.3)	<ul style="list-style-type: none"> Boulder Clearance Operations: 10 m² Laydown and Trench and Burial of Production Pipeline, Gas Lift Pipeline and Control Umbilical: 528,000 m² Rock Cover: 98,950 m² Pipeline Crossings: 11,300 m² 	617,672	0.62	111,760	0.112

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Aspect	Assumptions	Estimated Area of Seabed Disturbance (Highest impact)			
		Temporary Impacts		Long Term Impacts	
		m ²	km ²	m ²	km ²
	<ul style="list-style-type: none"> Trench Transition: 1,500 m² Temporary Initiation Anchors and Wires and Temporary Laydown Areas: 1,672 m² 				
Installation of Subsea Infrastructure (Sections 7.2.4 & 7.2.5)	<ul style="list-style-type: none"> Installation of subsea infrastructure at Kyla ('fishing friendly' Xmas tree, 'fishing friendly' valve skid, tie-in spools, umbilical jumpers and concrete mattresses): 2,246.5 m² in total, with 1,050.5 m² being long term Installation of subsea infrastructure at Bittern (tie-in structure, tie-in spools, jumpers and concrete mattresses): 4,078.2 m² in total, with 1,872 m² being long term 	3,402.2	0.0034	2,922.5	0.003
Total		817,346	0.819	114,683	0.115

7.3 Assessment of Impacts

7.3.1 Mooring of Semi-submersible MODU (Anchors and Ground Chains)

The total seabed disturbance area from MODU anchors and mooring lines is equal to circa. 76,272 m² (0.076 km²). As described in Section 7.2.1, a small area of seabed where each of the eight anchors are placed will be compressed as the anchors sink into the seabed. The movement of the mooring lines (ground chains and pennant wires) attached to the anchors as they sweep across the seabed will also cause localised direct abrasion damage to the habitats and species beneath for the duration of their deployment. In addition, when the anchors and chains are removed, scars, and sometimes anchor mounds, may be left on the seabed. In particular, anchor mounds may be formed during the retrieval of anchors in sedimentary areas, particularly where clay is present immediately beneath the surficial sediments. The indirect effects of the anchoring include the re-suspension of sediments, and subsequent smothering of seabed habitats and species, which are likely to occur over a wider area as sediments are re-suspended and transported away from the immediate vicinity of the MODU anchoring area.

Seabed Sediments

Mooring of the semi-submersible MODU will physically disturb the seabed sediment. There is little quantitative information available on the likely recovery time from the physical disturbance of anchor placement. However, indications are available from studies carried out for seabed disturbance from towed fishing gear (Løkkeborg, 2005). These suggest that it is likely that some level of recovery will occur in the sediments following anchoring operations. The longevity of the physical abrasion scars on the seabed is dependent on the type and energy of the local benthic environment. Seabed scars in higher energy, sandy or shallow environments may disappear within days or months of initial disturbance, whilst those in lower energy silty and deeper areas may still be faintly visible after 18 months.

The Kyla Development is located in an area containing potential cuttings piles associated with the prior Kyle field. These historic cuttings piles have the potential to be disturbed by the anchoring of the MODU. However, a multibeam echosounder geophysical survey of the Kyla Field undertaken as part of the Kyle pre-decommissioning survey scope did not identify a discernible physical cuttings pile. The historic cuttings piles are believed to have dispersed and now lie flush with the seabed, although seabed samples taken during the pre-decommissioning survey of the Kyle area show a chemical footprint (elevated THC levels) covering an area of 1,432 m² (CNRI, 2021). The proposed Kyla Development well is located ca. 0.30 km southwest of the K12 well, 0.33 km southwest of the K15 well and over 3 km south southeast of the K13 and K14 wells; these are the development wells at the historic Kyle field. Therefore, dependent on the anchor, the mooring of the MODU has the potential to disturb any contaminated sediment present. However, results from the 2025 survey show all stations within the vicinity of the proposed Kyla Development area have recorded THC and heavy metal concentrations that are considered consistent with background concentrations (Gardline, 2025b), indicating that disturbance of contaminated sediment is unlikely.

As discussed in Section 4.2.2, seabed sediments within the Kyla Development area have been identified as being sandy, showing moderate amounts of fines and a negligible gravel content (Gardline, 2025a; 2025b). The Kyla Development is also located within a seasonally influenced dynamic area (DESNZ, 2022). Consequently, any seabed scarring resulting from the anchoring of the MODU at the proposed Kyla well location have the potential to persist only in the short to medium term and the likelihood of anchor mounds forming is very low. No evidence of scarring in the seabed at the historic Kyle field was found during the pre-decommissioning survey (Fugro, 2020).

The sensitivity of seabed sediments to the mooring of the MODU as a result of the Kyla Development is therefore considered to be **Low**. The receptor is of local importance for sediment type, classed as Low value, and the overall resistance and resilience is High as recoverability is expected in the short to medium term given the sediment type and moderate energy environment. The magnitude of impact is predicted to be **Minor**; it will be limited to a very small area (ca. 0.076 km²), with any change to

baseline conditions predicted to be temporary in nature. Effects on seabed sediments from the mooring of the semi-submersible MODU are therefore assessed as **Minor** and not significant.

Benthic Communities

The vulnerability of benthic species to the effects of physical disturbance and smothering (through the resuspension of sediments) is variable and dependant on the individual's mobility, physiology and ecology. Annelid species dominated the infaunal community at the proposed Kyla Development area accounting for 66.97% of the total individuals. These species were followed by Arthropods, molluscs, and echinoderms (refer to Section 4.3.2; Gardline, 2025b).

Sessile epifauna, and a proportion of the infauna (animals that burrow into the sediment or form tubes within it) such as polychaete worms and burrowing species in the direct footprint area of the MODU mooring system (ca. 0.076 km²) may experience injury and mortality from compression and abrasion. However, recovery is expected to occur once the MODU has moved off location. The re-colonisation of the impacted area can take place in a number of ways, including mobile species moving in from the edges of the area (immigration), juvenile recruitment from the plankton, or from burrowing species digging back to the surface (Neal and Avant, 2008). Where sedimentation does impact negatively on benthic species, consequences are likely to be short-lived for the majority of species as most of the smaller sedentary species (such as polychaete worms) have short lifecycles and recruitment of new individuals from outside of the disturbed area will be rapid (Tillin and Tyler-Walters, 2014).

The seapens and burrowing megafauna communities habitat, an OSPAR Threatened and/or Declining Habitat, has been reported to occur within the wider region surrounding the proposed Kyla Development. Across the Kyla survey area, some similarity to this habitat was observed at the majority of stations and when considering the survey data overall, burrows were classified as rare to frequent, suggesting that there is some similarity to a sea pen and burrowing megafauna communities habitat, as per OSPAR (2010). Although burrows were present, burrowing fauna were rarely sighted with only a single individual of *N. norvegicus* observed across the survey area to confirm the burrow inhabitants, therefore burrows could not confidently be attributed to any of the classified megafauna species within the seapen and burrowing megafauna community habitat classification. The sea pen and burrowing megafauna communities habitat is also listed as a key component biotope within the broader Burrowed mud habitat, which is designated as a PMF (NatureScot, 2022). Sediments across the Kyla survey area were classified as muddy sand to slightly gravelly muddy sand, suggesting some ecological similarities to the Burrowed mud PMF (refer to Section 4.3.2).

Abrasion and physical disturbance of surface of seabed is likely to affect mobile and sessile epifaunal and shallow burrowers. Damage to seapen species is likely to take place as a result of greater sediment disturbance as a result of the anchors being placed on the seabed and the lateral movement of the mooring chains. However, experimental studies have shown that all three species of seapen can re-anchor themselves in the sediment if dislodged (Eno et al., 1996). Eno et al. (1996) also found that even if damaged *Funiculina quadrangularis* appeared to remain functional and this could also be true of the other sea pens. Tuck et al. (1998) found that abrasion and physical disturbance had no effect on *Virgularia mirabilis* populations and Kinnear et al. (1996) found that sea pens were quite resilient to being smothered, dragged or uprooted. Using both the Feature Activity Sensitivity Tool (FeAST), and the resistance of this habitat to sub-surface abrasion (e.g. anchors on the seabed), surface abrasion (e.g. mooring chains on the seabed) and physical disturbance is assessed as low and recovery is medium, therefore overall sensitivity is assessed as medium (Hill et al., 2023; FeAST, 2025).

Ocean quahog (*Arctica Islandica*), listed as listed as a PMF in Scottish waters and an OSPAR Threatened and/or Declining species, has also been reported to inhabit the wider region surrounding the proposed Kyla Development. More specifically the East of Gannet and Montrose Fields NC MPA, located approximately 13.4 km north of the proposed Kyla Development area is designated for the conservation of *A. islandica*. Thirty-one juvenile *A. islandica* individuals were recorded across the Kyla Development area, although no adult specimens were observed within samples (refer to Section 4.3.2).

The ocean quahog is of conservation importance due to its slow growth, late age of reaching reproductive maturity and vulnerability to disturbance (JNCC, 2014). FeAST indicates that ocean quahog has high sensitivity to sub-surface abrasions / penetration (i.e. anchor placement) and low sensitivity to surface abrasion (i.e. MODU mooring line touchdown) (FeAST, 2025; Tillin et al. 2010).

In summary, the sensitivity of seabed communities to the footprint of the MODU is considered to be **High to Very High**. Some of the receptors are of international importance and are of Very High value, but for the majority of species the overall resistance and resilience is High as recoverability of benthic communities is expected in the short to medium term. Sea pen and burrowing megafauna habitat and ocean quahog (*A. islandica*) are the exception to this. The sea pen and burrowing megafauna habitat has a Low to Medium resistance and resilience to disturbance arising from the mooring of the MODU and ocean quahog has a Low resistance and resilience to the movement of the mooring chains on the seabed (FeAST, 2025). The magnitude of impact is predicted to be **Minor** as any impacts will occur over a relatively small area (ca. 0.076 km²) and will be temporary in nature, with recovery likely occurring in the short to medium term. Effects on seabed communities from mooring of the MODU are therefore assessed as **Minor** and not significant.

Fish and Shellfish

The Kyla Development area is located within the spawning and nursery grounds for a number of fish species (refer to Section 4.3.3), including herring and sandeels which have a dependency on specific substrata for spawning and are therefore considered to be the most vulnerable to seabed disturbance.

Herring and sandeels are a commercially and ecologically important fish species which lay their eggs only in clean, sandy, and gravelly sediments. Sandeels are a key prey resource, particularly for seabirds, and an important link between zooplankton and top predators (Frederiksen et al., 2006). Sandeels and herring are also Scottish PMFs and UK BAP species (NatureScot, 2020; JNCC, 2007). Fish egg development and hatching success is vulnerable to the effects of sediment smothering and abrasion (DESNZ, 2022). However, as discussed in Section 4.3.2, the proposed Kyla Development area contains habitat that is 'unsuitable' for both herring and sandeels.

Exposure of fish to increased turbidity reducing visual acuity and reduction of available habitat caused by mooring of the MODU at the proposed Kyla drill centre location may affect foraging behaviour (Bakke et al., 2013) and temporarily displace fish from their spawning and nursery areas. However, given the localised area of impact (ca. 0.076 km²) and the mobile nature of the species, any displaced fish are likely to find foraging opportunities, as well as suitable spawning and nursery areas in adjacent locations. The spawning grounds within which the Kyla Development area is located are part of wider spawning grounds within the CNS and, as such, Kyla is not considered to be a key habitat for these fish species.

In summary, the sensitivity of fish and shellfish to the mooring of the MODU is considered to be **High**. The majority of receptors are of national importance and are of High value. The exception to this is the species likely to be present in the Kyla development area classified as PMFs; these species have a Very High value. The overall resistance and resilience is High as recoverability is expected in the short term. The magnitude of impact is predicted to be **Negligible** with immeasurable changes in the baseline environment. Effects on fish and shellfish from the mooring of the MODU on the seabed are therefore assessed as **Negligible** and not significant.

7.3.2 Deposit of Drill Cuttings, Muds and Cement on the Seabed

As discussed in Section 7.2.1, as a highest impact, it has been assumed that the drill cuttings discharged from the Kyla Development well (2,387,000 kg (2,387 tonnes)) have the potential to be deposited within an area of up to 0.12 km² surrounding the drilled well location (based on a threshold for bottom deposition of 1.0 mm) (RPS, 2025). A high exposure level of drill cuttings (based on a threshold for bottom deposition of ≥ 10.2 mm mm) is likely to be deposited within an area of 0.01 km² (RPS, 2025). Any cement discharged at the seabed during cementing operations will also be deposited within this area.

Research has shown that the effects on seabed fauna from the deposition of drill cuttings and fine solids are usually subtle or undetectable, although the presence of drilling material at the seabed close to the drilling location (less than 500 m) is often detectable chemically (e.g. Cranmer, 1988, Neff et al. 1989, Hyland et al. 1994, Daan & Mulder, 1996). Barium (Ba) in the form of barite is a weighting material used to increase the density of drilling muds and can contain measurable concentration of heavy metals as impurities, including cadmium, chromium, copper, lead, mercury, and zinc (NRC, 1983; McLeese et

al., 1987). As a result of this, Ba in the seabed sediment can be used as an indication of previous drilling activities.

For assessment purposes, thermal cuttings treatment is being evaluated to treat the LTOBM contaminated cuttings from Kyla to an acceptable overboard disposal limit (<1% oil on cuttings). A joint study including eight research papers reported to The Oil Industry International Exploration and Production Forum (E&P Forum) in 1996 found no evidence of significant changes to the natural benthic community or re-colonisation of the seabed when exposed to low oil on cuttings concentrations (<1%) (E&P Forum, 1996). Furthermore, the same report found that the impact of LTOBM on benthic communities was directly related to the oil concentration, with a lower concentration reducing the impacts. Given that the discharge of LTOBM cuttings from Kyla will be treated to an oil on cuttings concentration to <1 %, this aspect has been scoped out from detailed assessment. The remainder of this section therefore concentrates on impacts relating to the deposition of Water Based Mud (WBM) drill cuttings on the seabed.

Drilling history at the Kyla field location suggests that discharges of oil-based drilling muds and synthetic based drilling muds occurred during the 1990s and 2000s, with the cuttings piles at the field previously estimated to cover over 0.0043 km². However, as noted above, these cuttings piles are no longer visible (Fugro, 2020). During the 2025 Kyla survey, all stations within the vicinity of the proposed Kyla Development area have recorded THC and heavy metal concentrations that are considered consistent with background concentrations, although concentrations of Ba were found to be above the background levels for the area (Gardline, 2025b) (refer to Section 4.2.2).

Seabed Sediments

The seabed sediments at the Kyla well location were interpreted to be represented by the Folk Classification ‘muddy sand’ and ‘slightly gravelly muddy sand’. The discharge of drill cuttings, muds and cement from the Kyla Development well will initially alter the seabed topography and sediment structure of a small area close to the well. The material deposited will be a mixture mostly of cuttings (rock fragments and sediment removed from the well) of various sizes and drilling mud including particles of barite (barium sulphate). It is feasible that changes in sediment particle size characteristics could affect the suitability of the seabed for re-colonisation by species normally characteristic of the area, although it is anticipated that the sediments will return to their original composition under the influence of seabed currents and natural sedimentation.

In the CNS, near-bed current velocities and sediment mobility are generally sufficient to prevent detectable local accumulation of cuttings, as noted during the Kyle pre-decommissioning survey which did not identify any discernible physical cuttings piles. It has been predicted that any surface-hole cuttings piles in the SNS and CNS area will be dispersed typically over a timescale of one to five years, mainly through re-suspension and bedload transport due to tidal and wave-induced currents (DTI, 2001; Breuer et al. 2004).

The sensitivity of seabed sediments to the discharge of drill cuttings, muds and cement as a result of the Kyla Development wells is therefore considered to be **Low**. The receptor is of local importance for sediment type, classed as Low value, and the overall resistance and resilience is High as seabed currents are likely to prevent local accumulations of cuttings or piles from persisting. The magnitude of impact is predicted to be **Minor** as the disturbance to seabed sediments will be localised to the Kyla well location. Effects on seabed sediments from the discharge of drill cuttings, muds and cement are therefore assessed as **Minor** and not significant.

Benthic Communities

The accumulation of drill cuttings, mud and cement at the Kyla well location is likely to change the benthic community in the immediate area by burying some animals and impairing the feeding and respiration of others. It is expected that the communities in the immediate vicinity of the well will be lost, and that increased concentrations of suspended particles near the seabed may also impair respiratory and feeding processes, inducing metabolic stress and reducing growth and survival rates. Filter feeding organisms (for example, hydroids and bryozoans) that rely on suspended particles as a source of food are likely to be more vulnerable to the impacts of the drilling operations than the scavengers that rely on the deposition of suspended material. The net result therefore is likely to be a

reduction in species diversity and production and a change in the species composition of the community, predicted to be within ca. 150 m of the wellhead (the area experiencing moderate to high exposure to cuttings) (RPS, 2025). However, as the main impact is primarily physical, it is anticipated that the sediment communities will begin to recover once the drilling operations have ceased. Re-colonisation of the impacted area can take place in a number of ways, including mobile species moving in from the edges of the area (immigration), usually more effective for the larger epifaunal species, juvenile recruitment from the plankton or from burrowing species digging back to the surface.

Considerable data has been gathered from the North Sea and other production areas, indicating that localised physical effects are the dominant mechanism of ecological disturbance, where cuttings, muds and cements are discharged (DECC, 2011).

For example, a comprehensive desk study of the composition, environmental fates and biological effects of WBM cuttings and muds was prepared on behalf of the Petroleum Environmental Research Forum and the American Petroleum Institute by Neff (2005). The review, covering more than 200 publications and reports, concludes that effects of WBM cuttings piles on bottom living biological communities are caused mainly by burial and low sediment oxygen concentrations resulting from organic enrichment. Toxic effects, when they occur, are probably caused by sulphide and ammonia by-products of organic enrichment (DECC, 2011).

Further evidence of recovery of seabed communities following drilling can be seen from the research work undertaken by AUMS (1987). A benthic environmental survey was undertaken in 1987 at three single well sites in the CNS (at depths of 102, 120 and 130 m respectively). The wells had been drilled five years prior to the survey using a WBM and a total of approximately 800 tonnes of cuttings had been deposited on the seabed at each location. The results of the survey indicated that, with the exception of a slightly elevated barium concentration, levels of sediment metals and hydrocarbons were similar to background concentrations. The analysis of the benthic fauna indicated that, even at sites closest to the wellheads, full recovery of the impacted sediments had taken place. These well sites were revisited by Oil and Gas UK (formerly UKOOA) in 2005 with analysis of the sediment samples showing that the area had recovered to be consistent with background conditions (Hartley Anderson Ltd, 2005).

The habitats and species present at the proposed Kyla well location are typical of the CNS region. Annelids dominated within the infaunal community, making up five of the top 10 ranked species (Gardline, 2025b). The most abundant species was the polychaete *Paramphinome jeffreysii*. The next most dominant taxon was the polychaete *Ampharete falcata*.

As noted in Section 7.3.1, across the Kyla survey area, some similarity to the seapens and burrowing megafauna communities (burrowed mud) habitat (an OSPAR Threatened and/or Declining Habitat and Scottish PMF) was observed (refer to Section 4.3.2). Data taken from FeAST indicates that high rates of siltation may adversely affect this habitat type, with the habitat having low tolerance and medium recovery to the pressure and therefore a medium sensitivity (Tillin et al. 2010; FeAST, 2025). As such, there is a possibility that this habitat type could be adversely impacted by siltation caused by the discharge of cuttings, muds and cement. However, the species that inhabit this type of benthic habitat are deemed to be highly recoverable (Hill et al., 2023). In addition, studies on the reproduction of *Pennatulaphosphorea* (sea pens) suggest that these species have lecithotrophic larvae which have the ability to remain in the water column until suitable habitat is located, thus possibly avoiding settlement on sediment that has been disturbed (DECC, 2016).

Ocean quahog (*A. islandica*), an OSPAR Threatened and/or Declining species and Scottish PMF, have also been recorded across the Kyla Development area (refer to Section 4.3.2). Ocean quahog burrow into the sediment, they use a short inhalant siphon which sits above the sediment surface for feeding and respiration (Taylor, 1976). Data taken from FeAST indicates that high rates of siltation may adversely affect ocean quahog, with the species having no tolerance and low recovery to the pressure and therefore a high sensitivity (Tillin et al. 2010; FeAST, 2025). As such, there is a possibility that ocean quahog could be adversely impacted by siltation caused by the discharge of cuttings, muds and cement.

In summary, the sensitivity of seabed communities to the discharge of drill cuttings, muds and cement as a result of the Kyla Development is considered to be **High to Very High**. Some of the receptors are of international importance and are therefore of Very High value, but the overall resistance and

resilience is High for the majority of species as recoverability of benthic communities is expected in the short term. Ocean quahog are the exception to this as they have a Low resistance and resilience to high rates of siltation. The magnitude of impact is predicted to be **Minor**; there will only be a temporary change to the baseline conditions, predicted to occur in the short to medium term, with any changes occurring within close proximity to the Kyla well location (out to a maximum distance of 0.33 km from the release location based on a sediment bottom thickness of 1 mm). Effects on seabed communities from the discharge of drill cuttings, muds and cement are therefore assessed as **Minor** and not significant.

Fish and Shellfish

As discussed in Section 4.3.3, a number of fish species are known to use the waters in the vicinity of the Kyla Development location, and some use the area as a spawning and / or nursery ground. The Kyla field is located in an area which has been identified as a potential spawning ground for cod, lemon sole, mackerel (high intensity), Norway pout (high intensity), and sandeel; with the area also acting as a nursery area for anglerfish, blue whiting, cod (high intensity), European hake, haddock, herring, ling, mackerel, Norway pout, plaice, sandeel, spurdog, and whiting. However, the Kyla 2025 survey found the habitat was 'unsuitable' for both spawning herring and sandeels (refer to Section 4.3.2).

Exposure to increased turbidity caused by the discharge of drill cuttings and muds may reduce the visual acuity of fish utilising the area potentially affecting foraging behaviour (Bakke et al., 2013). Fish may also be temporarily displaced from their spawning and nursery areas due to the settlement of drill cuttings, muds and cement on the seabed. However, given the localised area of impact and the mobile nature of the species, any displaced fish are likely to find foraging opportunities, as well as suitable spawning and nursery areas in adjacent locations.

In summary, the sensitivity of fish and shellfish to the discharge of drill cuttings, muds and cement as a result of the Kyla Development is considered to be **High**. The species present are typical of the wider area in this region of the CNS, although anglerfish, blue whiting, cod, herring, ling, mackerel, Norway pout, sandeels, spurdog and whiting are listed as PMFs in Scottish waters, whereby this designation should seek to protect these features (see Section 4.3.3) and, as such, are of Very High value, but the overall resistance and resilience is High as recoverability is expected in the short to medium term. The magnitude of impact is predicted to be **Minor** there will only be a temporary change to the baseline conditions, predicted to occur in the short to medium term, with any changes occurring within close proximity to the Kyla well location (out to a maximum distance of 0.33 km from the release location based on a sediment bottom thickness of 1 mm). Effects on fish and shellfish from the discharge of drill cuttings, muds and cement are therefore assessed as **Minor** and not significant.

