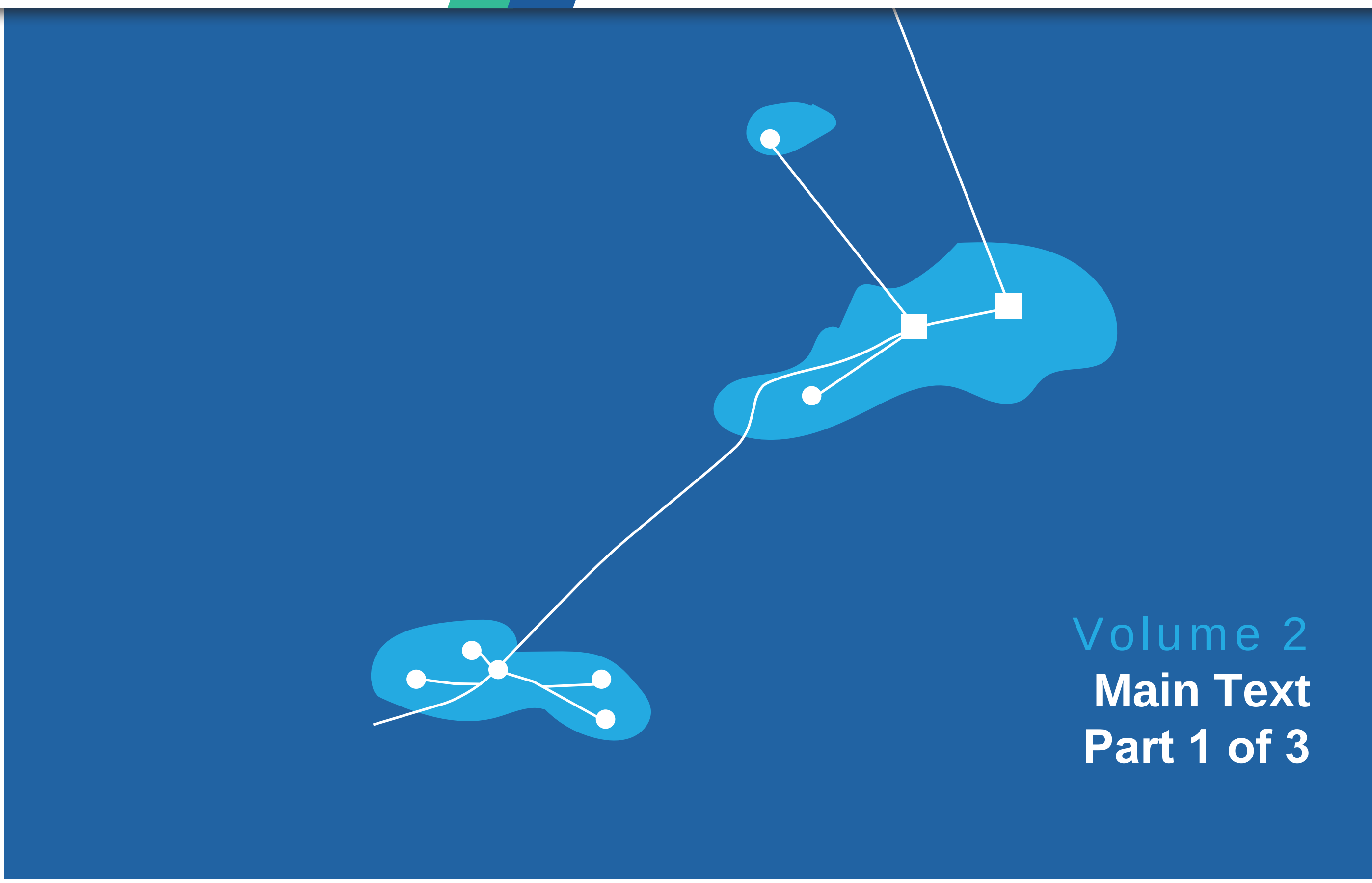
Kinsale Area Decommissioning Project

Environmental Impact Assessment Report



Volume 2
Main Text
Part 1 of 3

253993-00-REP-08 | 30 May 2018

Table of Contents

Tables

Figures

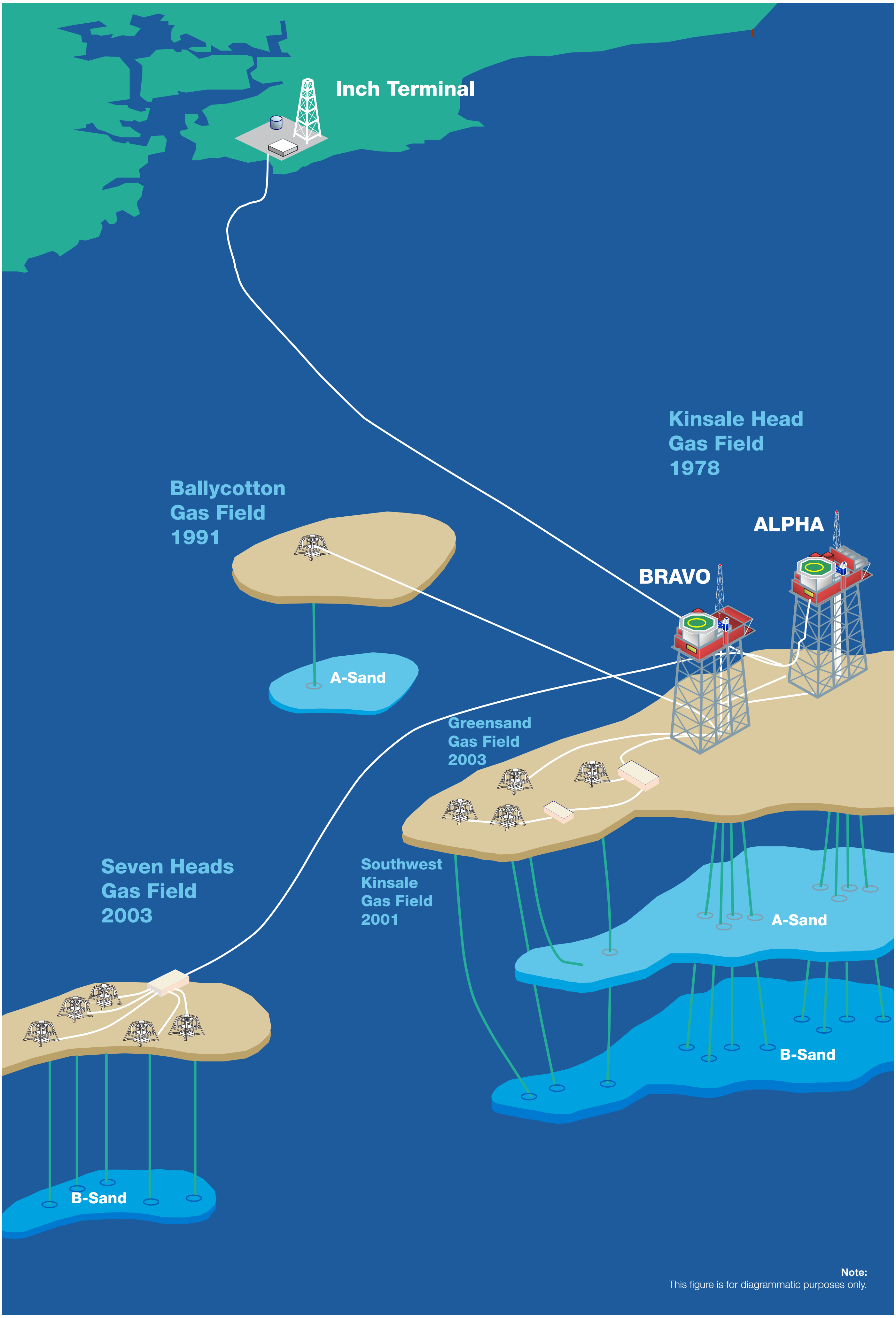
Appendices

Kinsale Area Decommissioning Project

Glossary of Terms

Hartley Anderson

ARUP


Inch Terminal
Kinsale Head
Gas Field
1978
ALPHA
BRAVO
Ballycotton
Gas Field
1991
A-Sand
Greensand
Gas Field
2003
Seven Heads
Gas Field
2003
Southwest
Kinsale
Gas Field
2001
A-Sand
B-Sand
B-Sand
Note:
This figure is for diagrammatic purposes only.

Glossary of Terms

Term	Explanation
AA	Appropriate Assessment
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
Bathymetry	Measurement of depth of water in oceans, seas, or lakes
Benthic Zone	Ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers
Biotope	Region of a habitat associated with a particular ecological community
Buoyancy tank	An enclosed air-filled section of a boat, ship or hovercraft designed to keep it afloat and prevent it from sinking
Bunker	Fill the fuel containers of a ship (refuel)
Bunkering	Supply of fuel for use by ships in a seaport
CA	Comparative Assessment
Cantilever	Structural element anchored at only one end to a support from which it is protruding
Caprock	Harder or more resistant rock type overlying a weaker or less resistant rock type
CCS	Carbon Capture and Storage
CRU	Commission for Regulation of Utilities Water and Energy
Cephalopods	Any member of the molluscan class Cephalopoda such as a squid, octopus or nautilus
CFP	Common Fisheries Policy
CH_4	Methane
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLC	CORINE Land Cover
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Concrete mattress	A series of concrete blocks usually connected by polypropylene ropes resembling a rectangular mattress, used for the weighting and/or protection of seabed structures including pipelines
CoP	Cessation of Production: the stage at which, after all economic development opportunities have been pursued, hydrocarbon production ceases.
CORINE	Co-Ordinated Information on the Environment
CSO	Central Statistics Office
CSV	Construction Support Vessel
DCCAE	Department of Communications, Climate Action and Environment
DCENR	Department of Communications, Energy and Natural Resources
DECC	Department of Energy & Climate Change (UK)

Term	Explanation
Decommissioning	Planned shut-down or removal of a building, equipment, plant, offshore installation etc.., from operation or usage offshore.
Demersal	Living close to the floor of the sea or a lake
Diesel	A low viscosity distillate fuel
DP	Dynamic Positioning: the use of thrusters and real time positional information to maintain the location of a vessel
Drill cuttings	Rock from the wellbore resulting from the mechanical action of the drill bit
DTTAS	Department of Transport, Tourism and Sport
DSV	Diving Support Vessel
ED	Electoral Division
EEMS	Environmental and Emissions Monitoring System
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
Epifauna	Animals living on the surface of the seabed or a riverbed, or attached to submerged objects or aquatic animals or plants.
EU28	Denotes the 28 member countries which make up the European Union
EUNIS	European Nature Information System
FBE	Fusion Bonded Epoxy
Flowline	Pipeline carrying unprocessed oil/gas within the oil or gas field area
Freespan	A free span on a pipeline is where the seabed sediments have been eroded, or scoured away leaving a void under the pipeline so that the pipeline is no longer supported on the seabed
GHG	Greenhouse gas
GNI	Gas Network Ireland
Grout	Particularly fluid form of concrete used to fill gaps, generally a mixture of water, cement, and sand
GWP	Global warming potential
HES	Health, Environment and Safety
HGV	Heavy Goods Vehicle
HFCs	Hydrofluorocarbons
HLV	Heavy-Lift Vessel
ICES	International Council for the Exploration of the Sea
IEMA	Institue of Environmental Management and Assessment
IMO	International Maritime Organisation
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's marine Resource, joint venture between the Geological Survey of Ireland and the Marine Institute.
In-Situ	In the original place.
Interconnector	Structure which enables energy to flow between networks, refers to international connections between electricity and natural gas networks

Term	Explanation
IOSEA	Irish Offshore Strategic Environmental Assessment
IPCC	Intergovernmental Panel on Climate Change
IRPA	Individual Risk Per Annum
Jacket	The structure comprising the “legs” of the offshore platform connected together by horizontal and diagonal trusses and usually made of welded tubular steel. The jacket is typically secured to the seabed by piles
Jack-up rig	A mobile floating drilling rig typically with three long triangular truss legs which can be lowered to the seabed to provide stability once on location
KA	Kinsale Alpha platform
KADP	Kinsale Area Decommissioning Project
KB	Kinsale Bravo platform
KPIs	Key Performance Indicators
km	Kilometre: 1,000m, equivalent to 0.54 nautical miles
L_{Aeq}	Sound levels that vary over time which results in a single decibel value which takes into account the total sound energy over the period of time of interest
LAT	Lowest Astronomical Tide
LCA	Life cycle assessment
Likelihood – Remote	Unlikely to occur
Likelihood – Unlikely	Once during decommissioning activity
Likelihood – Possible	Foreseeable possibly once a year
Likelihood – Likely	Once a month or regular short term events
Likelihood - Definite	Continuous or regular planned activity
LPP	Layer polypropylene
LULUCF	Land Use, Land Use Change and Forestry
LWIV	Light Well Intervention Vessel
Major Effect	• Change in ecosystem leading to medium term (2+ year) damage with recovery likely within 2 - 10 years to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites • Transboundary effects expected • Moderate contribution to cumulative effects • Issue of public concern • Possible effect on human health • Possible medium term loss to private users or public finance
Manifold	A pipe or chamber branching into several openings.
MARPOL	The International Convention for the Prevention of Pollution from Ships
Megaripple	An extensive undulation of the surface of a sandy beach or sea bed

Term	Explanation
Moderate Effect	• Change in ecosystem leading to short term damage with likelihood for recovery within 2 years to an offshore area less than 100 hectares or less than 2 hectares of a benthic fish spawning ground • Possible but unlikely effect on human health • Possible transboundary effects • Possible contribution to cumulative effects • Issue of limited public concern • May cause nuisance • Possible short term minor loss to private users or public finance
MODU	Mobile Offshore Drilling Unit
MPA	Marine Protected Area
MRCC	Marine Rescue Co-ordination Centres
Natura 2000 sites	Natura 2000 is a network of nature protection areas in the territory of the European Union. It is made up of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) designated respectively under the Habitats Directive and Birds Directive.
Negligible Effect	Change is within scope of existing variability but potentially detectable.
Nephrops	Genus of lobsters comprising a single extant species
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Statement
nm	Nautical Mile (1852m = 1 minute of latitude = 1/60 degree of latitude)
NMVOCs	Non-methane volatile organic compounds
None Foreseen (Effect)	No detectable effects.
NOx	Nitrogen Oxides
NPWS	National Parks and Wildlife Service
NTM	Notice to Mariners
NUI	Normally Unmanned Installation: an installation with minimal facilities which is not permanently crewed and is controlled from a remote location (e.g. other platform or shore)
OBMs	Oil Based Mud
OCNS	Offshore Chemical Notification Scheme
OECD	Organisation for Economic Co-Operation and Development
OGUK	Oil & Gas UK
OSPAR	Oslo and Paris Convention
OWF	Offshore Wind Farm
P&A	Plug and Abandon (wells)
PAD	Petroleum Affairs Division of the Department of Communications, Climate Action and Environment
Pelagic (fish)	Fish which live in the pelagic zone. The pelagic zone is any water in sea or lake which is neither close to the bottom nor near the shore.
PETRONAS	Petroliam Nasional Berhad

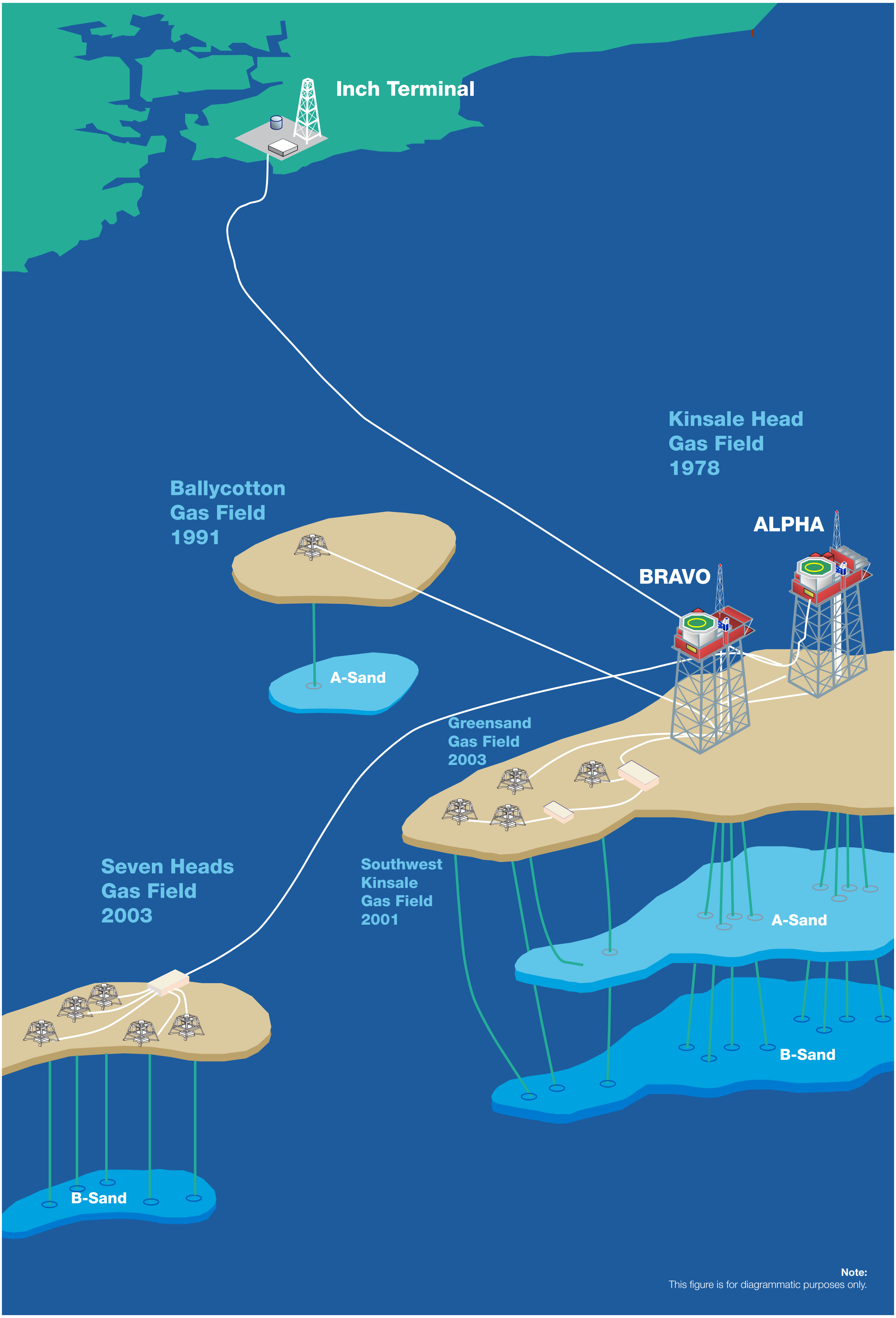
Term	Explanation
PFCs	Perfluorocarbons
Phytoplankton bloom	Plankton consisting of microscopic plants.
Piece Medium	Method of decommissioning the topside structures which involves the separating of the topsides into a number of medium size pieces for removal with a heavy lift vessel and transported to shore for further dismantling. Also known as 'reverse installation'.
Plankton	Small and microscopic organisms drifting or floating in the sea or fresh water
PLEM	Pipeline End Manifold
PLL	Potential Loss of Life
PLONOR	Pose Little or No Risk
PM_{10}	Particulate matter and smaller particulate matter of diameter less than or equal to 10 micrometers
Positive Effect	• Activity may contribute to recovery of habitats • Positive benefits to local, regional or national economy
PSV	Platform supply vessel
PUDAC	Permit to Use or Discharge Added Chemicals
Quaternary	The most recent major geological subdivision, encompassing the past ~2.6 million years up to and including the present day
RAMSAR	Intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
RF	Recovery Factor
Rigless intervention	A well-intervention operation conducted with equipment and support facilities that precludes the requirement for a rig over the wellbore
RMP	Record of Monuments and Places
ROV	Remotely Operated Vehicle: a small, unmanned submersible used for inspection and the carrying out of some activities such as valve manipulation
SAC	Special Area of Conservation: established under the Habitats Directive
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SEA	Strategic Environmental Assessment
Seafastening	Action of fastening/securing cargoes on ship with the aim of preventing them from movement while the ship is in transit
Semi-submersible rig	A floating mobile drilling rig supported on a number of pontoons, and typically anchored to the seabed while on station
Severe Effect	• Change in ecosystem leading to long term (10+ year) damage with poor potential for recovery to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites • Major transboundary effects expected • Major contribution to cumulative effects • Issue of acute public concern • Likely effect on human health • Long term, substantial loss to private users or public finance
SF	Sulphur hexafluoride

Term	Explanation
SFPA	Sea Fisheries Protection Authority
Shears	Cutting instrument in which two blades move past each other
Shelter	Place giving temporary protection from bad weather or danger
Shingle	a mass of small rounded pebbles
Shut-in	to close off a well so that it stops producing
Sidescan sonar	category of sonar system that is used to efficiently create an image of large areas of the sea floor
SO_2	Sulphur Dioxide
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area: established under the Birds Directive
Steel jackets	Structural sections made of tubular steel members, and are usually attached to the seabed using piles
Subcrop	Part of a geological formation that is close to the surface but is not a visible exposing of bedrock
Subsea manifold	Large metal piece of equipment made up of pipes and valves, designed to transfer oil or gas
SWK	South West Kinsale
TEG	Triethylene Glycol
Tidal Channel	Protion of a stream that is affected by ebb and flow of ocean tides, in the case that the subject stream discharges to an ocean, sea or strait
Tie-backs	Link between a satellite field and an existing production facility
TII	Transport Infrastructure Ireland
Topsides	The collective name for the many drilling, processing, accommodation and other modules which when connected together make up the upper section of the platform which rests on the installation jacket
TVD	Total Vertical Depth
UHO	Underwater Heritage Order
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKOOA	UK Offshore Operators Association
UNCLOS	UN Convention on the Law of the Sea
Umbilical	Cable and/or hose which supplies required consumables to an apparatus
VMS	Vessel Monitoring System
WDC	Western Drill Centre
WEEE	Waste Electrical and Electrical Equipment
Wet Gas	Any gas with a small amount of liquid present
WFD	Water Framework Directive

Kinsale Area Decommissioning Project

Section 1

Introduction


Inch Terminal
Kinsale Head
Gas Field
1978
ALPHA
BRAVO
Ballycotton
Gas Field
1991
A-Sand
Greensand
Gas Field
2003
Seven Heads
Gas Field
2003
Southwest
Kinsale
Gas Field
2001
A-Sand
B-Sand
B-Sand
Note:
This figure is for diagrammatic purposes only.

1 Introduction

1.1 Introduction

PSE Kinsale Energy Limited (Kinsale Energy) is preparing for the decommissioning of the Kinsale Area gas fields and facilities, which are coming to the end of their productive life, having been in production since 1978. The Kinsale Area gas fields and facilities are located in the Celtic Sea, between approximately 40 and 70km off the County Cork coast as well as onshore at Inch, Co. Cork (**Figure 1.1**).

1.2 Project Background

Pursuant to section 13 of the Petroleum and Other Minerals Development Act 1960 as amended (1960 Act), two petroleum leases have been granted in respect of the Kinsale Area gas fields and facilities: one for the Kinsale Head Gas Fields dated 7 May 1970 and one for the Seven Heads Gas Field dated 13 November 2002. Pursuant to the terms of these Petroleum Leases, a plan of development was submitted and agreed with the then Minister for Industry and Commerce in respect of Kinsale Head and the then Minister for Communications, Marine and Natural Resources in respect of Seven Heads.

The Kinsale Area gas fields and facilities are coming to the end of their productive life and PSE Kinsale Energy is now preparing Decommissioning Plans setting out the proposals for the decommissioning of the Kinsale Area facilities. Pursuant to Section 13 of the 1960 Act Kinsale Energy intends to submit these Decommissioning Plans as an addendum to the existing plans of development, which were submitted to and agreed with the then Minister under the terms of the Petroleum Leases under section 13 of the 1960 Act. In accordance with section 13A of the 1960 Act, this Environmental Impact Assessment Report (EIAR) has been prepared to accompany the Decommissioning Plans.

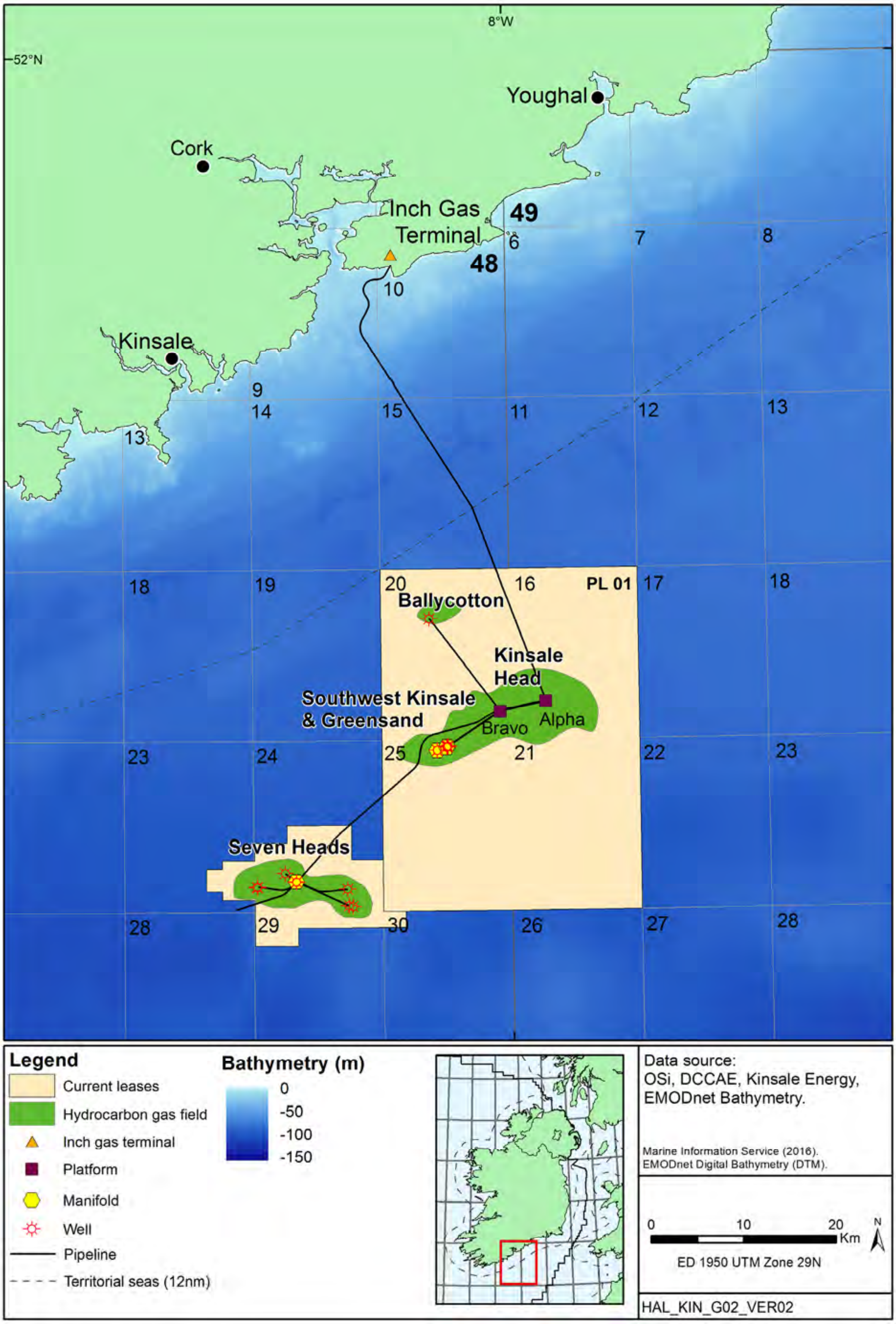
This EIAR provides an assessment of all likely significant environmental impacts of the decommissioning of the Kinsale Area gas fields to enable the Minister for Communications, Climate Action & Environment to undertake an Environmental Impact Assessment to determine whether the proposed decommissioning of the offshore and onshore facilities associated with the Kinsale Area fields would or would not be likely to have significant effects on the environment.

The facilities subject to the Decommissioning Plans are:

- The Kinsale Alpha (KA) and Kinsale Bravo (KB) platforms, which includes both their topsides and jackets,
- All subsea and platform wells including the wellhead structures,
- All infield subsea infrastructure associated with the wider Kinsale Area fields (Kinsale Head, South West Kinsale, Greensand, Ballycotton and Seven Heads), including manifolds,
- All infield subsea pipelines, umbilicals and protection materials, and
- The main export pipeline between KA and the Inch Terminal on the Co. Cork coastline.

The Decommissioning Plans do not include the Kinsale Area onshore gas terminal at Inch, Co. Cork, the decommissioning of which is covered by planning permission granted by Cork County Council (planning reference no. 2929/76). This EIAR, however, assesses the environmental impact of the entirety of the proposed Kinsale Area facilities decommissioning project including the decommissioning of the Inch onshore gas terminal.

Figure 1.1: Location of the Kinsale Area and its related fields and infrastructure



1.3 EIAR

Directive 2011/92/EU[1] on the assessment of the effects of certain public and private projects on the environment sets out the requirements in relation to Environmental Impact Assessments (EIAs). Directive 2014/52/EU[2] amends Directive 2011/92/EU (together the "EIA Directive") and replaces the requirement to prepare an Environmental Impact Statement (EIS) with the requirement to produce an Environmental Impact Report (EIAR). Sections 13A and 13B of the 1960 Act transposed the provisions of Directive 2011/92/EU in relation to the development of petroleum, however, at the time of publication of this EIAR, Directive 2014/52/EU has not been transposed into Irish law, despite the passing of the transposition date.

This EIAR has been prepared in compliance with both Directive 2014/52/EU and Directive 2011/92/EU.

Article 5(2) of the EIA Directive outlines the information to be included in an EIAR:

1. Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report. The information to be provided by the developer shall include at least:

(a) a description of the project comprising information on the site, design, size and other relevant features of the project;

(b) a description of the likely significant effects of the project on the environment;

(c) a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;

(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;

(e) a non-technical summary of the information referred to in points (a) to (d); and

(f) any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected.

Following consultation with the Department of Communications, Climate Action and Environment, Kinsale Energy is submitting an EIAR to accompany the Decommissioning Plans pursuant to section 13A of the 1960 Act.