7.3.3 Installation of Subsea Infrastructure

Water Quality

There is a potential that the installation of the subsea infrastructure required for the proposed Kyla Development could result in a reduction of water quality. This could arise from the resuspension of sediment during the installation of the subsea infrastructure at the Kyla and Bittern locations, and the installation of the production pipeline, gas lift pipeline and umbilical leading to increased turbidity and a higher concentration of contaminated sediments in the water column. The greatest amount of sediment resuspension will take place during the pipeline and umbilical trench and burial operations.

Suspended sediment is not expected to persist within the water column beyond a day following the completion of subsea infrastructure installation activities (Dale et al., 2011; Black and Parry, 1999). It is worth noting that during pipeline and umbilical installation, increased suspended sediment in the water column is unlikely to occur across the full length of the pipeline and umbilical trenches (ca. 14 km) during a 24 hour period. These operations will take place over several days focussing on smaller segments of the route each day (refer to Section 3.4.6). In addition, at stations within the vicinity of and along the proposed pipeline route (KS04, KS07 to KS09, KB01 to KB02), Effects Range Low (ERL) values were not exceeded for any heavy metals. Therefore, heavy metal concentrations will not be elevated to point of affecting the water quality when the sediment becomes suspended (See Section 4.2.2). The heavy metal concentrations along the pipeline route and within the vicinity of the pipeline route were also similar to background levels (See Section 4.2.2). In summary, the resuspension of

sediments arising from the installation of subsea infrastructure is unlikely to result in high turbidity for a prolonged period or a significant concentration of contaminants entering the water column.

The sensitivity of water quality to the increase turbidity as a result of the Kyla Development is considered to be **Low**. The receptor has a Low value; as only the water column in relatively close proximity to the installation operations will be impacted, hence it is considered to be of local importance; but the overall resistance and resilience is Very High as recoverability is expected in the short term. The magnitude of impact is predicted to be **Negligible** with immeasurable changes in the baseline environment pertaining to water quality. Effects on water quality from the installation of subsea infrastructure are therefore assessed as **Negligible** and not significant.

Seabed Sediments

Temporary Impact

There will be temporary disturbance arising from the trenching and backfill operations during pipeline and umbilical installation, temporary initiation anchors and wires, the use of temporary laydown areas for wet storage and installation of subsea infrastructure at both Kyla and Bittern estimated to amount to approximately 0.623 km² (see Section 7.2.6).

It is likely that a proportion of the sediments displaced for the purpose of pipeline laying and burial, and the installation of subsea infrastructure at the Kyla and Bittern locations will become suspended in the bottom few metres of the water column. Within the vicinity of the proposed Kyla Development (KS01 to KS12, KB01 to KB02), the sediments are relatively fine (sandy and muddy) in nature which means that plumes or re-suspended sediment will tend to re-settle within 24 hours. The trench and burial operations may also result in the temporary formation of mounds either side of the pipelines and umbilical during the trenching phase which will be replaced during the burial phase.

Furthermore, the operations to install the subsea infrastructure at Kyla and Bittern, the use of the temporary initiation anchors and wires, and temporary laydown areas for wet storage will physically disturb the sediment. However, as discussed in Section 7.3.1, it is likely that any seabed scarring will persist only in the short to medium term and given the sandy sediment type at Kyla the likelihood of anchor mounds forming is very low.

In summary, sensitivity of seabed sediments to the temporary seabed disturbance as a result of the Kyla subsea infrastructure installation is therefore considered to be **Low**. The receptor is of local importance for sediment type, classed as Low value, and the overall resistance and resilience is High as seabed currents and nature of the sediment means that plumes or re-suspended sediment will tend to re-settle quickly (within 24 hours) and will not be prolonged or affect large areas. In addition, quick recovery following any scarring is predicted. The magnitude of impact is predicted to be **Minor** given the relatively small highest impact area for temporary seabed disturbance (0.623 km²) which will be impacted and the temporary nature of any impacts. Effects on seabed sediments from the temporary seabed disturbance as a result of the Kyla Development seabed infrastructure installation are therefore assessed as **Minor** and not significant.

Long Term Impact

Installation of the subsea infrastructure will result in the loss of sandy and muddy sediment habitat from the area, and the introduction of novel hard substrata. This will mostly comprise of subsea infrastructure items, rock cover and concrete mattresses. In the highest impact case, the total area of long-term sandy sediment habitat loss is estimated to amount to approximately 0.115 km² for the life of the Kyla Development (ca. 8 years) and beyond depending on how the infrastructure is decommissioned. This area is small in comparison to the area of similar habitat available across the wider area.

In summary, the sensitivity of seabed sediments to the long term disturbance from the installation of subsea infrastructure and rock cover and concrete mattresses as a result of the Kyla Development is considered to be **Medium** in the vicinity of the proposed Kyla Development. The receptor is of local importance for sediment type, classed as Low value, but the overall resistance and resilience is Medium, as there will be a permanent change to the habitat type, which will last for as long as the subsea infrastructure, rock cover and concrete mattresses remain in place. The magnitude of impact,

however, is considered to be **Negligible** given the small highest impact area (0.115 km²) which will be impacted compared to the available sandy sediment habitat type. Effects on seabed sediments from the subsea infrastructure installation activities are therefore assessed as **Negligible** and not significant, particularly as the impacted sediment is characteristic of the wider area.

Benthic Communities

Temporary Impact

The installation of the pipelines and umbilical, and subsea infrastructure will also result in sediment suspension and re-settlement outside of their direct footprint. Exposure to higher than normal loads of suspended sediments have the potential for negative impacts on habitats and species in the surrounding area. The re-settlement of sediments may result in the smothering of epifaunal species (Gubbay, 2003) with the degree of impact related to their ability to clear particles from their feeding and respiratory surfaces (Rogers, 1990). However, 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 impact of temporarily increased sedimentation rates. Depending on the sedimentation rates, infaunal species and communities can also work their way back to the seabed surface through blanket smothering (Neal and Avant, 2008).

Within the vicinity of the proposed Kyla Development (KS01 to KS12, KB01 to KB02), the sediments are relatively fine (sandy and muddy) in nature which means that plumes or re-suspended sediment will tend to re-settle within 24 hours and will not be prolonged or affect large areas. Where sediment re-suspension does occur, the majority of species present, particularly the infaunal communities, are expected to recover in the short term (Defra, 2010). Furthermore, large scale field experiments by Dernie *et al.* (2003) investigated the response to physical disturbance of marine benthic communities within a variety of sediment types (clean sand, silty sand, muddy sand and mud). Of the four sediment types investigated, the communities from clean sands had the most rapid recovery rate following disturbance and mud the slowest. The sediment type that is prevalent within the proposed Kyla Development is muddy sand, which has a slower recovery rate following disturbance.

As noted above, the Kyla survey area shows some similarity to the seapens and burrowing megafauna communities (burrowed mud) habitat (an OSPAR Threatened and/or Declining Habitat and Scottish PMF) (refer to Section 4.3.2). The sea pen and burrowing megafauna communities habitat has also been found to likely be present at the Bittern field (Fugro, 2017; 2023). Data taken from FeAST indicates that high rates of siltation may adversely affect this habitat type, with the habitat having low tolerance and medium recovery to the pressure and therefore a medium sensitivity (Tillin *et al.* 2010; FeAST, 2025). In addition, the resistance of this habitat to sub-surface abrasion (e.g. the use of temporary initiation anchors and temporary laydown areas) and physical disturbance is assessed as low and recovery is medium, therefore overall sensitivity is assessed as medium (FeAST, 2025). As such, there is a possibility that this habitat type could be impacted by siltation and abrasion caused by the installation of the pipelines and umbilical, subsea infrastructure at the Kyla and Bittern locations, as well as the use of temporary anchors and initiation wires and temporary laydown areas.

The OSPAR Threatened and/or Declining species, ocean quahog (*A. islandica*) have also been recorded across the Kyla Development area (refer to Section 4.3.2). During historic surveys at Bittern, no adult individuals of *A. islandica* were present, but juvenile individuals were recorded (Fugro, 2017; 2023). Data taken from FeAST indicates that high rates of siltation may adversely affect ocean quahog, with the species having no tolerance and low recovery to the pressure and therefore a high sensitivity (Tillin *et al.* 2010; FeAST, 2025). In addition, the species has a high sensitivity to sub-surface abrasions / penetration. As such, ocean quahog could be adversely impacted by the installation of subsea infrastructure.

In summary, the sensitivity of seabed communities to the temporary seabed disturbance as a result of installation of the Kyla subsea infrastructure is generally considered to be **High**. The majority of the receptors are of national importance and are of **High** value, with **High** overall resistance and resilience as recoverability of benthic communities is expected in the short term. Ocean quahog and the seapens and burrowing megafauna habitat are the exception to this, being of **Very High** sensitivity, with **Very High** value. They also have a **Low** and **Medium** resistance and resilience respectively to sub-surface

abrasion and siltation. The magnitude of impact is predicted to be **Minor**; there will only be a temporary change to the baseline conditions, predicted to occur in the short to medium term, with any changes occurring limited to a relatively small area (ca. 0.623 km²) in the highest impact case. Effects on seabed communities from the temporary seabed disturbance as a result of the installation of the Kyla subsea infrastructure are therefore assessed as **Minor** and not significant.

Long Term Impact

The seabed beneath the subsea infrastructure and rock cover and concrete mattress protection will be compacted. The sessile epifauna, and a proportion of the infauna (animals that burrow into the sediment or form tubes within it) such as polychaete worms in the direct footprint area of the Kyla Development infrastructure will be lost from compression and abrasion. However, the consequences for most species in context to the wider region are expected to be short-lived as most of the smaller sedentary species (such as polychaete worms) have short lifecycles and high reproductive rates (Tillin and Tyler-Walters, 2014). Annelids dominated within the infaunal community, making up five of the top 10 ranked species (Gardline, 2025b). The most abundant species was the polychaete *Paramphinome jeffreysii*. The next most dominant taxon was the polychaete *Ampharete falcata*.

The physical presence of the subsea structures and the rock protection over the pipelines and umbilical, will introduce a new stable hard substrata to the area and over time a new rocky substrate habitat will become established. Seabed animals within the direct footprint of the protective rock material will be damaged, displaced or smothered resulting in the mortality and loss of individuals of species but the material itself could, over time, function as reef habitat providing additional attachment sites for the indigenous sessile communities, such as sponges or hydrozoans, as well as refugia for mobile epibenthos such as Paguroidea or fish. Pidduck et al. (2017) highlight that rock dump material has the potential to act as an artificial reef supporting reef communities. The rate of colonisation of the rock protection material, if used, will be dependent on recruitment rates from local reproducing populations but is expected to be slow due to the slow growth, low recruitment rates and late maturity of deep, cold water assemblages (Cordes, 2016; Jones et al., 2012). However ultimately this new seabed feature is expected to be colonised by the same types of mobile and encrusting epifaunal animals already present on cobbles and boulders in the wider CNS area.

Data taken from FeAST indicates that the resistance of seapens and burrowing megafauna communities (burrowed mud) habitat to sub-surface abrasion (e.g. the placement of subsea infrastructure, rock cover and concrete mattresses) and physical disturbance is assessed as low and recovery is medium, therefore overall sensitivity is assessed as medium (FeAST, 2025). In addition, FeAST indicates that the sensitivity of this habitat type to the physical change of habitat (e.g. long term presence of subsea infrastructure, rock and concrete mattresses) is high with a low tolerance and very low recovery potential (FeAST, 2025). As such, it is likely that the seapens and burrowing megafauna communities (burrowed mud) habitat could be adversely impacted by abrasion and habitat change caused by the installation of the subsea infrastructure, rock cover and concrete mattresses at Kyla, Bittern and along the proposed pipeline route.

With regards to ocean quahog, data taken from FeAST indicates that the species has a high sensitivity to sub-surface abrasions / penetration (i.e. installation of subsea infrastructure, rock cover and concrete mattresses). In addition, FeAST indicates that the sensitivity of this species to the physical change of habitat (e.g. long term presence of subsea infrastructure, rock and concrete mattresses) is high as the change in habitat is likely to result in the habitat being unsuitable (Tillin et al., 2010; FeAST, 2025). As such, there is a possibility that ocean quahog could be impacted by the installation of subsea infrastructure, rock cover and concrete mattresses.

Overall, the introduction of novel hard substrata by the Kyla Development is very small and localised (confined to an area of ca. 0.115 km² in the highest impact case) and, whilst it will represent a change to the benthic environment locally it is not expected to cause any widespread changes to the marine life present in the area.

In summary, the sensitivity of the majority of seabed communities to long term impacts from the installation of seabed infrastructure, rock cover and concrete mattresses as a result of the Kyla Development is considered to be **High** as the habitats and species present are typical of this area. The receptors are of national importance and are of High value, and the overall resistance and resilience is

Medium as there will be a permanent change to the habitat type, which will last for as long as the subsea infrastructure, rock cover and concrete mattresses remain in place. Ocean quahog and the seapens and burrowing megafauna habitat are the exception to this, being of **Very High** sensitivity, with Very High value. They also have a Low resistance and resilience respectively to sub-surface abrasion and physical change to the habitat (the installation of seabed infrastructure, rock cover and concrete mattresses). The magnitude of impact is predicted to be **Minor** as although the impact will last the duration of the Kyla Development, these effects will be limited to a very small area (0.115 km²). Effects on seabed communities from installation of seabed infrastructure, rock cover and concrete mattresses are therefore assessed as **Minor** and not significant, given that any change to the benthic environment will be localised and is not expected to cause any widespread changes to the marine life present in the area.

Fish and Shellfish

Temporary Impact

Increased turbidity caused by seabed disturbance from the installation of subsea infrastructure at the Kyla and Bittern locations, the installation of the pipelines and umbilical, the temporary initiation anchors and wires and the use of temporary laydown areas for wet storage in the proposed Kyla Development area may affect foraging behaviour of fish due to reduced visual acuity (Bakke et al., 2013) and could temporarily displace fish from their spawning and nursery areas. However, given the localised area of impact (ca. 0.623 km²) and the mobile nature of the species, any displaced fish are likely to find foraging opportunities, as well as suitable spawning and nursery areas in adjacent locations. The spawning grounds within which the Kyla Development area is located is part of wider spawning grounds within the CNS and, as such, is not considered to be a key habitat for these fish species. As noted above, the Kyla 2025 survey also found the habitat was 'unsuitable' for both spawning herring and sandeels.

The sensitivity of fish and shellfish to the temporary seabed disturbance as a result of the Kyla subsea infrastructure installation is therefore considered to be **High**. Although the species present are typical of the wider area in this region of the CNS, anglerfish, blue whiting, cod, herring, ling, mackerel, Norway pout, sandeels, spurdog and whiting are listed as PMFs in Scottish waters, whereby this designation should seek to protect these features (see Section 4.3.3) and, as such, are of Very High value, but the overall resistance and resilience is also High as recoverability is expected in the short term. The magnitude of impact is predicted to be **Minor** there will only be a temporary change to the baseline conditions, predicted to occur in the short to medium term, with any changes occurring within a relatively small area (0.623 km²). Effects on fish and shellfish from the temporary seabed disturbance as a result of the Kyla Development are therefore assessed as **Minor** and not significant.

Long Term Impact

The physical presence of the Kyla Development subsea infrastructure, pipelines, rock and concrete mattresses on the seabed will provide a new stable hard substrata, resulting in the long term loss of seabed habitat within an area of ca. 0.115 km². However, the spawning grounds within which the Kyla Development area is located are part of wider spawning grounds and, as such, the area is not considered to be a key habitat for these fish species. In addition, the habitat within the proposed Kyla Development area is considered to be 'unsuitable' for both spawning herring and sandeels (refer to Section 4.3.2).

The sensitivity of spawning fish to the long term disturbance as a result of the installation of seabed infrastructure pipelines, rock cover and concrete mattresses as a result of the Kyla Development is considered to be **High**. Although the species present are typical of the wider area in this region of the CNS, anglerfish, blue whiting, cod, herring, ling, mackerel, Norway pout, sandeels, spurdog and whiting are listed as PMFs in Scottish waters, whereby this designation should seek to protect these features (see Section 4.3.3) and, as such, are of Very High value, but the overall resistance and resilience is also High as recoverability is expected in the short term. The magnitude of impact is predicted to be **Negligible** with immeasurable changes in the baseline environment due to the very small area affected (0.115 km²). Effects on spawning fish from the installation of subsea infrastructure, rock cover and concrete mattresses are therefore assessed as **Negligible** and not significant.

7.4 Mitigation Measures

Seabed disturbance impacts as a result of the proposed Kyla Development will be minimised by the implementation of the following mitigation measures:

- Use the optimised number of MODU anchors and length of ground chains to maintain stability and integrity.
- MODU anchors will be set at the optimum angle for the local seabed sediments, reducing the potential drag across the seabed and helping them to become suitably embedded;
- The MODU mooring system (anchors and chains) will be placed in accordance with site survey results so as to prevent damage to sensitive seabed habitats.
- A full Chemical Hazard Assessment and Risk Management (CHARM) assessment of the proposed chemicals to be used and discharged, as required under the Offshore Chemicals Regulations 2002 (as amended), will be undertaken during the permitting process prior to drilling operations commencing and, as part of chemical selection and assessment process, less hazardous alternatives will be sought in preference for any chemicals identified to be high risk (e.g. those with substitution warnings).
- If deemed feasible, thermal cuttings treatment will be used to treat the LTOBM contaminated cuttings from Kyla to an acceptable overboard disposal limit (<1% oil on cuttings) or alternatively LTOBM cuttings will be skipped and shipped for disposal onshore.
- A ROV and chemical dye will be used to monitor cement returns when cementing both the conductor and 20" casing to help ensure the volume of cement discharged to the seabed is kept at a minimum.
- Route selection and optimisation will be based on acquired Environmental, Geophysical, and Geotechnical survey data.
- The width of the working corridors during pipeline and umbilical installation operations will be minimised as far as possible.
- Any boulders removed from the pipelines and umbilical lay corridors will be placed appropriately on the seabed to avoid a snag hazard and their as-left position recorded.
- Use of DP installation vessels (where applicable) as opposed to anchored vessels.
- Rock will be deployed from a DP rock dumping vessel using a fall pipe and the rate and locations of deployment will be controlled on board the vessel and monitored using high resolution survey / sonar equipment.
- Size of subsea infrastructure will be optimised for the Kyla Development.
- Subsea infrastructure layout, trench transitions and pipeline crossing designs optimised to minimise material deposited.
- Monitoring of integrity of subsea infrastructure, including the pipelines / umbilical and stabilisation material throughout production operations and taking remedial action, if required.
- Minimise amount of deposited material whilst still achieving the required level of stabilisation / protection.

7.5 Residual Effects

In summary, no significant residual effects on water quality, seabed sediments, seabed communities or fish are predicted as a result of disturbance to the seabed during the life of the Kyla Development. The highest impact case total area of seabed that will be directly impacted temporarily by the Kyla Development is estimated at around 0.819 km², and the highest impact case total area of seabed that will be directly impacted in the long term by the Kyla Development is estimated at around 0.115 km². This is a relatively small area in comparison to the seabed available in the CNS region, with similar water depths, sediment types and benthic communities. It is, however, recognised that some aspects associated with the Kyla Development (i.e. installation of the subsea structures, UHB mitigation and rock / mattress protection) will have longer term impacts on sediment communities, due to permanent habitat change, although direct physical injury of benthic species will only occur when the infrastructure or material is first placed on the seabed.

7.6 Transboundary Impacts

The Kyla Development lies approximately 72 km to the south west of the UK / Norway median line at its closest point. The environment within which the proposed Kyla Development area is located is relatively stable compared to other more heterogeneous and transient areas such as the SNS. In the highest impact case, impacts arising from the Kyla Development extend out to 0.33 km from the east most point within the development area (drill cuttings from the well location) and therefore will not cross over the transboundary line. As such, significant transboundary impacts caused by seabed disturbance are not predicted.

7.7 Cumulative Impacts

Effects of seabed disturbance resulting from oil and gas activities will be cumulative to those of other activities, particularly trawling activities. The Kyla Development is located within an area of low fishing intensity for demersal species. However, the majority of fishing activities are carried out using demersal gear, and as such, it is considered that the contribution of other forms of seabed disturbance, such as offshore installation activities, are minor in comparison to the direct physical effects of fishing (DESNZ, 2022).

The proposed Kyla Development lies within an area of moderate to high oil and gas activity (refer to Section 4.4.3) and will tie back into an existing Bittern subsea manifold located 12 to 13.2 km northwest of the proposed Kyla well location. Apart from Bittern, the closest producing field to Kyla is the Starling subsea gas field (operated by Shell UK), located in UKCS Block 29/3a approximately 12 km to the northeast, which is tied back to the Shearwater platform (refer to Section 4.4.4). The nearest Floating Production, Storage and Offloading Facility (FPSO) is the Triton FPSO (operated by Dana) which is located approximately 20 km northwest of the Bittern DCB manifold and 30 km northwest of the proposed Kyla well. The next nearest FPSO is the Catcher FPSO (operated by BW Offshore) which is located approximately 24 km southwest of the Bittern DCA manifold. The nearest platform to the Bittern DCB manifold is the Gannet A platform (operated by Shell UK) located approximately 30 km north. The nearest platform to the proposed Kyla well is the West Franklin WHP (operated by Total Energies) which is located approximately 36 km northeast. The Belinda field which is currently in development is located approximately 14 km north of the Bittern DCB manifold and 24 km northwest of the proposed Kyla well (refer to Section 4.4.4).

As the majority of these fields are currently producing, excluding Belinda which will achieve first oil before the Kyla Development operations begin, the only activities that could result in cumulative seabed disturbance impacts are in the event of any maintenance construction work (e.g. spot rock-deposits) or incremental drilling activity. As such it is unlikely that there will be any significant cumulative impacts with respect to seabed disturbance and ongoing production activities.

In addition, the Kyla Development will take place within the vicinity of the historic Kyle field. The proposed Kyla Development is located ca. 0.3 km from the closest historic Kyle well (refer to Section 4.4.4). Although the cuttings discharge may extend out to 0.33 km, it is unlikely that significant cumulative impacts will arise as a multibeam echosounder geophysical survey of the Kyle Field undertaken as part of the pre-decommissioning survey scope did not identify a discernible physical

cuttings pile. The historic cuttings piles are believed to have dispersed and now lie flush with the seabed. Seabed samples taken during the pre-decommissioning survey of the Kyle field do show a chemical footprint (elevated THC levels) covering an area of 1,432 m²; however, this elevation is not considered to be significant contamination (Fugro, 2020; CNRI, 2021). In addition, recent survey results show all stations within the vicinity of the proposed Kyla Development area have recorded THC and heavy metal concentrations that are considered consistent with background concentrations (Gardline, 2025b).

There are no operational, under construction or consented offshore windfarms in the vicinity of the proposed Kyla Development area. The closest offshore windfarm is the Cerulean Winds Cedar Project, currently in the pre-planning stage, located approximately 9.5 km southwest of the Kyla Development (refer to Section 4.4.5). The next closest windfarm is the Cenos Offshore Wind Farm, currently in the planning stage, which would be located approximately 15.5 km northeast of the Kyla Development. Construction at this wind farm is not scheduled to begin until 2030, which would be after first gas is achieved at the Kyla Development. As such it is unlikely that there will be any significant cumulative impacts with respect to seabed disturbance and offshore wind development activities.

8 Underwater Noise Emissions

8.1 Introduction

Marine fauna, including fish and marine mammals, have developed a range of complex mechanisms for both emitting and detecting underwater noise signals that allow them to communicate, avoid predators and other perceived dangers, locate food and mates, and navigate (Richardson et al., 1995; DOSITS, 2017). Sounds are particularly important for intra-species communication as they can convey significant amounts of information quickly and over great distances (DOSITS, 2017). As such, many marine species are vulnerable to anthropogenic noises that may disrupt their ability to perceive their surrounding environment.