This EIAR assesses the impact of the entirety of the proposed Kinsale Area facilities decommissioning project and includes an assessment of all likely significant environmental impacts for decommissioning of the onshore gas terminal at Inch.

1.4 Consent Application Process

A two stage consent application process is proposed for both the Kinsale Head Gas Fields and Seven Heads Gas Field Decommissioning Plans. The reasoning for this approach is to reflect project scheduling requirements and to facilitate studies on the potential for any re-use options for the Kinsale Area facilities (see **Section 3.3**). It is anticipated that both staged consent applications, for the Kinsale Head Gas Fields and Seven Heads Gas Field, will be submitted before cessation of production. The scope of work involved in decommissioning the Kinsale Area facilities, covered by each consent application, is outlined as follows:

- **Works covered in consent application 1:**
    - **Facilities preparation**: disconnect and degas process plant and pipelines (Pipelines displaced with seawater, and inhibited seawater in the case of the 24" export pipeline and the 18" Seven Heads pipeline).

[1] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification).
[2] Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.

- **Wells**: plug and abandon all platform and subsea wells and removal of any surface component of these wells, including wellhead structures and platform conductors.
- **Platform topsides**: complete removal in accordance with OSPAR Decision 98/3.
- **Subsea structures**: (e.g. manifolds, wellhead protection structures): full removal in accordance with OSPAR Decision 98/3, including the removal of connecting spool pieces, umbilical jumpers and protection materials.

- **Works covered in consent application 2:**
  - **Platform jackets:** complete removal in accordance with OSPAR Decision 98/3.
  - **Offshore pipelines and umbilicals**: rock cover of freespans and/or remaining exposed sections and remaining *in situ* protection materials.
  - **Export pipeline (offshore and onshore section)**: fill onshore section with grout (if a viable re-use option is not identified) and rock cover of freespans and/or remaining exposed sections in offshore section.

Decommissioning the Inch Terminal will involve full removal and reinstatement to agricultural use, as per the terms of the site planning permission (Cork County Council planning reference 2929/76). As noted above, this scope of work will not be included in the Decommissioning Plan consent applications, but this EIAR assesses the impact of the entirety of the proposed Kinsale Area facilities decommissioning project and includes an assessment of all likely significant environmental impacts for decommissioning of the onshore gas terminal at Inch.

The project to decommission all of the above facilities is hereinafter referenced as the Kinsale Area Decommissioning Project (KADP). This EIAR has been prepared to provide information on the potential environmental impacts of the proposed project and to propose mitigation measures to reduce the residual impacts of the project.

1.5 Environmental Assessment Process

The environmental assessment process has been initiated at an early stage in project planning. Information was collected on the natural environment and other users of the sea relevant to the Kinsale Area, using both desk-based and field-based techniques, including a four week offshore pre-decommissioning environmental survey carried out in May 2017. A range of decommissioning options (alternatives) were identified through a series of engineering and environmental studies. These have formed the environmental assessment process.

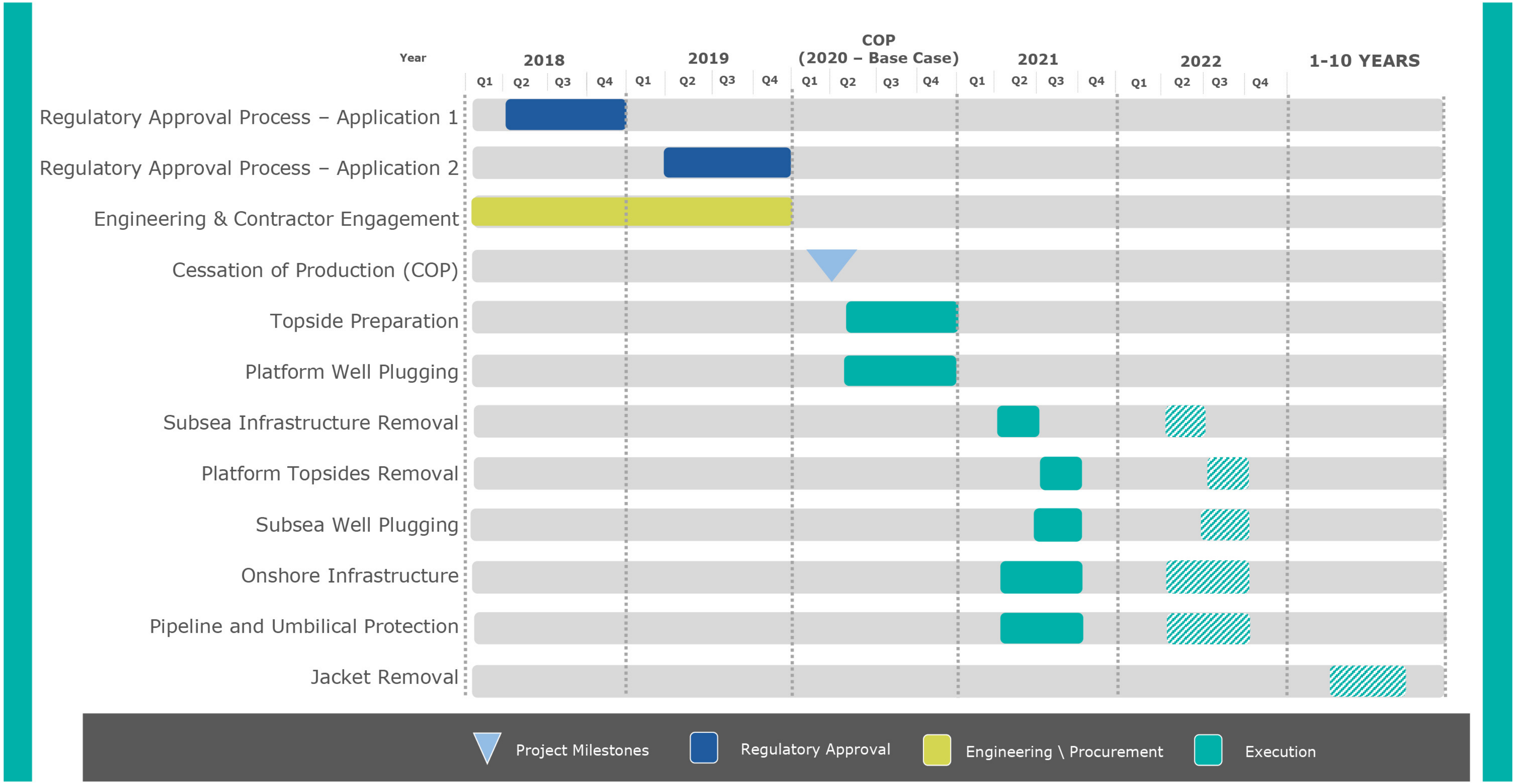
This Environmental Impact Assessment Report (EIAR) has been prepared in compliance with the requirements of the EIA Directive and implementing legislation.

This EIAR has also been prepared in accordance with the guidelines published by the Environmental Protection Agency (EPA) entitled *Guidelines on the information to be contained in Environmental Impact Assessment Reports DRAFT* published August 2017.

1.6 Overall Project Schedule

The final detailed decommissioning project schedule will be developed once all decommissioning contractors and services have been appointed. However, a conservative overall project schedule is detailed in **Figure 1.2** below which has been used for the basis of the environmental assessment.

Figure 1.2: Indicative Project Schedule



Note: The actual timing of Cessation of Production will depend on field economics (gas prices) and facilities performance, currently anticipated between 2020 and 2021. The timing of activities may also vary depending on company strategy and availability of specialised marine vessels.

1.7 Structure of the EIAR

The EIAR comprises nine sections, a non-technical summary and appendices, as summarised in **Table 1.1** below. Figures and tables are interspersed throughout the document.

The EIAR is in accordance with the requirements of Article 3 of the EIA Directive as follows:

'1 'The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:

a. Population and human health;

b. Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC,

c. Land, soil, water, air and climate;

d. Material assets, cultural heritage and the landscape;

e. The interaction between the factors referred to in points (a) to (d).

2 The effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned.'

Effects likely to arise from the activities associated with the KADP (relevant to those factors within the meaning of Article 3(1), above) have been identified on the basis of the nature of the project as described in **Section 3**, considered against the description of the environment as described in **Sections 4** and **5** and the understanding of impact pathways. The process of identifying those environmental factors likely to be significantly affected by the KADP and associated results are documented in **Section 6**. The major sources of potentially significant effect have been grouped against those decommissioning activities identified to likely directly or indirectly affect one or more relevant environmental factors (and interactions between these), and are described and assessed in detail in **Section 7**. **Appendix D** includes a summary description and assessment of those activities/sources of potential effect which are identified in **Section 6** to have potential minor and negligible effects positive or negative effects. Environmental management actions (including proposed mitigation measures) and residual effects for the decommissioning activities are identified throughout the **Section 7** assessment and are summarised in **Section 8**.

Table 1.1: Report section content summaries

Section	Content Summary
Non-Technical Summary	Intended as a comprehensive stand-alone summary of the EIAR, its findings and conclusions.
Glossary of Terms	Abbreviations and technical terms
Section 1: Introduction	Provides a background to the KADP, the scope and structure of the Environmental Impact Assessment Report, progress to date on the environmental assessment process.
Section 2: Legal & Policy Framework	Provides an overview of the legislative and policy context of relevance to the decommissioning of the offshore and onshore Kinsale facilities.
Section 3: Project Description	Describes the facilities of the Kinsale Area of relevance to the KADP and the proposed approach to decommissioning these, including a consideration of alternatives considered.
Section 4: Characteristics of the Marine Environment	Provides an overview of the ecological, physical and socio-economic character of the offshore area of relevance to the KADP.
Section 5: Characteristics of the Terrestrial Environment	Provides an overview of the ecological, physical and socio-economic character of the terrestrial area of relevance to the KADP.

Section	Content Summary
Section 6: Environmental Assessment Methodology and Identification of Potentially Significant Effects	Identifies effects likely to arise from the activities associated with the KADP, as described in Section 3, on the environment, as described in Section 4 and 5. Those activities identified as being sources of potentially significant effects are tabulated and summarised before being described and assessed further in Section 7.
Section 7: Consideration of Potential Significant Effects	Provides a description and assessment, including of cumulative effects, of those activities identified as being sources of potentially significant effects in Section 6.
Section 8: Management of Residual Effects and Conclusion	Summary of legal standards and controls, environmental management commitments which form standard practice, and any proposed mitigation and residual risks as identified in the EIAR.
Section 9: References	A list of all references cited in the text.
Appendix A: International and European Legislation	International and European legislation and conventions forming the legal framework within which the decommissioning of offshore facilities must be undertaken in Ireland.
Appendix B1: Seabed Features & Habitats	An overview of the seabed topography, sediments and fauna from mapping, sampling and photography.
Appendix B2: Archaeological Assessments	List of archaeological assessment records and external pipeline survey records of the Kinsale Area
Appendix C: Characteristics of the Terrestrial Environment – Biodiversity	Further details of the terrestrial biodiversity background to the Kinsale Area
Appendix C2: Characteristics of the Terrestrial Environment - Archaeology	Further details of the terrestrial archaeological and historical background to the Kinsale Area
Appendix D: Positive, minor or negligible issues	Assessment of potential positive, minor or negligible impacts
Appendix E: Comparative Assessment	Report detailing the pipeline, umbilical and protective materials comparative assessment of alternatives
Appendix F: List of Consultees	List of statutory, non-statutory bodies and other interested parties consulted during the preparation of this EIAR.
Appendix G: Consultation material	Copies of the public consultation newspaper advert and an information leaflet prepared for the KADP.

1.8 Consultation

During the preparation of this EIAR, discussions were had and/or correspondence made with statutory and non-statutory bodies and other interested parties in order to ensure that issues relating to the proposed KADP were addressed. The parties consulted include the following:

- Petroleum Affairs Division (PAD) - Department of Communications, Climate Action and Environment
- Commission for Regulation of Utilities (CRU),
- Marine Planning and Foreshore Unit – Department of Housing, Planning and Local Government
- Cork County Council
- National TFS (TransFrontier Shipments) Office, Dublin City Council
- National Parks and Wildlife Service (NPWS)
- National Monuments (NM)
- Ervia
- Gas Networks Ireland (GNI)
- ESB
- Cork Port Operations
- Naval Operations (Cork)
- South West Regional Fisheries Forum
- South East Regional Fisheries Forum
- Birdwatch Ireland
- Irish Whale and Dolphin Group (IWDG)
- Cork City Council
- TDs and local councillors

For a full list of consultees, please refer to **Appendix F.**

A consultation response was received from the Irish Whale and Dolphin Group (IWDG) noting the need to ensure that the decommissioning works will not disturb or degrade the marine habitat for cetaceans.

The proposed decommissioning scope of work and the environmental assessment has had due regard to the concerns regarding the protection of cetaceans and ensures that potential adverse effects are minimised.

A written response was also received from Dublin Airport Authority (DAA) stating that DAA has no observations to make on the KADP.

A meeting was held between Kinsale Energy, Arup/Hartley Anderson and NPWS during the consultation process. At this meeting Kinsale Energy outlined the proposed decommissioning project as well as detailing the methodology being used to assess ecological impacts and impacts on Natura 2000 sites. NPWS requested that the following was also considered:

- To consult with the IWDG for data on cetaceans.
- To consider the Marine Institute's Fisheries Ecosystems Advisory Services (FEAS) survey data, in particular marine mammal and seabird observations made during the Celtic Sea herring and ground fish surveys.

Subsequent to the meeting, useful information was obtained from both the IWDG and FEAS publications which has been reflected in the KADP EIAR.

A response was also received from the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht regarding the underwater archaeology assessment. The environmental assessment has had due regard to underwater archaeology.

In addition to the above, two public consultation sessions were undertaken with invitations made to all key stakeholders and interested members of the local community. The first information session took place at the Clayton Hotel, Cork City On 18th April 2018. An advertisement was placed in the local newspapers and letters sent to key stakeholders. The second public information session was hosted in the Aghada Community Centre, East Cork on 19th April 2018. This was arranged to facilitate residents living in the area of the onshore Inch terminal. Letters of invitation were individually delivered to residents in the Inch area in advance of the information session.

Both public information sessions were well received, with a total attendance of 45 people across both sessions. Feedback received from stakeholders has been positive and will be monitored and managed for the duration of the project.

Copies of the newspaper advert and an information leaflet giving an overview of the project are provided in **Appendix G.**

1.9 List of Contributors

The environmental appraisal was undertaken, and EIAR prepared, by a team of competent experts on behalf of Kinsale Energy.

The compilation and editing of the document was supervised by Sheila O'Sullivan. Sheila holds a BEng in Civil and Environmental Engineering and is a chartered member of Engineers Ireland. She has worked full time as a consultant engineer for over 11 years, in the Designer and Project Manager role for numerous major infrastructure projects.

The following experts have undertaken the environmental appraisal and prepared the EIAR:

Name	Qualification	Relevant Experience	Contribution to EIAR
Hartley Anderson Limited – Offshore/marine environmental consultants			
Dr JP Hartley	BSc (Hons) Zoology with Marine Zoology, PhD	Dr JP Hartley is a marine environmental consultant scientist with over 35 years of environmental assessment (EIA, SEA, HRA), applied marine research and environmental management experience in Ireland, the UK and internationally.	Section 4, 6, 7, 8, Appendix B, Appendix D - Characteristics of marine

Name	Qualification	Relevant Experience	Contribution to EIAR
		He is technical Director of the independent environmental consultancy Hartley Anderson Ltd, which he co-founded. He is joint project director for the UK Offshore Energy Strategic Environmental Assessment programme from 1999 to date. He is a regular contributor to university Masters programmes. He has served on a range of marine scientific research and management steering groups for Renewables, Aggregate, Climate Change and Environmental Monitoring.	environment and appraisal; Review of entire EIAR.
Dr DM Borthwick	MA (Hons) Geography, PhD	Dr DM Borthwick has over ten years of experience in environmental assessment for offshore energy involving work at the strategic (SEA) and project (EIA) levels, including screening and Appropriate Assessment under the Habitats Directive. He has led or participated in Environmental Impact Assessments for offshore projects (oil and gas and carbon dioxide transport and storage) in the North Sea. He has technical expertise in geology, substrates and coastal processes, seascape, marine archaeology and climate, Geographic Information Systems (GIS) marine spatial data and analysis.	Section 3, 4, 6, 7, 8, Appendix D – project description, Characteristics of marine environment and appraisal
Dr RJ Trueman	BSc (Hons) Environmental Biology, PhD	Dr RJ Trueman has over 15 years of relevant experience, worked on EIAs for offshore projects in the North and Irish Seas, for oil and gas production and carbon dioxide transport and storage. He has also been involved in Strategic Environmental Assessment (SEA) for energy related plans and programmes in the marine and terrestrial environment, and related Appropriate Assessments.	Section 4, 7, Appendix D - Characteristics of marine environment and appraisal
Dr F Marubini	BSc (Hons.) Biology, PhD	Dr F Marubinin has two decades of experience in marine ecology research and its application to sustainable environmental management. He held several advisory roles to the UK Government including on marine biodiversity, marine species, fisheries policy, marine mammals, marine turtles and coral reef ecology within UK waters and internationally. He is a technical expert in noise and marine mammals for strategic and project level environmental assessments of offshore energy projects.	Section 4, 7 - Characteristics of marine environment and appraisal
Mr DA Vale	BSc (Hons.) Biology, MSc Marine and Fisheries Science	Mr DA Vale has ten years of experience in SEA and EIA for offshore energy. He has been involved in project level EIA and related activity permitting for a range of marine energy projects and for a number of oil and gas operators in the North Sea. He is a technical expert in fish and fisheries for strategic and project level environmental assessments of offshore energy projects.	Section 4 - characteristic of marine environment
Mrs SK Hartley	BSc (Special Hons.) Applied Zoology, PGCE	Mrs SK Hartley is an environmental consultant with more than 25 years of environmental practice and project management in Ireland the UK and internationally. She is Managing Director of the independent environmental consultancy Hartley Anderson Ltd, which she co-founded. She is joint project director for the UK Offshore Energy Strategic Environmental Assessment programme from 1999 to date. Establishment of assessment criteria and documented procedures, stakeholder engagement, technical input on policy and legislation, technical challenge and quality review, interpretation and communication of technical issues to lay audiences.	NTS, Section 6, 7, 8 – Marine environment appraisal
Dr AM Brown	BSc Marine Geography, MRes Marine and	Dr AM Brown is a marine scientist with a broad knowledge-base and strong research background, including specialisations in environmental assessment, GIS, offshore energy, marine mammals and fisheries. He has worked on EIA, SEA, Habitat Regulation	Section 7, Appendix D – Marine

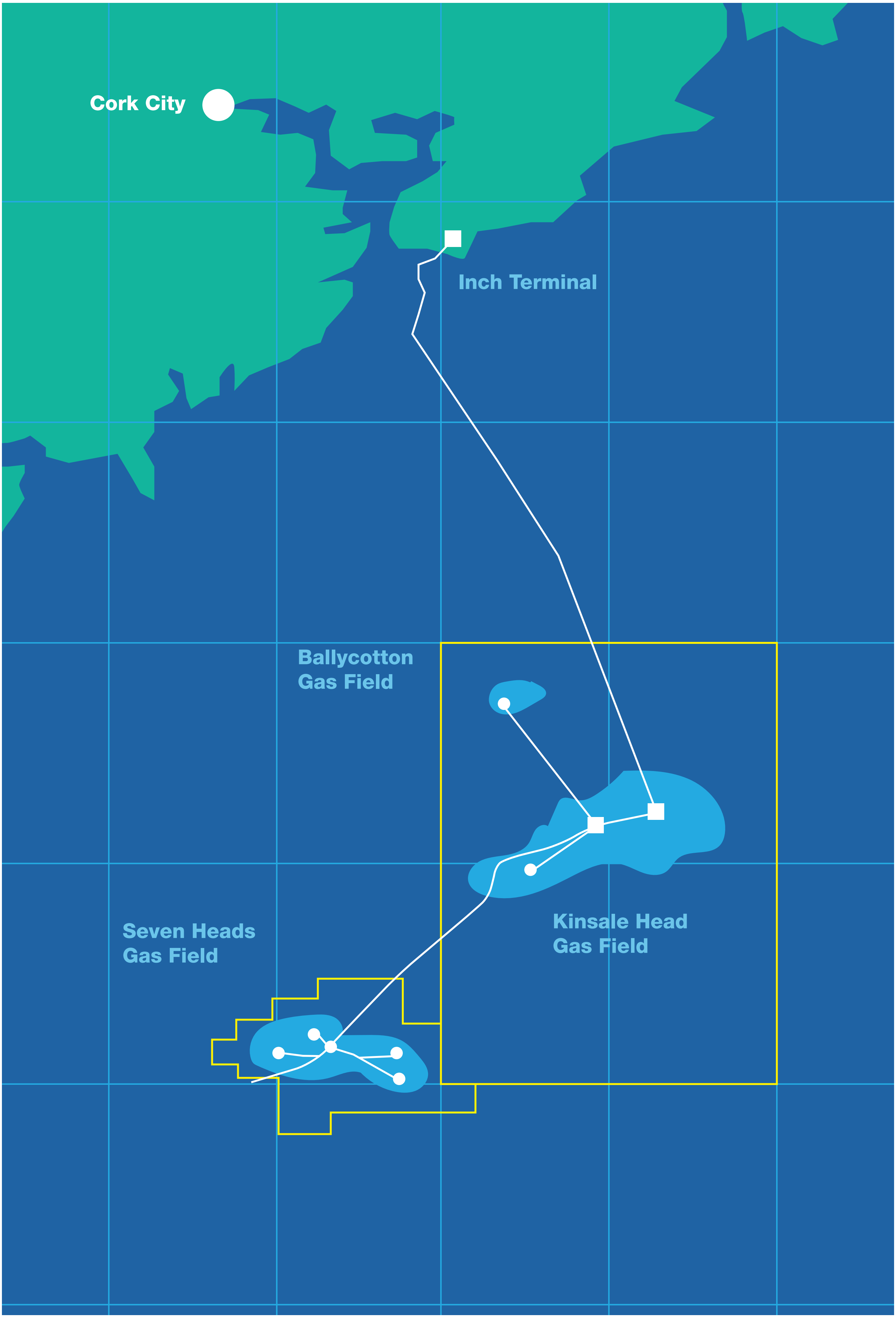
Name	Qualification	Relevant Experience	Contribution to EIAR
	Fisheries Science, PhD	Assessment and conducted noise assessments for several projects.	environment appraisal
Dr GM Bishop	BSc (Hons.) Biological Sciences, PhD	Dr GM Bishop has over 30 years marine research and environmental management experience and has been continuously involved in marine environmental management and environmental assessments (as team member, team coordinator or client), primarily for the offshore energy industry covering a wide range of activities from exploration drilling in environmentally sensitive waters, oil and gas field platform and subsea developments and subsea infrastructure decommissioning.	Section 4 - Characteristics of marine environment
Mr KM Carey	BSc Zoology, MSc Applied Geospatial Information Systems	KM Carey has five years Geographic Information System (GIS) applied experience in map production and data management for a range of marine environmental assessments, including national scale SEA and project specific EIA and permit applications.	Maps used in Sections 1, 3, 4 and Appendix B
Arup – Onshore/terrestrial environmental consultants			
Clodagh O'Donovan	BE, MEngSc, CEng, FIEI, FConsEI, MCIWEM, C.WEM	Clodagh O'Donovan is a chartered civil engineer, with over 20 years' experience in the consultancy business in Ireland. As Environmental Team Leader for Arup Ireland, Clodagh has direct responsibility for both the team and the projects that it undertakes. Over her career, Clodagh has led the preparation of EIA and AA documentation for a wide range of projects, including in particular, the energy sector, where she has specialist knowledge.	Review of EIAR
Ria Lyden	BE, MBA, CEng, FIEI, MIStructE	Ria Lyden has a Bachelor of Engineering degree in civil engineering and a Master of Business Administration degree. She is a fellow of the Institution of Engineers of Ireland and has over 20 years' experience as an environmental consultant. Ria has prepared or supervised the preparation of sixty environmental impact statements for a wide range of industrial, commercial, energy and infrastructure projects.	Section 2 - Legal and Policy Framework
Olivia Holmes	BSc, MSc, CEng MIEI, MCIWEM, C.WEM	Olivia Holmes has eighteen years' experience in Environmental Engineering focussing primarily on Appropriate Assessment (AA) and Environmental Impact Assessment (EIA) and planning and waste management. She has led the preparation of a number of large-scale multi-disciplinary EIA projects and planning and other consent applications.	Section 5, 6, 7, Appendix D - Characteristics of terrestrial environment and appraisal
Dixon Brosnan Environmental Consultants – Onshore ecological consultants			
Carl Dixon	BSc (Applied Ecology), MSc (Ecological Monitoring)	Carl Dixon has 18 years experience in environmental and ecological consultancy. During that time he has worked on a range of small and large scale infrastructural projects including roads, gas pipelines, quarries, energy projects, wind farms and quarries. He has particular expertise in preparing Appropriate Assessment (AA) Screening Reports, Natura Impact Statements (NIS) and Ecological Impact Assessments and coordinating detailed ecological assessments for complex projects.	Section 5 - Onshore biodiversity

PSE Kinsale Energy Limited, the project client also contributed to the EIAR.

Kinsale Area Decommissioning Project

Section 2

Legal and Policy Framework


Cork City
Inch Terminal
Ballycotton
Gas Field
Seven Heads
Gas Field
Kinsale Head
Gas Field

2 Legal and Policy Framework

2.1 Legislative Framework

2.1.1 Introduction

This section sets out the relevant National and European legislation in relation to the statutory consent application process, particularly in respect of the EIA process.

A key international convention, relevant to the KADP (the OSPAR Convention) is also outlined in Section 2.1.4, with other relevant European legislation and international conventions outlined in Appendix A.

2.1.2 Relevant National Legislation

Petroleum and Other Minerals Development Act, 1960, as amended

The Petroleum and Other Minerals Development Act, no 7 of 1960, as amended, ("1960 Act") regulates offshore petroleum (including gas) exploration and production activities in Ireland. The Minister for Communications, Climate Action and Environment is the competent authority under the 1960 Act.

A petroleum lease is the authorisation, issued under Section 13 of the1960 Act, to allow the exploitation of a commercial petroleum discovery. The Kinsale Area facilities operate under two petroleum leases.

- Petroleum Lease No 1 (OPL 1 - 1970): Kinsale Head, Southwest Kinsale and Ballycotton Gas Fields, and
- Seven Heads Petroleum Lease (2002): Seven Heads Gas Field.

The 1992 Licensing Terms address the surrender of a petroleum lease in Section 33[3]. The abandonment of wells is covered in Section 57[4]. The abandonment of fixed facilities is covered in Section 71[5].

Under Section 28 of the 1992 Licensing Terms, Kinsale Energy must apply for the Minister's approval under Section 13/13A of the 1960 Act, as amended, for the KADP.

The requirements of the 1992 Licensing Terms can be summarised as follows:

- The Minister must be given at least 12 months' notice of the intention to determine the petroleum leases,
- An abandonment plan must be submitted in writing to the Minister,
- The plan must contain information on the abandonment and removal of any facilities,
- The plan must contain technical, economic and financial information, as will enable the Minister to evaluate the proposals fully and to assess their economic, social, safety and environmental implications.

Section 13A of the 1960 Act, as amended, requires an applicant, submitting a plan to the Minister for approval, to submit an environmental impact statement (EIS) (or EIAR under the latest EU Directive) and requires the Minister to undertake an environmental impact assessment (EIA) in certain circumstances. Further detail in this regard is set out in Section 2.2 below.

Continental Shelf Act

The Continental Shelf Acts, 1968 to 1995 ("1968 Act, as amended") is the legislative regime applying to the Continental Shelf. The Continental Shelf is the area of sea and seabed between the 12 nautical mile limit and the 200 nautical mile limit.

---

[3] DMNR (1992), page 28.
[4] DMNR (1992), page 41.
[5] DMNR (1992), page 38.

Section 5 of the 1968 Act, as amended, imposes the requirement to obtain consent from the Minister to "*construct, alter or improve any structure or works in or remove any object or material from a designated area."*

The Continental Shelf Designated Areas Order 1993 SI 92 of 1993, Section 2, defines the "*designated area*" as the "*The area set out in paragraph 1 of the Schedule to this Order is hereby designated as an area within which the rights of the State outside the territorial seas over the sea bed and subsoil for the purpose of exploring such sea bed and subsoil and exploiting their natural resources are exercisable*." The Schedule provides a list of points specified by latitude and longitude to define the Continental Shelf.

The Minister can require the applicant for consent under the Continental Shelf Act, as amended, to provide plans and particulars and may require the applicant to publish a notice of the application[6]. The Minister can refuse consent or can attach conditions to the consent, either at the time of giving consent or any time thereafter[7]. The Minister can hold an inquiry into granting consent[8].

The Minister for Communications, Climate Action and Environment is the competent authority under the Continental Shelf Act, as amended.

Apart from the Inch Terminal and the parts of the export pipeline on land and on the Foreshore, the Kinsale Area facilities are located on the Continental Shelf. The KADP will involve altering or removing objects or material from the seabed of the Continental Shelf. Consequently, consent under the Continental Shelf Act will be required for the KADP.

Foreshore Acts

The Foreshore Acts 1933 to 2014 ("Foreshore Acts"), regulate development on the foreshore.

The Foreshore is defined as the land and seabed between the high water of ordinary or medium tides (shown as 'HWM' on Ordnance Survey Maps) and the outer limit of the foreshore. The outer limit of the foreshore is taken to be coterminous with the seaward limit of the territorial seas of the state. This is typically taken to mean the twelve-mile limit. Twelve nautical miles is approximately 22.24 kilometres. The Foreshore Acts require that a lease or licence must be obtained from the Department of Housing, Planning, Community and Local Government for undertaking any works or placing structures or material on, or for the occupation of, or removal of material from, State-owned foreshore. The Marine Planning and Foreshore Section of the Department of Housing, Planning, and Local Government is the competent authority under the Foreshore Acts.

Part of the Kinsale Area export pipeline is located on the Foreshore. A Foreshore Licence MS 51/8/584 was granted in 1978 for the part of the Kinsale Area export pipeline on the Foreshore, as the Foreshore was defined in 1978. In 1978 the Foreshore extended from the high water mark to a 3 mile limit, rather than the current 12 mile limit. The licence MS 51/8/584was amended in 1997 to take account of the 12 mile limit. The 1997 amendment provided for the licence to be surrendered by notification to the Minister and payment of a fee. A new Foreshore Licence would be required for any additional works, to be undertaken on the Foreshore as part of the KADP.

[6] 1968 Act, as amended, Section 5(3)
[7] 1968 Act, as amended, Section 5(4), 5(5) and 5(6)
[8] 1968 Act, as amended, Section 5(7) and 5(8)

2.1.3 Relevant European Legislation

Environmental Impact Assessment Directive 2011/92/EU amended by Directive 2014/52/EU

A directive requiring the assessment of the impacts of certain projects on the environment (EIA) has been in force since 1985, following the adoption of Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment. The EIA Directive of 1985 was amended three times by Directive 97/11/EC, Directive 2003/35/EC and 2009/31/EC. It was ultimately codified and repealed by Directive 2011/92/EU, EU (2011). Directive 2011/97/EU was amended in 2014 by Directive 2014/52/EU, EU (2014a).

The Directive applies to a wide range of public and private projects, which are defined in Annex I and II. For the projects listed in Annex I of the Directive, EIA is mandatory. For projects listed in Annex II, Member States have the option of requiring EIA for projects, which meet defined thresholds or criteria, or for projects subject to a case by case examination. Member State competent authorities are required to consider the criteria laid down in Annex III as part of this process.

The Directive is implemented in Ireland through a number of measures, as discussed in more detail in **Section 2.2** below.

Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC and 2009/147/EC)

The Habitats Directive, EEC (1992), was adopted in 1992. The Habitats Directive provides for the conservation of biodiversity in Europe. The main aim of the Habitats Directive is to achieve and maintain favourable conservation status for habitats and species within the Natura 2000 network.

The Birds Directive, EEC (1979) and EC (2009), seeks to protect, manage and regulate all bird species naturally living in the wild, including their eggs, nests and habitats, and to regulate the exploitation of these species. Special measures are to be implemented for the protection of the habitats of certain bird species, identified in the Birds Directive, and for migratory species. The Birds Directive establishes a network of Special Protection Areas (SPAs) to protect migratory species and species, which are rare, vulnerable, in danger of extinction, or otherwise require special attention.

Special Areas of Conservation (SACs), Candidate Special Areas of Conservation (cSACs) and Special Protection Areas (SPAs) form a pan-European network of protected sites known as Natura 2000 sites. The Habitats Directive sets out a unified system for the protection and management of SACs and SPAs. Article 6(3) and 6(4) of the Directive set out key elements of the system of protection, including the requirement for Appropriate Assessment of plans and projects as follows:

- Article 6(3): *“Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.”*
- Article 6 (4): *“If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the* overall coherence of Natura 2000 is protected. It shall inform the Commission of the *compensatory measures adopted”.*

The Habitats Directive and the Birds Directive are enacted into Irish law by the *Wildlife Acts 1976 – 2010*, the *European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), (as amended),* and *the Planning and Development Acts 2000 to 2017*. These pieces of national legislation provide the legislative framework for the establishment of Natura 2000 sites in Ireland.

The KADP will be subject to the requirements of the Habitats and Birds Directives. Kinsale Energy has prepared a screening report for Appropriate Assessment in respect of the KADP (reference, 253993-00-REP-14). This screening report provides the information required to allow the competent authority to conclude, on the basis of the best scientific knowledge and in view of the conservation objectives of the relevant SACs, cSACs and SPAs, that the KADP, individually or in combination with other plans or projects, is not likely to have a significant effect on any SAC, cSAC or SPA.

Article 12 of the Habitats Directive is aimed at the establishment and implementation of a strict protection regime for species listed in Annex IV within the whole territory of the Member States (i.e. in locations outside protected areas as well as inside their boundaries).

Article 12 of the Directive states:

"1. Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) in their natural range, prohibiting:

(a) all forms of deliberate capture or killing of specimens of these species in the wild;

(b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration;

(c) deliberate destruction or taking of eggs from the wild;

(d) deterioration or destruction of breeding sites or resting places.

2. For these species, Member States shall prohibit the keeping, transport and sale or exchange, and offering for sale or exchange, of specimens taken from the wild, except for those taken legally before this Directive is implemented.

3. The prohibition referred to in paragraph 1 (a) and (b) and paragraph 2 shall apply to all stages of life of the animals to which this Article applies.

4. Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned."

Under Article 12 of the Habitats Directive, all species listed in Annex IV are afforded strict protection, prohibiting deliberate capture, disturbance and destruction of all life stages and deterioration or destruction of breeding sites or resting places. In addition, species listed in Annex II are afforded the same protection, even when not present in numbers which result in the designation of a Natura 2000 site.

The Report for the Purposes of Appropriate Assessment Screening and Article 12 Assessment Screening (reference, 253993-00-REP-14) also provides the information required to allow the competent authority to determine whether or not the proposed decommissioning works will result in the deliberate disturbance or destruction of any of the species listed in Annex IV (a) of the Habitats Directive that may be present in the study area. The assessment takes into account the status and sensitivities of relevant Annex IV species to potential impacts associated with decommissioning activities.

2.1.4 Relevant International Conventions

The OSPAR Convention, OSPAR (1992), is the current legislative instrument regulating international cooperation on environmental protection in the North-East Atlantic. It replaces the 1972 Oslo Convention on dumping waste at sea and the 1974 Paris Convention on land-based sources of marine pollution. Ireland has ratified the Convention.

The Convention applies to the internal waters and the territorial seas of the Contracting Parties, the sea beyond and adjacent to the territorial sea under the jurisdiction of the coastal State to the extent recognised by international law, and to the high seas, including the bed of all those waters and its subsoil, situated within specified limits of the Atlantic and Arctic Oceans.

Under paragraph 2 of the OSPAR Decision 98/3, the dumping, and leaving wholly or partly in place, of disused offshore installations is prohibited within the OSPAR maritime area. The conditions that would allow for a derogation from these Decision 98/3 requirements do not apply to the Kinsale Area facilities.

See **Appendix A** for further information on the OSPAR Convention and other international conventions relevant to the KADP.

2.1.5 Summary of key relevant National and European legislation

Table 2.1 below summarises the relevant key National, European and International legislation and the associated consents and requirements for decommissioning of infrastructure relevant to the KADP.

Table 2.1: Key National, European and International legislation relevant to the KADP

Relevant Legislation	Consents / requirements for Decommissioning
Section 13 of The Petroleum & Other Minerals Development Act 1960	Application will be made pursuant to Section 13 for decommissioning.
Section 5 of The Continental Shelf Act 1968	Application for the consent to "alter/construct/improve" works or structure in 'or remove any object or material from' the Continental Shelf designated area.
Section 3 of the Petroleum (Exploration and Extraction) Safety Act 2010	Part IIA of the Electricity Regulation Act 1999 - Section 13D renders the decommissioning of petroleum infrastructure and the abandoning of any well as a "designated petroleum activity". Section 13E requires a safety permit to carry out designated petroleum activity. Kinsale Energy's current safety permit does not include decommissioning. Approval of Safety Case required for decommissioning.
Energy (Miscellaneous Provisions) Act 1995, Section 17	The Minister (for Transport, Energy and Communications) shall not approve abandonment without consent of the Minister for the Marine.
European Communities (Birds and Natural Habitats) Regulations 2011 – 2015	Screening to be undertaken by competent authority to determine whether actions will affect European sites and species. Screening appraisal report to be submitted to competent authority.
	Transposes Habitats Directive (92/43/EEC) and Birds Directive (2009/147/EC) into Irish law.
Environmental Impact Assessment Directive 2011/92/EU amended by Directive 2014/52/EU	EIA Screening, and EIA if required, to be undertaken by competent authority.
Decisions 98/3, OSPAR (1998)	The dumping, and leaving wholly or partly in place, of disused offshore installations is prohibited within the OSPAR maritime area.

2.2 Legislative basis for EIA and EIAR

As detailed in **Section 2.1.2** above, pursuant to Section 13A of the Petroleum and other Minerals Development Act 1960 (as amended) ("1960 Act"), Kinsale Energy is seeking the consent of the Minister for Communications, Climate Action and Environment for the decommissioning of the Kinsale Area gas fields and facilities (Kinsale Area Decommissioning Project - KADP). Pursuant to Section 13B of the 1960 Act, the Minister will consider whether the proposed plan of decommissioning would be likely to have significant effects on the environment.

Based on information submitted on the characteristics of the project and its likely significant effects on the environment, the Minister determined that having regard to Annex III of the EIA Directive and given the potential for significant adverse environmental effects by virtue, inter alia , of the nature, size and location of the project, an Environmental Impact Assessment Report would be required to support the consent applications.

2.3 EIAR Guidance and Methodology

In preparing this EIAR, in addition to the requirements of the Directive, consideration was given to the guidance provided in the following documents:

- Environmental Impact Assessment of Projects Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU), EU 2017a
- Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU), EU 2017b
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of the Environment, Community and Local Government (DoECLG), 2013).
- Guidelines on the information to be contained in Environmental Impact Assessment Reports draft August 2017 (EPA, 2017a).
- Advice Notes for Preparing Environmental Impact Statements draft September 2015 (EPA, 2015b)

2.4 Policy Framework – Kinsale Energy Environmental Management System Overview

In addition to the legislative basis set out above, and adhering to the OSPAR Convention requirement to protect the maritime area against the adverse effects of human activities, Kinsale Energy (as a wholly owned subsidiary of PETRONAS) operates a Health, Safety and Environment Management System (HSEMS) based on the requirements of internationally accepted standards for Environmental Management (ISO14001) and for Occupational Health and Safety (OHSAS18001).

Kinsale Energy's Health, Environment and Safety (HES) policy commits the company to take all reasonable and practical steps to prevent and eliminate risks of injuries, occupational illness, damage to property and the conservation of the environment. This policy is applicable to Kinsale Energy's activities and those of its contractors. All contractors must adhere to all Kinsale Energy HES policies and procedures.

The Kinsale Energy HSEMS is structured around 8 elements which are summarised below:

Leadership and Commitment: addresses top-down commitment and company culture necessary for success in the systematic management of HES.

Policy & Strategic Objectives: a written HES Policy is required as a minimum. In setting strategic objectives and developing a HES Plan, management is required to consider the overall risk levels of its business activities taking into consideration the legal requirements, technological change, emerging issues and key stakeholders expectations.

Organisation, Responsibilities, Resources, Standards & Documents: addresses the organisation of people within Kinsale Energy, and the resources and documentation for sound and sustainable HES performance. Requires that the organisation and resources are adequate for its purpose, and that responsibilities for safety critical positions at all levels are clearly described, communicated and understood. It requires that staff based offshore are developed following structured competency assessment and training systems.

Hazards and Effects Management Process (HEMP): describes the identification of hazards and evaluation of HES risks for all activities, products and services, and the development of control and recovery measures to reduce HES risks to as low as reasonably practicable (ALARP).

Planning and Procedures: addresses asset integrity, procedures and work instructions, work permit system, management of change, contingency and emergency planning expectations, legislation compliance, process safety management, purchasing and procurement.

Implementation and Monitoring: addresses how activities are performed and monitored, and how corrective action is taken when necessary.

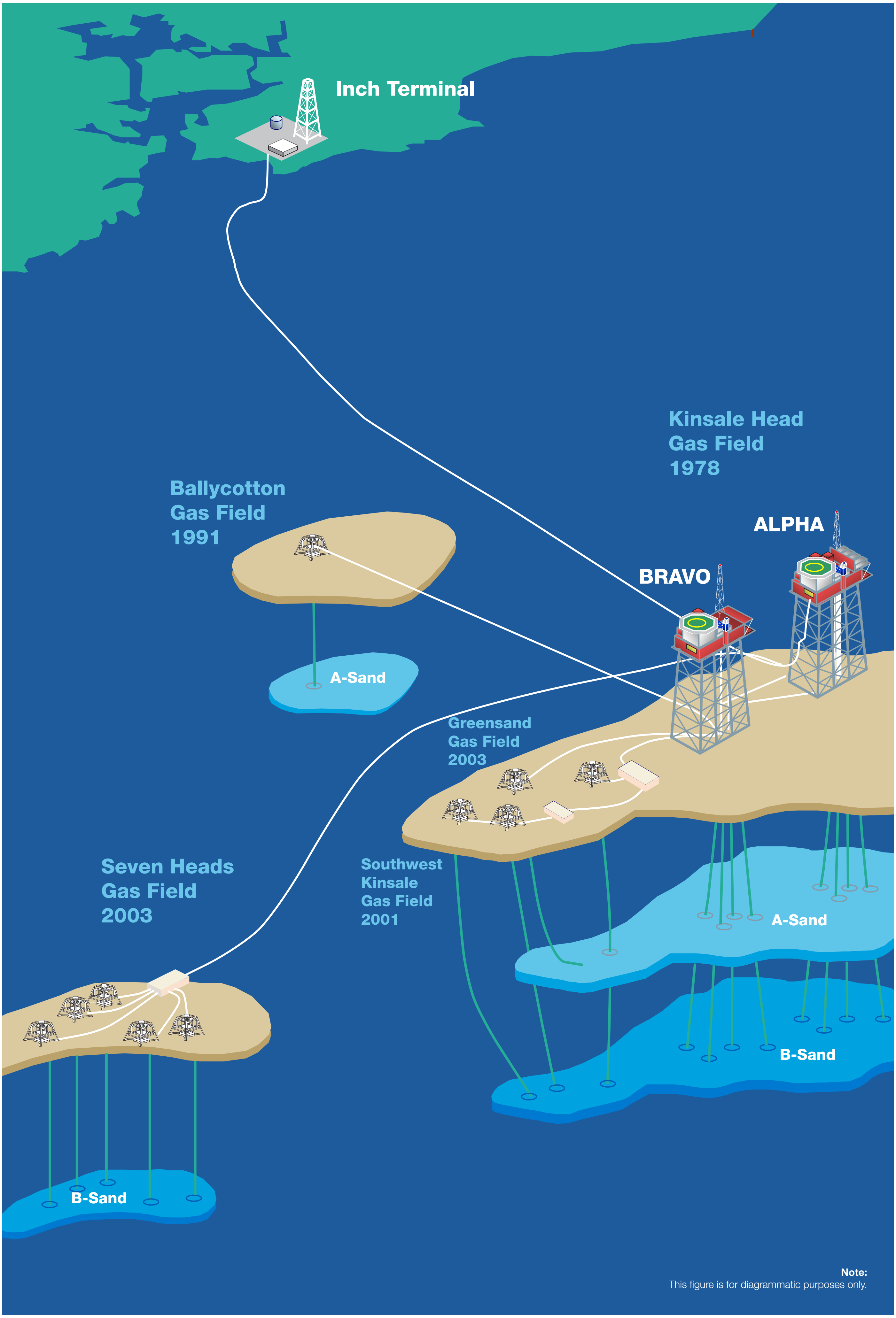
Audits: puts in place a programme to review and verify the effectiveness of the management system. It includes audits by independent auditors of processes or facilities.

Management Review: a formal process for management to review the effectiveness and suitability of the Management System in managing HES risks and ensuring continual improvements in HES performance. A management review occurs every 2 months at the HES Management Committee meeting.

Kinsale Area Decommissioning Project

Section 3

Project Description



Note:
This figure is for diagrammatic purposes only.

3 Project Description

3.1 Introduction

This section provides an inventory and description of the Kinsale Area infrastructure and the decommissioning options identified, including consideration of alternatives discounted. This information is used along with the description of the environment in **Section 4** and **Section 5** as the basis for the assessment in **Sections 6** and **Section 7**. See **Glossary** for abbreviations and technical terms.

3.1.1 History of the Kinsale Area

The Kinsale Head Gas Field was discovered in 1971 and was brought on-stream in 1978 under a Plan of Development approved by the then Dept. of Industry and Commerce. The Kinsale Head field was developed with two fixed steel platforms (Kinsale Alpha and Kinsale Bravo) with gas exported by pipeline from Kinsale Alpha to the onshore Inch Terminal. The discovery of the field was the basis for the development of the natural gas industry in Ireland and Kinsale Head was Ireland's only source of gas until the installation of an interconnector pipeline from Scotland in 1993.

Following the Kinsale Head discovery, there was extensive exploration of the Celtic Sea with ~90 wells drilled, the last was the Midleton well in Block 49/11 drilled by Kinsale Energy in 2015. However, despite the intensive exploration effort, no other large fields have been discovered, although a number of smaller gas fields have been commercially exploited as subsea tie-backs to Kinsale Head.

The development of the smaller gas fields, which would not have been economic on a stand-alone basis, and technical modifications to the Kinsale Head facilities (e.g. installation of compression), have prolonged the life of the main field which is currently expected to remain viable for a further 2-3 years even at current low production rates and pressures.

The Kinsale Area fields, infrastructure and production status are summarised in **Table 3.1**.

Table 3.1: Summary of Development History for the Kinsale Area Fields

Lease	Field	No. of Wells	Facilities	Date/First Production	Status (2018)
OPL-01	Kinsale Head	14	Kinsale Alpha (Manned Platform with production, drilling & accommodation) 7 x Platform Wells	1978	Producing
			Compression added	1992	
			Kinsale Bravo (Manned Platform with production, drilling & accommodation) 7 x Platform Wells	1979	Producing (1 Well Shut-In)
			Compression added	1993	
			Kinsale Bravo Converted to Normally Unmanned Installation	2001	
	Ballycotton	1	1 x Subsea Well	1991	Shut-In
	Southwest Kinsale	3	3 x Subsea Wells	1999 – 2001	Producing
	Greensand	1	1 x Subsea Well	2003	Producing
Seven Heads	Seven Heads	5	1 x Subsea Manifold 5 x Subsea Wells	2003	Producing (1 Well Shut-In)

Notes:

*Associated pipeline and umbilical details are found in **Table 3.4** and **Table 3.5**.*

In 2001 Southwest Kinsale was redeveloped to enable gas from the adjacent offshore gas fields to be stored in the reservoir. In 2006, further modifications were made to convert the field into an offshore storage facility for gas from the onshore network. The last of the storage gas was withdrawn from Southwest Kinsale reservoir in March 2017 and the field currently operates as a gas production reservoir only.

In addition to those wells numbered above, there are four previously abandoned exploration wells which require removal of their redundant wellheads as part of the KADP.

3.1.2 Rationale for Decommissioning

The Kinsale Area gas fields have been in production since 1978 (Kinsale Head) and it is expected that the economic extraction of gas will no longer be viable by approximately 2020/2021, whereupon the fields will be shut-in, the wells plugged and abandoned and the associated facilities decommissioned as described below.

The main producing reservoirs have been drawn down to extremely low pressures and are expected to be in the order of 50 - 100 psia at cessation of production (CoP), such that there are no further cost-effective production technology modifications that can be applied to extend field life. The offshore production wells and Kinsale Alpha export compressor pressures are also approaching a technical limit (offshore production wells bottom-hole pressures (sub-hydrostatic) and the Kinsale Alpha export compressor suction pressure (less than 5psig)), for offshore natural gas fields operation.

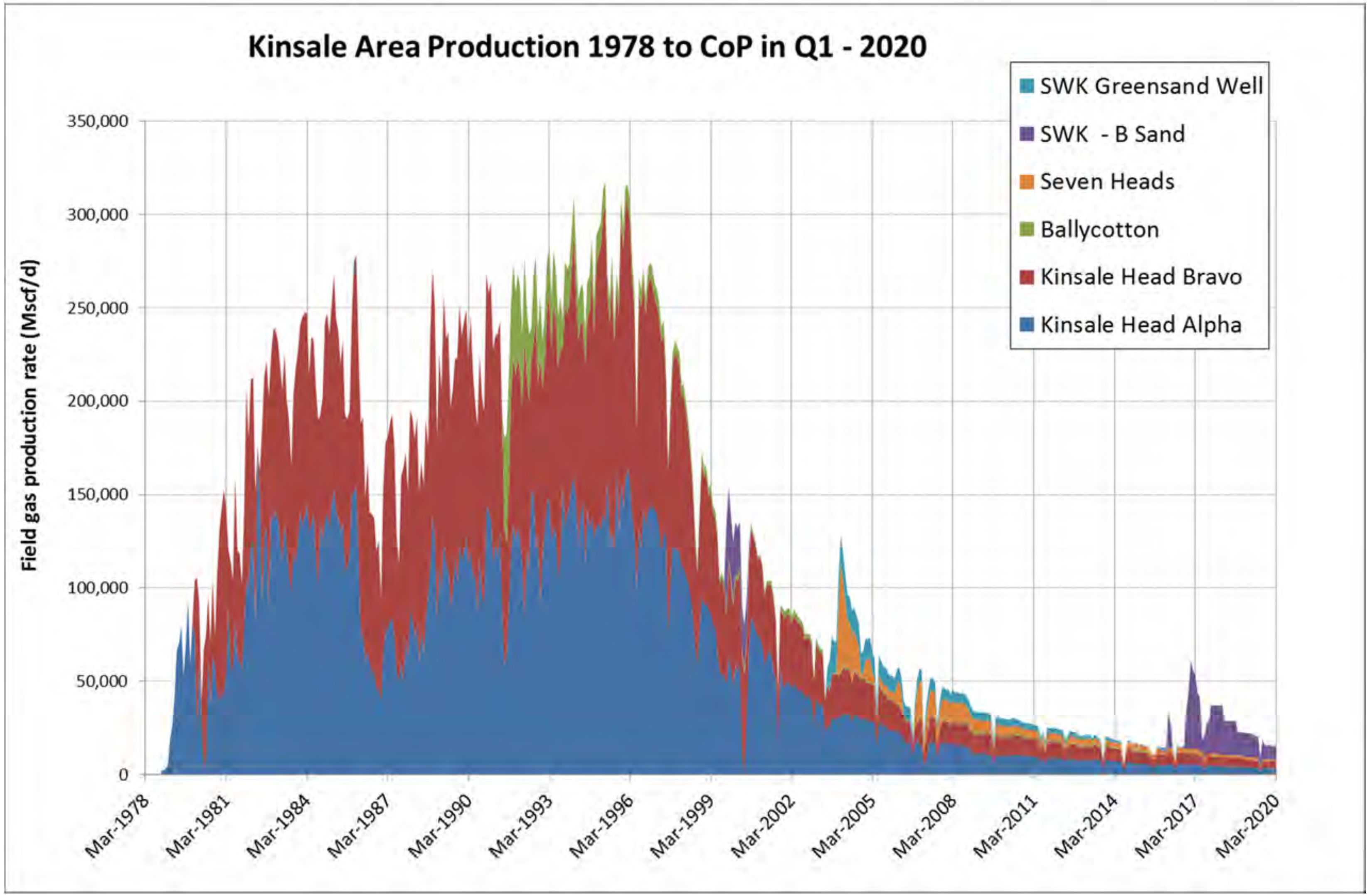
Production History

The original Kinsale Head Field Development Plan envisaged a 20 year production profile with a total ultimate recovery of 0.915 trillion cubic feet (TCF) of gas, corresponding to a Recovery Factor (RF) of ~70%.

In fact, the Kinsale Head Gas Field has produced ~1.76TCF of gas since start up to the end of 2017 and is ultimately expected to produce ~1.77TCF or approx. 96% of the estimated Gas in Place in the reservoir. High recovery factors are also expected for the other fields which have been developed via the Kinsale Head facilities.

Peak production levels were achieved in the mid-1990's and since then gas production levels have decreased significantly – with current (2018) daily average rates being less than 5% of peak rates. **Figure 3.1** is a graph showing daily average gas production from the fields to date. Field and facility performance have been carefully and pro-actively managed to maximise and extend economic production. However, given the continuing declines in gas rates, no economically sustainable investment program or technical improvements can be implemented to further extend economic production.

Figure 3.1: Kinsale Area gas fields – production rates



3.2 Kinsale Area Facilities

The Kinsale Area facilities to be decommissioned are detailed in **Section 3.2.1** to **Section 3.2.6** and summarised in the tables shown in **Section 3.2.7**.The facilities are described under the following headings:

- Kinsale Head Development
- Ballycotton Subsea Development
- Southwest Kinsale and Greensand Subsea Developments
- Seven Heads Subsea Development
- Wells
- Onshore Pipeline and Terminal

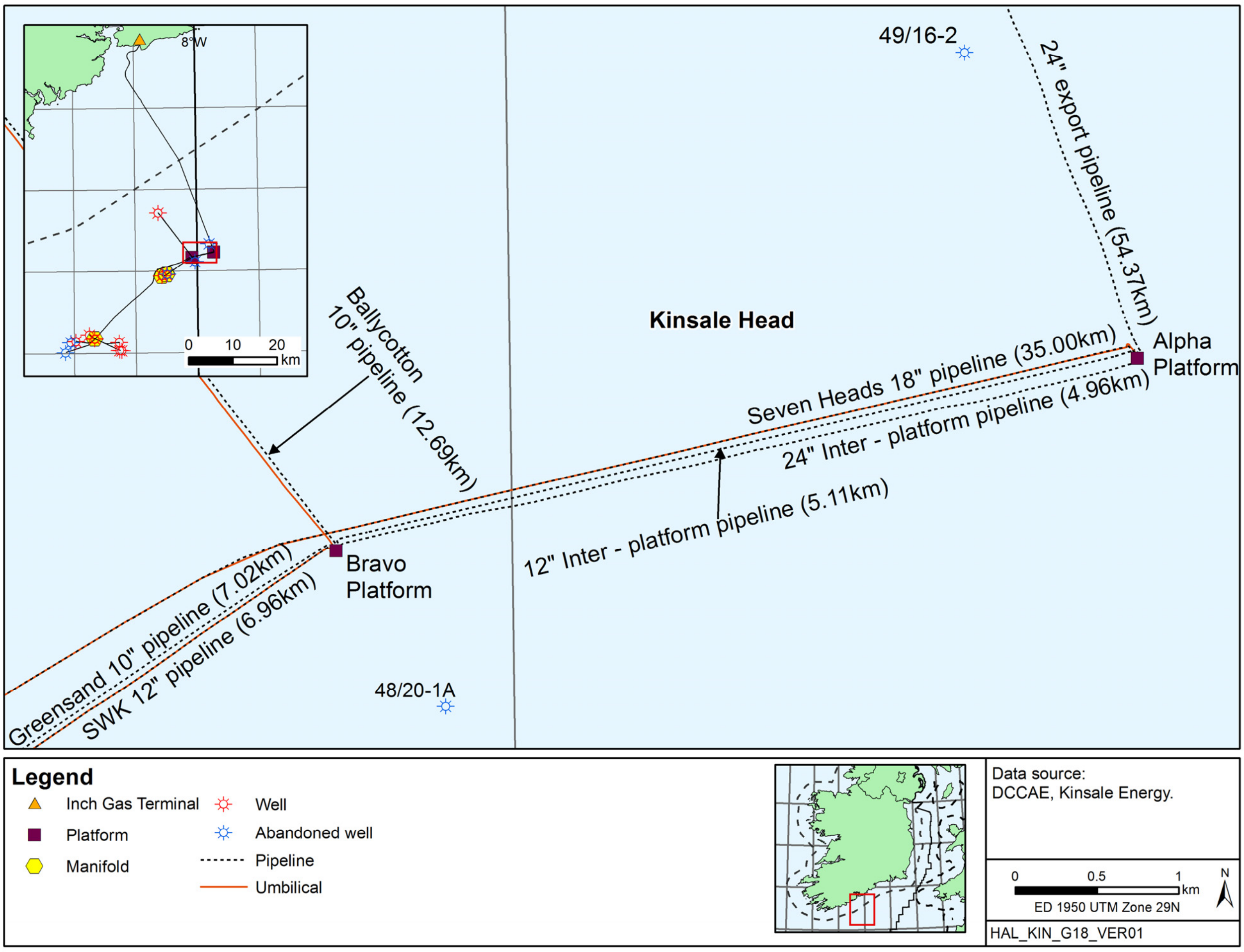
The original Kinsale Head field development was undertaken using fixed steel platforms, as described below. All subsequent developments (Ballycotton, Southwest Kinsale, Greensand and Seven Heads) used subsea well technology whereby underwater wellheads are controlled from a host platform (Kinsale Alpha or Kinsale Bravo) by means of an electro hydraulic control umbilical.

It should be noted that hydrocarbons produced in the Kinsale Area are dry natural gas with small amounts of condensate from Seven Heads field (e.g. no sludges, solid naturally occurring radioactive materials (NORM), liquid hydrocarbons or H2S are present). The reservoirs producing to the Kinsale Area platforms do not produce sand, and the water associated with the gas is “water of saturation” and is fresh water. No solid sample taken from the Kinsale Area platforms or associated wells, has ever been classed as positive for low specific activity (LSA) or Naturally Occurring Radioactive Material (NORM). This demonstrates that there is no LSA or NORM associated with the Kinsale Area platforms.

It should also be noted that oil based muds were only used in the drilling of one well in the Kinsale Area (the cuttings of which were not discharged to sea, with all material being returned to shore). Any resulting well cutting piles are now non-existent in the Kinsale Area with the 2017 seabed survey confirming all such piles have dispersed.

3.2.1 Kinsale Head Development

Figure 3.2: Overview of the Kinsale Head Facilities



Kinsale Alpha Platform

The Kinsale Alpha (KA) platform was installed in 1977. It incorporated drilling, production and accommodation facilities (**Figure 3.3**). KA comprises an eight-leg piled steel jacket with a total weight in air of ca. 8,100 tonnes. It supports an integrated deck module support frame and topsides of some 4,700 tonnes, which was installed in seven sections. Maximum accommodation is 43 persons, with present routine manning levels around 15-20 persons. The platform has 9 well slots, of which 7 have been used. The drilling facilities were installed as an integrated package which was removed following completion of the KA wells and transferred to Kinsale Bravo (KB). Subsequent modifications have included cantilever additions in 1991-1992 (the Eastern Compression Cantilever), 2001 (the Injection Compression Cantilever) and 2003 (the Seven Heads Cantilever). Processing of gas for all of the fields in the Kinsale Area is undertaken at KA. The gas is exported from KA to the Inch Terminal on the Co. Cork coastline, approximately 50km to the north.