This section assesses whether the underwater noise emissions generated by the Kyla Development has the potential to result in a significant disturbance, or cause injury to, sensitive marine fauna.

In addition, the Conservation of Offshore Marine Habitats and Species Regulations 2017 make it an offence to deliberately capture, kill, injure or disturb any European Protected Species (EPS; species listed in Annex IV of the Habitats Directive, including all species of cetaceans), in such a way that is likely to:

- a. Impair their ability to survive, to breed or reproduce, or to rear or nurture their young; or in the case the case of animals of a hibernating or migratory species, to hibernate or migrate;
- b. Affect significantly the local distribution or abundance of the species to which they belong.

This section therefore also assesses if the Kyla Development activities, either alone or in combination with other activities, are likely to cause an offence involving an EPS.

8.2 Assessment of Impacts

8.2.1 Kyla Noise Sources

Development activities identified in the ENVID workshop which result in underwater noise emissions with the potential to result in significant effects on marine fauna were limited to the noise generated from potential piling operations during the installation of the valve skid at the proposed Kyla well location and the tie-in structure, if required, at the Bittern manifold.

It is assumed that both the valve skid and tie-in structure would be held in place by four tubular piles each, one at each corner, each with a diameter of 24-inch and length of up to 24 m. The piles would be secured into the seabed using a maximum hammer blow energy of 90 kJ, with a maximum blow rate of 50 blows per minute. It is expected that the hammering operations for each pile will be ongoing for up to two hours. A soft start is assumed with a ramp up from 30% energy to full energy over 5 minutes, with a reduced blow rate of 6 strikes per minute. Each pile is estimated to take 2 hours to install, giving a total maximum piling duration of 8 hours for each structure.

Given the characteristics of the proposed piling operations and the impulsive nature of the sound produced, this activity will result in the largest impact to marine fauna. Therefore, underwater sound propagation modelling has been conducted to estimate the extent of potential injury or behavioural disturbance to marine mammals and fish from the proposed piling operations.

It is acknowledged that the vessels associated with drilling, subsea installation, inspection and maintenance and decommissioning for the Kyla Development will also generate underwater noise of a continuous (non-impulsive) nature.

The MODU used to drill the Kyla well will be held in place through the use of anchors and mooring chains, but will also operate a DP system, when necessary. The DP thrusters continually produce cavitation bubbles that, when they implode, leads to the generation of underwater noise (Fischer, 2000; Wyatt, 2008). In addition to the noise produced from the thrusters, sound will also propagate from rotating machinery such as generators, pumps and the drilling unit and risers (McCauley, 1994). Source levels associated with a typical semi-submersible drilling rig may be up to 170 dB re 1µPa @ 1m (Richardson et al., 1995), although other studies have recorded slightly lower levels at 154 dB re 1µPa

@ 1m (measured from the SEDCO 708 semi-submersible MODU in water depths of 114 m) (Greene, 1986 cited in Genesis, 2011). The noise produced will therefore be of a relatively low level, although it will be continuous and generated for long periods throughout the drilling phase.

For other vessels, sound levels and frequency characteristics are roughly related to ship size and speed, but there is significant individual variation among vessels of similar classes. Large vessels (greater than 100 m length) typically have sound pressure levels (SPLs) within the range of 180-190 dB re 1 μ Pa @ 1m, whilst most support vessels, assuming a medium-size ship (50 – 100 m in length), have sound pressure levels within the range of 165-180 dB re 1 μ Pa @ 1m (OSPAR, 2009). The highest sound levels are expected from short-term energy-demanding activities, for example when using DP thrusters to position vessels on location (Genesis, 2011). The majority of the acoustic energy from vessels is below 1 kilohertz (kHz), typically within the 50-300 hertz (Hz) range, although cavitation from propellers produces sounds at frequencies of between 1 kHz and 125 kHz (Genesis 2011; Hermannsen et al. 2014).

The noise emissions from construction activities e.g. trenching or rock placement, are usually dwarfed by the noise emissions from the vessels themselves (DECC, 2011).

There is evidence that vessel traffic may influence marine mammals in several ways, with reported responses including avoidance, changes in swimming and surfacing patterns, alteration of the intensity and frequency of calls and increases in stress-related hormones (Erbe et al., 2019, Veirs et al. 2016, Rolland et al. 2012 and Dyndo et al. 2015). Harbour porpoise and minke whale have been shown to respond to vessels by moving away from them, while some other species, such as common dolphin, have shown attraction (Palka & Hammond, 2001). In addition, fish have been shown to avoid vessel traffic through diving, horizontal movements and tilting behaviours (De Robertis and Handegard, 2013). However, although vessel noise may cause localised changes in distribution of marine mammals and fish in the immediate vicinity of the vessel, the limited temporal scale of vessel use means these small-scale changes will not result in population level effects and therefore no significant impacts are predicted.

Given the above, this assessment is focused on the potential impact to marine fauna from the proposed piling operations as the impulsive nature of the sound produced from this activity will result in the largest impact to marine fauna. Therefore, underwater sound propagation modelling has been conducted to estimate the extent of potential injury or behavioural disturbance to marine mammals and fish from the proposed piling operations. The modelling has assumed that piling operations will adhere to the following schedule for each pile:

- 15 blows at 30% energy (27 kJ), delivered at a strike rate of 6 strikes per minute, over a period of 2.5 minutes;
- 15 blows at 60% energy (54 kJ), delivered at a strike rate of 6 strikes per minute, over a period of 2.5 minutes;
- 5,750 blows at 100% energy (90 kJ), delivered at a strike rate 50 strikes per minute, over a period of 1 hour and 55 minutes.

Within a 24-hour period, this schedule is repeated 4 times (once for each pile), giving a total maximum piling duration of 8 hours. The apparent source levels, based off direct measurements of similar piling operations, are presented in Table 8.1.

Table 8.1: Piling Source Levels for different impact piling energies used in the piling sequence (Subacoustech, 2025)

Blow Energy	Estimated Source Level (@ 1m) ^{Note 1, Note 2}	
	$L_{p,pk}$ (dB re 1 μ Pa)	$L_{E,p,ss}$ (dB re 1 μ Pa ² s)
30 % (27 kJ)	204.2	189.6
60 % (54 kJ)	211.9	192.7
100 % (90 kJ)	216.7	194.8

^{Note 1} $L_{p,pk}$ = Sound Pressure Level peak, the highest (zero-peak) positive or negative sound pressure, in decibels. $L_{E,p,ss}$ = Sound Exposure Level (SEL), single strike, calculation of the sound exposure level representative of a single noise impulse.

^{Note 2} "Source levels" are really "apparent source levels," as they would appear at great distance for the purposes of environmental modelling. A real noise level measured 1 m from a foundation pile struck by a hammer is extremely complex and less useful for modelling at long range.

8.2.2 Underwater Noise Transmission

As sound spreads underwater, it decreases in intensity (attenuates) with distance from the source. The rate of attenuation is affected by sound absorption or scattering by organisms in the water column, reflection or scattering of the sound wave at the seabed, which varies depending on sediment type, and the temperature, pressure, water column stratification, salinity and even weather (Munk and Zachariasen, 1991; Richardson et al., 1995). It also reflects and scatters at the sea surface, which varies depending on sea state conditions. Consequently, actual sound transmission has considerable temporal and spatial variability that is difficult to quantify.

In order to estimate the received sound pressure levels from the proposed piling operations in the waters surrounding Kyla and Bittern, Subacoustech was commissioned to undertake underwater sound propagation modelling in accordance with the recommendations in the National Physical Laboratory Good Practice Guide 133 for Underwater Noise (Robinson *et al.*, 2014). A copy of the underwater noise modelling report is provided for reference in Appendix D.

Modelling of underwater noise is complex and can be approached in several different ways. For this assessment, a numerical approach has been used based on two different solvers using the dBSea modelling software:

- A parabolic equation (PE) method for lower frequencies (12.5 Hz to 250 Hz); and
- A ray tracing method for higher frequencies (315 Hz to 100 kHz).

The PE method is widely used but has computational limitations at high frequencies. Ray tracing is more computationally efficient but is not suited to low frequency noise (Etter, 1991).

A wide array of input parameters including bathymetry, sediment data, sound speed and source frequency content were input into the model to ensure the results are as accurate as possible (Subacoustech, 2025). A summary of the key input parameters is provided in Table 8.2.

Table 8.2: Modelling Input Parameters

Input Parameter	Kyla Piling Data
Modelling Location ¹	56°53'0.43"N; 1°13'49.04"E (ED50)
Location Depth	91 m
Piling Parameters	Pile: 0.61 m (24-inch) diameter x 24 m length, installed to a depth of 20 m. Maximum hammer blow energy: 90 kJ
Source Depth Below Surface	79 m (midpoint of pile above the seabed)
Source Level (Maximum)	$L_{p,pk}$: 216.7 dB re 1 μ Pa @ 1 m $L_{E,p,ss}$: 194.8 dB re 1 μ Pa ² s @ 1 m

¹ Modelling was undertaken at the proposed Kyla valve skid location only. However, the results are also applicable to the proposed tie-in structure location given the similarity in water depth and the homogeneous nature of the sediment type at the Kyla and Bittern locations.

The results of the modelling are summarised below, with reference to the criteria used to assess the noise impact on relevant marine species; Popper et al. (2014) for fish and Southall et al. (2019) for marine mammals. Note, the Southall et al. (2019) paper is effectively an update of the previous Southall et al. (2007) paper and provides identical thresholds to those from the National Marine Fisheries Service (NMFS) (2018) guidance for marine mammals.

It should be stressed that while the modelling results present specific ranges at which impact thresholds are met, these ranges should be considered worst case in determining whether receptors will experience environmental effects during the proposed piling operations.

8.2.3 Potential Impacts on Fish

Sounds produced by fish are predominantly related to reproduction or conveying territorial aggression or predation (DOSITS, 2017). As such, many fish species have developed sensory mechanisms for detecting, locating and interpreting underwater sounds. Hearing ability is highly variable between fish species. Species with a connection between the inner ear and the swim bladder, a gas-filled organ primarily used for buoyancy, are more sensitive to sound (Hawkins, 1993; Moyle and Cech, 2004; Popper, 2012). Fish may tentatively be separated into:

- Category I - Fish with no swim bladder or other gas volume (particle motion detectors), such as flatfish, mackerel and sharks, skates and rays (Myrberg, 2001) and sandeels (Mason, 2013). These species tend to have relatively low auditory sensitivity;
- Category II - Fish with a swim bladder or other gas volume, and therefore susceptible to barotrauma (injury caused by increased air or water pressure), but where the organ is not involved in hearing (particle motion detectors);
- Category III - Fish with a swim bladder or other gas volume, and therefore susceptible to barotrauma, where the organ is also involved in hearing (sound pressure and particle motion detectors), such as cod and herring and relatives (Hawkins, 1993; Popper et al., 2014; DOSITS, 2017).

The adult fish community in the vicinity of the Kyla Development is dominated by demersal species such as dab, long rough dab, whiting, haddock and plaice. Species such as anglerfish, blue whiting, European hake, haddock, herring, lemon sole, ling, mackerel, Norway pout, plaice, spurdog, and whiting are also predicted to have nursery and spawning grounds within the vicinity of the Kyla Development area. Although Ellis *et al.*, 2012 show mapped spawning areas for cod and sandeels, the Scottish NMPI indicates that the Kyla area is unlikely to offer suitable spawning habitat for these species. In addition, elasmobranch species such as cuckoo skate, lesser-spotted dogfish / small spotted catshark and starry ray / thorny skate may be present in the area (see Section 4.3.3).

The majority of the above listed species have a swim bladder which is either in close proximity, or mechanically connected to the ears and would therefore be classified as Category III fish. Category III fish that utilise the Kyla Development area include blue whiting, cod, European hake, haddock, herring, ling, Norway pout, sprat and whiting. Although, Category III fish are more sensitive to noise, in general, marine species tend to have relatively poor auditory sensitivity, and generally cannot hear sounds at frequencies above 1 kHz (DOSITS, 2017). Physiological damage to fish eggs and larvae is also of particular concern, since unlike adult fish they are unable to move away from a noise source and are therefore at greater risk of mortality (Turnpenny and Nedwell, 1994).

Potential effects on fish from impulsive noise sources, such as those from piling operations, range from behavioural changes including fish moving away from an area or ceasing feeding, to physiological changes such temporary hearing loss, tissue damage or even death (DOSITS, 2017). For this application, the effects of noise on fish have been assessed using the criteria from Popper et al. (2014) for pile driving (see Table 8.3).

Table 8.3: Popper *et al.* (2014) Criteria for Pile Driving – Quantitative and Qualitative ^{1, 2, 3}

Fish Category	Mortality and Potential Mortal Injury	Impairment			Behaviour
		Recoverable Injury	Temporary Threshold Shift (TTS)	Masking	
Category I fish	>219 L _{E,p} >213 L _{p,pk}	>216 L _{E,p} >213 L _{p,pk}	>>186 L _{E,p}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Category II fish	210 L _{E,p} >207 L _{p,pk}	203 L _{E,p} >207 L _{p,pk}	>186 L _{E,p}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Category III fish	207 L _{E,p} >207 L _{p,pk}	203 L _{E,p} >207 L _{p,pk}	186 L _{E,p}	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate
Eggs and larvae	>210 dB L _{E,p} >207 L _{p,pk}	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low

¹ N = Near-field, I = Intermediate-field, F = Far-field

² Where insufficient data on impacts are available (which is the case for masking and behavioural effects from pile driving), qualitative criteria have been given, summarising the effect of the noise as having either a high, moderate or low effect on a receptor in either the near-field (tens of metres), intermediate field (hundreds of metres), or far-field (thousands of metres). These qualitative effects are not investigated further.

³ L_{p,pk} = peak SPL and L_{E,p} = SEL

Where cumulative thresholds are required for fish, both a stationary and fleeing animal model has been used. Most species described by Popper *et al.* (2014) are likely to move away from a sound that is loud enough to cause harm (Dahl *et al.*, 2015; Popper *et al.*, 2014). For those species that flee, a speed of 1.5 ms⁻¹ (based on Hirata, 1999) is considered a conservative speed at which to base a fleeing animal model. However, considering the diversity of species described by Popper *et al.* (2014), whether an animal flees or remains stationary in response to a loud noise will differ between species. It is recognised that there is limited evidence for fish fleeing from high level noise sources in the wild. Those species that are likely to remain stationary are thought more likely to be benthic species or species without a swim bladder, due to their reduced hearing capabilities making these species the least sensitive to noise (e.g., Goertner *et al.*, 1994, 1978; Stephenson *et al.*, 2010; Halvorsen *et al.*, 2012). Despite this, including only a stationary animal model as a worst-case scenario is likely to greatly overestimate the potential risk to fish species. Therefore, this assessment considers impact ranges from both fleeing and stationary receptors.

Table 8.4 gives the predicted maximum impact ranges for species of fish as a result of the underwater noise generated from the proposed piling operations, using the Popper *et al.* (2014) criteria. The peak SPL (L_{p,pk}) maximum impact ranges have been modelled for the first strike of the piling operations (30 % energy) and a strike a maximum energy (100 % energy) (Subacoustech, 2025).

Table 8.4: Predicted Maximum Impact Ranges for Fish (from Pile Driving), based on Popper et al., 2014 Thresholds (Subacoustech, 2025) ¹

Criteria ³	Maximum Impact Range ²		
	Category I fish	Category II fish	Category III fish
Mortality and Potential Mortal Injury			
L _{p,pk} at first strike (30 % Energy)	< 10 m	< 10 m	< 10 m
L _{p,pk} at maximum energy (100 % Energy)	< 10 m	< 10 m	< 10 m
L _{E,p,24h} (Fleeing 1.5 ms ⁻¹)	< 10 m	< 10 m	< 10 m
L _{E,p,24h} (Stationary)	30 m	110 m	180 m
Recoverable Injury			
L _{p,pk} at first strike (30 % Energy)	< 10 m	< 10 m	< 10 m
L _{p,pk} at maximum energy (100 % Energy)	< 10 m	< 10 m	< 10 m
L _{E,p,24h} (Fleeing 1.5 ms ⁻¹)	< 10 m	< 10 m	< 10 m
L _{E,p,24h} (Stationary)	40 m	310 m	310 m
Temporary Threshold Shift (TTS)			
L _{p,pk} at first strike (30 % Energy)	-	-	-
L _{p,pk} at maximum energy (100 % Energy)	-	-	-
L _{E,p,24h} (Fleeing 1.5 ms ⁻¹)	10 m	10 m	10 m
L _{E,p,24h} (Stationary)	3,900 m	3,900 m	3,900 m

Notes

¹ For Popper et al., 2014 Thresholds see Table 8.3.

² Values and impact ranges below 10 m have not been presented as the modelling processes are unable to specify any greater level of accuracy at these ranges with confidence.

³ L_{p,pk} = peak SPL and L_{E,p} = SEL

It can be seen from Table 8.4 that according to the peak sound pressure level (L_{p,pk}) metric, the largest predicted range for the threshold of mortality does not differ between fish categories and is predicted at less than 10 m from the piling operations.

Using the sound exposure level (SEL) across the entire piling sequence (L_{E,p,24h}) metric (8 hours of piling in 24 hours), the largest predicted range for the threshold for mortality also does not differ between fish categories and is predicted at less than 10 m from the piling operations if they are assumed to flee from the source. If they are assumed to remain stationary, the largest predicted range for mortality is for fish with a swim bladder involved in hearing (Category III fish) at 180 m from the piling operations.

Using the sound exposure level (L_{E,p,24h}) metric, the largest predicted range for the threshold for recoverable injury is predicted for fish with a swim bladder (involved and not involved in hearing) at 310 m from the piling operations, if they are assumed to remain stationary. Using the sound exposure level (L_{E,p,24h}) metric, the largest predicted range for the threshold of Temporary Threshold Shift (TTS) is at 10 m (all fish categories), if they are assumed to flee from the source, and is at 3.9 km from the piling operations (all fish categories), if they are assumed to remain stationary. However, it is worth noting that a stationary receptor is likely to be over-precautionary as it involves a receptor staying in the same location throughout the entire piling operation (Subacoustech, 2025).

Most noise produced by fish is related to reproduction, therefore many fish are more receptive and more sensitive to introduced noise during reproductive periods and spawning events. Disturbance to fish during key lifecycle events may have greater impacts at a population level as it could deter individuals away from crucial habitats. The waters surrounding the Kyla Development have been

identified as spawning and nursery grounds for a number of fish species (refer to Section 4.3.3). However, the area likely to be impacted by the proposed piling operations is considered to represent only a small proportion of the spawning and nursery grounds available to each fish species. In addition, as the proposed piling operations will be temporary (occurring for approximately 48 hours) they will not be conducted over an entire spawning / nursery period for any one species and are therefore unlikely to result in significant disruption.

The sensitivity of fish to the underwater noise generated during the proposed piling operations is therefore considered to be **High**; the receptor is of **Very High value** as many of the species that may be present in the Kyla Development area (e.g. anglerfish, blue whiting, cod, herring, ling, mackerel, Norway pout, sandeels, spurdog and whiting) are listed as Priority Marine Features (PMFs) in Scottish waters (see Section 4.3.3), but has some tolerance / ability to adapt to effects (**High resistance and resilience**). Based on the assessment as detailed above, the magnitude of impact is predicted to be **Minor** as any impacts will be in fairly close proximity to the source and the period during which fish may encounter sound from the proposed operations is short, with piling operations anticipated to only be ongoing for approximately 48 hours in total, with only 8 hours of piling per 24-hour period. With the implementation of a soft-start procedure (refer to Section 8.3), it is expected that the majority of fish in the area would be able to disperse to areas where injury or mortality would not occur. Furthermore, if fish are disturbed by sound, evidence suggests they will return to an area once the activity causing the disturbance has ceased (Slabbekoorn et al., 2010). Effects on fish are therefore considered to be **Minor** and not significant.

It is also noted that fish are an important food source for seabirds and marine mammals. As such, seabirds and marine mammals could be indirectly impacted by changes in the abundance of fish; however, given the relatively small impact range for fish, indirect impacts on seabirds and marine mammals are not predicted to be significant.

8.2.4 Potential Impacts on Marine Mammals

Introduction

Marine mammals, in particular, cetaceans, rely almost exclusively on sound for navigating, foraging, breeding and communicating (Clark, 1990; Edds-Walton 1997; Tyack and Clark, 2000). The extent to which intense underwater sound might adversely impact a species is dependent upon the incident sound level, sound frequency, and duration of exposure and/or repetition rate of the sound wave.

The Southall et al. (2019) guidance groups marine mammals into categories of similar species and applies filters to the unweighted noise to approximate the hearing sensitivities of the receptor. The hearing groups given in Southall et al. (2019) are summarised in Table 8.5, along with the corresponding marine mammal species that have been recorded in the CNS.

Table 8.5: Marine Mammal Hearing Groups and their Generalised Hearing Range (Southall et al., 2019)

Functional Group	Estimated Auditory Bandwidth	Marine Mammal Species Found in the CNS ¹
Low-frequency (LF) cetaceans	7 Hz – 35 kHz	Minke whale, fin whale
High-frequency (HF) cetaceans	150 Hz – 160 kHz	White-sided dolphin, white-beaked dolphin, common dolphin, Risso's dolphin, killer whale, bottlenose dolphin
Very High-frequency (VHF) cetaceans	275 Hz – 160 kHz	Harbour porpoise
Phocid carnivores in water (PCW)	50 Hz to 86 kHz	Harbour seal, grey seal

¹ See Section 4.3.5

Physiological Impacts

When marine mammals are exposed to intense sound, an elevated hearing threshold may occur, known as a threshold shift (TS). If the hearing threshold returns to the pre-exposure level after a period of time, the TS is known as TTS. If the threshold does not return to the pre-exposure level, it is known as a permanent threshold shift (PTS) and is considered to result in injury (Finneran et al., 2000; Southall et al., 2007).

Southall et al. (2019) gives individual criteria for marine mammal hearing groups based on whether the noise is considered impulsive or non-impulsive. The study categorises impulsive noises as having high peak sound pressure, short duration, fast rise-time and broad frequency content at source, and non-impulsive sources as steady-state noise. Piling is considered an impulsive noise, whereas drilling, as well as other more low-level, continuous noises, such as that generated by vessel activity, are considered non-impulsive. These differences are important to consider regarding the potential for auditory injury, as impulsive noise is generally more injurious than non-impulsive noise.

Southall et al. (2019) also presents single pulse, unweighted peak sound pressure level ($L_{p,pk}$) and cumulative weighted sound exposure level ($L_{E,24h,wtd}$) criteria for both onset of PTS and TTS. To account for the fact that different species groups use and hear sound differently, the thresholds in the cumulative weighted sound exposure level metric incorporate auditory weighting functions. As dual metrics, onset of PTS /TTS is considered to have occurred when either one of the two metrics is exceeded.

The predicted maximum PTS and TTS impacts ranges using the impulsive criteria for marine mammals for the noise associated with the proposed piling operations are summarised in Table 8.6. The $L_{p,pk}$ maximum impact ranges have been modelled for the first strike of the piling operations (30 % energy) and a strike a maximum energy (100 % energy) (Subacoustech, 2025).

Hastie et al. (2019) found that impulsive sound can be considered non-impulsive 3.5 km from the source, while Southall (2021) suggests noise should be non-impulsive if energy above 10 kHz is absent. Since impact piling is an impulsive noise source that is likely to propagate more than 3.5 km from the source, the true impact range is likely to lie between the impulsive and non-impulsive ranges. Thus, this study considered the impulsive and non-impulsive sound criteria for marine mammal PTS and TTS thresholds from Southall et al. (2019).

Table 8.6: Predicted Marine Mammal PTS / TTS Maximum Impact Ranges, based on Southall et al. (2019) Impulsive and Non-impulsive criteria (Subacoustech, 2025) ¹

Hearing Group ²	Threshold (Unweighted $L_{p,pk}$)	Max Impact Range (30 % Energy)	Threshold (Unweighted $L_{p,pk}$)	Max Impact Range (Maximum Energy)	Impulsive Threshold (Weighted $L_{E,24h,wtd}$) ⁴	Max Impact Range	Non-impulsive Threshold (Weighted $L_{E,24h,wtd}$) ⁴	Max Impact Range
PTS Onset (Impulsive)								
LF cetaceans	219 dB	NE	219 dB	NE	183 dB	10 m	199	< 10 m
HF cetaceans	230 dB	NE	230 dB	NE	185 dB	< 10 m	198	< 10 m
VHF cetaceans	202 dB	< 10 m	202 dB	20 m	155 dB	10 m	173	< 10 m
PCW	218 dB	NE	218 dB	NE	185 dB	10 m	201	< 10 m
TTS Onset (Impulsive)								
LF cetaceans	213 dB	NE	213 dB	< 10 m	168 dB	8,800 m	179	80 m
HF cetaceans	224 dB	NE	224 dB	NE	170 dB	< 10 m	178	< 10 m
VHF cetaceans	196 dB	< 10 m	196 dB	40 m	140 dB	3,400 m	153	30 m
PCW	212 dB	NE	212 dB	< 10 m	170 dB	70 m	181	< 10 m

¹ Values and impact ranges below 10 m have not been presented as the modelling processes are unable to specify any greater level of accuracy at these ranges with confidence.

² LF = Low-frequency, HF = High-frequency, VHF = Very high-frequency and PCW = Phocid carnivores in water (see generalised hearing ranges in Table 8.5).

³ NE = No Exceedance

⁴ For the $L_{E,24h,wtd}$ modelling a fleeing animal model has been assumed. The fleeing animal model assumes that marine mammals flee from the source at a constant rate of 1.5 ms^{-1} (Otani et al., 2000), with the exception of LF cetaceans, which flee at a rate of 3.25 ms^{-1} (Blix and Folkow, 1995).

Using the unweighted peak sound pressure level ($L_{p,pk}$) criteria, the very high frequency (VHF) cetacean group are predicted to have the largest PTS impact ranges, with animals within 20 m of the proposed piling operations at maximum energy likely to exceed the PTS threshold for VHF cetaceans.

When the weighted cumulative sound exposure level ($L_{E,24h,wtd}$) criteria for impulsive noise is applied to the predicted noise contours, the low frequency (LF) and VHF cetacean groups and PCWs are predicted to have the largest PTS impact ranges. Animals within 10 m of the piling operations are predicted to exceed the PTS threshold for LF and VHF cetaceans and PCWs, under the impulsive criteria. This assumes that the pile driving equipment is continuously operational for 24 hours, and that the animals flee away from the noise source at a constant speed.

When the weighted cumulative SEL ($L_{E,24h,wtd}$) criteria for non-impulsive noise is applied to the predicted noise contours, the LF and VHF cetacean groups and PCWs are predicted to have the largest PTS impact ranges. Animals within less than 10 m of the piling operations are predicted to exceed the PTS threshold for LF and VHF cetaceans and PCWs, under the non-impulsive criteria. This assumes that the pile driving equipment is continuously operational for 24 hours, and that the animals flee away from the noise source at a constant speed.

To put the modelling results into context, Table 8.7 calculates the number of animals which may be exposed to PTS / TTS onset using the density and abundance estimates from the MMMU of relevance to the Kyla Development (refer to Section 4.3.5). Note estimated density and abundance is only available for those species which are commonly observed in this region of the North Sea. The number of harbour seals and grey seals has not been calculated due to the extremely low density (0.00% of the at-sea population per 25 km²) found in the vicinity of Kyla.

It can be seen from Table 8.7 that for the majority of species it is predicted that less than one individual may be injured by the proposed piling operations or experience a temporary, recoverable reduction in hearing sensitivity. However, using the impact ranges from the weighted cumulative impulsive criteria, ca. 19 harbour porpoises and 3 minke whales could experience a temporary, recoverable reduction in hearing sensitivity (TTS). These numbers are small enough that there would be no effect at the population level, based on the percentage of the corresponding reference population potentially impacted, and the fact that these individuals are likely to recover.

Given the above, the sensitivity of marine mammals to physiological impacts has been evaluated as **Very High**; the receptor is of international importance (Very High value) and has limited tolerance / ability to adapt to the effect (Low to Medium resistance and resilience). As there is the potential for individuals to be permanently physically injured as a result of the proposed piling operations, albeit only a very small number, the magnitude of the impact has been assessed as **Moderate**, although it should be noted that the period during which individuals may encounter sound from the proposed operations is relatively short (piling operations may be ongoing for approximately 48 hours, with piling operations occurring for only 8 hours within a 24-hour period) and individuals are likely to move out of the area of impact once the proposed piling operations have commenced. Effects on marine mammals due to PTS / TTS onset as a result of the underwater noise emissions generated from the proposed piling operations are therefore predicted to be **Moderate** and significant prior to the implementation of operational mitigation measures. However, the possibility of PTS / TTS impacts occurring will be significantly reduced with the use of a 500 m mitigation zone, since piling operations will not commence until monitoring confirms that the area is clear of marine mammals. Soft-starts will also be incorporated into the piling schedule design (see Section 8.3). Residual effects on marine mammals are therefore reduced to **Minor** and would not be significant.

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Table 8.7: Estimated Number of Animals Potentially Experiencing PTS / TTS from the proposed Kyla Piling Operations ^{1, 2, 3, 4}

Species	Management Unit	Abundance	Estimated Density in Area (animals / km ²)	Southall et al. (2019) Unweighted L _{p,pk} criteria (Maximum Energy)				Southall et al. (2019) Impulsive Weighted L _{E,24h,wtd} criteria (fleeing)				Southall et al. (2019) Non-impulsive Weighted L _{E,24h,wtd} criteria (fleeing)			
				PTS		TTS		PTS		TTS		PTS		TTS	
				Max number of animals impacted	Approx. % of reference population	Max number of animals impacted	Approx. % of reference population	Max number of animals impacted	Approx. % of reference population	Max number of animals impacted	Approx. % of reference population	Max number of animals impacted	Approx. % of reference population	Max number of animals impacted	Approx. % of reference population
Harbour porpoise	North Sea (678,206 km ²)	346,601	0.511	< 1	<0.0003	< 1	<0.0003	< 1	<0.0003	< 19	<0.005	< 1	<0.0003	< 1	<0.0003
Bottlenose dolphin	Greater North Sea (639,886 km ²)	2,022	0.003	NE	0	NE	0	< 1	< 0.05	< 1	< 0.05	< 1	< 0.05	< 1	< 0.05
Risso's dolphin	Celtic and Greater North Seas (1,560,875 km ²)	12,262	0.007	NE	0	NE	0	< 1	<0.008	< 1	<0.008	< 1	<0.008	< 1	<0.008
Common dolphin		102,656	0.065	NE	0	NE	0	< 1	< 0.001	< 1	< 0.001	< 1	< 0.001	< 1	< 0.001
Minke whale		20,118	0.012	NE	0	< 1	<0.005	< 1	<0.005	< 3	< 0.02	< 1	<0.005	< 1	<0.005
White-beaked dolphin		43,951	0.028	NE	0	NE	0	< 1	<0.002	< 1	<0.002	< 1	<0.002	< 1	<0.002
White-sided dolphin		18,128	0.011	NE	0	NE	0	< 1	<0.006	< 1	<0.006	< 1	<0.006	< 1	<0.006

Notes

¹ See Section 4.3.5 for MMMU abundance and population data; taken from IAMMWG (2022).

² Calculation method based on Southall et al. (2007) as recommended by JNCC (2010a): impact area x density

³ Max number of animals impacted has been rounded up to a whole number.

⁴ NE = No exceedance

Behavioural Impacts

Marine mammals may also experience behavioural impacts in response to underwater noise emissions. Examples of behavioural responses include orientation or attraction to or from the noise source, increased alertness, modification of their own sound production characteristics, change in movement or diving behaviour, temporary change in habitat use and, in severe cases, panic, fleeing, or stranding behaviour, which may indirectly result in injury or death.

Southall et al. (2019) do not provide quantitative thresholds for disturbance to marine mammals from impulsive or non-impulsive noise sources. For Special Areas of Conservation (SACs) in UK waters, a minimum Effective Deterrent Range (EDR) of 20 km has been proposed by the Joint Nature Conservation Committee (JNCC) for assessing the significance of noise disturbance to harbour porpoise (VHF cetacean) from pin piling operations (JNCC, 2025). This value is based on a review study carried out by Brown et al. (2025). In the absence of agreed metrics for measuring marine mammal disturbance outside of SACs, an EDR of 20 km has been applied for all species in this assessment.

Using an EDR of 20 km, Table 8.8 calculates the number of animals which may experience some sort of behavioural impact using the density and abundance estimates from the MMMUs of relevance to the Kyla Development area.

Table 8.8: Estimated Number of Animals Potentially Experiencing Behavioural Impacts from the Proposed Kyla Piling Operations ^{1,2}

Species	Management Units	MMMU Data (IAMMWG, 2022)		Behavioural Changes	
		Abundance	Estimated Density in Area (animals / km ²)	Max number of animals impacted	Approx. % of reference population
Harbour porpoise	North Sea (678,206 km ²)	346,601	0.511	< 643	0.186
Bottlenose dolphin	Greater North Sea (639,886 km ²)	2,022	0.003	< 4	0.198
Risso's dolphin	Celtic and Greater North Seas (1,560,875 km ²)	12,262	0.007	< 9	0.073
Common dolphin		102,656	0.065	< 82	0.080
Minke whale		20,118	0.012	< 16	0.080
White-beaked dolphin		43,951	0.028	< 36	0.082
White-sided dolphin		18,128	0.011	< 14	0.077

¹ See Section 4.3.5 for MMMU abundance and population data.

² Calculation method based on Southall et al. (2007) as recommended by JNCC (2010a): impact area x density

It can be seen from Table 8.8 that although the number of individual cetaceans which could temporarily exhibit some form of change in behaviour for the period in which they encounter sound from the proposed piling operations ranges from less than 4 for bottlenose dolphin to less than 643 for harbour porpoise, the percentage of the corresponding reference population impacted is comparatively low (less than 1%) for all species.

It should be noted, however, that the proposed piling operations will only be ongoing for approximately 48 hours, with pile driving occurring for only 8 hours within each 24-hour period. Temporarily affecting a small proportion of a population is highly unlikely to result in population level effects. In addition,

behavioural changes such as moving away from an area for short periods of time, reduced surfacing time, masking of communication signals or echolocation clicks, vocalisation changes and separation of mothers from offspring for short periods, do not necessarily imply that detrimental effects will result for the animals involved (JNCC, 2010a).

Given the above, the sensitivity of marine mammals to behavioural impacts has been evaluated as **High**; the receptor is of international importance (**Very High value**) but is generally tolerant of behavioural effects and will immediately recover once operations cease (**High resistance and resilience**). The magnitude of impact is predicted to be **Minor** as the period during which marine mammals may encounter sound from the proposed operations is short and individuals are likely to move out of the area of impact once the proposed operations have commenced. Any behavioural impacts will be short term and temporary and will cease once the piling operations have been completed and there will be no long-term reduction in the size of their available habitat, with individuals returning to the area on completion of the operations. Effects on marine mammals due to behavioural impacts as a result of the underwater noise emissions generated from the piling operations are therefore predicted to be **Minor** and are not considered to result in significant effects on the environment. However, mitigation measures will be implemented, as outlined in Section 8.3, to ensure behavioural impacts are minimised as much as possible.

8.2.5 European Protected Species (EPS) Risk Assessment

JNCC has produced good practice guidelines (JNCC, 2010a) and protocols for marine industries on how to assess the likelihood of committing an offence under The Conservation of Offshore Marine Habitats and Species Regulations 2017, how to avoid it and whether a licence to carry out activity might be required or not. It is considered that adherence to these guidelines constitutes best practice and will minimise the risk of committing an injury offence.

To reduce the risk of deliberate injury to any EPS, Serica will ensure that the JNCC protocol for minimising the risk of injury to marine mammals from piling noise is followed (JNCC, 2010b).

With regards to a disturbance offence, this is more likely where an activity causes persistent (sustained and chronic) noise in an area for long periods of time. For most cetacean populations in the UK, disturbance in terms of the EPS is unlikely to result from single, short term operations such as the proposed Kyla piling operations. Although the activity may result in temporary sporadic disturbance to cetaceans, it is unlikely to impair the ability of an animal to survive or reproduce nor result in significant effects on the local abundance or distribution. However, in order to minimise the risk of disturbance to an EPS, mitigation measures have been proposed in Section 8.3.

Given the above, the proposed Kyla piling operations will therefore not constitute an offence under The Conservation of Offshore Marine Habitats and Species Regulations 2017.

8.2.6 Potential Impacts on Seabirds

Direct effects on seabirds from the underwater noise generated during the proposed piling operations could occur through physical damage, or through disturbance of normal behaviour. The proposed Kyla Development is located within an important area for black-legged kittiwake, Atlantic puffin, northern gannet and northern fulmar in the breeding season. During the winter months, black-legged kittiwake, common guillemot, Atlantic puffin and northern fulmar are predicted to be found in comparatively higher densities within the vicinity of proposed Kyla Development, with guillemot also present during the post-dispersal period (refer to Section 4.3.4).

There is little information on the ability of seabirds to hear underwater, although it is thought that they have relatively poor hearing, with peak hearing sensitivity below 2 kHz (Dooling and Therrien, 2012). Surface diving seabirds are considered to be more at risk of underwater noise emissions as they spend longer periods of time below the water compared to seabirds which forage by surface feeding or plunge diving.

There is little research available regarding the impact of piling operations on seabirds. However, monitoring conducted during the construction of the Offshore Wind Farm Egmond aan Zee in the Dutch section of the North Sea demonstrated that pile driving activities caused temporary disturbance to local seabird populations, with diving species such as auks, divers, and sea ducks showing the strongest

avoidance behaviour. Terns and gulls were far less affected due to their feeding strategies and coastal distribution. Importantly, once pile driving ceased, seabirds returned to the area, and no evidence of long-term displacement or population decline was detected. The study concluded that while pile driving can disrupt seabird activity in the short term, it did not result in lasting ecological harm to seabird communities in the region (Leopold and Camphuysen, 2009).

Given the above, the sensitivity of seabirds to underwater noise from the proposed piling operations has been evaluated as **High**; seabirds are of international importance (**Very High value**) but any impacts are likely to be temporary caused by displacement, with the majority of birds likely to have vacated the area due to disturbance before the piling reaches maximum energy (**High resistance and resilience**). The magnitude of impact is predicted to be **Negligible** due to the short duration (48 hours, with only 8 hours of piling per 24-hours period) and limited scale of the proposed piling operations, with evidence indicating that seabirds will return to the area once the piling operations have ceased. In addition, there is alternative foraging habitat available to the seabirds in the wider area. Effects on seabirds as a result of the underwater noise emissions generated from the proposed piling operations are therefore **Negligible**.

8.3 Mitigation Measures

As noted in Section 8.2.4, the use of soft start procedures and at least a 500 m mitigation zone is important to reduce the overall impact of the proposed piling operations on marine mammals. Serica will therefore ensure that the piling operations follow the JNCC protocol for minimising the risk of injury to marine mammals from piling noise (JNCC, 2010b). Specifically, this will involve applying the following measures:

- Use of properly qualified, trained and equipped marine mammal observers (MMOs) or passive acoustic monitoring (PAM) operatives to detect marine mammals within a 500 m “mitigation zone” and potentially recommend a delay to piling operations. MMOs / PAM operatives will carry out a 30 minute pre-piling survey and if an animal is detected then work should be delayed until it has left the area;
- If piling is to be carried out at night or in poor visibility, PAM will be used to carry out the 30-minute pre-piling survey;
- If deploying PAM, Serica will also ensure that contractors implement the JNCC guidance for the use of Passive Acoustic Monitoring in UK waters (JNCC, 2023);
- Soft-start of piling, whereby there is an incremental increase in power and, therefore, sound level. This should be carried out over a minimum period of 20 minutes. This is believed to allow any marine mammals to move away from the piling location and reduce the likelihood of exposing the animal to sounds which can cause injury; and
- Repeat of the pre-piling survey and soft-start whenever there is a break in piling of more than 10 minutes.

The use of soft-start procedures, as described above, is also likely to reduce the impact of acoustic emissions on other marine species as it allows mobile species, such as fish, to move out of the area of greatest impact.

8.4 Residual Effects

In summary, it is possible that short term behavioural effects may be observed among marine mammals, fish and seabirds as a result of the underwater noise emissions generated from the proposed Kyla Development, but any impacts will be mitigated by adherence to the mitigation measures detailed in Section 8.3 such that any residual effects are predicted to be **Minor** to **Negligible** and not significant.

8.5 Transboundary Impacts

The Kyla Development lies approximately 72 km to the south west of the UK / Norway median at its closest point. Given the distance, underwater noise emissions generated from the proposed Development operations are unlikely to be detected into international waters and therefore no significant transboundary impacts are anticipated.

8.6 Cumulative Impacts

There is the potential for underwater noise emissions to have a cumulative impact on marine fauna, particularly on marine mammals, if impulsive noise was generated from other anthropogenic sources (e.g. seismic or piling from other CNS oil and gas activity or renewable energy activity) within a similar timeframe.

There are no operational, under construction or consented offshore windfarms in the vicinity of the proposed Kyla Development area. The closest offshore windfarm is the Cerulean Winds Cedar Project, currently in the pre-planning stage, located approximately 9.5 km southwest of the Kyla Development (refer to Section 4.4.5). The next closest windfarm is the Cenos Offshore Wind Farm, currently in the planning stage, which would be located approximately 15.5 km northeast of the Kyla Development. Construction at this wind farm is not scheduled to begin until 2030.

The other oil and gas developments in the area may also be undertaking noisy activities which have the potential to act cumulatively with the Kyla Development in increasing injury risk to fish, marine mammals and seabirds. However, given the mitigation measures which will be in place for the Kyla Development, simultaneous noisy activity should not act in combination with any other development to produce significant cumulative effects.

9 Greenhouse Gas Emissions

9.1 Introduction

This section assesses the significance of the likely effects of GHG emissions generated by the proposed Kyla Development, namely CO₂, CH₄ and N₂O, on the climate. This is in accordance with the DESNZ supplementary EIA guidance for assessing the effects of downstream Scope 3 emissions on climate from offshore oil and gas projects (DESNZ, 2025c), published following the Finch judgment, 2024¹.

This section is structured as follows:

- **Section 9.2 (GHG Emissions Sources):** defines the direct and indirect GHG emissions sources arising from the Kyla Development.
- **Section 9.3 (Environmental Protection Objectives):** sets out the key international climate change agreements and UK climate legislation and policies designed to reduce GHG emissions and reach net zero by 2050.
- **Section 9.4 (UK Oil & Gas Industry - Net Zero Targets and Progress to Date):** describes the NSTD, a strategic partnership between the UK government and the offshore oil and gas industry to support the sector's shift toward net zero.
- **Section 9.5 (Serica's Approach to Decarbonisation):** presents Serica's approach to decarbonisation.
- **Section 9.6 (Assessment of Impacts):** assesses the impact of the GHG emissions generated from the proposed Kyla Development on the climate and the significance of any likely effects, using the principles set out in IEMA (2022). GHG emissions have been evaluated in the context of a global baseline scenario of GHGs, as described in Section 4.2.6, with consideration given to international climate change agreements, UK climate legislation and their associated emissions reduction pathways. The alternative concept options considered for the Kyla Development are explored in Section 2, but these would not materially affect the estimate of GHG emissions to be generated.
- **Section 9.7 (Mitigation measures):** identifies the measures available to Serica to avoid or reduce the GHG emissions generated by the Kyla Development.
- **Section 9.8 (Other Relevant Considerations):** provides information on how the proposed Kyla Development would contribute to the UK's energy security and economic growth, align with the UK Government's stated objectives for the future of the North Sea and enable a managed transition to net zero.
- **Section 9.9 (Residual Effects):** presents the residual effects which will remain after the implementation of the proposed mitigation measures.

9.2 GHG Emissions Sources

To help delineate direct and indirect emission sources, the GHG Protocol; a widely used international accounting tool for government and business leaders to understand, quantify, and manage GHG emissions, categorises GHG emissions into the following three 'scopes':

- Scope 1 covers direct GHG emissions from sources that are owned or controlled by the company;
- Scope 2 covers indirect GHG emissions generated from purchased or acquired electricity, steam, heat and cooling;

¹ Finch Judgment, 2024: UK's Supreme Court ruling in 2024 that a decision to grant planning permission for an onshore oil development project at a site in Surrey was unlawful, because downstream GHG emissions from the combustion of the oil produced were not assessed in the EIA as part of the planning decision.

- Scope 3 emissions include all other indirect GHG emissions that occur in a company's value chain, which are not directly controlled or owned by the company.

Table 9.1 categorises the GHG emissions which will be generated from the proposed Kyla Development into the relevant GHG Protocol scope, noting that Serica has control over its direct emissions and has limited or no influence over its indirect emissions, particularly those associated with the end use of sold hydrocarbons.

Table 9.1: GHG Emission Types, Scopes and Kyla Development Sources

Emissions Type	GHG Protocol Scope	Definition	Kyla Development GHG Emissions Sources
Direct emissions	Scope 1	Emissions from sources that are owned or controlled by the reporting company	<ul style="list-style-type: none"> • The incremental emissions from the Triton FPSO as a result of Kyla coming online, including fuel combustion for power generation and venting.
Indirect emissions	Scope 2	Emissions generated from purchased or acquired electricity, steam, heat and cooling	<ul style="list-style-type: none"> • Not applicable as electricity will not be purchased or acquired by Serica for the Kyla Development.
	Scope 3	All indirect emissions (not included in scope 2) that are a consequence of the activities of the reporting company, but occur at sources owned or controlled by another company	<ul style="list-style-type: none"> • Fuel burnt for power generation on the MODU, vessels and helicopters during drilling, installation, inspection, maintenance and decommissioning activities; • Further refinement, transportation and distribution of Kyla hydrocarbons once they leave Triton, but prior to end use of sold products; • Burning of the extracted Kyla hydrocarbons (i.e. end use of sold products, based on the presumption that all end use Kyla hydrocarbons are eventually combusted).

The GHG Protocol further divides Scope 3 emissions into distinct categories split between two main groups: upstream and downstream emissions.