There is an exclusion zone, (ref S.I. No. 285/1977) for other sea users, bounded by a line which is 500m at all points from a straight line joining the KA and KB platforms. This results in an elongated 500m exclusion zone around the KA, KB platforms and the entire stretch between them.

Figure 3.3: Kinsale Alpha

Kinsale Bravo Platform

The Kinsale Bravo (KB) platform (**Figure 3.4**) was installed in 1977 and was originally almost identical to KA. An eight-leg piled steel jacket with a total weight in air of some 7,600 tonnes supports an integrated deck module support frame and topsides of about 3,700 tonnes, which was installed in seven sections. The platform has 9 well slots, of which 7 have been used. The wells were completed using the drilling package transferred from KA, which was subsequently removed. Production from KB, which includes produced gas from the Kinsale Head, SW Kinsale, Greensand and Ballycotton fields, is routed to KA for processing and export. Accommodation on KB was originally for 46 persons but it was converted to a Normally Unmanned Installation (NUI) in 2001, with emergency accommodation for 9 persons. The compression modules and control room which were added in 1993 have been removed.

As noted above there is an elongated 500m exclusion zone around the KB platform and the entire stretch between the KA and KB platforms.

Figure 3.4: Kinsale Bravo

Export pipeline

The main export pipeline from KA to the Inch Terminal consists of a 55.57km, 24” concrete coated pipeline installed in 1977. The pipeline is mainly surface laid but with some buried sections and rock placement at strategic locations. The pipeline is buried from 2km seaward of the landfall to the landfall and for the 1.2km inland from the landfall as far as the Inch Terminal.

KA to KB pipelines

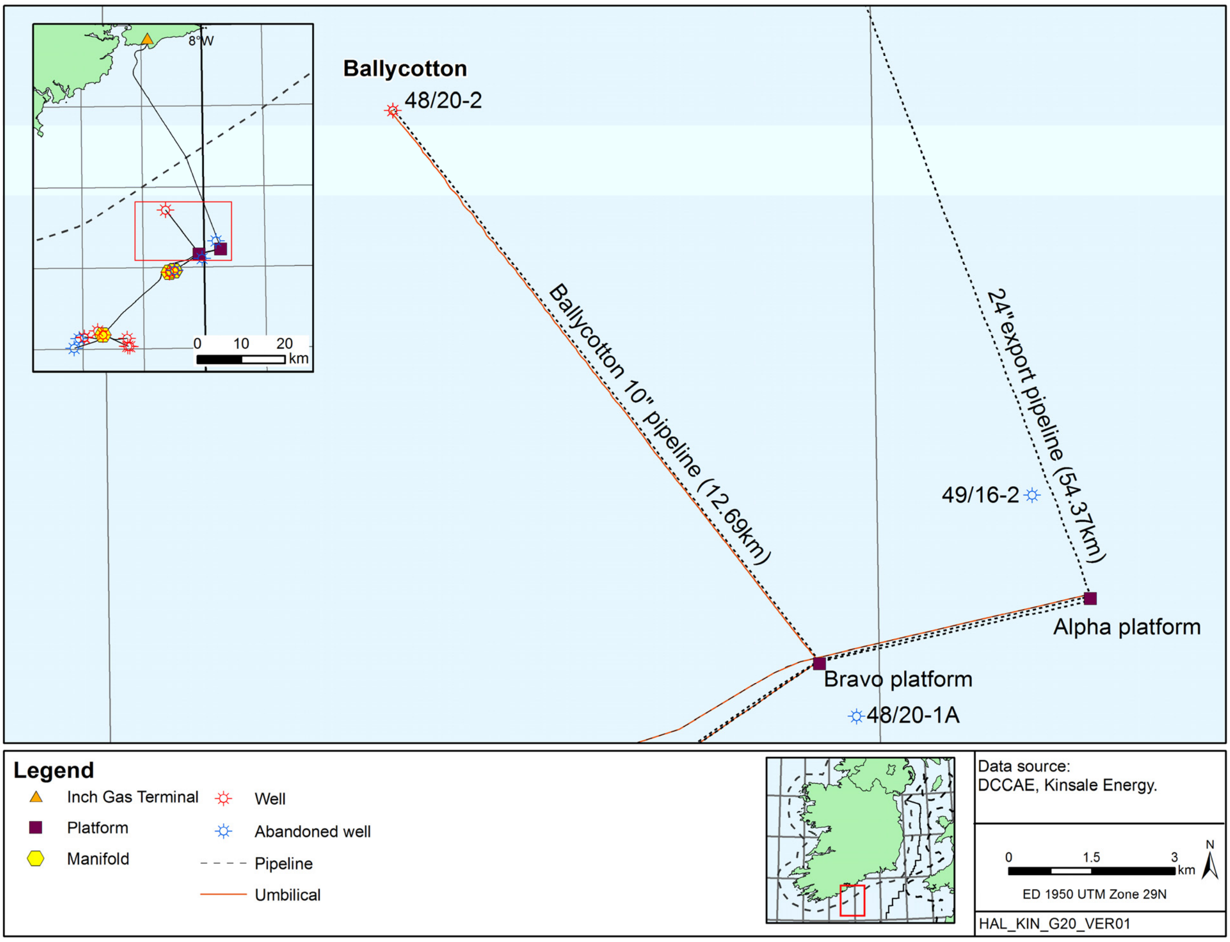
Two pipelines connect the KA and KB platforms, a 24” concrete coated pipeline (4.96km) and a 12” three layer polypropylene (PPL) coated pipeline (5.11km). The pipelines were installed in 1977 and 2001 respectively and are both surface laid, with rock having been placed at strategic locations along the 24” pipeline.

3.2.2 Ballycotton Subsea Development

The 12.69km 10” Ballycotton pipeline was installed in 1991, and connects well 48/20-2 to KB and is trenched and buried throughout most of its length though with some exposed sections, and mattress protection, particularly at the wellhead end, which is extensively protected. The umbilical (control cable) is trenched separately to the pipeline and is of similar length (13.00km). There are two infield crossings of the Ballycotton pipeline close to KB (**Figure 3.2**) by the Seven Heads pipeline and umbilical, each of which is protected with concrete mattresses.

There is a 500m exclusion zone, for other sea users, around the Ballycotton well 48/20-2 (ref S.I. No. 226/1991).

Figure 3.5: Ballycotton Facilities



3.2.3 Southwest Kinsale and Greensand Subsea Developments

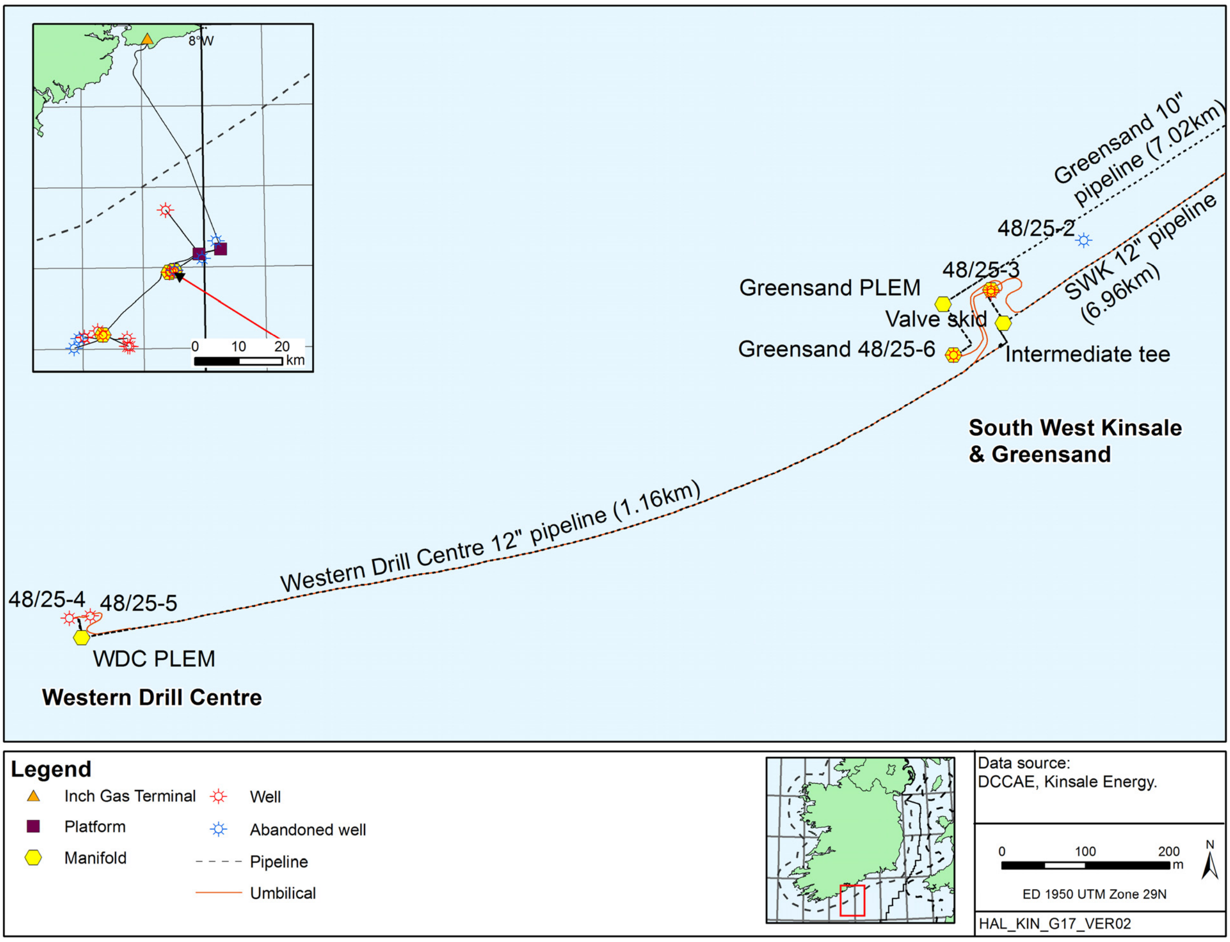
The Southwest Kinsale (SW Kinsale) development is connected to the KB platform via a 6.96km, 12" pipeline installed in 1999, which is partially trenched and buried, and rock covered where required trenching depths could not be reached. Concrete protective mattresses cover both ends of the pipeline, on its approach to the SW Kinsale valve skid and at its connection with KB. The SW Kinsale valve skid is tied into well 48/25-3 and an intermediate tee skid which connects the Western Drill Centre (WDC) extension.

The WDC extension is a similar 12" pipeline 1.16km in length installed in 2001, which is rock-covered along its length. The WDC pipeline terminates at the WDC Pipeline End Manifold (PLEM) and is connected via spool pieces to the 48/25-4 and 48/25-5 wells.

A subsea well completion (Greensand) in the "A" sand zone of SW Kinsale was installed in 2003 and the infrastructure is immediately adjacent to that of SW Kinsale. The 7.02km 10" pipeline is rock-covered along its length to KB with the exception of a short section approaching the Greensand PLEM. Spool pieces connect the Greensand PLEM to well 48/25-6.

There is an exclusion zone, for other sea users (ref S.I. No. 6/2003), bounded by a line which is 500m at all points from a straight line joining the SW Kinsale well 48/25-3 and a point at the WDC wells. This results in an elongated 500m exclusion zone around the Southwest Kinsale, Western Drill Centre and Greensand wells.

Figure 3.6: Southwest Kinsale and Greensand



A common umbilical serves the SW Kinsale and Greensand infrastructure and runs parallel with the SW Kinsale pipeline and under the same protection materials. In the immediate vicinity of the SW Kinsale and Greensand wells/subsea infrastructure there are control umbilicals which are under concrete protection mattresses.

3.2.4 Seven Heads Subsea Development

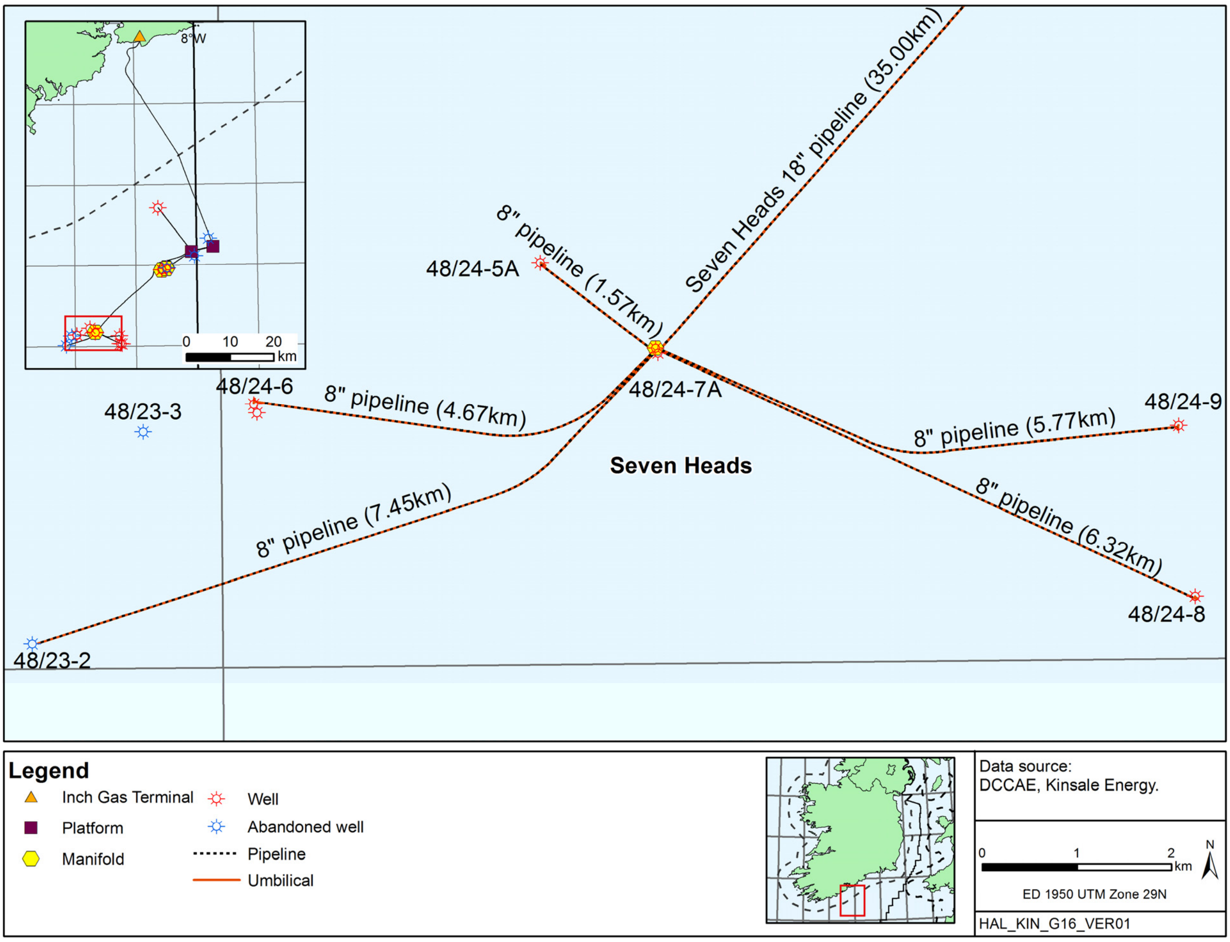
The Seven Heads field was developed by a group led by Ramco Energy in 2003; Ramco's interest (86.5%) was subsequently acquired in 2006 and is now operated by PSE Seven Heads Ltd, a subsidiary of PSE Kinsale Energy Limited.

Seven Heads is connected to KA via a 35.00km concrete coated 18" pipeline installed in 2003, which is variously buried, exposed or rock covered. The control umbilical is laid alongside the pipeline with the same protection. The 18" pipeline terminates at the Seven Heads manifold, which connects the export line to six separate 8" flowlines and umbilicals of various lengths (0.06-7.45km). Only five of the infield pipelines and umbilicals are connected to active subsea wells (48/24-5A, 48/24-6, 48/24-7A, 48/24-8 and 48/24-9), but all have rock cover and concrete mattress protection.

The Seven Heads pipeline and umbilical cross the active Hibernia Atlantic "D" and the disused PTAT telecommunications cables. A separate telecommunications cable (Hibernia Express, installed in 2015) crosses over the Seven Heads pipeline and umbilical to the south of these. These are separated by concrete mattresses.

There is a 500m exclusion zone, for other sea users, around the Seven Heads manifold and each of the Seven Heads active subsea wells (ref S.I. No. 685/2003).

Figure 3.7: Seven Heads Facilities



3.2.5 Wells

There are a total of 28 wells to be decommissioned, 14 associated with the KA and KB platforms and the remaining 14 made up of 10 subsea development wells in satellite fields and 4 previously abandoned exploration wells in the Kinsale Area which require their wellheads to be removed.

All development wells are completed with a Xmas Tree structure, located on the seabed for the subsea development wells (see **Figure 3.8**) and on the platform cellar deck for the platform wells.

Figure 3.8 Typical subsea Xmas Tree structure

3.2.6 Onshore Pipeline and Terminal

The gas produced from the Kinsale Head field and subsea tie backs is transported to shore in the 24” export pipeline to an onshore terminal at Inch, approximately 1.20km inland from the landfall at Inch. The terminal was constructed in 1978.

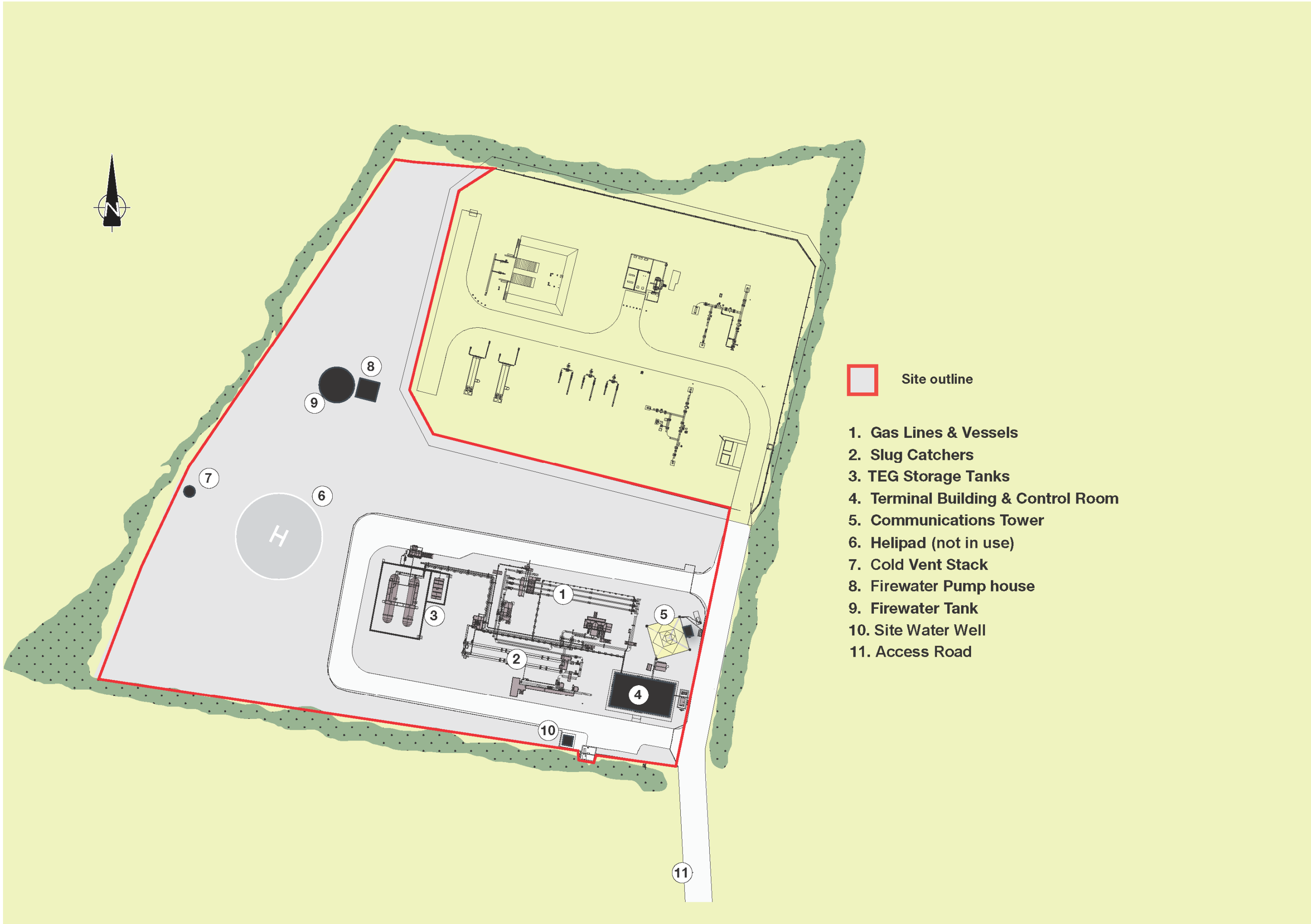
The aerial photograph in **Figure 3.9** below shows the Inch terminal layout. The onshore section of the Kinsale Area facilities are located on the southern portion of the site and include the communications tower as shown in the photograph. The facilities outlined in red are part of the Irish gas transmission system owned by Gas Networks Ireland and do not form part of the KADP.

Figure 3.9: Inch Terminal

The Kinsale Energy equipment and structures on the terminal site are shown in **Figure 3.10**. The Inch Terminal site comprises a site area of 2.3 Ha, some 220m^2 (9.7%) of which is occupied by buildings, a 20m high vent stack, 98m high communications tower with concrete foundations, and access road.

The onshore Inch Terminal is a small sized onshore terminal used for metering and does not include any gas processing as all gas leaving KA platform already meets the Commission for Regulation of Utilities (CRU) Gas Quality Specification for export to the Gas Networks Ireland onshore grid.

Figure 3.10: Inch Onshore Terminal layout plan



Not to scale

3.2.7 Summary of Kinsale Area Facilities

Tables 3.2 to 3.7 summarise the Kinsale Area facilities to be decommissioned.

Table 3.2: Kinsale Area wells to be decommissioned

Well no.	Drill date	Location/associated development	Present status
Platform Wells			
49/16-A1	08/07/1978	Kinsale Head (KA)	Gas Producer
49/16-A3	24/12/1978	Kinsale Head (KA)	Gas Producer
49/16-A4	08/08/1978	Kinsale Head (KA)	Gas Producer
49/16-A5	09/04/1978	Kinsale Head (KA)	Gas Producer
49/16-A6	15/11/1978	Kinsale Head (KA)	Gas Producer
49/16-A7	19/01/1979	Kinsale Head (KA)	Gas Producer
49/16-A9	22/05/1978	Kinsale Head (KA)	Gas Producer
49/16-B1	07/06/1979	Kinsale Head (KB)	Gas Producer
49/16-B3	26/09/1979	Kinsale Head (KB)	Gas Producer
49/16-B4	27/06/1979	Kinsale Head (KB)	Gas Producer
49/16-B5	13/05/1979	Kinsale Head (KB)	Gas Producer
49/16-B6	30/06/1979	Kinsale Head (KB)	Gas Producer
49/16-B7	18/07/1979	Kinsale Head (KB)	Gas Producer
49/16-B9	10/08/1979	Kinsale Head (KB)	Gas Producer, shut in.
Subsea Wells			
48/20-2	01/03/1989	Ballycotton	Gas Producer; shut-in
48/25-3	30/07/1995	SW Kinsale	Gas Producer
48/25-4	25/04/2001	SW Kinsale (WDC)	Gas Producer
48/25-5	28/04/2001	SW Kinsale (WDC)	Gas Producer
48/25-6	22/04/2003	Greensand	Gas Producer
48/24-5A	05/08/2001	Seven Heads	Gas Producer; shut-in
48/24-6	15/03/2003	Seven Heads	Gas Producer
48/24-7A	16/05/2003	Seven Heads	Gas Producer
48/24-8	12/06/2003	Seven Heads	Gas Producer
48/24-9	24/06/2003	Seven Heads	Gas Producer
Plugged and Abandoned Wells			
48/25-2	13/09/1971	Kinsale Head	Plugged and abandoned.
49/16-2	04/07/1973	Kinsale Head	Plugged and abandoned.
48/20-1A	06/05/1972	Kinsale Head	Plugged and abandoned.
48/23-3	03/05/2006	Seven Heads	Plugged and abandoned.

Table 3.3: Platforms (Topsides & Jackets) to be decommissioned

Structure	Description	Dimensions	Weight (in air)
Kinsale Alpha	Manned platform – Topsides & Jacket standing in approximately 89.9m of water. Topside details: • Cellar deck – equipment and wellheads • Main deck - accommodation on the west side with 43 beds • Vent stack on the north west side of the platform • Helideck on south west side of the platform Jacket details: • 8-legged piled steel lattice structure, with piles driven to an approximate depth of 50m below the seabed • 9 conductor slots (7 conductors) • Risers / J-tubes:	Topside: Main Deck area 165 x 83 ft (50.3 m x 25.3 m) Cellar Deck area 152 x 83 ft (46.3 m x 25.3 m) Jacket: Base 70m x 44m, Height 98m, 7 plan bracing levels	Topside: 4,700Te approx. Jacket: 8,100Te approx. (including main members, risers, caissons, marine growth, piles to seabed level, grout, mudmats & anodes)
Kinsale Bravo	Normally unmanned platform – Topsides & Jacket standing in approximately 90.5m of water KB Topside details: • Cellar Deck – Equipment and wellheads • Main Deck - Temporary accommodation only Jacket details: • 8-legged piled steel lattice structure, with piles driven to an approximately depth of 50m below the seabed • 9 conductor slots (7 conductors) • Risers / J-tubes	Topside: Main Deck area 165 x 83 ft (50.3 m x 25.3 m) Cellar Deck area 152 x 83 ft (46.3 m x 25.3 m) Jacket: Base 70m x 44m, Height 98m, 7 plan bracing levels	Topside: 3,700Te approx. Jacket: 7,600Te approx. (including main members, risers, caissons, marine growth, piles to seabed level, grout, mudmats & anodes)

Source: Genesis (2011), Xodus (2016a)

Table 3.4: Pipelines to be decommissioned

Pipeline	Length (km)	Description	Year installed	Status	Tie-in spools pieces	Protection materials	Comments
	Onshore						
Inch Terminal to Inch Beach landfall export pipeline	1.20km	24″ X60 steel, coal-tar epoxy	1977	Active	Inch Terminal pipeline entry buried with Inlet Stop Valve P149 in pit	25mm concrete coated section from the vegetation zone above the beach to 150m from Lowest Astronomical Tide (LAT)	
	Kinsale Head, Southwest Kinsale, Greensand & Ballycotton						
Inch Beach landfall to Kinsale Alpha export pipeline	54.37km	24″, X60 steel, coal-tar epoxy and concrete coated	1977	Active	50mm concrete coated tie-in at KA.	Intermittent grout bag supports at 11 locations. Rock cover totals 5.8km, covering a number of strategic locations.	Number of non-critical freespans detected. Cumulative freespan length 1,822m
Kinsale Alpha (KA) to Kinsale Bravo (KB) export pipeline	4.96km	24″ X52 steel, coal-tar epoxy and concrete coated	1977	Active	50mm concrete coated tie-in at KA and KB.	Rock cover totals 96m, covering a number of strategic locations.	12 non-critical freespans detected. Cumulative freespan length 205m
KA to KB pipeline	5.11km	12″ X52 steel, 3LPP coated	2001	Active	25m spool underneath each jacket, 40m spool connecting pipeline at KA end.	No pipeline protection. 2 support ramps of grout bags at KA and KB tie-in spools. 34 mattresses (6x3x0.15m) used at each tie-in location at KA and KB.	8 non-critical freespans detected. Cumulative freespan length 188m

Pipeline	Length (km)	Description	Year installed	Status	Tie-in spools pieces	Protection materials	Comments
Southwest Kinsale pipeline	6.96km	12″ X52 steel, 3LPP coated	1999	Active	36m spool at KB, vertical leg to riser end. Single spool between valve skid and 48/25-3 tree.	Rock cover totals 2.6km. 4 mattresses (5x3x0.15m) at SWK end and 20 mattresses (5x2.2x0.15m) at the KB end. Tie-in spools include 6 mattresses (5x2.2x0.15m) at KB and 8 mattresses (6x3x0.15m) at SWK.	No freespans identified
Extension pipeline to Western Drill Centre	1.16km	12″ X52 steel, 3LPP coated	2001	Active	2 x 6" spools to WDC 48/25-4 and 48/25-5 trees. 34m long spool between skids at SWK.	Rock cover along entire length. 8 mattresses (5x3x0.15m) at WDC on PLEM to tree spools. 6 mattresses (5x3x0.15m) on spool between skids at SWK. 4 mattresses (5x3x0.15m) at SWK on pipeline end. 4 mattresses (5x3x0.15m) at WDC on pipeline end.	No freespans identified
Greensand pipeline	7.02km	10″ X52 steel, 3LPP coated	2003	Active	Two 10″ spools at KB. Two 6″ spools between the Greensand well (48/25-6) and PLEM and one 10″ spool connecting the PLEM to the greensand pipeline.	Rock cover along entire length. 10 mattresses (6x3x0.15m) at Greensand pipeline end and 13 mattresses at KB pipeline end. Spools with groutbag support at KB. KB spool protection includes 9 mattresses (6x3x0.15m). Well spool protection includes 13 mattresses (6x3x0.15m).	No freespans identified