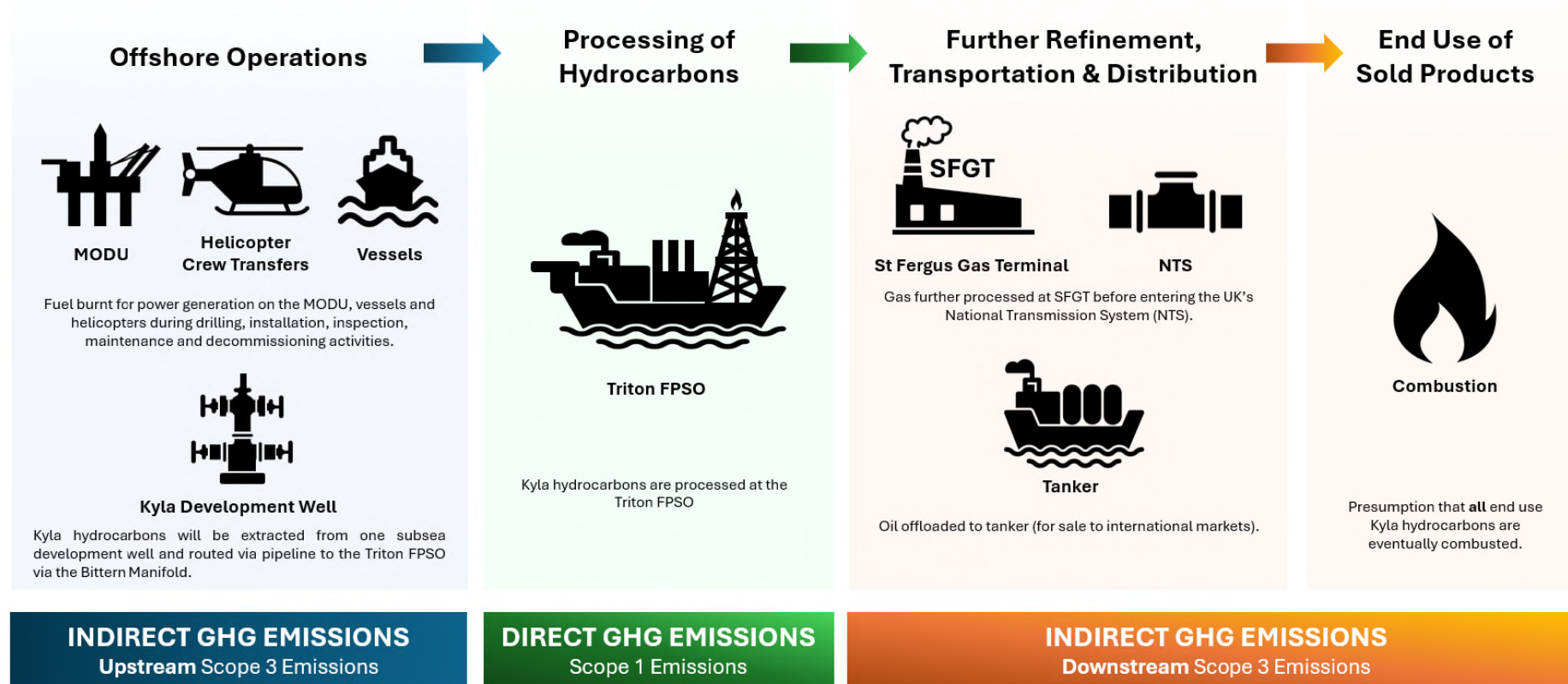
For Kyla, Scope 3 upstream emissions are the indirect emissions which will be generated by Serica's contractors offshore when extracting, producing and exporting Kyla hydrocarbons to the Triton FPSO, as well as during offshore decommissioning operations upon cessation of production.

Scope 3 downstream emissions are the indirect emissions which will be generated once the Kyla hydrocarbons have been processed at the Triton FPSO and sold, including from transportation, further processing and distribution, as well as from the end use of the sold product (namely, the presumption that all end use Kyla hydrocarbons are eventually combusted). Of note, oil from Triton is typically tankered to Rotterdam where oil volumes are integrated into the wider European oil sales market. Gas from Triton is piped to the St Fergus terminal where it enters the UK's national transmission system.

Figure 9.1 provides an overview of the GHG emissions sources and GHG Protocol scopes relevant to the proposed Kyla Development value chain.

Figure 9.1: Overview of Kyla Development GHG Emission Sources and GHG Protocol Scopes over the Project Value Chain

Kyla Development GHG Emissions



9.3 Environmental Protection Objectives

Environmental Protection Objectives (EPOs) related to climate change are the international agreements and national legislation, which aim to mitigate climate change, with a target of reaching net zero² global GHG emissions. A summary of key climate change EPOs relevant to oil and gas projects has been provided below, along with applicable UK Government Net Zero strategies and sector specific policies and plans. These have been considered when assessing the impact of the proposed Kyla Development's GHG emissions on the global climate.

9.3.1 International Agreements

The UNFCCC signed in 1992, is the principal global treaty for coordinating international responses to climate change. It entered into force in March 1994 and has been ratified by 197 countries. COP, which meets annually, is the supreme decision-making body of the UNFCCC and relies on the scientific assessments of the IPCC to inform its decisions and guide negotiations. The IPCC produces co-ordinated assessments of climate science, the social and economic impacts of climate change, and potential response strategies, achieving this through a series of assessment cycles. The 6th IPCC assessment report cycle concluded in March 2023, the conclusions from which have been used to inform this assessment.

The Kyoto Protocol was the first global initiative to minimise GHG emissions, adopted at COP3 in 1997 and ratified by the UK in May 2002. It set legally binding targets for developed, industrialised countries to reduce their GHG emissions on average by 5% by 2012 (in relation to 1990), followed by a second commitment period to reduce emissions on average by 18% by 2020 (in relation to 1990).

Building upon this, the Paris Agreement was adopted in 2015 and requires all major GHG emitting countries to reduce their emissions. The aim of the Paris Agreement is to restrict global temperature change to well under 2°C above pre-industrial levels and pursue efforts to keep it below 1.5°C. The Agreement also established NDCs, which describe individual countries' climate action plans. The UK ratified the Paris Agreement in November 2016.

The United Nations SDGs were established to promote peace, prosperity, and environmental protection by 2030. These goals were adopted by all UN Member States in 2015 as part of the 2030 Agenda for Sustainable Development. The Paris Agreement is explicitly referenced in SDG 13 (Climate Action), which is focused on limiting and adapting to climate change (United Nations, 2025).

9.3.2 UK Climate Change Legislation

The Climate Change Act 2008 (as amended) sets a legal requirement to achieve a 100% reduction in net GHG emissions by 2050 relative to 1990 levels ('net zero') and delivers on the commitment that the UK made by ratifying the Paris Agreement. The Act also established the CCC, an independent statutory body set up to advise the UK government on setting and meeting GHG reduction goals.

The Climate Change Act requires the UK government to set five-yearly legally-binding carbon budgets, twelve years in advance, from 2008 to 2050, which restrict the amount of GHGs the UK can emit (Table 9.2). The UK is currently in the Fourth Carbon Budget period (2023 - 2027).

Under the Paris Agreement, the UK has also set two NDC emissions reduction targets, as detailed in Table 9.2.

² A state where the amount of GHGs emitted is balanced by the amount removed from the atmosphere.

Table 9.2: UK Carbon Budgets & NDCs

Carbon Budget / NDC	Carbon Budget Level	Reduction Below 1990 Levels	Met?
1 st Carbon Budget (2008 to 2012)	3,018 MtCO _{2e}	25%	Yes
2 nd Carbon Budget (2013 to 2017)	2,782 MtCO _{2e}	31%	Yes
3 rd Carbon Budget (2018 to 2022)	2,544 MtCO _{2e}	37% by 2020	Yes
4 th Carbon Budget (2023 to 2027)	1,950 MtCO _{2e}	51% by 2025	In progress
NDC (2030)	-	68% by 2030	In progress
5 th Carbon Budget (2028 to 2032)	1,725 MtCO _{2e}	57% by 2030	-
6 th Carbon Budget (2033 to 2037)	965 MtCO _{2e}	78% by 2035	-
NDC (2035)	-	81% by 2035	-
7 th Carbon Budget (2038 to 2042) ¹	535 MtCO _{2e}	87% by 2040	-

¹ Published by the CCC in February 2025. The UK Government will respond to the CCC's advice and set the seventh carbon budget in law by 30 June 2026.

9.3.3 UK Net Zero Strategies and Sector Specific Policies and Plans

In 2021, the UK submitted its Net Zero Strategy: Build Back Greener (HM Government, 2021) to the UNFCCC, which set out how it proposes to deliver the Fourth, Fifth and Sixth Carbon Budgets and the 2030 NDC, as well as Net Zero GHG emissions by 2050. However, following the energy security crisis and rising gas and fossil fuel prices in 2022, an Independent Review of Net Zero (DESNZ, 2023) was commissioned to make recommendations on how the UK could achieve its legally binding Net Zero target in a way that drives economic growth, energy security, and affordability.

Powering Up Britain, The Net Zero Growth Plan (DESNZ, 2023) builds on the Net Zero Strategy, and responds to the recommendations made in the Independent Review of Net Zero. It acknowledges that fossil fuels will retain a crucial role in the energy system until there are credible clean energy alternatives that can replicate their role, with natural gas playing a role for years to come, particularly in the hardest to decarbonise sectors. Following this, the UK Government has published the Clean Power 2030 Action Plan (DESNZ, 2024a), which outlines the UK government's strategy to achieve a fully decarbonised electricity system by 2030 and the Carbon Budget and Growth Delivery Plan (HM Government, 2025), which sets out how the UK will continue to reduce emissions in line with the Climate Change Act.

The 'Balanced Pathway' Scenario (CCC, 2025a) is a framework proposed by the CCC for the UK's approach to achieving Net Zero emissions by 2050. In the Net Zero aligned Balanced Pathway scenario, there is a declining but continued demand for oil and gas through 2050 which requires that the UK imports oil and gas given the projected levels of UK production.

The UK's Net Zero targets and strategies are supported by sector-specific policies and plans. Both the North Sea Transition Deal (refer to Section 9.4) and the British Energy Security Strategy (HM Government, 2022) are predicated on continuing UK North Sea oil and gas production alongside mandating GHG emissions reductions and decarbonisation. The OGA Strategy (OGA, 2021) maintained MER of hydrocarbons as the NSTA's Central Obligation and clarified that this included the objective of net zero by 2050. In November 2025, the UK Government published the North Sea Future Plan (DESNZ, 2025b), which also recognised the important role that oil and gas will play in the UK's energy mix for decades.

To promote industry good practice, MER and efforts to achieve net zero by 2050, the NSTA has produced a set of stewardship expectations. Stewardship Expectation 11 'Net Zero' sets out NSTSA's view as to how UK North Sea companies can reduce their GHG emissions and support delivery of the UK's net zero target. Building on Stewardship Expectation 11, in March 2024 the NSTA published the OGA Plan (NSTA, 2024c), which sets out the requirements for industry to meet the requirement, as set out in the OGA Strategy, for GHG emissions reductions from the production of oil and gas.

The ZRF Initiative, introduced by the World Bank in 2015, also commits the UK government and industry to end routine flaring at production sites no later than 2030 and to ensure that new developments are designed without the need for routine flaring of any associated gas which may be produced from the field.

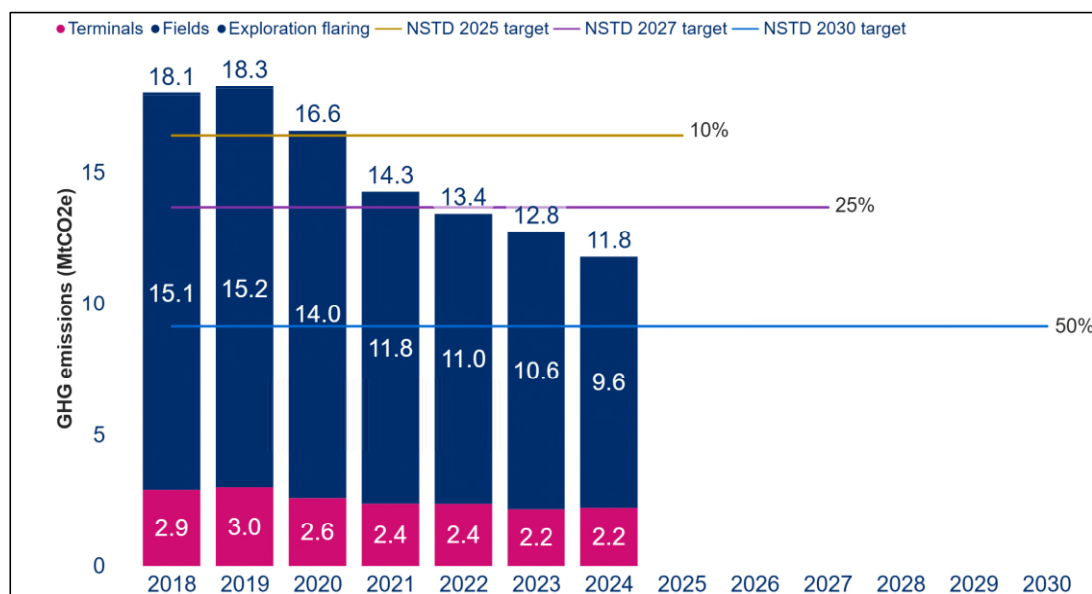
The UK is also a member of the Global Methane Pledge, to collectively reduce global methane emissions by at least 30% by 2030 compared to 2020 levels.

The majority of upstream GHG emissions generated offshore during the development of the Kyla field will be as a result of vessel usage. In 2023, the IMO adopted the IMO 2023 Strategy (IMO, 2023). This envisages an average reduction in carbon intensity of international shipping of least 40% by 2030 (as compared to 2008). It also sets out an ambition that zero or near-zero GHG emission technologies, fuels and/or energy sources represent at least 5% of the energy used by international shipping by 2030.

9.4 UK Oil & Gas Industry - Net Zero Targets and Progress to Date

The NSTD prescribes reductions against a 2018 baseline in offshore production GHG emissions of 10% by 2025, 25% by 2027 and 50% by 2030, pursuant to creating a net zero basin by 2050. To date the UK's oil and gas industry has successfully reduced upstream emissions by 34%, surpassing the 2027 target (Figure 9.2). Based on the current trajectory, the target of halving emissions between 2018 and 2030 is well within reach (OEUK, 2025a; NSTA, 2025a).

Figure 9.2: Progress of UK upstream oil & gas GHG emissions against NSTD targets (NSTA, 2025a)



In 2024, GHG emissions from the production of UK oil and gas, which includes emissions from offshore oil and gas fields, onshore processing terminals and oil and gas exploration activity, totalled an estimated 11.8 Mt CO₂e. To put this in context, GHG emissions from upstream oil and gas activity accounted for 3.3% of net UK territorial GHG emissions in 2023, according to data from NAEI (NSTA, 2025a).

The majority of GHG emissions from the production of UK oil and gas are generated from the offshore installations, with the largest contributors being gas and diesel combustion for power generation, followed by flaring and venting (NSTA, 2025a). Emissions from offshore installations fell in 2024, down 5% compared to 2023 and 34% against the 2018 baseline year, driven by improvements in power efficiency and management, reductions in venting and flaring and asset decommissioning (OEUK, 2025a).

Methane emissions from offshore installations have reduced substantially since the NSTD was agreed, down by 57% against a 2018 baseline, delivering a reduction of 0.85 million tonnes of CO₂e and exceeding the original target of 50% by 2030 (OEUK, 2025a).

Beyond 2030, absolute emissions associated with oil and gas production are predicted to fall due to a combination of lower output, a reduction in flaring and venting and production from lower-emission installations replacing production from older installations (OEUK, 2024).

9.5 Serica's Approach to Decarbonisation

This section outlines Serica's approach to decarbonisation. Serica Energy Chinook Limited is a subsidiary of Serica Energy plc and operates under the Group's policies.

9.5.1 Serica's Commitment to Reduce GHG Emissions

Serica is aligned to the objectives and targets of the NSTD. The following summary are examples of Serica's decarbonisation strategy and activities:

- Serica is executing an ERAP for the Bruce hub located in the UK Northern North Sea, which it operates.
- In the joint ventures (JVs) in which it is a non-operating partner, Serica seeks to influence and support the operators to identify and implement projects to reduce emissions from the relevant assets.
- Specifically in relation to the Triton FPSO, the proposed host for the Kyla field, Serica is engaged with Dana, the operator, on the development and implementation of the Triton ERAP (see section 9.5.3).
- Serica engages with its suppliers to promote initiatives that reduce the impact on the environment, such as vessel sharing, waste reduction and enhanced emissions monitoring.

9.5.2 Emissions Reporting and Governance

Robust emissions reporting is central to Serica Energy's environmental governance framework. Serica reports GHG emissions under several schemes:

- UK ETS — for installations regulated under emissions permits;
- EEMS — annual environmental reporting;
- OGMP 2.0 – for improving the reporting and verification of the Company's methane emissions data, so that they may identify areas for further methane reduction and mitigation;
- ESG reporting – scope 1, 2 and 3 emissions are reported annually in Serica's ESG disclosures.

Responsibility for emissions quantification and regulatory reporting lies with Serica's HSE Team, while Board-level accountability is maintained through quarterly HSE performance reviews with the Sustainability Committees.

9.5.3 Triton Emissions Reduction Action Plan

The Triton FPSO will serve as the infrastructure host for the Kyla field. Serica is engaged with Dana, the operator of the Triton FPSO, on the Triton ERAP. Serica is contributing its operational experience from the Bruce asset, specifically sharing engineering knowledge and lessons learned regarding flare gas and vents recovery systems. Dana own expertise, gained in large part through the design and installation of a successful flare gas recovery system on its previously operated Western Isles asset, also informs the Triton ERAP (refer to Section 9.7).

9.6 Assessment of Impacts

The Supplementary EIA Guidance (DESNZ, 2025c) mandates an assessment of the significance of the likely effects of Scope 3 emissions, including those resulting from the cumulation of effects with other existing or approved projects, at both a global and national level.

The significance of the Kyla Development's GHG emissions has been assessed using a matrix-based approach, in which receptor sensitivity and impact magnitude are combined to determine the overall level of significance. The assessment methodology is detailed in Section 5 and further contextualised for GHG emissions in Section 9.6.2. Appendix E provides a breakdown of the emissions generated from the sources identified in Section 9.2 and outlines the method, assumptions and GHG conversion factors used to quantify the emissions.

9.6.1 Quantification of GHG Emissions

Total GHG Emissions

Table 9.3 quantifies the GHG emissions (expressed in terms of kilotonnes (kt) of CO₂e) arising from the proposed Kyla Development, over the life of the field in three production case scenarios: P10 (High), P50 (Mid) and P90 (Low).

Scope 3 emissions are estimated on the assumption of end use combustion of all the extracted Kyla hydrocarbons. This represents by far the largest component of the total GHG emissions generated over the life of the field (ca. 81%). However, the actual end-use of the Kyla hydrocarbons may vary. Gas from the Kyla field will enter the UK's NTS via the St Fergus terminal to be transported through a network of pipelines across the UK. The gas is delivered to end users, such as gas-fired power stations, large industrial users and regional gas distribution networks that connect to individual homes and businesses. The oil exported by tanker from the Triton FPSO is typically taken by tanker to Rotterdam and integrated into the wider European oil sales market. Oil volumes are converted into usable fuels such as gasoline, diesel and jet fuel, with byproducts from this process often serving as raw materials for chemical productions, generating plastics, fertilizers, and pharmaceuticals. Consequently, it is possible that not all Kyla hydrocarbons will be combusted.

Table 9.3: Kyla Development Total GHG Emissions

Emissions Category	Total GHG Emissions (kt CO ₂ e) ¹		
	P10 (High)	P50 (Mid)	P90 (Low)
Total Direct GHG Emissions (Scope 1)	50.36	35.72	20.31
Total Indirect Upstream GHG Emissions (Scope 3)	53.19	53.19	53.19
Total Indirect Downstream GHG Emissions (Scope 3)	7,030.90	5,000.23	2,807.61
Grand Total	7,134.45	5,089.14	2,881.11

¹ Refer to Appendix E for the methodology used to estimate GHG emissions.

Carbon Intensity

Over the life of the Kyla field, the Triton FPSO including Kyla throughput will have an average carbon intensity of 29.9 kg carbon dioxide per barrel of oil equivalent (CO₂/boe) in the unabated scenario, decreasing to 23.3 kgCO₂/boe if all abatement projects identified in the Triton Emissions Reduction Action Plan are implemented over the period from 2028 to 2035. In comparison, the average carbon intensity for FPSOs in the CNS in 2024 was 30.5 kg CO₂/boe. When filtering by installation age (>25 years old) this increases to 37.5 kgCO₂/boe (NSTA, 2025b). The emissions intensity for UKCS offshore fields in 2024 was 24.0 kg CO₂/boe (NSTA, 2025a).

No Project ('Do Nothing') Scenario

The non-development of the Kyla field (the 'do nothing' scenario) would result in the non-recovery of a viable domestic hydrocarbon resource and associated project related GHG emissions.

The IPCC indicates that global demand for oil and gas is expected to persist as the world works towards net zero. Consequently, combustion of hydrocarbons and their associated GHG emissions will be prevalent across future climate pathway scenarios.

The Kyla Development involves bringing the previously decommissioned Kyle field back into production through the utilisation of existing North Sea oil and gas infrastructure (principally the Triton FPSO). The project will contribute to the UK meeting its energy requirements through domestic resources during the energy transition and is consistent with responsible stewardship of remaining offshore reserves (refer to Section 9.8).

9.6.2 Evaluating Significance

The principles set out in IEMA (2022) have been used to help evaluate the significance of the effects of the GHG emissions generated from the proposed Kyla Development on the global climate, whereby the sensitivity of the receptor (i.e. the global climate) and magnitude of impact have been combined to derive the overall significance level.

As the assessment of impact significance is an inherently difficult process involving the projection of potential climate futures, consistent criteria (as defined in Section 5.3.1) have been applied to the process, noting that the key consideration when evaluating significance is not simply whether the project results in GHG emissions, or the absolute volume of those emissions, but whether the project aligns with the global and national emission reduction pathways required to meet the goals of the Paris Agreement.

In order to contextualise and evaluate the significance of the Kyla Development's GHG emissions, the following key data sources have been used:

- IPCC AR6 (IPCC, 2022) which explores the projected climate response to five emissions scenarios based on SSPs. The SSPs are baseline narrative scenarios that identify socio-economic and geopolitical assumptions and economic and technological trends. These are then combined with different emissions trajectories, based on the RCP scenarios from the IPCC's AR5, to explore climate outcomes consistent with specific global warming levels.
- IEA World Energy Outlook Scenarios (IEA, 2024; IEA, 2025), which model future global energy demand and supply under different policy scenarios, including:
 - The Announced Pledges Scenario (APS) which assumes governments will meet, in full and on time, all the climate-related commitments that they have announced, such as NDCs, to achieve net zero emissions by 2050. Note, IEA (2025) does not include for APS as at the time of publication insufficient countries had submitted their 2035 NDCs.
 - The Net Zero Emissions by 2050 Scenario (NZE) which shows a global pathway to reach net zero emissions from the energy sector by 2050 without offsets from other sectors. This emissions trajectory is consistent with keeping the temperature rise in 2100 below 1.5°C (with at least a 50% probability).
- UK carbon budgets, NDCs and the CCC's 'Balanced Pathway' scenario (CCC, 2025), which is a framework for the UK's approach to achieving net zero emissions by 2050. The 'Balanced Pathway' scenario includes future projections for UK oil and gas demand and production based on NSTA production projections of existing and future developments (including sanctioned but not yet producing fields).
- Production Gap Report (2025), which assesses the disparity between governments' planned fossil fuel production and production levels consistent with pathways limiting global warming to 1.5 °C and 2 °C. The report provides forward-looking projections of global oil and gas production based on governments' plans and policies, highlighting the extent to which existing and proposed developments exceed levels aligned with internationally agreed climate targets.