Pipeline	Length (km)	Description	Year installed	Status	Tie-in spools pieces	Protection materials	Comments
Ballycotton pipeline	12.69km	10″ X52 steel, 0.5mm FBE coated	1991	Not active, well shut in	30m tie-in spool to 48/20-2 tree and 20m tie-in spool at KB.	44 mattresses used for pipeline protection. Groutbag support at Ballycotton tree and KB spools. Grout bag berm 8m long at tee spool. 4 kennel-type protection tunnel for 20m on tree tie-in spool along with 3 mattresses (5x3x0.15m). 105 mattresses on pipeline end at tree. 9 stabilisation mattresses (2.5x1.5x0.15m) on pipeline end at KB.	8m freespan identified.
	Seven Heads						
Seven Heads export pipeline	35.00km	18″ X52 steel, 3LPP and concrete coated	2003	Active	Two 14″ tie-in spools, 44m and 36m in length at the manifold end. Two 14″ tie-in spools, 42m and 39m in length at the KA end.	10 mattresses (6x2x0.15m) and 25 mattresses (5x3x0.15m) at the manifold end. 41 mattresses (5x3x0.15m) on the pipeline end at KA. 3 mattresses (5x3x0.15m) at each of the two crossings over the Ballycotton pipeline and umbilical.	There are 3 communication cable crossings. The Seven Heads pipeline crosses over the Hibernia Atlantic “D” and the disused PTAT cable, while the Hibernia Express cable installed in 2015 crosses over the Seven Heads pipeline.
Seven Heads well 48/24-5A pipeline	1.57km	8″ X52 steel, 3LPP coated	2003	Active	8” spool, 44m long at the manifold.	22 mattresses (6x3x0.15m) and 4 mattresses (6x2x0.15m) at the manifold. 13 mattresses (6x3x0.15m) at the well.	No freespans identified

Pipeline	Length (km)	Description	Year installed	Status	Tie-in spools pieces	Protection materials	Comments
Seven Heads well 48/24-6 pipeline	4.67km	8″ X52 steel, 3LPP coated	2003	Active	Two 8” spools, 23m and 27m long at the manifold.	24 mattresses (6x3x0.15m) and 16 mattresses (6x2x0.15m) at the manifold. 27 mattresses (6x3x0.15m) at the well.	No freespans identified
Seven Heads well 48/24-7A pipeline	0.06km	8″ X52 steel, 3LPP coated	2003	Active	8” spool, 60m long at the manifold.	12 mattresses (6x3x0.15m) and 3 mattresses (6x2x0.15m) at the manifold.	No freespans identified
Seven Heads well 48/24-8 pipeline	6.32km	8″ X52 steel, 3LPP coated	2003	Active	Two 8” spools, 39m and 35m long at the manifold.	16 mattresses (6x3x0.15m) and 5 mattresses (6x2x0.15m) at the manifold. 37 mattresses (6x3x0.15m) at the well.	No freespans identified
Seven Heads well 48/24-9 pipeline	5.77km	8″ X52 steel, 3LPP coated	2003	Active	Two 8” spools, 51m and 34m long at the manifold.	24 mattresses (6x3x0.15m) and 4 mattresses (6x2x0.15m) at the manifold. 12 mattresses (6x3x0.15m) at the well.	No freespans identified
Seven Heads well 48/23-2 (abandoned) pipeline	7.45km	8″ X52 steel, 3LPP coated	2003	Not active	Two 8” spools, 33m and 25m long at the manifold.	26 mattresses (6x3x0.15m) and 19 mattresses (6x2x0.15m) at the manifold. 8 mattresses (6x3x0.15m) at the well.	No freespans identified. Well F flowline is inactive and was never used; filled with seawater since installation; well not tied-in

Source: Genesis (2011), Xodus (2016c), Anatec (2017) Kinsale Energy's as-built data for Seven Heads

Table 3.5: Umbilicals to be decommissioned

Umbilical	Diameter	Length	Current Burial Status / Installation Method	Protection materials	Comments
Southwest Kinsale umbilical	82mm	6.96km	Partially trenched. Laid alongside 12" South West Kinsale pipeline, sharing the same protection materials.	8 mattresses (6x3x0.15m) at KB end and 20 mattresses at the SWK tree end. Grout bags used to support a crossing with the SWK pipeline near KB.	
Western drill centre umbilical	82mm	1.16km	Laid alongside 12" South West Kinsale extension to Western Drill Centre, sharing the same protection materials.	Rock cover along majority of length. 8 mattresses (5x3x0.15m) and 6 mattresses (5x2x0.15m) cover the umbilicals to the trees. 24 mattresses (6x2x0.15m) cover the umbilical between the SWK tree and the pipeline rock placement.	
Greensand umbilical jumper	101mm	-	Laid on seabed and covered in concrete mattresses.	23 mattresses (6x2x0.15m) between Greensand and SWK wells.	
Ballycotton umbilical	98.2mm	13.00km	Trenched	The Seven Heads pipeline and umbilical cross over the Ballycotton umbilical. Crossing includes 3 mattresses (5x3x0.15m). 12 mattresses cover the umbilical to the tree and 3 mattresses cover the umbilical to KB.	9m freespan identified
Seven Heads Umbilical	123.5mm	35.00km	Laid alongside Seven Heads 18" pipeline, sharing the same protection materials.	Protection materials are the same as those listed in Table 4 for the Seven Heads pipeline cable crossings and tie-in to the platform and the manifold, along with 18 additional mattresses (6x2x0.15m) covering the umbilical tie-in to the platform.	Two 3rd party crossings of communication cables under the pipeline & umbilical: PTAT (Mercury) and 360 Atlantic "D" (360 Networks Inc.). One 3rd party crossing (Hibernia Express) over the pipeline & umbilical.
Seven Heads well umbilicals	93.2mm	0.06 to 7.45km	All laid alongside 8" pipelines and rock covered.	Protection materials are the same as those listed in Table 4 for the tie-in pipes, with 45 additional mattresses (6x2x0.15m) covering the umbilicals to the trees.	Well 48/23-2 (Well F) umbilical inactive and never used.

Source: Genesis (2011), Xodus (2016c), Anatec (2017), Kinsale Energy's as-built data

Table 3.6: Subsea infrastructure to be removed

South West Kinsale Valve Skid	
Manifold contains a 12” branch to tie-in the SWK well spool and a further 12” connection to tie-in the pipeline.	
Main structure: Protection blocks:	4.4x2.2x1.2m, 10.5Te 10x2.4x1.8m, weight 65Te (x2) 7.7x 2.4x1.8m, weight 45Te (x2)
South West Kinsale Intermediary Tee	
Located approximately 30m from the SW Kinsale valve skid. Connects the Western Extension pipeline to the SW Kinsale infrastructure in a daisy chain configuration.	
Main structure: Protection blocks:	6.5x3.2x1.4m, 8.4Te 8.75x 2.4x1.765m, weight 43Te (x3) 8.75x2.4x1.765m, weight 47Te (x1)
Greensands Pipeline End Manifold (PLEM)	
Manifold includes a 6” branch to tie-in the Greensand well spool and a 10” pipeline end flange.	
Main structure: Protection blocks:	4.7x2.3x1.7m, 9.2Te 10x2.4x1.8m, weight 65Te (x2) 7.7x2.4x1.8m, weight 45Te (x2)
Western Drill Centre PLEM	
Manifold has two 6” branches to tie-in the well spools and a 12” branch to tie-in the extension pipeline spool	
Main structure: Protection blocks:	4.7x2.2x1.7m, 9.2Te 10x2.4x1.8m, weight 65Te (x2) 7.7x2.4x1.8m, weight 45Te (x2)

Seven Heads Manifold	
Manifold housed within a rectangular steel protection frame with diagonal rakers at the corner members. Drop-in ballast weight inserts in the corner tubular members.	
Main structure: Manifold module: Corner weights: Total:	17x12mx6m (to end of diagonal rakers), 66.1Te 36.7Te 19.5Te (x4) 190Te
Well Head Protection Structures	
Four structures placed over SWK Wells 48/25-3, 4, 5 and Greensand Well 48/25-6. Steel tubular frame with concrete foundation blocks on two sides.	
Steel frame: Concrete blocks:	12x13m base, 4.3x4.35m top, 7m high, 25Te 133.3Te (6 concrete blocks of max individual weight 25Te)

Source: Genesis (2011), Xodus (2016c)

Table 3.7: Inch Onshore Terminal to be decommissioned

Terminal	Description	Dimensions
Inch Terminal	Onshore gas terminal equipment: • Gas lines, vessels & associated equipment, pipework, instrumentation & cabling • Tri-Ethylene Glycol (TEG) Storage Tanks Buildings: • Terminal Building; a single storey concrete building with precast concrete roof, containing rooms including a battery room, gas chromatograph room, control room, canteen and toilet • Firewater Pump house Other • Internal Roadway • Communications Tower • Helipad (not used) • Cold Vent Stack • Firewater Tank • Foul sewer drain and septic tank • Surface water drains and soakaways • Site water well • Three phase mains (ESB) supply	Site area: 1.66ha (excluding main access road – 0.64ha) Buildings: 223m^2 (Terminal Building – 215m^2, Firewater Pump House – 8m^2) Communications Tower: 98m high with concrete foundations Vent Stack: 20m high 16” vent

Source: Genesis (2011), Xodus (2016a)

3.3 Consideration of Potential Re-Uses

The Kinsale Area facilities have been designed for dry gas production and processing, and the majority of the facilities are now close to or beyond their original design lives. Nevertheless, parts of the facilities may be suitable for re-use, depending on the service, particularly the main Kinsale and Seven Heads export pipelines and the platform jackets.

Three potential re-uses have been considered at a high level. These are hydrocarbon production, carbon capture and storage (CCS) and offshore wind energy production.

Hydrocarbon Production

The Kinsale Area facilities are not designed for liquid hydrocarbon or wet gas production and are unlikely to be suitable for such use. Some of the facilities could potentially be re-used for a future dry gas development as host infrastructure. However, there are currently no known commercial dry gas discoveries in the vicinity nor is Kinsale Energy aware of any firm drilling plans for dry gas prospects within tieback distance of any of the facilities. There are a number of appraisal wells planned in the Barryroe field and the 18" pipeline from Seven Heads to Kinsale Alpha, could be used for export of associated gas from a potential development of that field

Carbon Capture and Storage

Kinsale Energy has carried out technical studies which would indicate that the main Kinsale Head reservoir may be suitable for CCS and also that some of the Kinsale Area facilities may be suitable for CO_2 transportation, particularly the 24" export pipeline and the jackets.

There is currently no commercial case for a merchant CCS service as CO_2 prices are too low to justify the required investment, however, this may change in the coming years. It is also noted that there is a proposal in Ireland's current National Mitigation Plan (July 2017) for DCCAE to explore the feasibility of utilising suitable reservoirs for CO_2 storage within the next 5 years. A feasibility study into the use of the Kinsale Head reservoir for CCS is being undertaken by Ervia.

Offshore Wind Energy Production

The main 24" export pipeline and landfall could possibly have a use as a cable conduit, for either fibre optic or high-voltage direct current (HVDC) cables (for example as part of a windfarm). The platform jackets could be used to support HV convertor stations. Kinsale Energy is not aware of any wind farm development being considered for the vicinity of any of the Kinsale Area facilities, so no proposal currently exists at this time.

Conclusion

No other re-use options have been identified at present. Should future circumstances change with respect to the potential for any of the re-use options identified above, then a leave *in situ* option, particularly with regard to the 18" Seven Heads export pipeline and the main 24" export pipeline and landfall, could facilitate the re-use of that infrastructure in the future. Additionally, the platform jacket removal campaign may be scheduled over a number of years (1-10 years), depending on vessel availability, cost efficiency and company strategy, which could extend the period over which an alternative use may be identified.

The above considerations inform a staged approach to the consent application process for the project, such that the wells, platform topsides, and subsea structures comprise the first consent application, and the pipelines and platform jackets comprise the second consent application.

Should any of the potential re-use proposals be taken forward, they would be subject to the requisite environmental assessments and consents at the appropriate time, which would also include a cumulative assessment of the decommissioning of the Kinsale Area facilities.

3.4 Decommissioning Alternatives Considered

3.4.1 Do Nothing Alternative

The do nothing scenario should be considered in the assessment of alternatives, in accordance with the EIA Directive.

As outlined in Section 1, the Kinsale Area facilities are operated in accordance with two petroleum leases:

- Petroleum Lease No 1 (OPL 1 - 1970): Kinsale Head, Southwest Kinsale and Ballycotton Gas Fields, and
- Seven Heads Petroleum Lease (2002): Seven Heads Gas Field.

It is a requirement of both leases that the facilities are decommissioned and decommissioning plans must be submitted to the Minister for approval, under the terms of the leases. In the context of the KADP therefore, the do nothing alternative is not an alternative which can be brought forward for assessment.

3.4.2 Other Decommissioning Alternatives Considered

This section describes a range of alternatives for the decommissioning of the facilities (alternatives within the meaning of the EIA Directive). Some of these alternatives, having been considered (in accordance with the EIA Directive), were discounted, for the reasons described herein. Other alternatives have been taken forward into the full environmental assessment. The impacts of the decommissioning options taken forward into the full assessment, on the environmental receptors relevant to the Kinsale Area (which are identified in **Section 4** and **Section 5)**, are assessed in **Section 6** and **Section 7**.

Table 3.8 sets out a summary of the decommissioning alternatives considered, with **Section 3.4.3** to **Section 3.4.6** providing further detail.

Table 3.8: Summary of decommissioning alternatives initially considered

Section Ref.	Facility	Decommissioning Alternatives Initially Considered	Comment
n/a	Platform and Subsea Wells	• Plug & Abandon	No technically recognised alternative
3.4.7	Platform Topsides	• Full Removal • Leave *in situ*	Leave *in situ* was initially considered as an alternative for the platform topsides, however, as no potential re-uses have been identified and due to legal obligations for the complete removal of structures (OSPAR Decision 98/3 – refer to **Section 2.1.4 and Appendix A**) the leave in situ alternative was not considered further.
3.4.4	Platform Jackets	• Full Removal • Partial Removal • Leave *in situ* • Toppling in current location	Partial removal, leave *in situ* or toppling in current location were initially considered as alternatives for the platform jackets but due to legal obligations for the complete removal of structures (OSPAR Decision 98/3 – refer to **Section 2.1.4 and Appendix A**) no alternative other than full removal was not considered further.

Section Ref.	Facility	Decommissioning Alternatives Initially Considered	Comment
3.3.5	Subsea structures	• Full Removal • Leave *in situ*	Leave *in situ* was initially considered as an alternative for the other subsea structures but due to legal obligations for the complete removal of structures (OSPAR Decision 98/3 – refer to **Section 2.1.4 and Appendix A**) the leave in situ alternative was not considered further.
3.3.6	Pipelines, Umbilicals and protection materials	• Full Removal • Partial Removal • Leave *in situ*	Full removal and partial removal were initially considered as alternatives for pipelines, umbilicals and protection materials. Refer to **Section 3.4.6** and **Appendix E** for details of a comparative assessment which considered the safety, environmental, technical, social and cost aspects of the various alternatives and which identified leave *in situ* as the optimal option.
3.3.7	Inch Terminal	• Full Removal	Pursuant to the conditions imposed under the original planning permission for the Inch Terminal, it is required to be fully removed upon the permanent cessation of its function and therefore no alternative options were considered.

3.4.3 Platform Topsides Decommissioning Alternatives

As indicated in **Table 3.8,** no re-use options have currently been identified for the Kinsale Area platforms (refer to **Section 3.3**) such that the platform topsides could be left *in situ*. As a consequence and to ensure compliance with OSPAR Decision 98/3, both KA and KB topsides will be completely removed and returned to shore for reuse, recycling and/or disposal.

3.4.4 Platform Jackets Decommissioning Alternatives

As indicated in **Table 3.8**, the Kinsale Area platforms will be removed in line with OSPAR Decision 98/3. However, Kinsale Energy initially considered a number of alternatives for the decommissioning of both KA and KB jackets including:

- Full removal
- Partial removal
- Toppling of jackets *in situ*
- Leave *in situ*

These decommissioning alternatives were considered to identify the preferred decommissioning option for the Kinsale Area platforms. Several studies have previously been carried out to inform the options selection for the decommissioning of the KA and KB platforms (Genesis 2011, Allseas 2012a, Xodus 2016d).

Partial removal of the jackets down to the top of footings or removal to -55m below sea level in accordance with the International Maritime Organisation (IMO) guidelines relevant to maritime security were considered as technically feasible, for example. However, both these options would not be in accordance with OSPAR Decision 98/3 and therefore were not considered further.

Toppling of the jackets is technically feasible, but due to the depth of water and size of structures 55m clear draught between the top of the structures and the water surface would not be provided in accordance with the IMO guidelines. Therefore, this alternative was also not considered further.

Similar to the platform topsides, no re-use options have currently been identified for the platform jackets (refer to **Section 3.3**), such that they could be left *in situ* but there remains the potential for re-use. If a re-use option is not identified in the decommissioning timescale (up to 10 years, see **Section 3.5.2.3**), the jackets will also be removed. Project execution phasing allows for the consideration of the removal of the topsides and jackets separately, not only in terms of maximising the potential for re-use of the jackets, but also in relation to vessel availability and cost efficiency. The possible alternatives in terms of phasing have been considered in the full assessment herein.

3.4.5 Subsea Structures Decommissioning Alternatives

Similar to the Kinsale Area platforms, all subsea structures (manifolds, valve skids and tee structures) will be removed, as they are interpreted to fall within the category “disused offshore installation” under OSPAR Decision 98/3, which may only be left in place, “when exceptional and unforeseen circumstances resulting from structural damage or deterioration, or from some other cause presenting equivalent difficulties, can be demonstrated.” This is not the case with the Kinsale Area subsea facilities and so all such facilities will be removed.

3.4.6 Pipelines and Umbilicals Decommissioning Alternatives

There are a number of alternative approaches to decommissioning of the Kinsale Area pipelines and umbilicals. In order to decide on the best approach, a Comparative Assessment (CA) of different options has been undertaken. The CA followed a systematic process, in which the safety, environmental, technical, social aspects and cost of the various options were evaluated. The process is documented in a CA report (refer to **Appendix E**) which includes the scoring methodology and scoring matrices for each of the options, and also narrative expanding upon the implications of each of the options.

3.4.6.1 Comparative Assessment

The framework for the CA drew on OSPAR 98/3 and Oil and Gas UK (OGUK) (2015) guidance, with a scoring system to assess each of the proposed decommissioning options covering safety, environment, technical, societal and economic criteria. The technical feasibility of any option was also considered in relation to industry experience to date, including from proposed approaches to the decommissioning of pipelines for fields in the North Sea, and related summary reports of experience to date (e.g. OGUK 2013).

Initially a set of 45 individual option considerations relating to each individual pipeline and umbilical were evaluated as part of the CA process, including various combinations of full removal, partial removal and leave *in situ*. On review of the initial results from this CA process it was considered that certain pipelines and umbilicals could be grouped and assessed together in view of their similarity (e.g. type and burial status). Additionally, as indicated in **Section 3.2**, with the exception of Ballycotton all umbilicals are laid next to their associated pipelines and share the same protection materials (e.g. rock or concrete mattresses). In practice, it is unlikely that the decommissioning of the umbilicals would take place separately and it was regarded that these could be assessed alongside their respective pipelines. Moreover, the similarity in the decommissioning options for each pipeline or umbilical resulted in initial CA scoring which was either not significantly different or the same for multiple options. For these reasons, umbilicals and pipelines were considered together.

The grouping resulted in two types of offshore pipeline/umbilical being defined along with their associated options:

- pipelines which are surface laid or exposed along much of their length and,
- pipelines and umbilicals which are largely under protective materials or buried.

In addition to refining the process by grouping similar pipelines/umbilicals, the initial consideration also allowed for the further definition of options for these groups.

For example the consideration of partial removal for those pipelines largely under protective materials or buried was not considered to be appropriate (e.g. as the results would not be appreciably different to the full removal option), and the results from the initial consideration also noted that the additional safety, technical and environmental risks from partial removal did not result in significant risk reduction, for example, compared to the equivalent option using rock cover. The following options were taken forward for further consideration in the final CA:

For surface laid pipelines and those exposed along much of their length:

- fully remove,
- leave in situ and rock cover those sections which are >50% exposed as well as pipe ends,
- leave in situ and rock cover pipe ends and any freespans

For pipelines and umbilicals largely under protective materials or buried:

- fully remove,
- leave in situ and rock cover pipe ends and any freespans (where applicable)

Criteria for evaluating the potential impact of the various options were developed for safety, environment, technical feasibility, society and cost categories. The CA used a scoring matrix (see OGUK 2015). For each of these categories, a number of sub-categories were incorporated. The sub-categories were scored using a five point classification based on the relative risk or expected magnitude of effect from each option. The criteria and scoring matrix is shown in **Table 3.9.**

The sub-criteria were scored on a five point scale ranging from 1 (Very Low) through to 5 (Very High), where 1 represents best performance/least significant impact/lowest risk and 5 worst performance/largest significant impact/highest risk. Scores for the sub-criteria were then weighted according to the level of definition and understanding of methods, equipment and hazards ("uncertainty").

Table 3.9: Comparative Assessment Relative Risk and Impact Criteria Scoring

Criteria	Sub criteria	Very Low	Low	Medium	High	Very High
		1	2	3	4	5
Safety	Risk to personnel offshore during decommissioning operations (Potential Loss of Life)	>0.00001	>0.0001	>0.001	>0.01	>0.1
Safety	Risk to personnel onshore during decommissioning operations	No risk. No onshore disposal elements	Minor/first aid. Handling <500 tonnes of material	Medical aid/lost time injury. Handling >500 tonnes of material.	Permanent disability/fatality	Multiple fatalities
Safety	Risk to divers during decommissioning operations (PLL)	>0.00001	>0.0001	>0.001	>0.01	>0.1
Safety	Risk to 3rd parties and assets during decommissioning operations	No risk	Loss of access to operational area	Interference with 3rd party operations altering safety risk	Damage to 3rd party asset/damage to vessel	Damage to 3rd party asset requiring remediation/loss of vessel
Safety	Residual risk to 3rd parties	No risk	Potential snagging risk	Damage/loss of fishing gear	Damage to vessel	Loss of vessel

Criteria	Sub criteria	Very Low	Low	Medium	High	Very High
		1	2	3	4	5
Environment	Chemical discharge	None	PLONOR chemicals only	No warnings or substitution labels RQ<1	Warning labels RQ>1	Warnings and substitution labels RQ>1
Environment	Seabed disturbance and/or habitat alteration including cumulative impact	0 - 1% of existing footprint	1 - 10% of existing footprint	10% - 50% of existing footprint	>50% - 100% of existing footprint	>100% of existing footprint
Environment	Total CO_2 Emissions (resulting from energy consumption associated with vessels, treatment of recovered material and rock cover)	<1000t	1,000-5,000t	>5,000-10,000t	>10,000-25,000t	>25,000t
Environment	Proportion of potential recyclable material returned	>80%	50% - 80%	30% - <50%	10% - <30%	<10%
Environment	Proportion of total landfill material returned	<10%	10% - <30%	30% - <50%	50% - 80%	>80%
Environment	Conservation sites and species (including noise effects)	No impact	Potential effects but unlikely to be detectable as within normal variability	Minor detectable effects with rapid recovery	Effects detectable, not affecting site integrity or species population	Significant effects on site integrity or population
Environment	Loss of containment to the environment of chemicals, hydrocarbons	None	Slight Impact Reportable spill	Minor Impact/ Localised Impact Spill requiring Tier 1 response	Major Impact Spill requiring Tier 2 response	Massive Impact Spill requiring Tier 3 response
Technical	Technical feasibility	Routine operations with high confidence of outcomes Very low risk of failure. Low technical complexity	Routine operations with good confidence of outcomes Low risk of failure.	Non-routine operations but with good experience base Low risk of failure. Medium technical complexity	Non-routine operations with limited experience base Moderate risk of failure.	Untried technique Higher risk of failure. High technical complexity

Criteria	Sub criteria	Very Low	Low	Medium	High	Very High
		1	2	3	4	5
Technical	Weather sensitivity	Operations not weather sensitive	Operations are little affected by weather	Requires good weather window	Requires typical summer good weather window	Requires long good weather window
Societal	Residual effect on fishing, navigation or other access (including cumulative)	No effect	Access to area unrestricted	Access to area with charted obstructions	Access to area with uncharted debris and obstructions	Closed access to area
Societal	Coastal communities	No impact	Impacts within normal variability of onshore operations	Short term nuisance during onshore operations	Medium term nuisance during onshore operations	Long term nuisance during onshore operations
Economic	Total cost	<€2million	€2-5 million	€5-10 million	€10-20 million	>€20 million
Economic	Residual liability including monitoring and remediation if necessary	No residual liability	Surveys and remediation unlikely to be required	Survey requirement anticipated but at declining frequency	Surveys and remediation likely to be required in each 5 year period	Annual survey and potential for remedial work

The overarching conclusion of the CA process was that the full removal options have the highest potential impact (reflected in these scoring worst using the CA criteria, particularly in respect of environment and health and safety, but also in technical and economic criteria) and are therefore least preferable with key findings summarised as follows:

- The full removal option represented the highest safety risk to personnel involved in the removal and recycling of the infrastructure and greatest technical risk due to relatively limited experience to date, particularly in the removal of large pipelines.
- While the methods for removing pipelines are transferrable from standard procedure elsewhere in the oil and gas industry, their implementation at the scale proposed by the option is not, and therefore it entails greater technical and safety risks.
- The snagging risks to fisheries have been assessed as being very low for the leave in situ options (Anatec 2017; even though it is noted that these risks would be removed by the complete removal of the facilities which could represent a long-term snagging hazard to fisheries).
- The environmental risks were highest for full removal as this option would generate an area of seabed disturbance greater than that occupied by the pipeline, and at least as great as that which would have been associated with installation. There would also be greater volumes of CO_2 emissions from longer vessel times in the field for the full removal option.
- Though full removal provides substantial returns to shore of recyclable material which could offset future emissions from products using the recycling materials, this was largely counteracted by emissions from vessels involved in removal, and the uncertainty relating to the recyclability of the concrete, in addition to greater onshore risks of material handling.

Whilst the same scores were achieved for residual societal risks (e.g. to fisheries) for both leave in situ options, the results of the fisheries study (Anatec 2017) indicate that risk could be reduced further through the adoption of rock cover on 50% exposed pipeline in addition to freespans, or a modified version of this which applies rock cover to all exposed sections.

- The costs of full removal options were significantly greater than for any other option considered.

Figures 3.11a-f below, taken from the CA report (refer to **Appendix E** for full report) summarise the average option scoring of the CA.

Figure 3.11a-f: The average option scoring of the Comparative Assessment for all pipelines and umbilicals

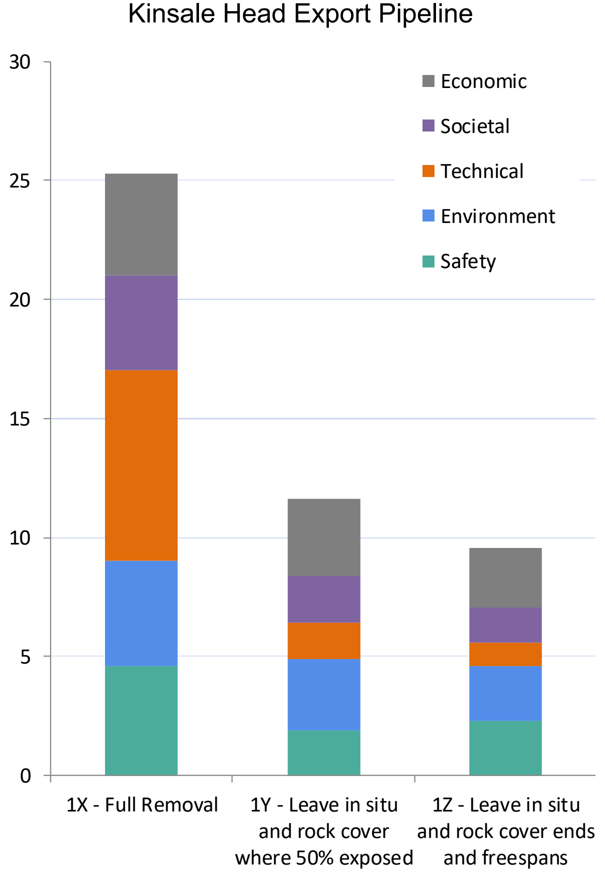


Figure 3.11a

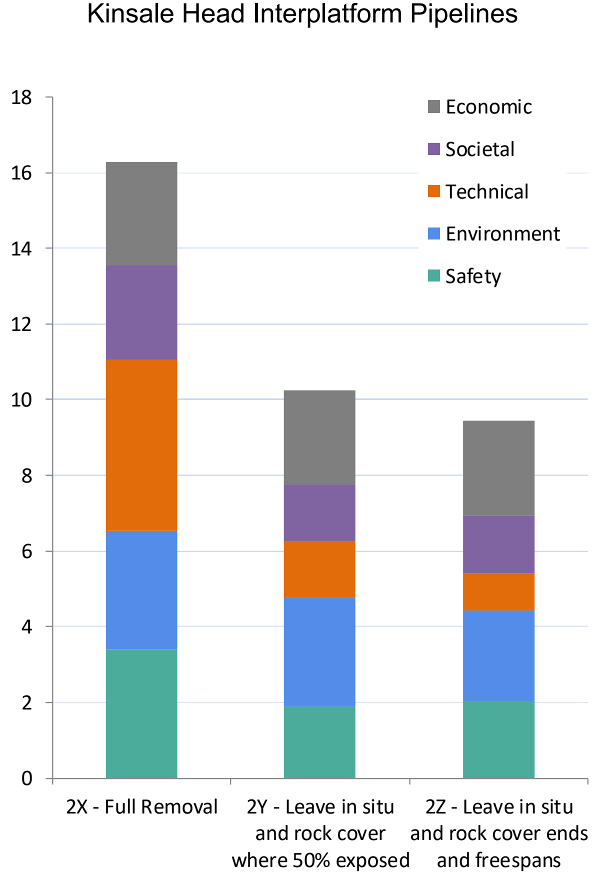


Figure 3.11b

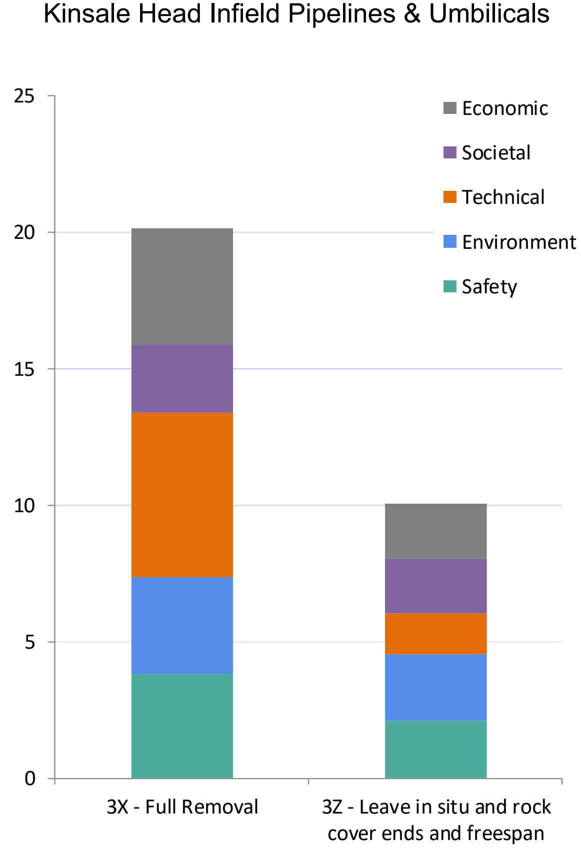


Figure 3.11c

Seven Heads Export Pipeline & Umbilical	Seven Heads Infield Pipelines & Umbilicals	Onshore Pipeline

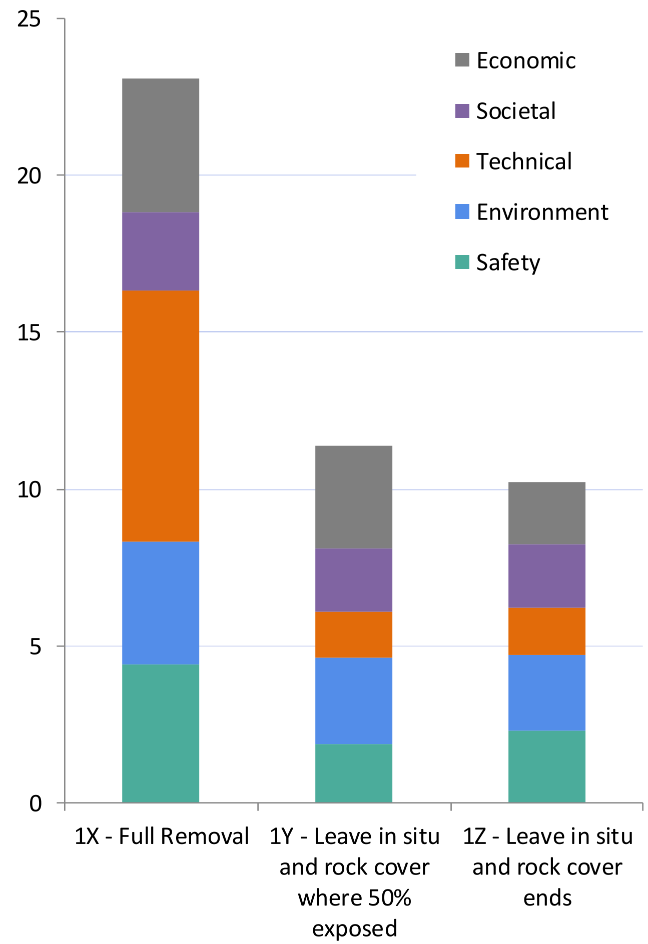


Figure 3.11d

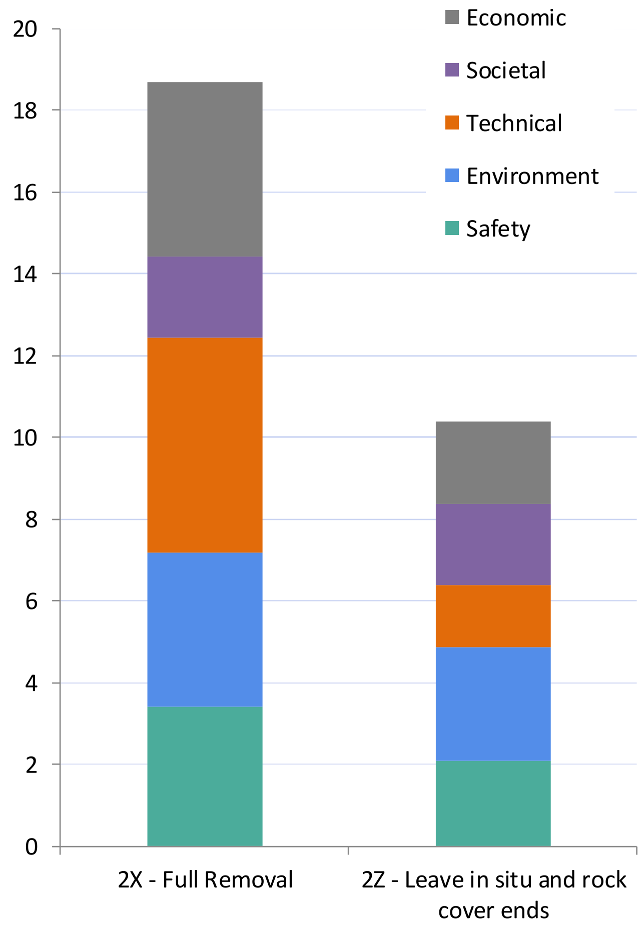


Figure 3.11e

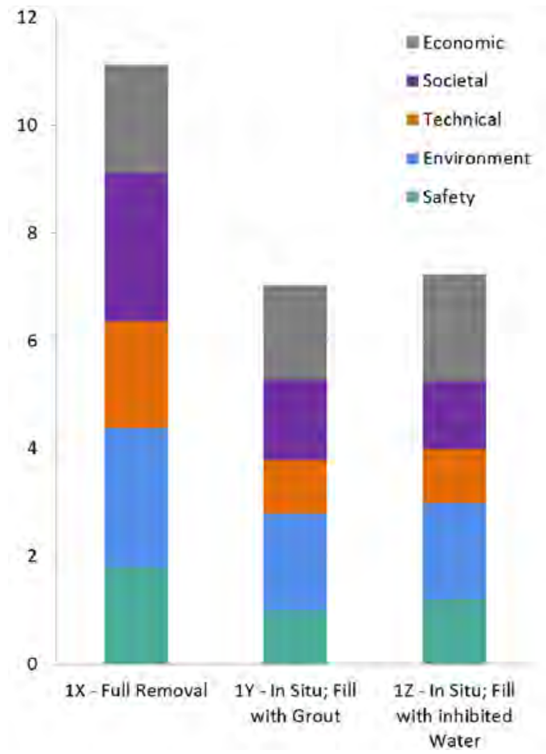


Figure 3.11f

Note: Lower score = lowest risk (best scoring option); higher score = highest risk (worst scoring option).

Based on the results of the CA, the most favourable options for the offshore pipeline infrastructure is to leave the pipelines and umbilicals *in situ* and to remediate freespans and cover the ends, using rock cover, to reduce future risks to 3rd parties. This option scores favourably for all the categories assessed, and the majority of sub-categories, including being the preferred option in terms of the environmental criteria considered. While additional rock placement may reduce 3rd party risk even further, this did not change the overall results of the CA. Nevertheless, in order to ensure a conservative assessment of possible impacts, two *in situ* decommissioning options have been assessed in this EIAR:

- rock cover remediation of pipe ends and freespans only (CA preferred option)
- rock cover the full length of pipelines, which are currently not buried or under protective material

3.4.6.2 Onshore Pipeline

The Comparative Assessment (refer to **Appendix E** for full report) also included the onshore section of the 24" export pipeline from Inch Terminal to the high water mark (HWM) at Inch beach. The options analysed within the CA were:

- Removal and disposal of the pipeline in its entirety,
- Leave pipeline in situ and fill with grout
- Leave pipeline in situ and fill with inhibited water

Similar to the offshore pipelines and umbilicals the overarching conclusion of the CA process is that the full removal option for the onshore pipeline has the worst scores across all the categories assessed and is therefore least preferable (see **Figure 3.11f**).

The two options to leave the onshore pipeline *in situ* (and fill with grout or fill with inhibited water) scored similarly and therefore, **both leave *in situ* options** have been considered for the purposes of assessment in this EIAR to provide a reasonable assessment of the associated impact.

The option to leave the pipeline *in situ* and fill with inhibited water would provide for future alternative re-use of the pipeline, while minimising impacts. This option would only be progressed if an alternative use and operator is identified prior to commencing pipeline decommissioning. In the event that no such re-use option is identified, the pipeline will be filled with grout.

3.4.6.3 Summary

For the purposes of this environmental assessment, the options to leave offshore pipelines and umbilicals *in situ* and rock cover freespans only, or to rock cover the full length of pipelines, which are currently not buried or under protective material (i.e. any exposed lengths), have both been brought forward for assessment in the EIAR, to ensure, in the event that more/less rock cover may be required during the decommissioning process, that the reasonable worst case has been identified and all likely impacts are assessed.

3.4.7 Onshore Terminal

The extant planning permission for the onshore terminal (Cork County Council reference no. 2929/76) requires the full removal of all infrastructure and the reinstatement of the site to agricultural use to the original contours. No alternative re-use has been identified for this facility and the full removal of all facilities on the site was considered the reasonable worst case alternative and was carried forward to the full environmental assessment.

3.4.8 Decommissioning Alternatives and Methodologies brought forward for full assessment

Table 3.10 sets out a summary of the selected decommissioning alternatives included in the full environmental assessment for each facility.

It also includes alternative methodologies which can be used to achieve each decommissioning alternative. The final decommissioning methodology for each facility will be determined in conjunction with the selected removal contractor, however, where alternative methodologies are available, these have been included for the purposes of environmental assessment as detailed in the following sections to provide an assessment of the reasonable worst case scenario of the potential associated impact. These will also inform the decommissioning plans.

The KA and KB platforms are comparable in design, but they have been modified since their original installation with both the removal and addition of modules. Consequently, they now have different overall topside weights and configurations. Despite these differences, the methods considered feasible to remove the platform topsides and jackets are essentially the same.

Section 3.5 describes the proposed decommissioning project, including the various alternative decommissioning options and alternative methodologies brought forward for full assessment in the EIAR.

Table 3.10: Summary of decommissioning alternatives (and associated alternative methodologies) progressed to full environmental assessment

Section Ref.	Facility	Chosen Decommissioning Alternative	Alternative Methodologies identified and considered for each chosen Decommissioning Alternative	
			Method	Vessel Type[9]
3.5.1	Platform Wells	Plug & Abandon	1. "Thru-tubing"	n/a – wells abandoned "rigless"
	Subsea Wells			a. Semi-submersible rig
				b. Light well intervention vessel / semi-submersible rig
3.5.2.2	Platform Topsides	Full Removal	1. Single Lift	a. Specialist HLV
				b. Conventional HLV
			2. Piece-medium (reverse installation)	a. Conventional HLV
3.5.2.3	Platform Jackets	Full Removal	1. Single Lift	a. Specialist HLV
				b. Conventional HLV
				c. Flotation
			2. Multiple Lift	a. Conventional HLV
3.5.3	Subsea structures	Full Removal	1. Single Lift	a. DSV

[9] Note that only the principal vessels involved are listed in this table, however other vessels, for example construction support (CSV), anchor handling (AHV), platform support (PSV) and guard vessels may also be used and are listed in full in relevant sections below.

Section Ref.	Facility	Chosen Decommissioning Alternative	Alternative Methodologies identified and considered for each chosen Decommissioning Alternative	
			Method	Vessel Type[9]
3.5.4	Pipelines, Umbilicals and protection materials	Leave *in situ*	Offshore: 1. Rock cover pipe ends and free spans 2. Rock cover pipe ends and all exposed sections • Note export pipeline will be filled with inhibited water if re-use identified	a. Rock placement vessel with remotely operated vehicle (ROV) supervision
			Onshore: 1. Fill with inhibited water, followed by grout if no re-use option identified (see **Section 3.3**)	n/a
3.5.6	Inch Terminal	Full Removal	Demolition and removal of all above ground facilities on site and reinstatement of the site to original ground condition	

3.5 Description of the Proposed Decommissioning Scope of Work

The broad scope of work involved in decommissioning the Kinsale Area facilities, including all decommissioning alternatives and methodologies which have been taken forward into the full environmental assessment as decommissioning options (refer to **Table 3.10**) are outlined below. More detail is provided in **Sections 3.5.1-3.5.7**.

- Facilities preparation: disconnect and degas process plant and pipelines (pipelines displaced with seawater, and inhibited seawater in the case of the 24” export pipeline).
- Wells: plug and abandon all platform and subsea wells and removal of any surface component of these wells, including wellhead protection structures and platform conductors.
- Platform topsides: complete removal of topsides either by single lift using a conventional or specialist heavy-lift vessel (HLV), or multiple lifts using a smaller HLV after cutting the topsides into sections, in accordance with OSPAR Decision 98/3.
- Subsea structures: (e.g. manifolds, wellhead protection structures): full removal in accordance with OSPAR decision 98/3 including the removal of connecting spool pieces and umbilical jumpers, and associated protection measures, for recycling/disposal.
- Platform jackets: complete removal by single lift using a conventional or specialist HLV, flotation, or multiple lift by smaller HLV by cutting the jacket into sections in accordance with OSPAR Decision 98/3.
- Offshore pipelines, umbilicals and protection materials: leave *in situ,* rock cover of freespans only or all exposed sections, and rock cover remaining *in situ* protection materials.

- Export pipeline (offshore and onshore section): leave *in situ,* fill onshore section with grout (if a viable re-use option is not identified) and rock cover of freespans only or all exposed sections in offshore section.
- Inch Terminal: full removal of facilities and reinstatement of site to the original contours and agricultural use, as per the terms of the site planning permission (Cork County Council planning reference 2929/76).
- Post-decommissioning survey: A debris clearance and pipeline route survey will be undertaken to confirm the completion of the decommissioning operations.

As indicated in Section 3.4.5, the final decommissioning methodology for each facility will be determined in conjunction with the selected removal contractor. The durations of each decommissioning option selected for the purposes of assessment have been chosen to be conservative; the actual durations are expected to be less.

Note that where durations of vessels, engaged in decommissioning activities, are provided, a contingency of 25% has been added to allow for weather or technical issues that could lead to activities taking longer than planned. This again ensures a conservative assessment.

3.5.1 Well Decommissioning

The Kinsale Area wells are drilled in the Cretaceous age “A” (Greensand) and/or “B” (Wealden) sands, which are overlain by a regional clay caprock seal (Gault Clay). Each platform well targets both intervals and production is comingled in the well, whereas the subsea wells variously target either the “A” sand (Ballycotton, Greensand) or “B” sand intervals (Southwest Kinsale, Seven Heads).

Reservoir pressures in the various fields, which were initially around 1500 psia, have substantially depleted through field life, with estimated pressures at time of cessation of production (CoP) in the order of 50-100 psia. Although well pressures will be sub-hydrostatic at the time of abandonment, the design of the permanent well barriers (plugs) conservatively accounts for the possibility of reservoir re-charge occurring and pressures regaining the original level over geological time. Permanent barriers (cement plugs) will be set at suitable depths in each well to isolate both the “A” and “B” sand formations from the surface.

The proposed approach to decommissioning each of the Kinsale Area wells (see **Table 3.11** & **Table 3.12**) was determined by studies undertaken by AGR (2016a, b) based on Oil and Gas UK (2015) well abandonment guidelines.

Whilst a mobile offshore drilling unit (MODU) may be used as part of the well decommissioning campaign for the subsea wells, no drilling operations will take place.

3.5.1.1 Platform wells

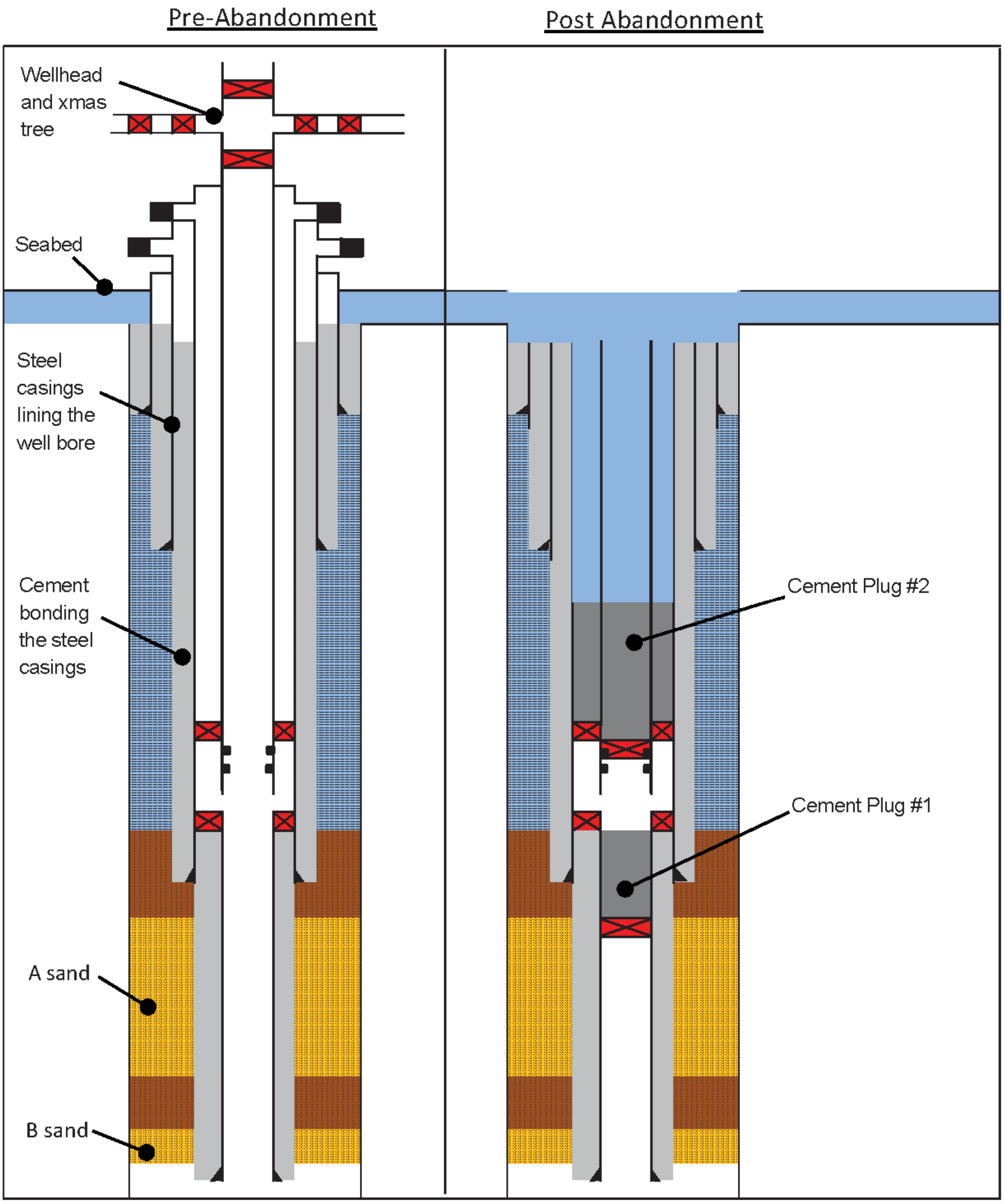
There are seven production wells on each platform all of which have a similar design, with a 20” conductor followed by 13⅜” and 9⅝” on 7” casings with wells reaching a total vertical depth (TVD) below seabed of ~3,000ft. All wells are completed with 7” production tubing and a Xmas Tree located on the platform cellar deck.

Due to the shallow well depth and the relatively simple completion design, a “thru-tubing” abandonment can be undertaken for the KA and KB platform wells using either “slickline” well intervention where tools are deployed into the well by wireline or coil tubing techniques. This approach minimises recovery of the 7” production tubing (which would otherwise significantly increase equipment requirements).

The use of a Jack-up or MODU beside the platform for well plug and abandonment (P&A) activities was discounted at an early stage of the study due to technical feasibility factors. A rigless intervention approach was determined to be the most suitable method for well P&A activities on both the Alpha and Bravo platform, utilising existing infrastructure and mobilising skid-mounted intervention equipment as required.

The proposed platform well abandonment methodology is summarised in **Table 3.11** and illustrated in **Figure 3.12.**

Figure 3.12: Typical Well Abandonment Diagram



Source: based on AGR (2017b).

A number of skid-mounted equipment modules will be required on the platforms to support abandonment operations including additional diesel power generators which will be needed to provide a minimum of 500kVa of dedicated power, along with pumping and cementing equipment and jacking units to recover the conductor and surface casing sections. For the purposes of estimating emissions associated with platform well decommissioning, it is considered that doubling the capacity of existing diesel generators will adequately cover the required loads.

The platform well abandonment activities are estimated to take approximately 155 days to complete (including a 25% contingency)[10]. This excludes mobilisation of the equipment to the platforms from Cork, which would involve up to 3 platform support vessel (PSV) trips.

Table 3.11: Platform well abandonment main steps

Item	Operation
1	Re-enter well and displace wellbore to sea-water
2	Install cement plugs downhole
3	Cut and recover 7" tubing ~150ft below seabed
4	Remove Xmas Tree
5	Recover conductor and casings

3.5.1.2 Subsea wells

All subsea wells will be decommissioned from a semi-submersible MODU (see **Figure 3.13**), and/or a light well intervention vessel (LWIV).

Figure 3.13: Typical semi-submersible drilling rig (MODU)

Normally two anchor handling vessels tow such a rig to the well location. On reaching the location, a third anchor handler is generally brought in to run and deploy the rig anchors.

[10] Based on AGR (2017b)

Mooring is achieved via the deployment of 8-12 anchors weighing approximately 12 tonnes each, connected to the rig by chain, a proportion of which will lie on the seabed (catenary contact) when the anchor is deployed. Minor adjustments to the rig position can be made by hauling or paying out the anchor chain. The precise arrangement of anchors around the rig will be defined by a mooring analysis which takes account of the local water depth, tidal and other currents, winds and seabed features. Due to the presence of subcropping chalk bedrock, with a thin sediment cover, it may be effective to pre-lay the MODU anchors in advance of the MODU's arrival at each well location. The MODU would normally move and re-anchor between each subsea well but the rig may be repositioned without lifting anchors between some closely spaced wells, such as the Southwest Kinsale wells.

The rig would have facilities for drilling (or in this case well plugging and abandonment), power generation, supporting utilities and accommodation. The rig will require refuelling (bunkering) during the abandonment programme which will be undertaken in calm seas and in accordance with procedures agreed with Department of Transport, Tourism and Sport (DTTAS). Helifuel supplies are replenished when necessary by replacing an empty with a full tank. Approximately 2 crew change helicopter trips per week will be made to and from Cork during the well abandonment campaign.

An alternative approach is to use a LWIV which can perform simple well plug and abandonment procedures such as those required for the majority of the subsea wells. A LWIV has the advantage of faster mobilisation and transit between wells and negates the requirement for anchor handling vessels or the deployment of anchors. However, a LWIV's limited deck space necessitates returns to port to replenish supplies of cement and there is a smaller operational weather window compared to the MODU. Such vessels are also not currently well equipped to deal with tubing recovery, which will be required for one of the Seven Heads wells (48/24-8) and therefore a MODU will need to be mobilised to abandon this well. The deployment of either a MODU or LWIV will be subject to vessel availability, schedule and detailed technical assessment. A construction support vessel (CSV) could be used to cut and retrieve the wellheads and casings following abandonment, whichever option is selected.

The subsea production wells (though with small variation in design and target formations) will be abandoned using the same "thru-tubing" approach outlined above for the platform wells, irrespective of whether a MODU or LWIV is used (see **Figure 3.12**). The Ballycotton well has a vertical Xmas Tree which requires different equipment to allow intervention, but the abandonment process is fundamentally the same as for all the other wells. The main steps for the abandonment of the subsea wells are set out in **Table 3.12**.

The four exploration wells (49/16-2, 48/20-1A, 48/25-2, 48/23-3) have already been abandoned to a standard suitable for permanent decommissioning such that the only remaining work required is to remove the wellhead and to sever the casings to 10ft below the seabed and recover these to shore. This can be completed from a CSV.

Though all of the subsea wells have a surface component in the form of subsea Xmas Trees, four have additional wellhead protection structures comprising a gravity based foundation of four concrete blocks over which sits a truncated triangular steel frame (see **Section 3.5.3** for more details). These will be removed prior to the well abandonment to allow access to the subsea wellheads. A LWIV and/or MODU rig would accommodate a crew in the order of 100 persons.

Table 3.12: Subsea well abandonment main steps

Item	Operation
1	Re-enter well and displace well bore to seawater
2	Slickline thru-tubing cementing and cutting and recovery of tubing ~400-600ft below seabed
3	Recover 4½" tubing and perform remedial cementing of 9⅝" section (*well 48/24-8 only)*
4	Remove Xmas Tree
5	Recover conductor and casings

The overall schedule to abandon the subsea wells is estimated at approximately 99 or 159 days (including a 25% contingency) depending on the chosen option outlined above. The estimation is based on the PSV duration which is required for the duration of the works for each option. A high level vessel breakdown for each of the two options is summarised in **Tables 3.13 and 3.14**.

These include mobilisation/demobilisation and infield rig/vessel moves and a 25% contingency. For the purposes of this environmental assessment, the vessel durations associated with the MODU option have been used, in **Section 7** as the worst case scenario.

Table 3.13: Subsea well abandonment timing (days) using a MODU

Vessel	Activity	Mob/ Demob	Transit	Operational	Total Duration	Total with Contingency
MODU	Well intervention and abandonment	11	32	84	127	159
AHV	Anchor handling for MODU	-	6	25	31	39
CSV	Wellhead and casing removal	4	6	25	35	43
PSV	Supply/standby during abandonment	-	-	84	127	159

Source: based on AGR (2017a)

Table 3.14: Subsea well abandonment timing (days) using a LWIV and MODU

Vessel	Activity	Mob/ Demob	Transit	Operational	Total Duration	Total with Contingency
LWIV	Well intervention and abandonment	1.5	10	46	57	72
MODU	Well intervention and abandonment of well requiring remedial cementing (48/24-8)	16	20	33	69	86
AHV	Anchor handling for MODU	-	6	7.5	14	17
CSV	Wellhead and casing removal	4	6	25	35	43
PSV	Supply/standby during abandonment	-	-	79	79	99

Source: based on AGR (2017b)

3.5.2 Kinsale Area Platforms Decommissioning

3.5.2.1 Offshore Facilities Preparation Works

Prior to decommissioning of the platforms, preparation works, such as cleaning and topsides preparation and disconnecting and degassing all process plant and pipelines is required. All of these works will be undertaken from the Kinsale Area platforms.

Topsides Preparatory Works

Cleaning and topsides preparation, following Cessation of Production (CoP), is the work required on all systems, plant and equipment to ensure that the platforms are free of hydrocarbon fuels, gases and removable hazardous materials. This ensures that during preparations and final removal of the topsides, no hazards from the production, operating or cleaning elements remain and that the topsides are handed over in a clearly defined and documented condition to facilitate topsides removal.

Initially, pipework and vessels on the topsides will be isolated from the wells, purged with nitrogen gas and vented to the atmosphere to ensure they are free of any residual natural gas.

Volumes of waste (water and corrosion debris (iron)) from the topsides cleaning are expected to be small as the hydrocarbons produced are dry natural gas (e.g. no sludges or solid naturally occurring radioactive materials (NORM) material are present).

These wastes will not be discharged to sea and along with any residual inventories of diesel, chemicals, condensate or aviation fuel, will be collected for onshore disposal under Kinsale Energy's existing waste management procedures.

Asbestos identified on the platforms (mainly building cladding material) will remain on the topsides and be taken away during the topsides removal. Asbestos and other hazardous waste will be handled and disposed of at appropriately licensed facilities in accordance with all relevant legislation. Contractors will be required to strictly adhere to all relevant legislation and guidelines in this regard.

An overview of the waste generated in cleaning the topsides, prior to the overall removal of the topsides to shore, is summarised in **Table 3.15**.

Table 3.15: Overview of topside cleaning waste generated

Waste Type	Composition of Waste	Disposal Route
On-board hydrocarbons	fuels and lubricants: • Diesel • Heli-fuel (Jet A1) • Lubricating Oils	Fuels and lubricants will be transported onshore for re-use/disposal within Ireland
Other hazardous materials & Waste Chemicals	Hazardous waste such as: • Batteries • Fluorescent tubes (containing mercury) • Fire Detectors (radioactive waste) • Fire extinguishants • Refrigerant gases • Tri-Ethylene Glycol (TEG) Hydraulic fluid • Hydraulic Fluid HW540 v2 • BOP fluid (Erifon HD856) (1% concentration).	Waste chemicals, and other hazardous materials will be transported ashore for re-use/disposal within Ireland or Europe Inventories of spare operating chemicals used e.g. (Tri-Ethylene Glycol (TEG) will be run down to minimum levels prior to Cessation of Production)
Original paint coating	The potential presence of lead based paints	May give off toxic fumes / dust if cutting is used so appropriate safety measures will be taken. Painted items will be disposed of appropriately onshore with consideration given to any toxic components

Pipeline Degassing and Umbilicals Contents Displacement

It is planned to remove gas from the pipelines shortly after cessation of production (CoP) by displacing the contents of the pipelines into the subsea wells by pumping seawater from the platforms. Surfactants may also be used prior to the final seawater displacement procedure to clean the pipelines (excluding the export pipeline) and ensure there is no residual hydrocarbons present (though note it is highly unlikely for there to be residual hydrocarbons in the pipelines in view of the production history). All infield pipeline contents will be displaced into the subsea wells and there will be no marine discharges from this activity.

The 24" export pipeline between Kinsale Alpha and the Inch Terminal (offshore and onshore sections) will be displaced from Kinsale Alpha into the terminal site where the seawater will be collected and stored in sealed containers. The seawater will then be disposed during the Inch Terminal decommissioning works (approximately 425m^3 of seawater transported for waste disposal to an appropriately licensed facility via 22HGV movements over 2 days). During the displacement of the export pipeline the majority of gas will be displaced into the gas network but small volumes of gas will be vented at the terminal site intermittently over a period of 2.5 days.

Following the initial displacement of the 24” export pipeline and the Seven Heads 18” export pipeline with seawater, inhibited seawater (approximately 15,800m^3 and 5,700m^3 respectively) will be placed into both export pipelines with both ends of the pipelines mechanically capped.

This will allow for the preservation of the export pipelines for a possible re-use, with a decision being made on the fate of the pipelines when the pipeline decommissioning works are undertaken (i.e. if no re-use option is identified at that time, the onshore section of the 24” export pipeline will be grout filled, and the inhibited water will be discharged at the seaward end (see **Section 3.5.4.2**)).