As global reduction pathways have been used to contextualise the impact the Kyla Development's GHG emissions will have on the climate, this approach is considered to be inherently cumulative as these pathways take into account a wide range of existing and planned projects and other activities. These forward-looking pathways provide a proxy for the evolving baseline, as they incorporate anticipated GHG emissions from existing and planned oil and gas developments, such as Kyla, as well as broader sectoral and policy trends, including those relating to future oil and gas development and consumption.

9.6.3 Sensitivity of the Global Climate

The sensitivity of the global climate to GHG emissions is **Very High**. The receptor has a Very High value, given the global effect of GHG emissions. The current state of the climate and the concentration of CO₂ and other GHGs in the atmosphere is described in Section 4.2.6. The Earth's climate is changing. Global temperatures continue to increase, with 2024 the warmest year on record, at 1.6°C above pre-industrial average levels. The IPCC AR6 states that it is "unequivocal that human influence has warmed the atmosphere, ocean and land". Estimates of current human-induced long-term global warming are around 1.31°C above pre-industrial levels and are rising at 0.26°C per decade (Foster, 2024). It is still considered technically possible, however, that the rise in long-term global temperature can be limited to 1.5°C (WMO, 2025), although at the recent COP30 in Brazil it was acknowledged that the world is likely to breach this threshold in the next decade, at least temporarily. Accordingly, Resistance and resilience is Medium.

9.6.4 Kyla in the Context of the Paris Agreement and Global Emissions Reduction Pathways

As noted in Section 4.2.6, the IPCC's SSP scenarios, combined with RCP scenarios - SSP1-1.9, SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5 - provide a framework for assessing future global GHG emissions trajectories under differing socio-economic and policy assumptions. These pathways illustrate how emissions may evolve under varying levels of climate ambition; from very low (SSP1-1.9) pathways consistent with limiting warming to 1.5°C, to very high (SSP5-8.5) pathways associated with continued fossil fuel use and limited mitigation.

To place the Kyla Development in this global context, Table 9.4 compares the total GHG emissions predicted to be generated by the Development in the reference year (2030) with the median global GHG emissions projected under each SSP scenario. Of note, cessation of production for Kyla is predicted to occur in or before 2035, in which case the Project will not contribute to the global GHG emissions in 2040 and 2050.

In 2030, Kyla's projected GHG emissions are estimated to represent between 0.00388% and 0.00180% of median global GHG emissions, depending on the SSP pathway considered (refer to Table 9.4). The proportion is highest under the SSP1-1.9 (very low) scenario, where global GHG emissions are projected to decline rapidly to around 33 GtCO₂e (median) per year in 2030, and lowest under the SSP5-8.5 (very high) scenario, where emissions reach approximately 71 GtCO₂e (median) per year in 2030. This variation reflects the differing assumptions about future global energy use and mitigation policy embedded within each pathway. Regardless, Kyla's contribution represents a very small fraction of projected global totals under all SPP scenarios. This comparison provides context for the Project's scale relative to global GHG emissions trajectories, resulting in a **Minor** magnitude of impact.

This point is further illustrated by the fact that the P10 case total GHG emissions generated from the Kyla Development over the life of the field (ca. 2028 – 2035) represent less than 0.00304% of the remaining global carbon budget under a 1.5°C scenario (235 GtCO₂e; GCP, 2024), 0.00122% under a 1.7°C scenario (585 GtCO₂e; GCP, 2024), and less than 0.00064% under a 2.0°C scenario (1,110 GtCO₂e; GCP, 2024). Given this proportional impact, development of the Kyla field will have a negligible impact on global temperatures.

Table 9.4: Kyla Development in the context of Future Global Shared Socioeconomic Pathways (IPCC, 2022)

Parameter	Reference Year			Key Assumptions of SSP
	2030	2040	2050	
GHG Emissions Scenario: SSP 1 – 1.9 (Very Low), limit warming to 1.5°C				
Median Global GHG Emissions (GtCO ₂ e/yr) ¹	33 (22 – 37)	18 (6 – 24)	8 (0 – 15)	Rapid decarbonisation, societies switch to more sustainable practices, inequality falls. Net zero CO ₂ achieved in ca. 2050.
Kyla projected proportion ²	0.00388%	N/A	N/A	
GHG Emissions Scenario: SSP 1 – 2.6 (Low), limit warming to 2°C				
Median Global GHG Emissions (GtCO ₂ e/yr) ¹	40 (30 – 49)	29 (21 – 36)	20 (14 – 27)	Socioeconomic shifts towards sustainability, but reduction in CO ₂ emissions is slower than SSP1-1.9. Net zero CO ₂ achieved in ca. 2070.
Kyla projected proportion ²	0.00320%	N/A	N/A	
GHG Emissions Scenario: SSP 2 – 4.5 (Intermediate), limit warming to 3°C				
Median Global GHG Emissions (GtCO ₂ e/yr) ¹	54 (50 – 62)	53 (48 – 61)	52 (45 – 57)	Current policies continue. Slow progress toward sustainability and development and income grow unevenly. CO ₂ emissions hover around current levels before starting to fall mid-century. Net zero CO ₂ is not achieved by 2100.
Kyla projected proportion ²	0.00237%	N/A	N/A	
GHG Emissions Scenario: SSP 3 – 7.0 (High), limit warming to 4°C				
Median Global GHG Emissions (GtCO ₂ e/yr) ¹	62 (53 – 69)	67 (56 – 76)	70 (58 – 83)	Fragmented, high fossil use, inequality. CO ₂ emissions roughly double from current levels by 2100
Kyla projected proportion ²	0.00206%	N/A	N/A	
GHG Emissions Scenario: SSP 5 – 8.5 (Very High), exceed warming of 4°C				
Median Global GHG Emissions (GtCO ₂ e/yr) ¹	71 (69 – 81)	80 (78 – 96)	88 (82 – 112)	Rapid economic growth without mitigation, fuelled by exploiting fossil fuels and energy-intensive lifestyles. Current CO ₂ emissions roughly double by 2050.
Kyla projected proportion ²	0.00180%	N/A	N/A	

¹ Data source (IPCC, 2022; Chapter 3, Table 3.2), median data shown with (Lower Range – Upper Range) of harmonised GHG emissions across the pathways.

² Based on the P10-case total gross GHG emissions generated from the Kyla Development in 2030 of 1,278.77 kt CO₂e. This assumes the high production case (P10 profile) and is based on the total direct GHG emissions (scope 1) and total indirect downstream GHG emissions (scope 3) generated in 2030.

9.6.5 Kyla in the Context of Future Global Oil and Gas Production Demand

The IPCC indicates that there is global demand for oil and gas in all future climate scenarios. Success in decarbonisation will reduce the demand for fossil fuels, however not all end-uses are expected to be commercially electrifiable in the short to medium term (i.e. within the life of Kyla Development) and many will require low GHG liquid and gaseous fuels (IPCC, 2023).

The UNEP Production Gap Report (PGR) (SEI, 2023; PGR; 2025) evaluates the fossil fuel production outlooks of twenty major producing countries, including the UK, and benchmarks these against climate model projections aligned with the Paris Agreement's temperature objectives. The "production gap" represents the shortfall between governments' planned fossil fuel output and the production levels consistent with pathways limiting global temperature change to 1.5°C or well below 2°C above pre-industrial levels.

Table 9.5 and Table 9.6 compare the proposed Kyla production rates in five reference years during the period from 2030 to 2050 with predicted future global oil and gas production rates under different international energy demand pathway scenarios, assuming that Kyla will cease production in or before 2035. Table 9.7 compares the proposed Kyla production rates during this period with predicted future global energy demand for total energy, oil, and gas.

It can be seen from Tables 9.6 to 9.8 that the proposed Kyla Development contributes a very small percentage towards predicted global oil and gas production rates and forecasted demand. As such, production from the Kyla field will have negligible impact on the pathways consistent with restricting global temperature change to well under 2°C above pre-industrial levels, resulting in a **Minor** magnitude of impact.

Table 9.5: Kyla Development in the context of Future Global Oil Demand across International Pathways (PGR, 2025)

Parameter	Reference Year				
	2030	2035	2040	2045	2050
IEA Announced Pledges Scenario (APS) ³					
Global Oil Production Value (Mbbbl/d) ¹	90.50	79.98	68.47	59.06	52.16
Kyla projected proportion ²	0.00663%	0.00377%	N/A	N/A	N/A
Pathways Consistent with 2°C (Median)					
Global Oil Production Value (Mbbbl/d) ¹	99.65	94.00	83.03	69.78	57.83
Kyla projected proportion ²	0.00602%	0.00321%	N/A	N/A	N/A
Pathways Consistent with 1.5°C (Median)					
Global Oil Production Value (Mbbbl/d) ¹	88.55	78.92	63.32	45.85	32.20
Kyla projected proportion ²	0.00677%	0.00382%	N/A	N/A	N/A

¹ Data source (PGR, 2025), values converted from exajoules (EJ) per year (EJ/yr) to Oil using a factor of million barrels per day (Mbbbl/d)

² Based on Kyla High Case (P10) production profile for Oil in the reference year (2030 = 5,997.00 bbl/d; 2035 = 3,018.00 bbl/d) – Refer to Appendix G.

³ An IEA scenario that models future energy demand and supply based on governments' announced climate pledges, even if not yet backed by detailed policies.

Table 9.6: Kyla Development in the context of Future Global Gas Demand across International Pathways (PGR, 2025)

Parameter	Reference Year				
	2030	2035	2040	2045	2050
IEA Announced Pledges Scenario (APS) ³					
Global Gas Production Value (Tm ³ /yr) ¹	4.03	3.51	3.08	2.76	2.48
Kyla projected proportion ²	0.00110%	0.00062%	N/A	N/A	N/A
Pathways Consistent with 2°C (Median)					
Global Gas Production Value (Tm ³ /yr) ¹	3.91	3.67	3.46	3.32	3.34
Kyla projected proportion ²	0.00113%	0.00059%	N/A	N/A	N/A
Pathways Consistent with 1.5°C (Median)					
Global Gas Production Value (Tm ³ /yr) ¹	2.72	2.37	2.20	1.99	1.78
Kyla projected proportion ²	0.00162%	0.00091%	N/A	N/A	N/A

¹ Data source (PGR, 2025), values converted from exajoules (EJ) per year (EJ/yr) to Gas using a factor of 0.029 trillion (Tera, 10¹²) cubic metres per year (Tm³/yr).

² Based on Kyla High Case (P10) production profile for Gas in the reference year (2030 = 44,173,335.00 m³; 2035 = 21,654,942.00 m³) – Refer to Appendix G.

³ An IEA scenario that models future energy demand and supply based on governments' announced climate pledges, even if not yet backed by detailed policies.

Table 9.7: Kyla Development in the context of Future Global Energy Supply (IEA, 2025)

Parameter	Reference Year		
	2035	2040	2050
IEA Net Zero Emissions by 2050 Scenario ⁵			
Natural Gas World Energy Supply (GtCO ₂ e) ¹	5.12	3.49	1.69
Kyla projected Gas proportion ²	0.00136%	N/A	N/A
Oil World Energy Supply (GtCO ₂ e) ¹	9.50	6.74	3.33
Kyla projected Oil proportion ³	0.00607%	N/A	N/A
Total World Energy Supply (GtCO ₂ e) ¹	42.74	41.26	42.72
Kyla projected Total proportion ⁴	0.00151%	N/A	N/A

¹ Source IEA World Energy Outlook 2025 Report (IEA, 2025), reference year values were calculated from EJ to Gt CO₂e using IPCC (2006) conversion factor (kg CO₂/GJ, kg CH₄/GJ and kg N₂O/GJ) alongside relevant AR5 GWP Values (CO₂ = 1, CH₄ = 28, N₂O = 265).

² Gas comparison based on the P10-case total GHG emissions generated from the Kyla Development in 2035 of 69.67 kt CO₂e, assuming Kyla high production case for Gas (P10 profile). The total is based on the total direct GHG emissions (scope 1) and total indirect downstream GHG emissions (scope 3) generated in 2035, with the Scope 1 emissions adjusted based on Gas:Oil production ratio of 86.11:13.89.

³ Oil comparison based on the P10-case total GHG emissions generated from the Kyla Development in 2035 of 576.61 kt CO₂e, assuming the Kyla high production case for Oil (P10 profile). The total is based on the total direct GHG emissions (scope 1) and total indirect downstream GHG emissions (scope 3) generated in 2035, with the Scope 1 emissions adjusted based on Gas:Oil production ratio of 86.11:13.89.

⁴ Total World Energy Comparison based on the P10-case total gross GHG emissions generated from the Kyla Development in 2035 of 646.28 kt CO₂e, assuming the Kyla high production case (P10 profile). The total is based on the total direct GHG emissions (scope 1) and total indirect downstream GHG emissions (scope 3) generated in 2035.

⁵ An IEA Scenario where net zero emissions by 2050 are consistent with a pathway well below 2°C.

9.6.6 Kyla in the Context of UK Carbon Budgets, NDCs and Emissions Reduction Pathways

CCC's Balanced Pathway

The CCC's Balanced Pathway, an emissions reduction pathway from 2025 to net zero by 2050, is in line with all of the UK's legislated carbon budgets and stated NDCs. The Balanced Pathway involves a steep decline in the consumption of oil and gas, reducing by 84% and 77% from 2025 levels respectively by 2050. Nonetheless, in this scenario, demand for oil and gas continues through 2050. The UK will continue to require gas for a variety of purposes, including the heating of buildings and marginal production within the power sector (NESO, 2025) and while demand for petroleum products is likely to fall in some parts of the economy such as road transport (i.e. a shift towards electric vehicles), all major forecasters expect resilient or even growing demand for other uses of hydrocarbons such as petrochemicals (IEA, 2018).

The majority of fuels currently used in the UK are traded internationally and the UK is a net importer of both oil and gas (PGR, 2025; CCC, 2025), which is projected to remain the case in the Balanced Pathway.

According to The Seventh Carbon Budget (CCC, 2025): declining production from the UK's North Sea basin indicates that GHG emissions will fall in the baseline pathway³ by around 40% by 2040 compared to 2025 levels, including the production emissions from potential new oil and gas fields. After taking account of the reduction in production and refining emissions due to declining baseline activity and cross-economy fuel switching, only around 13 MtCO₂e of emissions remain by 2040. In the Balanced Pathway, around 60% of these remaining emissions are abated. For oil and gas platforms, the majority of abatement results from electrification of offshore oil and gas platforms, and from reducing methane flaring and venting (CCC, 2025).

UK Carbon Budgets

As noted in Section 9.3.2, the Climate Change Act requires the UK government to set five-yearly legally binding carbon budgets, 12 years in advance, from 2008 to 2050. UK Carbon Budgets are economy-wide emissions limits, and do not prohibit oil and gas production.

To place the Kyla Development in the context of the UK carbon budgets, Table 9.8 compares the GHG emissions predicted to be generated by the Kyla Development with the fifth and sixth carbon budget allowances (i.e. the budgets which cover the period when the Kyla field is likely to be in production). As oil from the Kyla field will be exported to European markets, the carbon budget allowances have been compared with both the total gross GHG emissions (likely to be a very conservative overestimation of emissions as not all Kyla hydrocarbons will be combusted in the UK) and with direct (scope 1) emissions, which will occur in the UK.

Table 9.8: Kyla Development Emissions in the context of UK Carbon Budgets (CCC, 2025)

Carbon Budget (Period)	Carbon Budget Allowance (Mt CO ₂ e)	Kyla Projected Proportion of Carbon Budget	
		Kyla Total Gross GHG Emissions ¹	Kyla Scope 1 Emissions ²
Carbon Budget 5 (2028 to 2032)	1,725	0.28549% (4,924.68 ktCO ₂ e)	0.00205% (35.32 ktCO ₂ e)
Carbon Budget 6 (2033 to 2037)	965	0.21826% (2,106.22 ktCO ₂ e)	0.00156% (15.04 ktCO ₂ e)

¹ Based on the P10-case total GHG emissions (Scope 1 + Scope 3 Upstream & Downstream) generated from the Kyla Development for the relevant CB period (4,924.68 kt CO₂e for CB5 and 2,106.22 kt CO₂e for CB6), assuming the Kyla max production case (P10 profile). Noting that emissions from Kyla will start in September 2028, and end in December 2035 for the P10 case.

² Based on the total direct (Scope 1) GHG emissions generated from the Kyla Development for the relevant CB period (35.32 kt CO₂e for CB5 and 15.04 kt CO₂e for CB6), assuming the Kyla max production case (P10 profile). Noting that emissions from Kyla will start in September 2028, and end in December 2035 for the P10 case.

³ A hypothetical baseline pathway that does not include further climate action.

Given this insignificant proportion of the budgets as shown in Table 9.8, the GHG emissions generated by the Kyla Development would have no material influence on the UK's ability to meet its statutory carbon budget targets, resulting in a **Minor** magnitude of impact.

UK Nationally Determined Contribution (NDC)

The UK's 2030 NDC commitment is to reduce all GHG emissions by at least 68% by 2030 compared to 1990 levels, which is aligned with the Paris Agreement pathway for 1.5°C. Since submitting the NDC in December 2020, the UK has published a range of sectoral strategies and plans and has signed up to numerous pledges and actions to deliver on the 2030 target. The target was updated in 2022 but remains at an allowance of 254.08 MtCO₂e (UK Government, 2025). The UK's 2035 NDC target to reduce all GHG emissions by at least 81% by 2035, compared to 1990 levels (excluding international aviation and shipping emissions) was announced at COP29. The UK NDC was subsequently presented to Parliament in January 2025 (UK Government, 2025). The UK NDC is a 1.5°C aligned, economy-wide absolute emissions reduction target, covering all GHGs, sectors and categories which aims to achieve a target of 254.08 Mt CO₂e by 2030, and 155.3 MtCO₂e by 2035 (UK Government, 2025). The rate of GHG emissions reduction seen in 2023 is roughly in line with the annual pace of change needed to meet the 2030 NDC target (CCC, 2025).

The NDCs, as defined under the Paris Agreement and UNFCCC, track progress based on territorial emissions (UNFCCC, 2021). As oil from the Kyla field will be exported to European markets, the NDC allowances have been compared with both the total gross GHG emissions (likely to be a very conservative overestimation of emissions as not all Kyla hydrocarbons will be combusted in the UK) and with direct (scope 1) emissions, which will occur in the UK.

Table 9.9: Kyla Development Emissions in the context of UK NDC targets (UK Government, 2025)

NDC Target	NDC Allowance (Mt CO ₂ e)	Kyla Projected Proportion of NDC Allowance	
		Kyla Total Gross GHG Emissions ¹	Kyla Scope 1 Emissions ²
NDC 2030	254.08	0.50692% (1,287.99 ktCO ₂ e)	0.00363% (9.23 ktCO ₂ e)
NDC 2035	155.3	0.41615% (646.28 ktCO ₂ e)	0.00297% (4.61 ktCO ₂ e)

¹ Based on the P10-case total GHG (Scope 1 + Scope 3 Upstream & Downstream) emissions generated from the Kyla Development for the relevant NDC period (1,287.99 kt CO₂e for NDC2030 and 646.28 kt CO₂e for NDC2035), assuming the Kyla production case (P10 profile). Noting that emissions from Kyla will start in September 2028, and end in December 2035 for the P10 case.

² Based on the total direct (Scope 1) GHG emissions generated from the Kyla Development for the relevant NDC period (9.23 kt CO₂e for NDC2030 and 4.61 kt CO₂e for NDC2035), assuming the Kyla production case (P10 profile). Noting that emissions from Kyla will start in September 2028, and end in December 2035 for the P10 case.

Given these insignificant proportions, Kyla's direct operational emissions would have no material influence on the UK meeting its NDC targets resulting in a **Minor** magnitude of impact.

9.7 Mitigation Measures

As recognised in the supplementary EIA guidance, Serica as the developer does not have direct control over oil and gas end-use scope 3 emissions. Serica's emission reduction initiatives are, therefore, focused on reducing indirect Scope 3 upstream GHG emissions during the development execution and production phases.

Development execution

The following scopes for reducing emissions will be included in the development execution phase.

Drilling

- The proposed drilling project management contractor (Petrofac) includes within its standard procedures emissions reduction measures such as minimising unplanned sailings and flights.

- The contracts evaluation process will include emissions information from potential suppliers.
- The drilling rig selection process will factor in whether an energy control system is installed. The rig operator is required to be ISO 140001 (Environmental Management) and ISO 50001 (Energy Management) certified by DNV.
- The drilling rig will be moored during operations which has a lower fuel usage than operating on dynamic positioning.
- Electrical powerpacks, instead of diesel powerpacks, will be used for all services on the rig where these are compatible and available.

The well will be planned and designed to minimise Non-Productive Time (NPT) and Waiting on Weather (WoW).

Subsea facilities construction

- It is intended to install the Kyla production and gas lift pipelines and umbilicals by reel lay. This method is considered the most efficient for installing rigid pipelines, with reduced vessel time and vessel size (minimising atmospheric emissions), compared to other methods such as J-lay and S-lay.
- The production and gas lift pipelines will be installed in a piggyback arrangement to minimise the number of lay operations and to install both pipelines in a single trench. This reduces vessel time for both pipelay and trenching operations, thus minimising fuel consumption/carbon emissions.
- The selected base case development tie-ins are such that installation vessels are not required to enter the FPSO 500m zone, which would normally incur significant Non-Productive Time (NPT). Minimising NPT thus minimises vessel time and associated fuel usage/carbon emissions.
- The selected subsea layout design minimises the volume of rock required, thus minimising rock placement vessel time and associated fuel usage/carbon emissions.
- Only Tier 1 subsea installation contractors will be included in the tendering process. Tier 1 contractors have high specification vessels both in terms of fuel efficiency and vessel working limits (minimising waiting on weather time). These features minimise fuel usage and hence carbon emissions. Vessels proposed to be used will be assessed against fuel consumption as part of the tendering process.

Triton FPSO ERAP

With regards to direct (Scope 1) GHG emissions, responsibility for identification and implementation of emissions reduction initiatives at the Triton FPSO resides with the operator (Dana). Serica, as the operator of Kyla, will support the Triton FPSO operator as they continue to assess and implement reasonable decarbonisation strategies (see section 9.5.3).

In line with Stewardship Expectation 11, Dana, with support from Serica, is committed to reducing emissions from Triton as far as reasonable in the circumstances. Significant work has been undertaken to identify, assess and prioritise emissions reduction opportunities at Triton, with the aim of front end loading the engineering work and select feasible and deliverable projects (refer to Section 2.2.4).

Current ongoing projects to reduce emissions at Triton include:

- **Flare Gas and Venting Reduction Projects:**
 - An ongoing Zero Routing Flaring and Venting project aims to meet the ZRF&V target by 2030, primarily addressing Category A flaring and venting
 - Optimising existing asset operations to minimise non-routine flaring (Categories B and C) are also under investigation.

- **Fuel Gas Reduction Projects:**

- An ongoing assessment is currently reviewing options to optimise the onboard gas turbine generators and electric-drive gas export compression facilities with more efficient alternatives which may includes:
 - Reduction in demand from individual users (compressors & pumps)
 - Turbine replacement/ resizing for increased operating efficiency

9.8 Other Relevant Considerations

As noted in Section 9.3.2, the UK Net Zero Growth Plan (DESNZ, 2023b) acknowledges that fossil fuels will retain a crucial role in the energy system until there are credible and sufficient low carbon energy alternatives. The Independent Review of Net Zero (Mission Zero, 2023) recognises that the UK will still need oil and gas to secure its energy security and as transition fuels and in a net zero aligned Balanced Pathway scenario (CCC, 2025a).