Similarly to the offshore pipelines the umbilical chemical line contents will also be displaced by seawater into the subsea wells. The umbilical hydraulic line contents will not be displaced prior to decommissioning of the subsea facilities. These hydraulic lines consist of water based hydraulic fluid (approximately 29.5m^3 in total across all umbilicals) and will be released to sea during the umbilical jumper cutting for the jackets and subsea structures decommissioning or during degradation of the umbilicals over the following decades/centuries.

3.5.2.2 Topsides Removal

Removal – Single lift

The removal of the KA and KB topsides in a single lift may be undertaken by a specialist lift vessel such as a twin hulled ship shape heavy-lift vessel (HLV), or alternatively using a more conventional semi submersible HLV, with barge transport to a suitable disposal yard.

Single lift using specialist HLV

The following describes the procedure for a single lift based on a study by Allseas (2012a), with additional information provided on the use of a standard HLV from Genesis (2011). Engineering work required in advance of the lifting procedure may include the addition of module reinforcement and seafastenings, estimated to be between 22t and 43t (based on an assumed 0.5-1.0% of topside weight). The topsides will be separated from the jacket at a suitable point above sea level, using diamond-wire or hydraulic cutting tools, and transferred to a barge using support stools and a skid system. A combination of ballasting the HLV and deballasting the cargo barge will bring the topsides and stools together in a controlled manner. Once all of the topside weight has been transferred to the barge, the lifting system will be disconnected, allowing the barge to be unmoored and towed away.

On arrival at the disposal yard, the barge will be moored and ballasted to match the height of the quayside, and link beams run and connected to the barge to allow for the topsides to skid from the barge, during which ballasting of the barge will maintain its level with the quay.

The overall schedule for the lift of both topsides using a specialist HLV and their transport to the disposal yard is approximately 88 days (including a 25% contingency). This is based on the platform supply vessel (PSV) which is required for the longest duration as a worst case scenario. A high level breakdown of the vessel durations is provided in **Table 3.16**.

It should be noted that the vessel durations associated with this methodology are not the worst case scenario in terms of topsides removal methodology options. For the purposes of this environmental assessment, the vessel durations for the piece medium removal option below are considered the worst case scenario and it is these durations which have been used in **Section 7,** for the environmental assessment.

Table 3.16: Estimated removal duration (days) of KA and KB topsides in a single lift using a specialist HLV

Vessel	Mob/ Demob	Transit	Working	Total Duration	Total with Contingency
HLV	8	6	17	31	39
Barge	7	6	7	20	25
PSV	8	24	38	70	88
Tugs (4no.)	8	24	28	60	75
Guard Vessel	6	3	55	64	80

Source: based on Allseas (2012a & b)

Single Lift using conventional HLV

A more conventional HLV, a semi-submersible crane vessel or similar, could also be used to lift the topsides (see **Figure 3.14**). The removal would be analogous to that outlined above in terms of preparatory works e.g. module strengthening and cutting of the topsides from the jackets. The topsides would then be lifted onto a barge and transported to shore for recycling/disposal. A conventional HLV may require to be moored, using anchors. For example a 12 anchor mooring system analogous to that of a semi-submersible drilling rig would be required.

Figure 3.14: Conventional HLV, in this case Saipem 7000, lifting a topsides module

Source: worldmaritimenews.com; Courtesy of Saipem

Detailed structural analysis will be required to determine the extent of strengthening of the topside structure and provision of lifting points, required to perform a single lift in this way. Similar to the other removal options, it is assumed that the existing accommodation on KA will be utilised to support the preparation works to the topsides, for as long as possible, until the arrival of the HLV. On the KB platform, temporary accommodation will be used to facilitate the preparation works.

The overall schedule for the lift of both topsides using a conventional HLV and their transport to the disposal yard is approximately 88 days (including a 25% contingency). This is based on the estimated guard vessel duration which is assumed to be required for the duration of the HLV and PSV infield works as a worst case scenario. A high level breakdown of the vessel timings is provided in **Table 3.17**.

As detailed above, the vessel durations associated with this methodology are not considered to be the worst case scenario in terms of topsides removal methodology options. For the purposes of this environmental assessment, the vessel durations for the piece medium removal option below are considered the worst case scenario and it is these durations which have been used in **Section 7,** for the environmental assessment.

However, the potential use of anchors with the conventional HLV for this option has been assessed in **Section 7.**

Table 3.17: Estimated removal timing (days) of KA and KB topsides in a single lift using conventional HLV

Vessel	Mob/ Demob	Transit	Working	Total Duration	Total with Contingency
HLV	8	6	21	35	44
Barge	7	6	7	20	25
PSV	8	24	28	70	88
Tugs (4no.)	8	24	28	60	75
AHV	8	6	21	35	44
Guard Vessel	8	3	59	70	88

Source: based on vessels and durations provided by Kinsale Energy

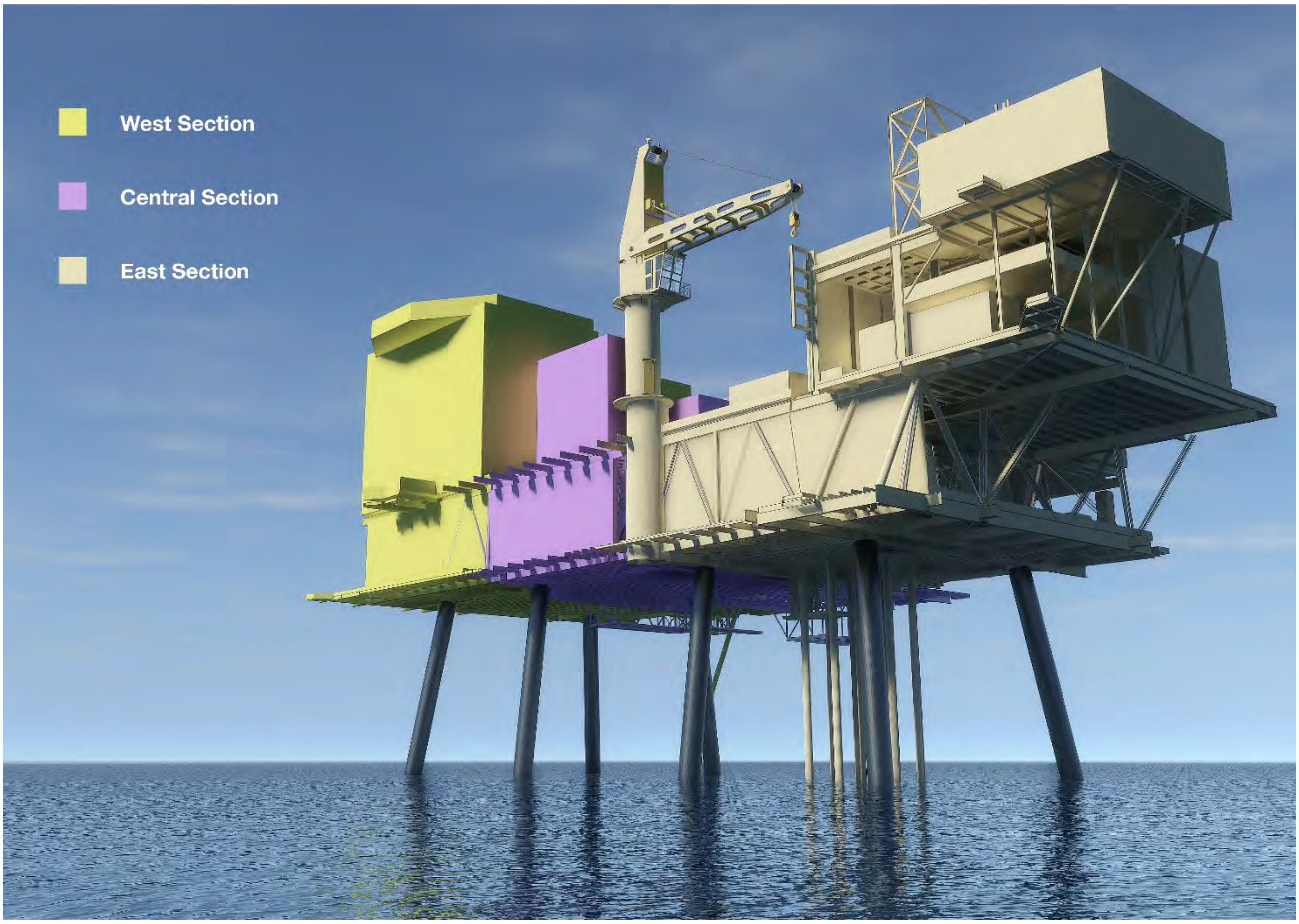
Removal – Piece-medium (reverse installation)

The reverse installation approach as a potential methodology option for topsides removal incorporates a combination of piece small and piece medium in which the equipment, secondary structures, modules and module support frame are removed in separate lifting operations.

See **Figure 3.15** for a schematic showing a view of the KA topsides module sections. The approach shown for the KA topsides will essentially be repeated for the KB platform.

It is assumed that the existing accommodation on KA will be used to support the preparatory and piece small work until arrival of the HLV, on which the workforce could be accommodated. On the KB platform, temporary accommodation will be installed to facilitate the piece medium and preparation works.

Figure 3.15: Kinsale Alpha topsides schematic showing the topside module sections



The overall schedule for the lift of both topsides and their transport to the disposal yard using the piece medium approach is estimated to be approximately 169 days (including a 25% contingency). This is based on the estimated guard vessel duration (vessel which is required for the longest duration) which is assumed to be required for the duration of the infield works being undertaken by the crane vessel, HLV, PSV and CSV, as a worst case scenario in the environmental assessment. A high level breakdown of the vessel timings for the entire schedule of works for the piece medium approach is provided in **Table 3.18.** There is the opportunity for simultaneous operations and resource sharing with the KA facility activities, which has been taken into account when estimating the total vessel durations to complete both KA and KB topsides decommissioning by reverse installation. As with all decommissioning options the ultimate lift strategy will depend on vessel availability, technical assessment, safety and commercial factors. For the purposes of this environmental assessment, the vessel durations associated with the piece medium remove option for the topsides have been used in **Section 7** as the worst case scenario.

Table 3.18: Estimated removal timing (days) of KA and KB topsides using reverse installation

Vessel	Mob/ Demob	Transit	Working	Total Duration	Total with Contingency
HLV	4	6	31	41	51
PSV	8	24	57	89	111
CSV	3	6	48	57	71
Cargo Barges (2no.)	36	24	69	129	161
Tugs (2no.)	8	24	11	43	54
Supply Boat	16	8	8	32	40

Vessel	Mob/ Demob	Transit	Working	Total Duration	Total with Contingency
AHV	8	24	31	63	79
Guard Vessel	6	3	126	135	169

Source: based on Xodus (2016d) and vessels and durations provided by Kinsale Energy

3.5.2.3 Jacket Removal

The separation of the jacket structures from pipelines and umbilicals on the seabed will be undertaken by ROV tooling wherever possible, or using divers and a DSV where required. It will not be necessary to uncouple at flanges as the pipelines and jackets have no future use, and so they will be cut using an external cutting tool, e.g. hydraulic shears. Spool pieces will be cut into recoverable sections of approximately 24m in length and lifted by a suitably equipped support vessel and transported to shore for recycling or disposal.

For a conservative assessment of the associated impact it is assumed that approximately 100m of spool pieces will be recovered at all platform tie-ins. In total, it is estimated that some 0.85km of spool pieces will be recovered during the jacket decommissioning, taking into account all pipeline connection points to the KA and KB jackets.

Protection materials covering these spool pieces will also be removed where required for access (134no. mattresses with each mattress assumed to be approximately 10Te). The method of removal for these items may include speed loaders or cargo nets. A number of other novel methods are also emerging in the market, as decommissioning activity increases (see Jee Ltd. 2015).

Once removed, the concrete mattresses will be returned to shore, where they will either be recycled or disposed of in landfill if recycling is not possible. In keeping with a waste-hierarchy approach, where possible, this material will be recycled as aggregate, but it may be necessary for some/all to be disposed of in landfill. For the purposes of this assessment it is assumed that all concrete mattresses returned to shore will be disposed of in landfill as this represents the worst case scenario for assessment purposes.

The removal of protection materials and the cutting and lifting of spool pieces will involve the use of a number of vessels including a CSV and PSV. The number of vessel days associated with these operations as part of the jacket decommissioning are included in **Table 3.19,** with the overall schedule for the removal of spool pieces and protection material and their transport to the disposal yard estimated at 71 days (including a 25% contingency).

Table 3.19: Estimated timing (days) for removal of spool pieces, umbilical jumpers and protection materials at the platform jackets

Vessel	Mob/ Demob/ Transit	Removal of protection material	Cut spool pieces & umbilical jumpers	Recover spool pieces	Total Duration	Total with Contingency
CSV	32	9	10	6	57	71
PSV	16	-	-	2	18	23

Source: Based on CA method statements (modified after Ramboll 2017a,b)

Regardless of the lift technique to be employed the jackets will be cut from the pile foundations at, or close to, seabed level using either an internal or external pile cutting tool. Internal leg surveys have been undertaken to confirm access for an internal pile cutting tool if they are to be cut internally. External cuts of the legs and piles could be made using diamond wire cutting tools, using remote tooling as far as possible, or diver intervention only if necessary.

The cutting tool will cut the legs at seabed level, as future exposure is not expected due to the hard strata at seabed level. In the worst case, it may not be possible to cut a leg at seabed level. If this situation arises, a short (~1m) section may be left exposed, and rock cover would be applied as part of the wider seabed remediation campaign.

Due to the high recyclability of steel (the dominant jacket material) the jackets will be recycled. The jackets will be removed to a dismantling yard, and recycling and waste facilities, which will be fully licensed for the relevant activities, will be selected by the removal contractor.

Marine growth comprising of a variety of hard- and soft-bodied organisms are present on the platform jackets, and it is proposed that the marine growth will be removed onshore following the removal and transport of the jackets to the disposal yard. A proportion of the marine growth will be removed offshore at cut locations, or will fall off in transit.

Following removal of the jackets, all significant debris on the seabed, which has accumulated around the jackets following years of operations, will be confirmed by the post-decommissioning survey (as detailed in **Section 3.5.5**) and will be removed using an ROV and grab. Larger items will be removed using a crane on a construction support vessel. Existing items known to be on the seabed include scaffolding boards and tubes, deck grating and miscellaneous construction debris, with no hazardous materials known to be present.

Removal – Single lift

Three options are potentially available to remove the jackets in a single lift. Two involve the use of specialist heavy lift vessels such as a twin hulled ship shape heavy-lift vessel (HLV) or a more conventional semi submersible HLV to lift the jackets, in a manner similar to topside removal, and transport them to a barge in sheltered water, prior to onward transport to a disposal yard. The third option is the use of a system involving attaching buoyancy caissons to the jacket, such that it can be floated and towed away using tugs.

Single Lift using specialist HLV

The following describes the procedure for a single lift based on a study by AllSeas (2012c & 2012d) using a specialist HLV, such as a twin hulled ship shape heavy-lift vessel (HLV). The HLV uses a Jacket Lift System (JLS), comprising a hoist and tilting lift beams with skids, which are used to rotate the jacket on removal onto its side, and manoeuvre it onto the vessel deck. **Figure 3.16** illustrates the HLV lifting a jacket from the seabed and aligning and tilting it onto the vessel deck for removal. Weight will be minimised by ensuring that as much water as possible from flooded jacket members is allowed to escape, which can be facilitated by the drilling of holes in these members.

Analogous to the transport of the topsides to the disposal yard described above, the barge with the jacket will be towed to the disposal yard and moored at the disposal yard quayside. It will be ballasted to the appropriate elevation, and the jacket will be skidded onto the quayside.

Figure 3.16: Specialist HLV, in this case, *Pioneering Spirit,* with jacket lifted from the seabed and tilted towards the vessel deck

Source: https://allseas.com

The overall schedule for the lift of both jackets together and their transport to the disposal yard is estimated at approximately 110 days (including a 25% contingency). This is based on the estimated guard vessel duration which is assumed to be required for the duration of the HLV and CSV infield works as a worst case scenario. A high level estimate of the vessel timings is provided in **Table 3.20**. For the purposes of this environmental assessment, the vessel durations associated with this option are not the worst case scenario for the removal option for the jackets. See vessel durations for the multiple lift option below which have been used in **Section 7,** for the environmental assessment worst case scenario.

Table 3.20: Estimated removal timing (days) of KA and KB jackets in a single lift using a specialist HLV

Vessel	Mob/ Demob	Transit	Work	Total Duration	Total with Contingency
HLV	3	6	22	31	39
Barge	7	6	11	24	30
CSV	2	6	57	65	81
Tugs (4no.)	8	24	44	76	95
Guard Vessel	6	3	79	88	110

Source: based on Allseas (2012c & d), and vessels and durations provided by Kinsale Energy

Single lift using conventional HLV

Similar to the topsides removal a conventional HLV could also be used for the removal of the jackets in a single lift. The overall schedule for the lift of both jackets and their transport to the disposal yard using this method is also estimated at 118 days (including a 25% contingency). This is based on the estimated guard vessel duration which is assumed to be required for the duration of the HLV and CSV infield works as a worst case scenario. A high level estimate of the vessel timings is provided in **Table 3.21**.

For the purposes of this environmental assessment, the vessel durations associated with the single lift option using a conventional HLV for the jackets are not the worst case scenario for the removal option for the jackets. See vessel durations for the multiple lift option below which have been used in **Section 7** as the worst case scenario. However, the potential use of anchors with the conventional HLV for this option have been assessed in **Section 7.**

Table 3.21: Estimated removal timing (days) of KA and KB jackets in a single lift using conventional HLV

Vessel	Mob/ Demob	Transit	Work	Total Duration	Total with Contingency
HLV	3	6	28	37	46
Barge	7	6	11	24	30
CSV	2	6	57	65	81
Tugs (4no.)	8	24	44	76	95
Guard Vessel	6	3	85	94	118
AHV	8	6	28	37	46

Source: based on vessels and durations provided by Kinsale Energy

Single lift using flotation

An alternative approach to jacket removal in a single lift is to use buoyancy tanks to float the jacket into a vertical mid-water position, in which it is towed to a sheltered location close to the disposal yard using tug vessels. On arrival, the ballast of the tanks is adjusted to rotate and lift the jacket to a horizontal position at the water surface where to can be towed and lifted onto the disposal yard quayside. A high level estimate of the vessel timings is provided in **Table 3.22,** with an overall schedule of 109 days for both jackets**.** This is based on the estimated guard vessel duration which is assumed to be required for the duration of the CSV and tug infield works as a worst case scenario.

For the purposes of this environmental assessment, the vessel durations associated with this option are not the worst case scenario for the removal option for the jackets. See vessel durations for the multiple lift option below which have been used in **Section 7,** for the environmental assessment worst case scenario.

Table 3.22: Estimated removal timing (days) of KA and KB jackets in a single lift using flotation

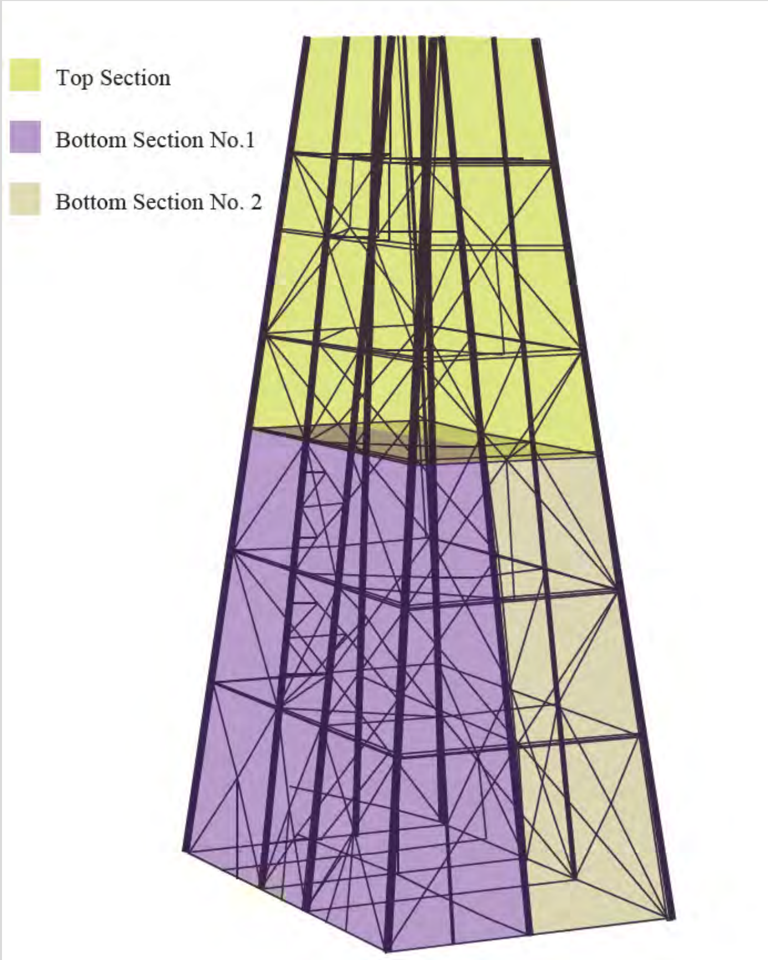
Vessel	Mob/ Demob	Transit	Work	Total Duration	Total with Contingency
CSV	2	6	57	65	81
Tugs (4no.)	8	12	84	104	130
Guard Vessel	6	3	78	87	109

Source: based on vessels and durations provided by Kinsale Energy

Removal – Multiple lift

If this methodology for removal was used, the KA and KB jackets would be cut into approximately 3 sections (see **Figure 3.17**) and removed in separate lifts, using a HLV, onto a waiting barge before being transferred to shore. Jacket members (legs and braces) will be cut using a combination of hydraulic shears for smaller cuts and abrasive water jet or diamond wire cutting for larger cuts.

Figure 3.17: Kinsale Alpha jacket schematic showing possible jacket sections



Preparatory work to lift the jackets will involve the same steps as for the single lift (above) with the drilling of holes into flooded members to allow water drainage to minimise weight, plus the installation of lifting points on the upper jacket section and the cutting of the jacket legs. The upper section would then be cut from the lower jacket sections, prior to these being separated and lifted using an internal lifting tool, which will be deployed into the jacket legs and secured.

For this environmental assessment, it is assumed the preparatory works will be undertaken from the HLV and a DSV, however, a PSV and/or CSV may be used for some of the preparatory works rather than the HLV depending on availability of vessels.

Each jacket section will be backloaded onto the HLV before being transferred to a barge where it will be seafastened for transport to the disposal yard.

The estimated vessel times for the multiple lift jacket removal procedure are indicated in **Table 3.23**, with the overall schedule for the lift of both jackets and their transport to the disposal yard using the multiple lift option estimated at 149 days (including a 25% contingency). This is based on the estimated guard vessel duration (vessel which is working for the longest duration) which is assumed to be required for the duration of the infield works being undertaken by the HLV, DSV and survey vessel as a worst case scenario.

For the purposes of this environmental assessment, the vessel durations associated with this option are the worst case scenario for the removal option for the jackets, which have been used in **Section 7,** for the environmental assessment worst case scenario. The potential use of anchors with the HLV for this option have also been assessed in **Section 7.**

Table 3.23: Estimated removal timing (days) of KA and KB platform jackets using the multiple lift jacket procedure

Vessel	Mob/ Demob	Transit	Working	Yard	Total Duration	Total with Contingency
HLV	4	6	58		68	85
DSV	3	6	40		49	61
Cargo Barges (3no.)	54	36	76	14	180	225 (75 per barge)
Tugs (3no.)	12	36	15		74	93
Supply Boat	8	4			12	15
AHV	8	24	58		90	113
Survey Vessel	2	6	12		20	25
Guard Vessel	6	3	110		119	149

Source: Based on Xodus (2016d) and vessels and durations provided by Kinsale Energy

Jacket Removal Deferral

As shown in **Figure 1.2**, the platform removal campaign may be scheduled over a number of years (1-10 years), depending on vessel availability and cost efficiency. It is possible that jacket removal may not take place immediately after topsides removal, in which case the jacket structures will be equipped with additional navigation aids and markers to ensure they do not form a hazard to other marine users and the surface safety zones will remain in place. Offshore platform jackets left in this way are commonly referred to as being in "lighthouse mode".

If jacket removal is scheduled to occur significantly later than the other facilities, this would allow further consideration of possible other uses for the jacket structure(s) for example, for hydrocarbon exploitation (with new topsides), carbon capture and storage or as part of a renewables development e.g. as a power hub.

If however, no re-use has been identified within this time period, the jackets will then be removed.

Lighting and Marking of the Platforms

Throughout the operational phase the Kinsale platforms have been marked with Aids to Navigation (AtoN) as agreed with the Commissioners of Irish Lights. Kinsale Energy will provide continuity of navigational safety from CoP through the removal of the topsides and jackets, although this will require changes to the specific Navigation Aids used. Before the start of decommissioning of the platform topsides Kinsale Energy will agree a lighting and marking plan as directed by the Commissioners for Irish Lights for the decommissioning phase of the project. This applies to establishment of new AtoN as well as disestablishment or changes to existing AtoN.

- All applications will be accompanied by an up to date Navigational Risk Assessment, with traffic analysis to inform the Commissioners of Irish Lights to set the Aids to Navigation requirements
- All Lighting and Marking proposals will comply with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation 0-139 on the Marking of Man-Made Offshore Structures (2013)
- Notices to Mariners will be issued highlighting the new marking arrangements

Kinsale Energy will provide solar powered Aids to Navigation (AtoN) marking on the jacket structures, after topsides removal, during the extended decommissioning phase (units will be self-contained with the ability to be monitored by satellite, if required).

3.5.3 Subsea Structures

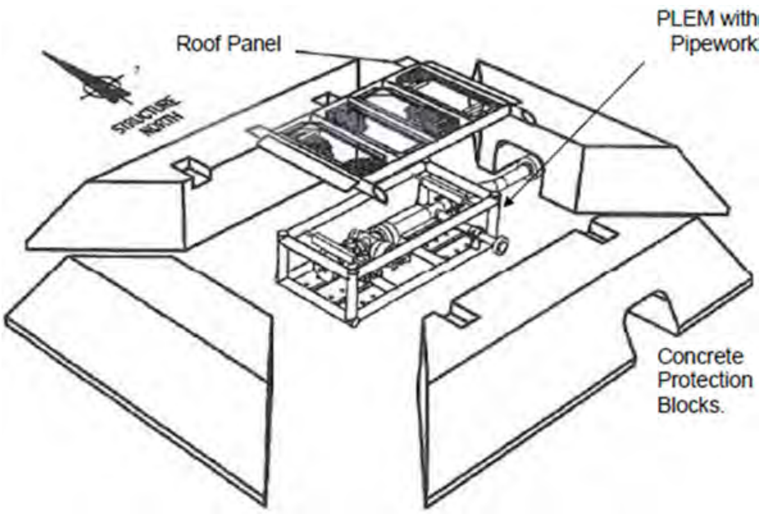
OSPAR Decision 98/3 states that, unless in exceptional circumstances, all subsea structures are to be removed during decommissioning, unless they are to remain *in situ* for an alternative use.

With no alternative use identified for the Kinsale Area subsea structures Kinsale Energy proposes to remove all subsea structures. The subsea structures in the Kinsale Area are as described in **Table 3.6** and are illustrated in **Figure 3.18**.

Figure 3.18: Subsea infrastructure

a) Wellhead protection structure

b) Typical Kinsale Area PLEM



c) Seven Heads manifold

3.5.3.1 Removal of Protection Materials

The concrete mattress and grout bag materials will be removed only when necessary to allow access to the tie-in facilities underneath, as indicated for the jacket removal in **Section 3.5.2.3**. **Table 3.24** details the number of mattresses to be removed to allow the removal of the spool pieces and umbilical jumpers at all subsea structures, with each mattress assumed to be approximately 10Te. Refer to **Table 3.25** for a conservative estimate of vessel days to complete the removal of these protection materials.

Table 3.24: Concrete mattresses to be removed at Subsea Structures

Pipelines and umbilicals	Estimated number of mattresses to be removed
12" SW Kinsale Pipeline & 12" Western Drill Centre & 10" Greensand & 10" Ballycotton & all associated umbilicals	196
Seven Heads 18" export pipeline and main control umbilical	8
Seven Heads 8" flowlines & umbilicals to wells	107
Total	**311**

Source: Based on CA method statements (modified after Ramboll 2017a,b)

3.5.3.2 Cutting and Removal of Spools and Umbilical Jumpers

The separation of subsea structures from pipelines and umbilicals will be undertaken by ROV tooling wherever possible, or using divers and a DSV where required, also as indicated for the jacket removal in **Section 3.5.2.3**.

For a conservative assessment of the associated impact it is assumed that approximately 50m of spool pieces will be recovered at all subsea structure tie-ins. In total, this amounts to an estimated 0.7km of spool pieces, taking into account all pipeline connection points.

The removal of protection materials and the cutting and lifting of spool pieces will involve the use of a number of vessels including a CSV and PSV. The number of vessel days associated with these operations are included in **Table 3.25**.

3.5.3.3 Removal of Wellhead Protection Structures

The wellhead protection structures need to be removed to allow access to the subsea trees and wellhead, for decommissioning. The steel structures will need to be cut/disconnected from the concrete foundation blocks, which anchor them to the seabed, and then the structures can be lifted to a vessel for onshore recycling/disposal. The foundation blocks will also be recovered individually, with each block having two lifting points. It is anticipated that existing lifting eyes will not be used and new lifting straps will be used for lifting structures to the vessel. An ROV will be used where possible, but a DSV with divers may also be used. For the purposes of this environmental assessment, the DSV methodology is included as a worst case scenario for the decommissioning of the subsea structures.

3.5.3.4 Removal of Valve skid, Intermediary Tee, PLEMS and Seven Heads Manifold

Initially all tie-ins (spool pieces and umbilical jumpers), will be disconnected and removed as detailed above. The concrete protection blocks, surrounding each structure will also be removed and recovered.