The UK is the second largest oil producer in Europe (excluding Russia), which has a massive oil supply deficit importing 80% of its crude oil supply. Consequently, the UK is critical to Europe's integrated energy system as an exporter of crude oil and importer of refined oil products largely within the northwest European market (OEUK, 2025c). Consistent with this pattern of trade, oil lifted from the Triton FPSO - of which production from Kyla will become part - is offloaded to tankers and predominantly delivered to Rotterdam.

All the gas produced from the Kyla field will be delivered into the NTS via the SFGT and will be consumed in the UK, which is projected to remain a substantial net importer of gas.

Production from the Kyla field will displace oil and gas imports. Other than gas delivered by pipeline from Norway, such imports typically have higher carbon intensity than domestic production once the emissions associated with transportation to the UK are included.

Moreover, Kyla hydrocarbons, when produced using existing infrastructure via Triton FPSO, have a forecasted carbon intensity between 6.78 kg CO₂e/boe and 7.48 kg CO₂e/boe (depending on the production case), which is well below the UKCS average carbon intensity of 24 kg CO₂e/boe (NSTA, 2025a).

In addition to its energy system role, the Kyla field will provide an economic contribution to the UK, through capital investment, supply chain activity and continued use of existing UK offshore infrastructure.

The development phase of the project has an estimated capital expenditure of approximately £185 million, supporting UK-based engineering, drilling, fabrication, marine and logistics activities. The Kyla Development will have a strong focus on UK content. Serica achieved the majority of the spend in the UK on the development of the Gannet E, Evelyn and Belinda fields which - like Kyla - are tie-backs to the Triton FPSO and is targeting a similar outcome for the Kyla Development. This project will, therefore, help to sustain employment, skills and capability within the UK offshore supply chain during the energy transition.

The Kyla field will also contribute to the broader financial resilience of the Triton hub throughput its productive life. This will help safeguard jobs associated with managing and operating the Triton FPSO and associated facilities.

As described above, the development of the Kyla field will have positive impacts on UK and European energy security, economic growth and jobs in the UK and net carbon emissions.

9.9 Residual Effects

Scope 3 emissions represent by far the largest component of the total GHG emissions which will be generated by the Kyla Development over the life of the field (ca. 81%). Serica as the developer does not have direct control over oil and gas end-use scope 3 emissions. Regardless, the GHG emissions associated with the Kyla Development represent a very small fraction of projected global GHG emissions under the IPCC's low (SSP1-2.6) emissions pathway consistent with limiting warming to 2°C (ca. 0.00320% of median global GHG emissions in 2030). Kyla will cease production in or before 2038, well before the global target for net zero emissions by 2050. In a Paris aligned oil and gas production pathway, the residual effects of the Kyla Development's GHG emissions on the global climate are considered to be **Minor**. In addition, the GHG emissions generated by the Kyla Development would have no material influence on the UK's ability to meet its Carbon Budget and NDC emissions reduction targets.

10 Marine Discharges

10.1 Introduction

Serica is committed to minimising discharges into the marine environment from its operations, as far as possible. This section assesses the potentially significant impacts on water quality and local flora and fauna that may arise from the following planned operational discharges associated with the proposed Kyla Development:

- **Discharge of Drill Cuttings and Muds**
 - Dispersion of Suspended Solids.
- **Discharge of Fluids Contaminated with Residual Hydrocarbons**
 - Thermally Treated LTOBM Cuttings Water.
 - Well Clean-up and Completion Brines.
 - Produced Water Discharge from Triton FPSO.
 - Subsea Intervention and Future Decommissioning Activities.
- **Discharge of Chemicals**
 - Discharge of Drilling, Cementing, Completion and Rig Chemicals during Drilling Operations.
 - Discharge of Subsea Commissioning Chemicals.
 - Discharge of Production Chemicals.
 - Subsea Intervention and Future Decommissioning Chemical Discharges.

Unplanned discharges leading to accidental releases to the sea are discussed in Section 11.

10.2 Assessment of Impacts

10.2.1 Discharge of Drill Cuttings and Muds

As described in Section 3.3.4, the Kyla development well will be drilled conventionally, with the upper hole sections (36" and 26", including respud options) drilled riserless using seawater with frequent bentonite sweeps circulated downhole to clean the wellbore. Without a marine riser in place, cuttings from these top-hole sections will be discharged directly from the wellbore at the seabed. For the deeper 17½", 12¼" and 9½" (under-reamed from 8½") sections (including contingency sidetrack options), a marine riser will be installed between the wellhead and MODU to allow cuttings and drilling mud to be circulated back to the MODU. These sections will be drilled using LTOBM. Although the final cuttings management approach has not yet been confirmed, for the purposes of this ES a precautionary worst-case assumption has been adopted whereby LTOBM-contaminated cuttings returned to the MODU are thermally treated offshore to achieve <1% oil-on-cuttings before being discharged to sea just below the surface. This scenario has therefore been used to support the cuttings dispersion modelling and associated impact assessment. A total of 895 m³ of cuttings and 365.1 m³ of drilling-mud solids have been modelled, representing the maximum worst-case discharge scenario for the Kyla well.

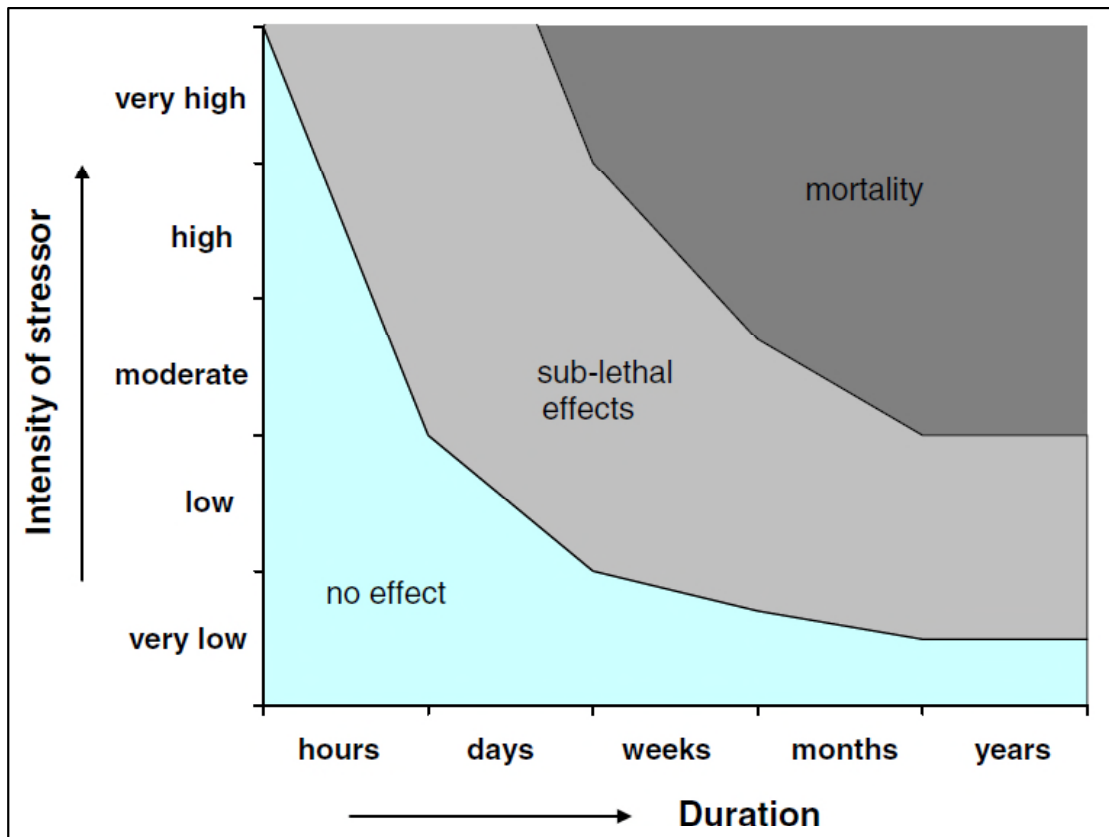
Drill Cuttings and Muds Dispersion Modelling

The discharge of drill cuttings and fluids from the MODU will result in a temporary effluent plume descending through the water column. To quantify the TSS concentrations in the water column and inform the assessment of potential environmental effects, simulations of the discharged drill cuttings and fluids from the proposed Kyla well has been completed using the three-dimensional (3D) dispersion model (MUDMAP) by RPS on behalf of Serica. MUDMAP can predict TSS plume concentrations and sediment deposition. A copy of the drill cuttings and muds dispersion modelling report is provided for reference in Appendix C. Note, impacts to the marine environment from the settlement of drill cuttings, muds and cement on the seabed are considered separately in Section 7.

To represent the combined influence of ocean drift currents and tidal currents at the Kyla location, ten years (2010 to 2019) of 3D HYCOM ocean data and HYDROMAP tidal data was generated for the study site. A grid covering a 50 km (longitude, x-direction) by 50 km (latitude, y-direction) region with varying depths was employed. For the purposes of the TSS assessment, the water column is discretised into 10 m vertical layers, allowing the model to resolve the vertical distribution and attenuation of suspended solids concentrations with depth. As the spud date can vary, a total of 100 trajectory simulations were modelled with varying start dates to assess a range of current conditions (RPS, 2025). Results from the 100 simulations were overlayed for stochastic analysis to determine maximum TSS concentrations based on acute (1-hour averaged concentration) and chronic (24-hour averaged concentration) exposure thresholds, in each grid cell.

A fundamental principle in assessing turbidity effects is the relationship between intensity (or TSS concentrations) and duration of exposure (Figure 10.1). High concentrations over a short duration may cause immediate stress or mortality, while prolonged exposures at lower concentrations can generate similar cumulative impacts.

Figure 10.1: Conceptual relationship between the intensity and duration of a stress event and the risk of sublethal and lethal effects on corals. The figure illustrates the general relationship between the magnitude of an increase in turbidity or sedimentation above background levels (vertical axis), how long it lasts (horizontal axis) and the onset of effects on corals (Erftemeijer et al., 2012) ^{Note 1}



Note 1: Although cold-water corals have not been recorded in vicinity of the Kyla location within the CNS, by applying thresholds based on coral responses, this assessment adopts a worst-case conservative benchmark that ensures the protection of the most sensitive ecosystem components.

The durations applied here are intentionally conservative. Acute effects in laboratory studies are typically assessed over 1–7 days and chronic effects over weeks to months (Brown et al., 2015; Stump et al., 2019). In contrast, this assessment uses exposure periods of 1 hour (acute) and 24 hours (chronic), reflecting the operational context in which TSS levels from drill cuttings can rise rapidly over minutes to days. These shorter durations ensure thresholds remain both protective and precautionary.

In offshore environments, background TSS concentrations are generally low, typically <10 mg/L, although naturally turbid nearshore systems can experience levels >100 mg/L (Erftemeijer et al., 2012). Experimental studies indicate that short-term TSS spikes of 50–100 mg/L can induce acute, sub-lethal

stress responses, including increased mucus production and reduced photosynthetic efficiency (Browne et al., 2015; Stump et al., 2019). Longer-term exposures at lower concentrations (15–50 mg/L) have been associated with chronic physiological impairment, reduced reproductive success and increased mortality (Browne et al., 2015; Erftemeijer et al., 2012). The final TSS thresholds derived for this assessment are presented in Table 10.1 (RPS, 2025).

Table 10.1: Reporting Thresholds for TTS Concentrations for the drill cuttings and unrecoverable muds discharge modelling (RPS, 2025)

Impact Level	Acute Exposure (1-hour averaged concentration) (mg/L)	Chronic Exposure (24-hour averaged concentration) (mg/L)	Notes/Comments
No Impact	<10	<5	Background or natural variability; corals tolerate well.
Low Exposure	10	5	Minor physiological stress; corals acclimate to short pulses.
Moderate Exposure	50	15	Sub-lethal effects; mucus production, reduced photosynthesis.
High Exposure	> 100	> 50	Tissue damage, mortality risk; chronic exposure particularly harmful.

The modelling of the water-column effects associated with the discharge of the Kyla cuttings and muds indicates that increases in TSS will be temporary, highly localised, and rapidly attenuated with distance from the release point (Figure 10.2 and Figure 10.3). The stochastic assessment, based on 100 simulations, shows that for acute exposure (1-hour averaged concentrations), the 10 mg/L low-exposure threshold extends no farther than 1.02 km from the MODU, with moderate exposure levels (50 mg/L) limited to 0.27 km and high-exposure concentrations (100 mg/L) confined within the same distance. The total area exceeding the acute low-exposure threshold is 1.19 km² (refer to Table 10.2). Under chronic exposure (24-hour averaged concentrations), the extent of elevated TSS is smaller still, with the 5 mg/L low-exposure threshold reaching 0.41 km, moderate concentrations (15 mg/L) extending to 0.19 km, and high-exposure levels (50 mg/L) not exceeding 0.08 km, covering a total area of 0.16 km² (refer to Table 10.2).

Deterministic modelling indicates that the higher-exposure TSS concentrations predicted by the stochastic assessment are vertically constrained within the water column (RPS, 2025). For riserless, near-seabed discharges, elevated TSS concentrations are predominantly confined to the lower 10 m of the water column, reflecting the discharge depth and the rapid settling of coarser particle fractions. Concentrations decrease rapidly with height above the seabed due to particle settling and vertical mixing, resulting in limited vertical plume extent. Conversely, for discharges released at the sea surface, the highest TSS concentrations are confined to the upper 10 m of the water column, with concentrations attenuating rapidly with depth as the plume disperses and mixes vertically. In both discharge scenarios, elevated concentrations are short-lived and restricted to the near-field plume, with rapid dilution occurring outside these zones due to the energetic hydrodynamic conditions of the CNS.

These results confirm that TSS elevations are short-lived (typically <24 hours) and rapidly diluted in the energetic CNS environment, with higher concentration thresholds occurring only in very close proximity to the discharge point. Accordingly, the likelihood of wider water-column impacts from suspended solids is considered to be low.

Table 10.2: Predicted total areas of coverage and maximum distances to acute and chronic exposure from the release location to each reporting threshold based on the results of all 100 simulations (RPS, 2025)

Reporting Threshold	Annual	
	Total Area of Coverage (km ²)	Maximum Distance (km) from the Release Location
Acute Exposure (1-hour averaged concentration)		
10	1.19	1.02
50	0.10	0.27
100	0.08	0.27
Chronic Exposure (24-hour averaged concentration)		
5	0.16	0.41
15	0.05	0.19
50	0.01	0.08

Figure 10.2: Predicted maximum 1-hour moving average of TSS concentrations, representing acute exposure, from the discharge of drill cuttings and muds. Results are based on 100 simulations and represent annual conditions (RPS, 2025)

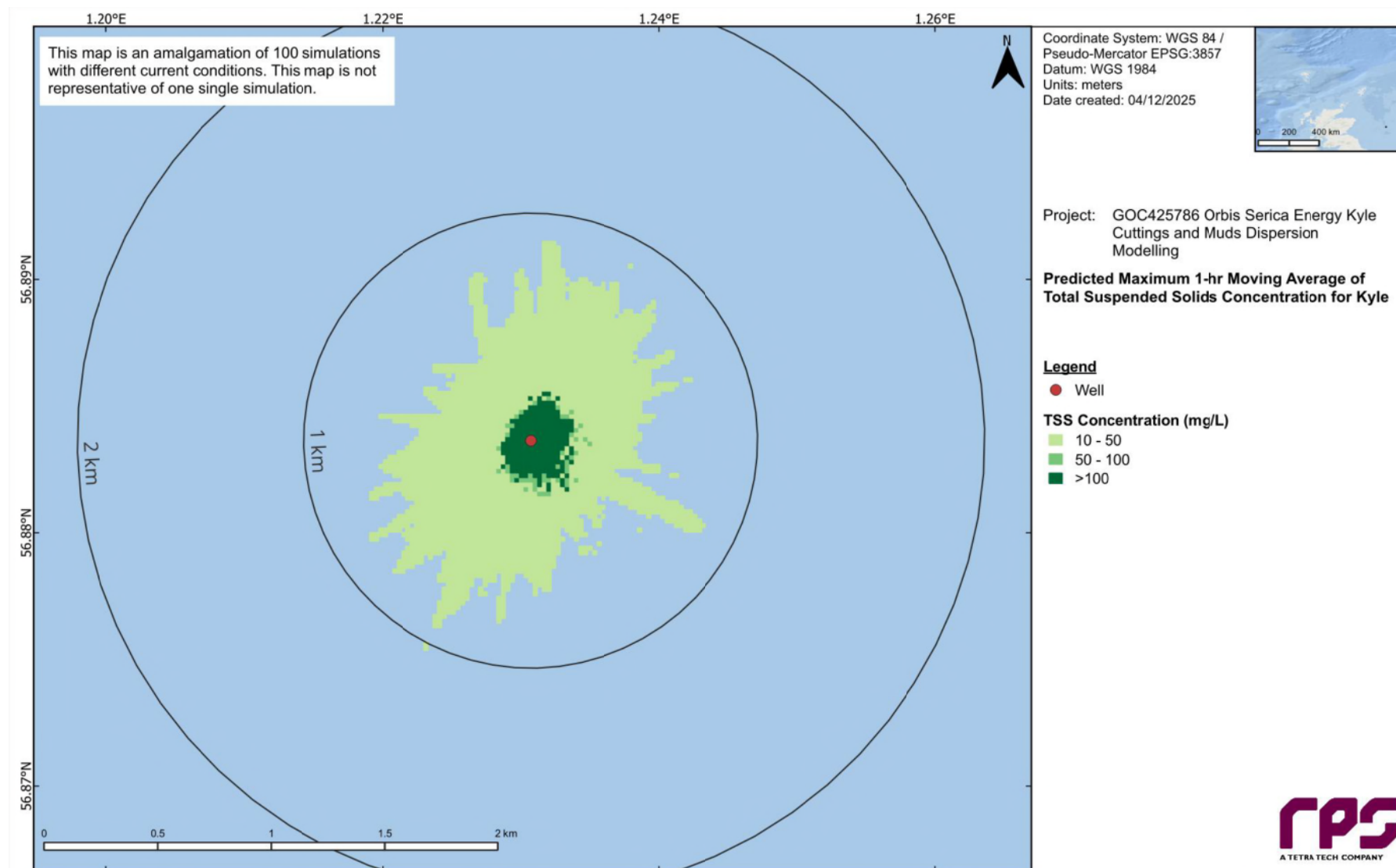
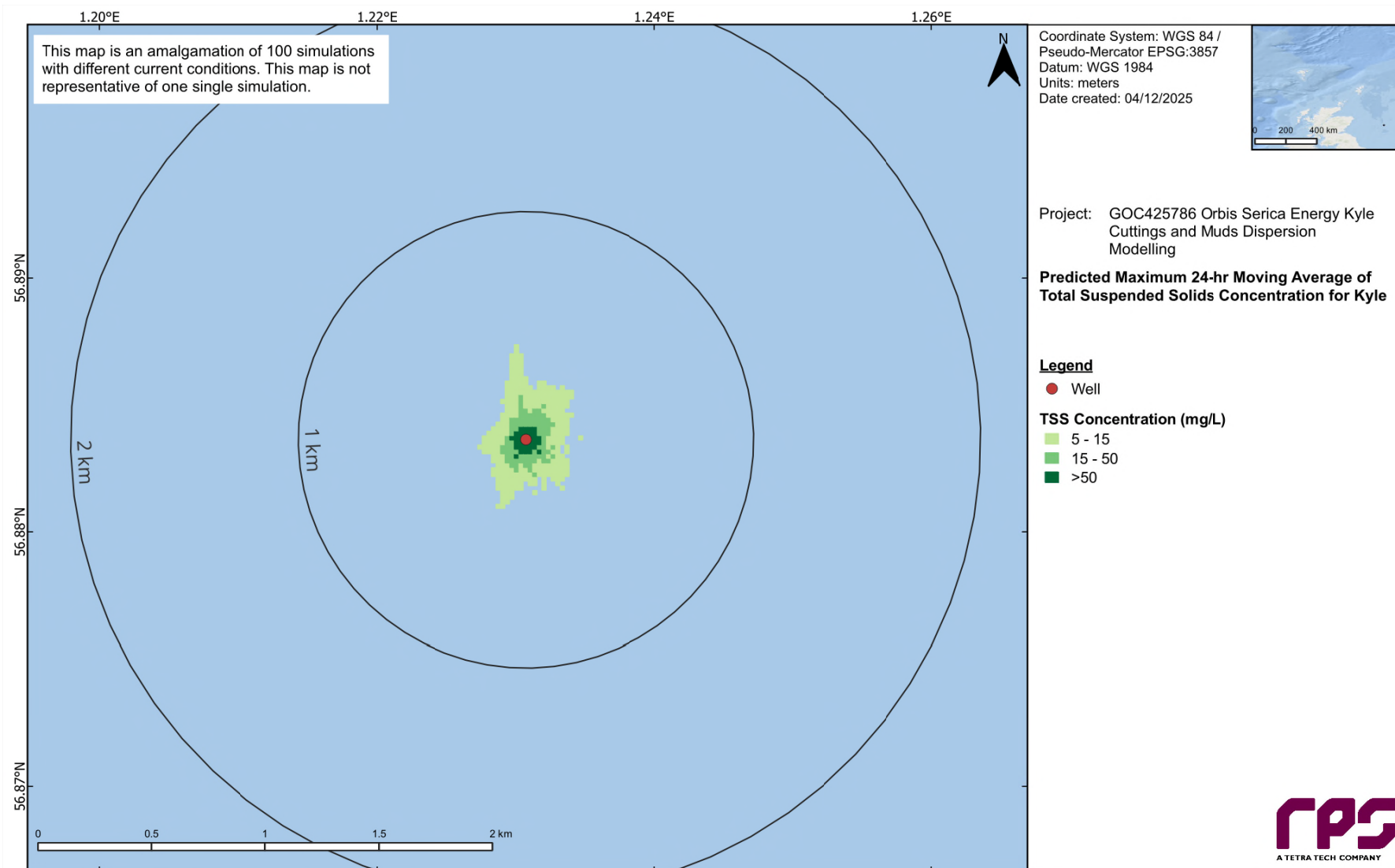


Figure 10.3: Predicted maximum 24-hour moving average of TSS concentrations, representing chronic exposure, from the discharge of drill cuttings and muds. Results are based on 100 simulations and represent annual conditions (RPS, 2025)



Water Quality

The sensitivity of the water column to contamination from the discharge of drill cuttings and muds is considered to be **Low**. The receptor has a Low value; as only the water column in relatively close proximity to the discharge point will be impacted, hence it is considered to be of local importance. The CNS area is characterised by persistent, long-period swells, complex current regimes and rapidly changing weather conditions. The water quality is subject to rapid refreshment rates and mixing of the water column, coupled with strong wave action on the sea surface. Therefore, the receptor resistance and resilience is Very High to drill cutting and mud discharges. The magnitude of impact is considered to be **Minor**, with a short-term temporary change in baseline environmental conditions. Effects on water quality due to the discharge of drill cuttings and muds are therefore assessed as **Minor**.

Plankton

The sensitivity of plankton to the planned discharge of drill cuttings and muds is considered to be **Low**. The receptor is of Medium value; the plankton community has a regional importance to the North Sea, providing a food source to higher trophic levels in this region. However, the temporary effluent plume resulting from the discharge of drill cuttings and muds is expected to disperse rapidly and the plankton has high recoverability in the short-term with high reproduction rates. Therefore, the receptor resistance and resilience is Very High to drill cutting and mud discharges. The magnitude of impact is considered to be **Negligible**, as the rapid dilution of the cuttings and muds plume in the water column is anticipated. Any changes to the plankton community are anticipated to be immeasurable / undetectable. Effects on plankton due to the discharge of drill cuttings and muds are therefore assessed as **Negligible**.

Benthic Communities

The impact to benthic communities from the discharge of drill cuttings, mud and cement at the proposed Kyla drill centre location is assessed in Section 7 (Seabed Disturbance).

Fish

The sensitivity of fish to the planned discharge of drill cuttings and muds is considered to be **Low**. The receptor has a High value; with many species listed as PMF in Scottish waters (see Section 4.3.3). However, the temporary effluent plume made from drill cuttings and muds is expected to disperse rapidly, and fish have the ability to avoid the impacted area. Therefore, the receptor resistance and resilience is Very High to drill cutting and mud discharges. The magnitude of impact is considered to be **Negligible**, as the rapid dilution of the cuttings and mud plume in the water column is anticipated. Any changes to the fish community are anticipated to be immeasurable / undetectable. Effects on fish due to the discharge of drill cuttings and muds are therefore assessed as **Negligible**.

10.2.2 Discharge of Fluids Contaminated with Residual Hydrocarbons

Residual hydrocarbons may be discharged during a small number of planned activities associated with the Kyla Development, as detailed below. These relate to the management of LTOBM-contaminated drill cuttings returned to the MODU, the discharge of completion brines following well clean-up operations, and the routine discharge of produced water once Kyla is brought online via the Triton FPSO. In addition, residual hydrocarbons may be discharged in future subsea intervention programmes and during decommissioning activities.

Thermally Treated LTOBM Cuttings Water

As described in Section 3.3.4, all deeper hole sections of the Kyla well (17½", 12¼" and 9½") and contingency sidetrack options will be drilled using LTOBM and circulated back to the MODU via the marine riser. Cuttings recovered at surface will be processed through a thermal cuttings treatment system to reduce the OOC content to below the offshore discharge limit of <1% OOC. During this process, heating and mechanical separation generate a small volume of recovered water that may contain low concentrations of dispersed LTOBM.

Following treatment, the recovered water will be passed through a filtration and separation package to achieve an oil-in-water concentration of ≤ 30 mg/l prior to overboard discharge. This treated water stream represents a minor hydrocarbon-bearing discharge, with the majority of the LTOBM recovered and recycled back into the active mud system.

The small quantities of residual LTOBM present in the treated cuttings water will be discharged at the sea surface, where the water column is naturally energetic and characterised by strong wave action and rapid mixing. Under these conditions, any trace hydrocarbons are expected to undergo immediate dilution and dispersion, followed by further attenuation through natural microbial degradation. As a result, no measurable or persistent accumulation of hydrocarbons in the marine environment is anticipated. Representative oil in water samples will be collected at the discharge point and analysed to verify hydrocarbon concentrations in the treated water stream. Serica will obtain consent to discharge the treated cuttings water via a Drilling Chemical Permit Subsidiary Application Template (SAT) submitted on the UK Energy Portal, in accordance with the Offshore Chemicals Regulations 2002 (as amended 2011).

Well Clean-up and Completion Brines

As described in Section 3.3.5, prior to production start-up the Kyla well will undergo a series of clean-up and displacement operations to remove residual drilling fluids, solids, and debris from the wellbore and to prepare the lower and upper completion assemblies. These activities involve displacing the in-situ LTOBM with a filtered completion brine, installing the lower completion and gravel pack, and subsequently displacing the upper sections of the well with fresh brine to ensure well integrity and prevent damage to the export pipeline. In total, approximately 3,000 bbl (477 m³) of completion brine will be discharged during the clean-up sequence. Although the brine is filtered prior to discharge, it may contain small quantities of entrained LTOBM residues mobilised during the displacement of the drilling fluid. In a worst-case scenario, the total mass of LTOBM hydrocarbons present in the discharged brine is estimated to be 14.3 kg. All fluids returned during clean-up operations will pass through a dedicated filtration and water-treatment package on the MODU and will only be discharged once the oil in water concentration has been reduced to ≤ 30 mg/l.

Any residual LTOBM present within the discharged completion brine will be released at the sea surface, where strong wave action and high natural mixing energy promote rapid dilution and dispersion. Under these energetic conditions, trace hydrocarbon concentrations are expected to dissipate quickly and be further reduced through natural microbial degradation, preventing any measurable or persistent accumulation in the marine environment. During well clean-up operations, representative oil in water samples will be collected at the discharge point and submitted for laboratory analysis to verify actual hydrocarbon concentrations. Serica will obtain consent to discharge these fluids through a Drilling Chemical Permit SAT on the UK Energy Portal, in accordance with the Offshore Chemicals Regulations 2002 (as amended 2011).

Produced Water Discharge from Triton FPSO

Once the Kyla well is brought online, produced fluids will be processed through the Bittern production train on the Triton FPSO. Produced water contaminated with reservoir hydrocarbons will be separated, treated and discharged overboard from Triton in accordance with the oil in water performance standard of ≤ 30 mg/l (monthly average), as required under the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended 2010) and regulated through Triton's existing Oil Discharge Permit.

Kyla's incremental contribution to Triton's total produced water load is expected to remain small throughout field life, with the forecast oil in water load attributable to Kyla estimated at 14.71 tonnes between 2028 and 2035 (refer to Section 3.5.3). Upon discharge, produced water enters the high-energy waters surrounding the FPSO, where strong tidal currents, wave action, and natural turbulence promote rapid dilution and dispersion of the treated plume. Under these conditions, any dissolved or dispersed hydrocarbons are expected to attenuate quickly and remain confined to a very localised area around the discharge point, with no potential for measurable or persistent accumulation in the wider marine environment. Produced water discharges will continue to be managed and monitored under Triton's existing Oil Discharge Permit requirements to ensure ongoing compliance with regulatory limits.

Subsea Intervention and Future Decommissioning Activities

Although detailed programmes for subsea intervention and decommissioning activities will be developed at a later stage, these operations may involve the discharge of small residual volumes of hydrocarbons entrained in fluids used for well access, plugging and abandonment, or line flushing. At this pre-development stage, the timing and volumes of such discharges cannot be quantified; however, based on similar North Sea projects, any hydrocarbon-bearing discharges associated with these activities are expected to be very small in scale and short-lived when compared with those generated during drilling and routine production operations.

Assessment of Impacts

Hydrocarbons cause toxicity in aquatic organisms by a mechanism referred to as non-polar narcosis (or non-specific) toxicity. This toxicity is reversible and is observed in most organisms when exposed to sufficient levels of hydrocarbons (e.g. the effects of alcohol or solvents on humans). The partitioning of an organic substance between water and a hydrocarbon phase is described by its octanol water partition coefficient. This value is determined in the laboratory by a standardised method and reported as a logarithmic value ($\log P_{ow}$). The higher the $\log P_{ow}$ value the greater the amount of substance that dissolves in the organic (octanol) phase. Correlations of $\log P_{ow}$ values with toxicity for single hydrocarbons indicate that solubility increases more rapidly with increasing $\log P_{ow}$ than does the dissolved fraction of the hydrocarbon (i.e. the concentration that causes effects). Although this relationship varies with species it may be concluded that above a certain $\log P_{ow}$ value a hydrocarbon will not exhibit acute toxicity. This relationship has been verified experimentally for fish and invertebrates; paraffinic hydrocarbons with carbon number 10 or greater ($\log P_{ow} > 5$) show no acute toxicity and paraffinic hydrocarbons with carbon number greater than 14 ($\log P_{ow} > 7.3$) show no chronic toxicity (CONCAWE, 2001). As such when an oil is released the lighter ends are likely to rapidly evaporate from the aquatic environment, whilst the heavier ends are not inherently toxic in aquatic systems.

Nonetheless, hydrocarbon constituents such as PAHs are of concern due to their potential mutagenic and carcinogenic properties. Despite this, many marine organisms, including fish and invertebrates possess enzymatic pathways to metabolise and detoxify PAHs at concentrations typically found in the marine environment (Stein *et al.*, 2010; Tuvikene, 1995; Rust *et al.*, 2004). Furthermore, the environmental fate of hydrocarbons involves a range of natural attenuation processes. Low molecular weight compounds may volatilise at the air–water interface or undergo biodegradation by native microorganisms. Others may precipitate after oxidation or become adsorbed onto suspended solids and sediments. These combined processes contribute to reducing both the concentration and bioavailability of hydrocarbon compounds in the receiving environment, thereby diminishing their overall toxicity to marine organisms (OGP, 2005).

Modelling and literature data suggest that the impacts of hydrocarbon discharges in open offshore environments are highly localised and transient. For example, a study conducted for the Norwegian petroleum sector found that while hydrocarbon effects may be observed at the level of individual organisms, no impacts were evident at the population or community level (OGUK, 2014).

Water Quality

The sensitivity of the water column to contamination from the discharge of residual hydrocarbons is considered to be **Low**. The receptor has a Low value; as only the water column in close proximity to the discharge point will be impacted, hence it is considered to be of local importance. The CNS area is characterised by persistent, long-period swells, complex current regimes and rapidly changing weather conditions. The water quality is subject to rapid refreshment rates and mixing of the water column, coupled with strong wave action on the sea surface. Therefore, receptor resistance and resilience is Very High to the discharge of residual hydrocarbons. The magnitude of impact is considered to be **Minor**, with no long-term changes in the baseline environment. Effects on water quality due to the discharge of residual hydrocarbons (from treated cuttings water, well clean-up fluid, produced water & future subsea intervention and decommissioning activity) are therefore assessed as **Minor**.

Plankton

The sensitivity of plankton to the discharge of residual reservoir hydrocarbons is considered to be **Low**. The receptor is of Medium value; the plankton community has a regional importance to the North Sea, providing a food source to higher trophic levels in this region. However, once discharged, the residual hydrocarbons are not expected to persist within the marine environment and the plankton has high recoverability in the short-term with high reproduction rates. Therefore, the receptor resistance and resilience is Very High. The magnitude of impact is considered to be **Negligible**, as the rapid dilution of the residual reservoir hydrocarbons in the water column are anticipated. Any changes to the plankton community are anticipated to be immeasurable / undetectable. Effects on plankton due to the discharge of residual hydrocarbons (from treated cuttings water, well clean-up fluid, produced water & future subsea intervention and decommissioning activity) are therefore assessed as **Negligible**.

Fish

The sensitivity of fish to the planned discharge of residual reservoir hydrocarbon is considered to be **Low**. The receptor has a High value; with many species listed as PMF in Scottish waters (see Section 4.3.3). However, the residual hydrocarbons are not expected to persist within the marine environment and fish do have some tolerance / ability to avoid, adapt and recover from hydrocarbon pollution. The magnitude of impact is considered to be **Negligible**, as the rapid dilution of the residual hydrocarbons in the water column are anticipated. Any changes to the fish community are anticipated to be immeasurable / undetectable. Effects on fish due to the discharge of residual hydrocarbons (from treated cuttings water, well clean-up fluid, produced water & future subsea intervention and decommissioning activity) are therefore assessed as **Negligible**.

10.2.3 Discharge of Chemicals

Chemical discharges associated with the Kyla Development will occur during a defined set of activities spanning drilling, cementing, well clean-up and completion, subsea commissioning, and routine production operations. These activities are described in Section 3 and summarised below. In addition, chemicals may be used and discharged in future subsea intervention programmes and during decommissioning activities.

Discharge of Drilling, Cementing, Completion and Rig Chemicals during Drilling Operations

Drilling operations will involve several chemical discharges that are regulated under the Drilling Chemical Permit SAT, submitted via the UK Energy Portal in accordance with the Offshore Chemicals Regulations 2002 (as amended 2011) (refer to Section 3.3). During riserless drilling of the top-hole sections, seawater and bentonite sweeps will be discharged directly to the seabed. In the deeper hole sections, LTOBM will be circulated back to the MODU and treated offshore; only the treated cuttings (<1% OOC) and associated water containing permitted mud system chemicals will be discharged following separation and treatment.

Cementing activities will also generate chemical discharges, including up to 123 m³ of cement slurry during installation of the 36" and 26" casings, with a further 123 m³ potentially discharged in the event of a re-spud, along with small volumes of cement-wash water from post-job cleaning (refer to Section 3.3.4).

During well clean-up and completion (refer to Section 3.3.5), approximately 477 m³ of filtered completion brine will be discharged once solids have been removed. Other specialist fluids used during clean-up—such as viscosified pills, surfactants and solvents—will be recovered to the MODU and, if contaminated, returned to shore for appropriate disposal; these fluids are not expected to be discharged offshore.

Routine MODU chemicals, including detergents, lubricants and hydraulic fluids used for equipment maintenance and BOP control, will also be used onboard. Any permitted discharges of these materials are likewise controlled under the Drilling Chemical Permit SAT. Collectively, these activities represent the principal chemical discharge streams during drilling operations.

Discharge of Subsea Commissioning Chemicals

During subsea installation and pre-commissioning, chemicals such as MEG gels, hydraulic fluids, corrosion inhibitors, oxygen scavengers and dyes will be injected into spools, jumpers and umbilical lines to preserve system integrity and to support leak detection during commissioning activities (refer to Section 3.4.5). These chemicals will remain fully contained within the subsea infrastructure and are not expected to be discharged during installation. Hydrotesting of the production system will require the use of chemically treated freshwater, with up to 400 m³ discharged from the Triton FPSO during dewatering. The use and discharge of chemicals during pre-commissioning operations will be detailed and assessed in the Pipeline Operations MAT and associated Chemical Permit SAT, submitted via the UK Energy Portal in accordance with the Offshore Chemicals Regulations 2002 (as amended 2011).

Discharge of Production Chemicals

During routine production operations, chemicals such as corrosion and scale inhibitors, deoilers, demulsifiers, antifoam agents and methanol will be used for flow assurance and process treatment (refer to Section 3.5.6). A proportion of these chemicals will partition into the produced water stream and be discharged from the Triton FPSO as part of normal operations. These chemical discharges will be regulated under the existing Triton Production Chemical Permit SAT, submitted via the UK Energy Portal in accordance with the Offshore Chemicals Regulations 2002 (as amended 2011).

Subsea Intervention and Future Decommissioning Chemical Discharges

In addition to the operational phases described above, limited chemical discharges may occur during future subsea intervention activities and eventual decommissioning of the Kyla well and associated infrastructure. These activities may require the use of small volumes of intervention fluids, barrier testing chemicals, or line-flushing additives and cement slurries / additives associated with plug and abandonment operations. The detailed chemical inventories will be defined at the appropriate regulatory stage; however, based on comparable CNS developments, the scale of chemical discharge during intervention and decommissioning is expected to be minor relative to drilling, clean-up and routine production operations. All chemicals used during these phases will be subject to separate permitting under the Offshore Chemicals Regulations 2002 (as amended 2011).

Assessment of Impacts

The chemicals discharges associated with the Kyla Development have the potential to result in a significant impact on the marine environment. Chemical discharges to the marine environment can result in wide ranging environmental impacts, including a decline in water quality, changes in water chemistry (such as pH and temperature), toxicity effects from chemical components and the contamination of seabed sediments as well as acute or long term effects on marine organisms. Whether these effects are realised depends on a number of factors such as the inherent toxicity of the material, the quantities discharged and resulting concentrations in the water column, the length of time biota are exposed to that concentration and the sensitivity of the organisms to the particular chemical (OGUK, 2019).

In accordance with the Offshore Chemical Regulations 2002 (as amended 2011), Serica considers the minimisation of chemical usage a priority and recognises that substitution is an important aspect of the OSPAR Harmonised Mandatory Control Scheme (HMCS). Where practicable, chemicals with a high risk profile will be substituted out in favour of those with an improved environmental profile and, wherever possible, chemicals will be chosen which are PLONOR (Pose Little Or No Risk).

Prior to operations commencing offshore, all CHARMable (Chemical Hazard Assessment and Risk Management) chemicals to be discharged will be assessed by calculating a Risk Quotient (RQ). Where chemical use and discharge results in a RQ value >1, thus indicating a possible risk of the discharge causing harm to the marine environment, further investigation of the product will be carried out to determine if the RQ can be lowered or if an alternative product can be used which produces a lower RQ. The site-specific risk assessment of the chemicals to be used and discharged will be detailed within the appropriate Chemical Permit SAT.

It is anticipated that once discharged, the majority chemicals used will rapidly disperse given the hydrographic regime in the area and will be readily broken down through natural biodegradation

processes. Note, in the event that LTOBM is not shipped to shore for disposal, the chemical additives returned to the MODU will pass through the thermal treatment unit on the MODU and are expected to be broken down by the thermal treatment (Vik et al., 2014).

Water Quality

The sensitivity of water column to contamination from the planned, routine discharge of chemicals is considered to be **Low**. The receptor has a Low value; as only the water column in close proximity to the discharge point will be impacted, hence it is considered to be of local importance. The CNS area is characterised by persistent, long-period swells, complex current regimes and rapidly changing weather conditions. The water quality is subject to rapid refreshment rates and mixing of the water column, coupled with strong wave action on the sea surface. Therefore, the receptor resistance and resilience is Very High to planned, routine chemical discharges. The magnitude of impact is considered to be **Minor**, with a short-term temporary change in baseline environmental conditions. Effects on water quality due to planned, routine chemical discharges are therefore assessed as **Minor**.

Plankton

The sensitivity of plankton to the planned, routine discharge of chemicals is considered to be **Low**. The receptor is of Medium value; the plankton community has a regional importance to the North Sea, providing a food source to higher trophic levels in this region. However, once discharged, the chemicals are not expected to persist within the marine environment and the plankton has high recoverability in the short-term with high reproduction rates. Therefore, the receptor resistance and resilience is Very High. The magnitude of impact is considered to be **Negligible**, as the rapid dilution of the chemicals in the water column are anticipated. Any changes to the plankton community are anticipated to be immeasurable / undetectable. Effects on plankton due to the routine discharge of chemicals are therefore assessed as **Negligible**.

Fish

The sensitivity of fish to the planned, routine discharge of chemicals is considered to be **Low**. The receptor has a High value; with many species listed as PMF in Scottish waters (see Section 4.3.3). However, the planned, routine discharge of chemicals is not expected to persist within the marine environment. The magnitude of impact is considered to be **Negligible**, as the rapid dilution of the planned, routine discharge of chemicals in the water column is anticipated. Any changes to the fish community are anticipated to be immeasurable / undetectable. Effects on fish due to the planned, routine discharge of chemicals are therefore assessed as **Negligible**.

10.3 Mitigation Measures

Impacts from marine discharges during the development of the Kyla will be minimised by the implementation of the following mitigation measures:

- A chemical risk assessment will be undertaken to identify the risk profile of chemicals to be used and / or discharged in accordance with the requirements of the Offshore Chemicals Regulations 2002 (as amended 2011). Where practicable, chemicals with a higher risk profile will be substituted out in favour of those with an improved environmental profile;
- Chemical use and discharge will be minimised as far as practicable;
- For assessment purposes, thermal cuttings treatment is being evaluated to treat the LTOBM contaminated cuttings to an acceptable overboard disposal limit (<1% oil on cuttings). If not selected / considered to be feasible, the LTOBM contaminated cuttings would be skipped and shipped onshore for disposal;
- During the drilling operations, any discharges of residual LTOBM hydrocarbons will be treated to meet oil in water limits of the Chemical Permit SAT. The discharge streams will also be monitored and sampled in accordance with the permit conditions;
- During the production operations, any discharges of residual reservoir hydrocarbons in the produced water stream will be treated to meet oil in water limits of the Triton Oil Discharge

Permit SAT. The discharge streams will also be monitored and sampled in accordance with the permit conditions.

10.4 Residual Effects

In summary, no significant residual effects on water quality or local flora and fauna are predicted as a result of routine marine discharges during the Kyla Development operations. The discharge of thermally treated LTOBM cuttings and associated solids during drilling is predicted to result in only short-lived and highly localised increases in water-column TSS, with modelling confirming that concentrations rapidly attenuate to background levels within a short distance of the MODU.

During the operational phase, Kyla production fluids will be processed via the existing Triton FPSO, resulting in a small incremental contribution to Triton's permitted produced water discharge. This incremental increase will be managed under Triton's existing Oil Discharge Permit and treated to meet the regulatory oil in water performance standard. Given the limited additional volumes attributable to Kyla, the high-energy receiving environment and the continued application of established treatment and monitoring controls, no discernible change to the existing produced water discharge plume or receiving water quality is anticipated.

Chemical discharges associated with drilling, completion, commissioning and routine production activities will be subject to risk assessment and permitting under the Offshore Chemicals Regulations 2002 (as amended 2011). Only chemicals with acceptable environmental profiles will be selected for use, and discharges will be controlled to ensure rapid dilution and dispersion in the receiving environment.

10.5 Transboundary Effects

The Kyla Development lies approximately 72 km to the south west of the UK / Norway median line at its closest point. It is very unlikely that marine discharges generated during the proposed Kyla Development operations would lead to transboundary impacts, as it is anticipated that discharges will be diluted rapidly, within close proximity to their release location.

10.6 Cumulative Effects

Marine discharges from the proposed Kyla Development will occur within a region of established oil and gas activity (refer to Section 4.4.3); however, the closest neighbouring assets are located at sufficient distances such that cumulative effects on the wider marine environment are not anticipated. The Kyla well will tie back to the existing Bittern subsea manifold located approximately 11–13 km to the northwest. Beyond Bittern, the nearest producing fields include the Starling subsea gas field (Shell UK), situated around 12 km to the northeast and tied back to the Shearwater platform, and the Triton FPSO (Dana), located approximately 20 km northwest of the Bittern DCB manifold and 30 km from the Kyla well. Other infrastructure in the area includes the Catcher FPSO (approximately 24 km southwest of the Bittern DCA manifold), the Gannet A platform (approximately 30 km north of the manifold), and the West Franklin WHP (approximately 36 km northeast of Kyla). The Belinda field, currently in development, lies approximately 14 km north of the Bittern DCB manifold and 24 km northwest of the proposed Kyla well and is expected to be online ahead of Kyla.

The only location where cumulative discharges may intersect is at the Triton FPSO, where Kyla's produced fluids will be processed alongside existing production streams. However, Kyla's incremental contribution to Triton's produced water and associated production chemical discharges is forecast to be small in comparison with the host facility's existing throughput (refer to Section 3.5). Although total produced water discharge volumes at Triton will increase once Kyla comes online, the combined discharges will remain within the limits authorised under Triton's existing Oil Discharge Permit and Production Chemical Permit SATs. As such, the addition of Kyla is not expected to result in a notable change in Triton's discharge footprint, and no significant cumulative effects are anticipated at the host facility.

Given the separation distances to other neighbouring assets, combined with the energetic and highly dispersive hydrodynamic conditions of the CNS, discharges from Kyla will rapidly dilute in the immediate vicinity of their release point and will not overlap with discharge plumes from adjacent

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developments. Overall, the discharges associated with Kyla are small in volume, short-lived and localised, and therefore no cumulative or in-combination impacts on water quality, plankton, fish or benthic habitats are expected.