Once all disconnections are made, the structures will be recovered to a vessel for onshore recycling/disposal. Similar to the wellhead protection structures, lifting straps will be used for lifting to the vessel. The lifting straps will be put in place using an ROV, where possible, but a DSV with divers may be used. Similar to the removal of the wellhead protection structures, for the purposes of this environmental assessment, the DSV methodology is included as a worst case scenario for the decommissioning of the subsea structures.

3.5.3.5 Vessels & Durations

The estimated vessel times for the subsea structures removal, as detailed for each structure type above assuming a DSV is required for the structure removal (conservative assumption), is indicated in **Table 3.25**, with the overall schedule for the removal of spool pieces and protection materials, and the lift of all structures and their transport to the disposal yard estimated at 110 days (including a 25% contingency). This is based on works not being undertaken in parallel as a worst case scenario. For the purposes of this environmental assessment, the vessel durations associated with this methodology are the worst case scenario for the decommissioning of the subsea structures, and as such, this methodology has been used in **Section 7,** which assesses the potential environmental impacts of the proposed project.

Table 3.25: Estimated removal timing (days) of the subsea structures

Vessel	Mob/ Demob/ Transit	Removal of protection material	Cut spool pieces & umbilical sections	Recover spool pieces	Removal of Structures	Total Duration	Total with Contingency
CSV	24	17	10	9	-	60	75
PSV	8	-	-	1	-	9	11
DSV	11	-	-	-	8	19	24

Source: Based on CA method statements (modified after Ramboll 2017a,b)

3.5.4 Pipelines and Umbilicals

The Kinsale Area pipelines and umbilicals to be decommissioned are detailed in **Table 3.4** and **Table 3.5**.

As noted in **Section 3.5.2.1** as part of the overall facilities preparatory works the pipeline contents and umbilical chemical line contents will be displaced with seawater in preparation for the pipeline decommissioning. The chosen decommissioning options for pipelines and umbilicals included in the full environmental assessment are as summarised in **Table 3.10** and detailed below.

3.5.4.1 Offshore Pipelines and Umbilicals

Both *in situ* decommissioning options involve rock cover remediation of pipe ends and rock cover of either freespans only, or the full length of pipelines, which are currently not buried or under protective material. Additionally, some mattresses or grout bags may be retained in place, where they are associated with sections of pipeline ends beyond the tie-in spools which are proposed to be recovered as part of the subsea structures removal. These will also be subject to rock placement.

For the purposes of this assessment, it is assumed that rock cover, on exposed pipe (including pipe ends), mattresses remaining *in situ* and freespans will be placed such that at least 0.2m cover will be provided at all points. The rock berm is calculated with a 1m wide berm over the pipe and mattresses (where present) and 1:2.5 slopes on either side. Similarly, rock cover at identified freespans will be placed with a 1m wide berm and 1:2.5 slopes on either side. These rock cover dimensions have been considered in order to provide a conservative yet reasonable assessment of the potential associated impact.

Table 3.26 provides estimates of the rock placement required for the two *in situ* options and the vessel days required to complete the required rock placement operations. The rock placement vessel used for this assessment is assumed to have an approximate rock carrying capacity of 9,260m^3 (25,000Te), with the capability of placing approximately 1,666m^3 (4,500Te) of rock per day.

Graded rock will be used similar to existing rock material specifications (1”-5”), with all rock being placed in a controlled manner using a dedicated dynamically positioned fall pipe vessel and monitored by an ROV during placement. The rock will be sourced onshore, most likely from a UK or Norwegian quarry, because currently there are no Irish quarries with high capacity facilities for loading ships.

Table 3.26: Estimated rock placement requirements for *in situ* decommissioning options

Pipeline	Pipe ends & freespans		Pipe ends & all exposed sections	
	Length of rock placement	Quantity	Length of rock placement	Quantity
Inch Beach landfall to Kinsale Alpha 24" pipeline	2,288m	3,790m^3 / 10,234Te	38,234m	56,542m^3 / 152,662Te
24" KA to KB Pipeline & 12" KA to KB Pipeline	573m	910m^3 / 2,456Te	9,344m	12,947m^3 / 34,958Te
12" SW Kinsale Pipeline & 12" western drill centre & 10" Greensand & 10" Ballycotton & all associated umbilicals	627m	714m^3 / 1,927Te	2,450m	1,866m^3 / 5,037Te
Seven Heads 18" export pipeline and main control umbilical	350m	626m^3 / 1,691Te	13,830	12,243m^3 / 33,057Te
Seven Heads 8" flowlines & umbilicals to wells	1,360m	1,247m^3 / 3,368Te	1,402m	1,282m^3 / 3,461Te
Total		19,676Te		229,175Te

Source: Based on CA method statements (modified after Ramboll 2017a, b) and length of pipeline exposure in Xodus (2016c)

The estimated vessel times for the pipeline, umbilical and protective material decommissioning is indicated in **Table 3.27**, with the overall schedule estimated between 16 and 104 days (including a 25% contingency) depending on the selected option. We have considered the more conservative requirement of rock covering the pipe ends and all exposed sections in Section 7, which assesses the worst case scenario likely environmental impacts associated with the decommissioning project.

Table 3.27: Estimated vessel timings (days) for pipeline and umbilical decommissioning

Vessel	Mob/ Demob/ Transit	Rock Placement	Total Duration	Total with contingency
Rock Placement Vessel (pipe ends & freespans)	8	5	13	16
Rock Placement Vessel (pipe ends & all exposed sections)	32	51	83	104

Source: Based on CA method statements (modified after Ramboll 2017a, b) and additional vessel timings for rock placement vessel based on indicative mob/demob timings: vessel rock capacity (25,000Te) and placement rates (4,500Te/day).

3.5.4.2 Onshore Pipeline

The onshore pipeline section will be filled with inhibited seawater pumped through the pipeline from Kinsale Alpha as part of the facilities preparatory works (detailed in **Section 3.5.2.1**). In the event that no re-use option is identified, the onshore pipeline is to be filled with grout. A plug will be inserted in to the pipeline and run down the pipe internally to the required location, and the onshore pipeline will then be filled from within the terminal site, with the grout transported in via road. The inhibited seawater within the offshore pipeline will also be discharged at its seaward end at this time. It is estimated that approximately 500m^3 of grout will be required to fill 2km of pipe. At no stage will intrusive or disturbance works occur along the length of the onshore pipeline, as all activities will either occur from the platform or the onshore terminal.

3.5.5 Post-Decommissioning Survey

A completion survey will be carried out to confirm the completion of the decommissioning work scope and enable debris clearance (existing operational debris or debris deemed to have arisen from the decommissioning operations) to be undertaken.

The pipelines and umbilicals decommissioned *in situ* will be surveyed post-decommissioning to accurately record their location and status. This information will be included in navigational charts and also passed on to representatives of the fishing community.

As a minimum, the area covered for debris clearance will include a 500m radius around any installation and up to a 100m wide corridor along the length of any pipelines and umbilicals (50m either side of pipelines). The offshore survey will be undertaken over approximately 5 days. Identification of debris would normally be conducted by side scan sonar and/or multi-beam echo sounder (MBES) with an ROV deployed to investigate and recover any potential hazards. Larger items of debris would be recovered by crane or grab from a construction support vessel. A seabed clearance certificate will be issued by the survey contractor to confirm completion of the works.

Standard overtrawling surveys will also be undertaken where wellheads, spool pieces etc., are removed to confirm the area is clear of debris and snagging hazards.

The offshore survey of the export pipeline will end at some 3km offshore of the landfall at Powerhead. A separate inshore survey involving a smaller vessel will also be undertaken.

3.5.6 Inch Terminal

The scope of work for the Inch Terminal decommissioning comprises the demolition and removal of all above ground facilities on site and reinstatement of the site to original ground condition (grassland), in accordance with the extant planning permission.

Prior to demolition and following Cessation of Production (CoP), Kinsale Energy will disconnect the terminal from the gas grid, purge the plant to render it hydrocarbon free, and all chemicals will be removed from site. Similar to the offshore topsides, volumes of waste (water and corrosion debris (iron)) are expected to be small as the hydrocarbons produced are dry natural gas (e.g. no sludges or solid NORM material are present). These wastes, along with any residual inventories of chemicals (TEG) will be collected for onshore disposal under Kinsale Energy’s existing waste management procedures.

The terminal facility will be disconnected from the power grid (three-phase ESB mains supply) and the telecommunications network (EIR telecommunications cable) prior to mobilisation of the demolition contractor.

Demolition works will be carried out by a suitably experienced contractor, who will operate in accordance with a construction Health and Safety Plan, Demolition Resource Plan and a Waste Management Plan.

The terminal demolition works will have a duration of approximately 16 weeks.

All buildings, above ground structures, roads and services (excluding the main access road which serves the adjacent Gas Networks Ireland above ground installation), vessels and above and below ground pipework (excluding the main export pipeline) will be fully demolished and the site reinstated to original ground condition (grassland).

The demolition methodology will be as follows:

Area of work	Demolition methodology
Pipe and Vessels	1. Cut all above ground pipework into sizes which can easily be handled and transported off site. 2. Remove all vessels/tanks/vent stack (cut from foundations) using a mobile crane and transport off site. 3. Excavate and remove all below ground pipework and transport off site (except for the main export pipeline – refer to Section 3.5.4.2 for decommissioning options). 4. Excavate/break out all pipework and vessel bases and remove off site. 5. Backfill all trenches with excavated material. 6. The materials will be removed from site using light and heavy goods vehicles.
Terminal Building	1. Soft Strip: strip out and removal of non-structural elements such as internal fittings and fixtures will be undertaken using small plant. 2. Any identified hazardous materials, such as asbestos will be removed in accordance with the relevant legislation and disposed of by specialist contractors to an appropriately licensed facility. 3. Deconstruct the concrete building walls, roof and floor 4. The materials will be removed from site using light and heavy goods vehicles. 5. Remove foundations down to concrete footings.
Site Services	1. Excavate and remove all underground utilities, including foul drains, firewater and electricity. 2. Road drains will be removed. 3. Plug and cap site water well approximately 1m below finished ground level.
Telecommunication mast	1. The removal of the telecommunication mast will require a mobile crane on site. 2. The mast will be cut in sections and removed from site. 3. Excavate/break out the foundations of the mast and break on site. 4. Remove the foundation material down to concrete footings.

Area of work	Demolition methodology
Access roads/hardstanding	1. The main access road (connecting to the local road network) will remain in situ for use as the Gas Networks Ireland installation site access. 2. The internal access roads and hardstanding areas will be excavated and removed off site. 3. The helipad tarmac area will be excavated and transported off site.
Fences	1. Remove all fences and associated foundations.
Reinstatement	1. On completion of the demolition, it is likely that subsoil and topsoil will need to be imported to site (estimated at approximately 12,000Te). 2. The subsoil/topsoil will be spread and seeded.

It is estimated that an average of approximately 11HGV movements per day (over 16 weeks) will be generated by the works based on the waste quantities to be removed, as detailed in **Table 3.28**, and the subsoil and topsoil to be imported.

3.5.7 Material Generated

Table 3.28 below summarises the estimated material generated from the KADP to be either recycled or disposed of onshore at licensed waste facilities.

The final disposal route and destination for items removed from the field, whether for recycling or disposal, is yet to be confirmed. A number of licensed sites within Ireland, UK, Norway and the Netherlands have currently been identified for recycling or disposal of the various items removed from the field. For the purposes of assessment, the final destination is assumed to be a site within Europe at a distance of 700nm from the Kinsale Area, which is the farthest distance within which the disposal route is realistically likely to be selected. This is to allow the assessment of the worst case scenario for the disposal route. The selection of the recycling and disposal sites will be made when the decommissioning contractor is appointed, with the selected sites at a distance of 700nm as a worst case scenario. The selected destination site will be an appropriately licensed site under the relevant legislation.

Table 3.28: Material Generated

Material Type	Wells	Platforms	Subsea Structures including spools, umbilical jumpers and protection materials	Inch Terminal
Steel	Total - 1,500Te for all wells, assuming recovery of casings to 3m below seabed and relevant sections of production tubing.	Alpha Total - 9134Te 4544Te - Topsides (695Te Piping, 179Te Deck Plate, 2457Te Equipment, 1396Te Structure less 183Te Asbestos) 4590Te Jacket Bravo Total - 7977Te 3594Te – Topsides (552Te Piping, 147Te Deck Plate, 1900 Equipment, 1128Te Structure less 133Te Asbestos) 4383Te Jacket	KH Total - 293Te (4x25 Te wellhead protection structures, 10.2 Te SWK Intermediate Tee, 12.3Te SWK Valve Skid, 11.1Te Greensand PLEM, 11.1Te WDC PLEM; 148Te spools) SH Total - 249Te (SH Manifold and spools)	Total - 110Te (Process Equipment)
Concrete	N/A	Alpha Total - 1567Te Grout (including grout in mudmats, grouted members & grout between pile and jacket legs) Bravo Total -1383Te Grout (including grout in mudmats, grouted members & grout between pile and jacket legs)	KH Total - 4452Te (4x134Te wellhead protection structures, 2x65Te and 2x45Te for SWK Valve Skid, Greensand PLEM and WDC PLEM; 3x43Te and 1x47Te for SWK Intermediate Tee	Total - 5339Te (4980Te - approx. depth of 0.15m across full site [1.66ha] requires removal, consisting of concrete foundations, gravel, hardcore, helipad, internal access tracks etc.; 20Te – 2.9mx2.9mx3m Pumphouse [200mm solid block walls and 225mm precast slab roof];

Material Type	Wells	Platforms	Subsea Structures including spools, umbilical jumpers and protection materials	Inch Terminal
			80Te Pipe spool Concrete Coating & 3000Te Concrete Mattresses) SH – 1452Te (42Te Pipe spool Concrete Coating and 1410Te Concrete Mattresses)	339Te – 11mx19.5mx3.5m Office Building [250mm cavity block walls and 225mm precast slab roof])
Non-ferrous Metals	N/A	Alpha - 108Te Anodes Bravo - 108Te Anodes	SH 0.12Te Anode	N/A
Asbestos	N/A	Alpha 183Te Bravo 133Te	N/A	N/A
Other Hazardous Waste	Small quantities of: • Excess cement ; minimised through effective planning to only make required quantity (likely discharged offshore) • Cement and steel millings (likely discharged offshore)	Small quantities of: • Fluorescent tubes (Mercury) • F&G Detectors (radioactive waste) • Fire Extinguishants • HFCs • TEG • Diesel • Heli-fuel • Lubricating Oils Hydraulic fluids • HW540 v2 • BOP fluid (Erifon HD856) (1% concentration). Other miscellaneous hazardous items such as: • Paint and Varnish • Batteries • Aerosols • Coolants	N/A	Small quantities of: • Fluorescent tubes (Mercury) • F&G Detectors (radioactive waste) • Fire Extinguishants • TEG • Diesel • Lubricating Oils • Hydraulic fluids Other miscellaneous hazardous items such as: • Paint and Varnish • Batteries • Aerosols • Coolants

Material Type	Wells	Platforms	Subsea Structures including spools, umbilical jumpers and protection materials	Inch Terminal
Other Non-hazardous Wastes*	N/A	Alpha Cabling 222Te (copper and plastics) Bravo Cabling 176Te (copper and plastics) Alpha Marine Growth 1450Te Bravo Marine Growth 1450Te	Umbilical quantities negligible (copper and plastics)	N/A
Total	**1,500Te**	**23,493Te**	**6,445Te**	**5,449Te**

Source: Genesis (2011), Xodus (2016a), Xodus (2016c), OHSS (2012), OHSS (2016), Ramboll (2017a), Ramboll (2017b), John O'Donovan & Associates (1976), well steel calculated on the bases of AGR (2017a), and assuming 43kg/m tubing on each production well.

3.5.8 Activity Scheduling

An indicative project programme is shown in **Figure 1.2** of this report. As detailed in **Section 1.6,** the final decommissioning project removal schedule will be completed once all decommissioning contracts have been awarded. The timing of platform removal and subsea well abandonments may vary depending on availability of specialised marine construction and drilling vessels (crane barges, MODUs etc.).

Post Cessation of Production (CoP), the platform well plug and abandonment (P&A) will be commenced and the pipelines connecting the platforms to the subsea wells will be displaced with seawater into the wells, in order to achieve hydrocarbon free status on the Kinsale Alpha and Bravo platforms. The 24" pipeline from KA to Inch Terminal, including the onshore pipeline, will also be filled with inhibited seawater at the start of the decommissioning programme. All of these offshore project activities up to the point where the platforms are hydrocarbon free will be carried out within the existing Kinsale Energy operations framework.

Upon completion of platform well P&A and subsea pipeline displacement activities, both Alpha and Bravo platforms will be de-manned and are then available for removal operations. The platform topsides will be removed within 1-2 years depending on vessel scheduling, and the jackets will be left *in situ* for a period of up to 10 years (see **Section 3.5.2.3**).

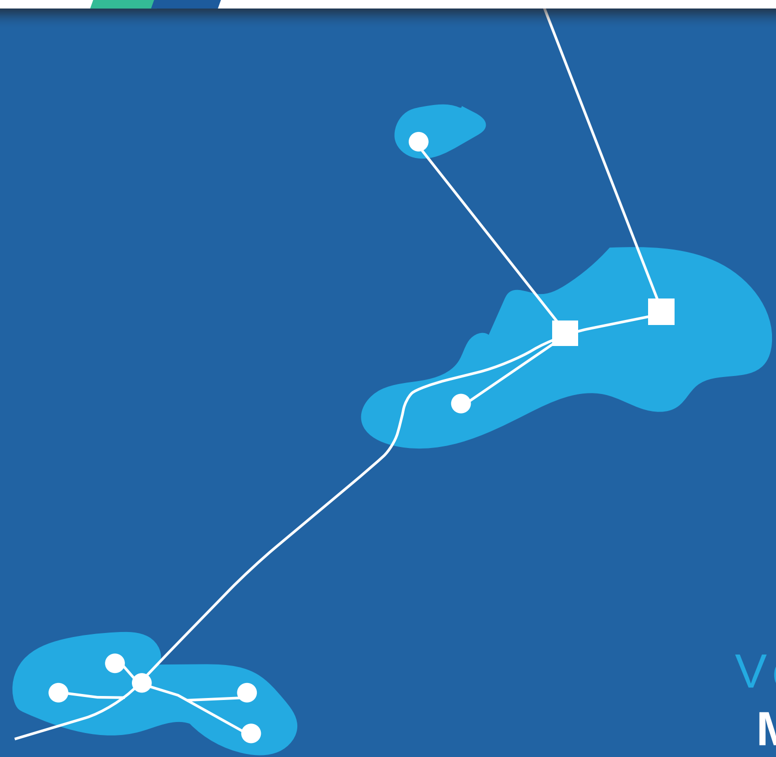
A subsea programme of works to remove subsea structures and protection materials and to disconnect spool pieces and umbilical jumpers will be completed in advance of subsea well plug and abandonment activities, which may be carried out by a rig or an intervention vessel, or a combination thereof. This may be completed before, after or during the removal of the platforms. The pipeline, umbilical and protective material rock placement works will be undertaken following the removal of the spool pieces and the umbilical jumpers.

The onshore terminal decommissioning which is of relatively short duration will be carried out at a suitable time within the overall project schedule. The onshore pipeline section will be grout filled at this stage, if no further use of the pipeline is anticipated.

KINSALE ENERGY

Kinsale Area Decommissioning Project

Environmental Impact Assessment Report



Volume 2

Main Text

Part 2 of 3

253993-00-REP-08 | 30 May 2018

Hartley Anderson

ARUP

Table of Contents

Page

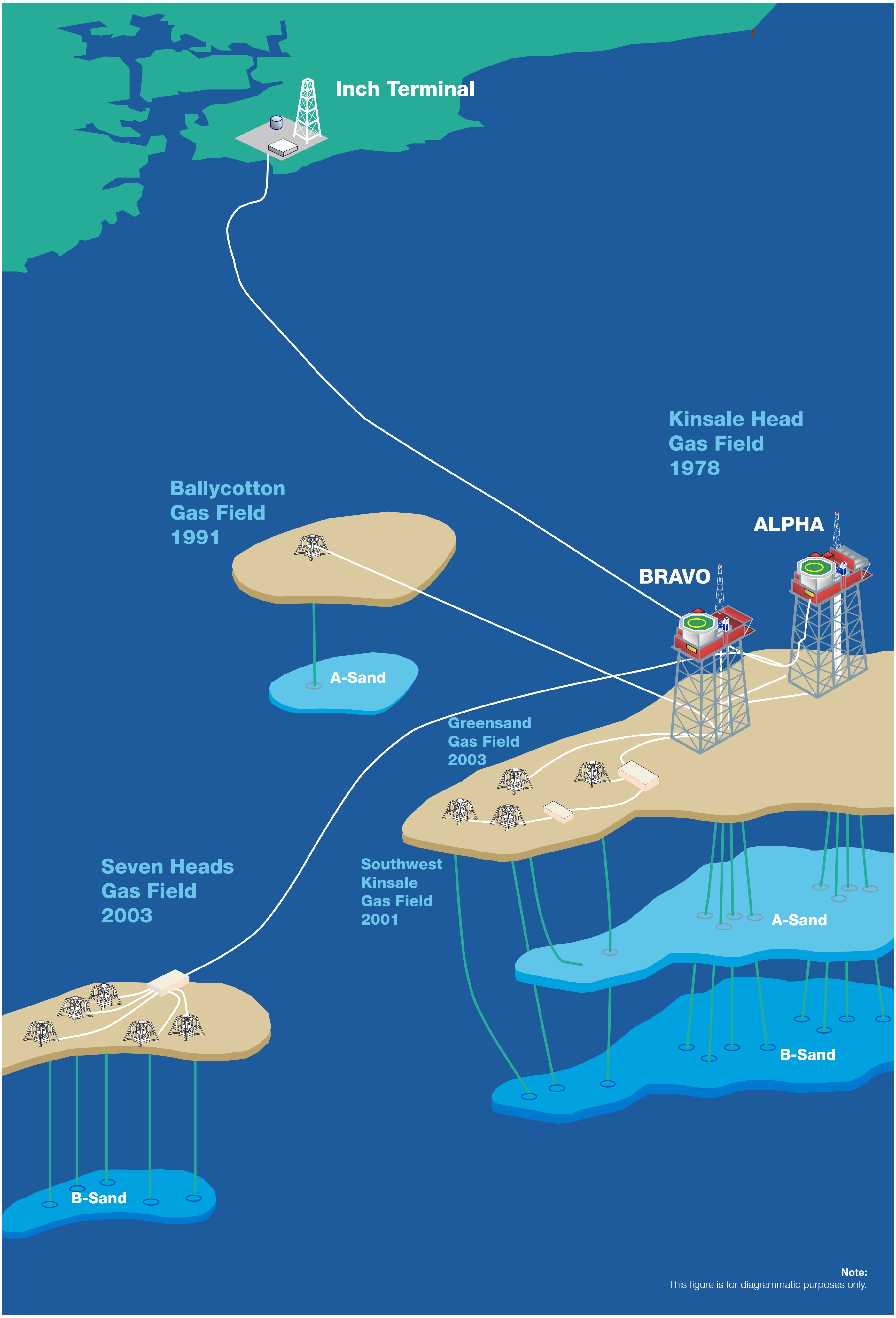
Tables

Figures

Appendices

Kinsale Area Decommissioning Project

Glossary of Terms


Inch Terminal
Kinsale Head
Gas Field
1978
ALPHA
BRAVO
Ballycotton
Gas Field
1991
A-Sand
Greensand
Gas Field
2003
Seven Heads
Gas Field
2003
Southwest
Kinsale
Gas Field
2001
A-Sand
B-Sand
B-Sand
Note:
This figure is for diagrammatic purposes only.

Glossary of Terms

Term	Explanation
AA	Appropriate Assessment
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
Bathymetry	Measurement of depth of water in oceans, seas, or lakes
Benthic Zone	Ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers
Biotope	Region of a habitat associated with a particular ecological community
Buoyancy tank	An enclosed air-filled section of a boat, ship or hovercraft designed to keep it afloat and prevent it from sinking
Bunker	Fill the fuel containers of a ship (refuel)
Bunkering	Supply of fuel for use by ships in a seaport
CA	Comparative Assessment
Cantilever	Structural element anchored at only one end to a support from which it is protruding
Caprock	Harder or more resistant rock type overlying a weaker or less resistant rock type
CCS	Carbon Capture and Storage
CRU	Commission for Regulation of Utilities Water and Energy
Cephalopods	Any member of the molluscan class Cephalopoda such as a squid, octopus or nautilus
CFP	Common Fisheries Policy
CH_4	Methane
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLC	CORINE Land Cover
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Concrete mattress	A series of concrete blocks usually connected by polypropylene ropes resembling a rectangular mattress, used for the weighting and/or protection of seabed structures including pipelines
CoP	Cessation of Production: the stage at which, after all economic development opportunities have been pursued, hydrocarbon production ceases.
CORINE	Co-Ordinated Information on the Environment
CSO	Central Statistics Office
CSV	Construction Support Vessel
DCCAE	Department of Communications, Climate Action and Environment
DCENR	Department of Communications, Energy and Natural Resources
DECC	Department of Energy & Climate Change (UK)

Term	Explanation
Decommissioning	Planned shut-down or removal of a building, equipment, plant, offshore installation etc.., from operation or usage offshore.
Demersal	Living close to the floor of the sea or a lake
Diesel	A low viscosity distillate fuel
DP	Dynamic Positioning: the use of thrusters and real time positional information to maintain the location of a vessel
Drill cuttings	Rock from the wellbore resulting from the mechanical action of the drill bit
DTTAS	Department of Transport, Tourism and Sport
DSV	Diving Support Vessel
ED	Electoral Division
EEMS	Environmental and Emissions Monitoring System
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
Epifauna	Animals living on the surface of the seabed or a riverbed, or attached to submerged objects or aquatic animals or plants.
EU28	Denotes the 28 member countries which make up the European Union
EUNIS	European Nature Information System
FBE	Fusion Bonded Epoxy
Flowline	Pipeline carrying unprocessed oil/gas within the oil or gas field area
Freespan	A free span on a pipeline is where the seabed sediments have been eroded, or scoured away leaving a void under the pipeline so that the pipeline is no longer supported on the seabed
GHG	Greenhouse gas
GNI	Gas Network Ireland
Grout	Particularly fluid form of concrete used to fill gaps, generally a mixture of water, cement, and sand
GWP	Global warming potential
HES	Health, Environment and Safety
HGV	Heavy Goods Vehicle
HFCs	Hydrofluorocarbons
HLV	Heavy-Lift Vessel
ICES	International Council for the Exploration of the Sea
IEMA	Institue of Environmental Management and Assessment
IMO	International Maritime Organisation
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's marine Resource, joint venture between the Geological Survey of Ireland and the Marine Institute.
In-Situ	In the original place.
Interconnector	Structure which enables energy to flow between networks, refers to international connections between electricity and natural gas networks

Term	Explanation
IOSEA	Irish Offshore Strategic Environmental Assessment
IPCC	Intergovernmental Panel on Climate Change
IRPA	Individual Risk Per Annum
Jacket	The structure comprising the “legs” of the offshore platform connected together by horizontal and diagonal trusses and usually made of welded tubular steel. The jacket is typically secured to the seabed by piles
Jack-up rig	A mobile floating drilling rig typically with three long triangular truss legs which can be lowered to the seabed to provide stability once on location
KA	Kinsale Alpha platform
KADP	Kinsale Area Decommissioning Project
KB	Kinsale Bravo platform
KPIs	Key Performance Indicators
km	Kilometre: 1,000m, equivalent to 0.54 nautical miles
L_{Aeq}	Sound levels that vary over time which results in a single decibel value which takes into account the total sound energy over the period of time of interest
LAT	Lowest Astronomical Tide
LCA	Life cycle assessment
Likelihood – Remote	Unlikely to occur
Likelihood – Unlikely	Once during decommissioning activity
Likelihood – Possible	Foreseeable possibly once a year
Likelihood – Likely	Once a month or regular short term events
Likelihood - Definite	Continuous or regular planned activity
LPP	Layer polypropylene
LULUCF	Land Use, Land Use Change and Forestry
LWIV	Light Well Intervention Vessel
Major Effect	• Change in ecosystem leading to medium term (2+ year) damage with recovery likely within 2 - 10 years to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites • Transboundary effects expected • Moderate contribution to cumulative effects • Issue of public concern • Possible effect on human health • Possible medium term loss to private users or public finance
Manifold	A pipe or chamber branching into several openings.
MARPOL	The International Convention for the Prevention of Pollution from Ships
Megaripple	An extensive undulation of the surface of a sandy beach or sea bed

Term	Explanation
Moderate Effect	• Change in ecosystem leading to short term damage with likelihood for recovery within 2 years to an offshore area less than 100 hectares or less than 2 hectares of a benthic fish spawning ground • Possible but unlikely effect on human health • Possible transboundary effects • Possible contribution to cumulative effects • Issue of limited public concern • May cause nuisance • Possible short term minor loss to private users or public finance
MODU	Mobile Offshore Drilling Unit
MPA	Marine Protected Area
MRCC	Marine Rescue Co-ordination Centres
Natura 2000 sites	Natura 2000 is a network of nature protection areas in the territory of the European Union. It is made up of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) designated respectively under the Habitats Directive and Birds Directive.
Negligible Effect	Change is within scope of existing variability but potentially detectable.
Nephrops	Genus of lobsters comprising a single extant species
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Statement
nm	Nautical Mile (1852m = 1 minute of latitude = 1/60 degree of latitude)
NMVOCs	Non-methane volatile organic compounds
None Foreseen (Effect)	No detectable effects.
NOx	Nitrogen Oxides
NPWS	National Parks and Wildlife Service
NTM	Notice to Mariners
NUI	Normally Unmanned Installation: an installation with minimal facilities which is not permanently crewed and is controlled from a remote location (e.g. other platform or shore)
OBMs	Oil Based Mud
OCNS	Offshore Chemical Notification Scheme
OECD	Organisation for Economic Co-Operation and Development
OGUK	Oil & Gas UK
OSPAR	Oslo and Paris Convention
OWF	Offshore Wind Farm
P&A	Plug and Abandon (wells)
PAD	Petroleum Affairs Division of the Department of Communications, Climate Action and Environment
Pelagic (fish)	Fish which live in the pelagic zone. The pelagic zone is any water in sea or lake which is neither close to the bottom nor near the shore.
PETRONAS	Petroliam Nasional Berhad

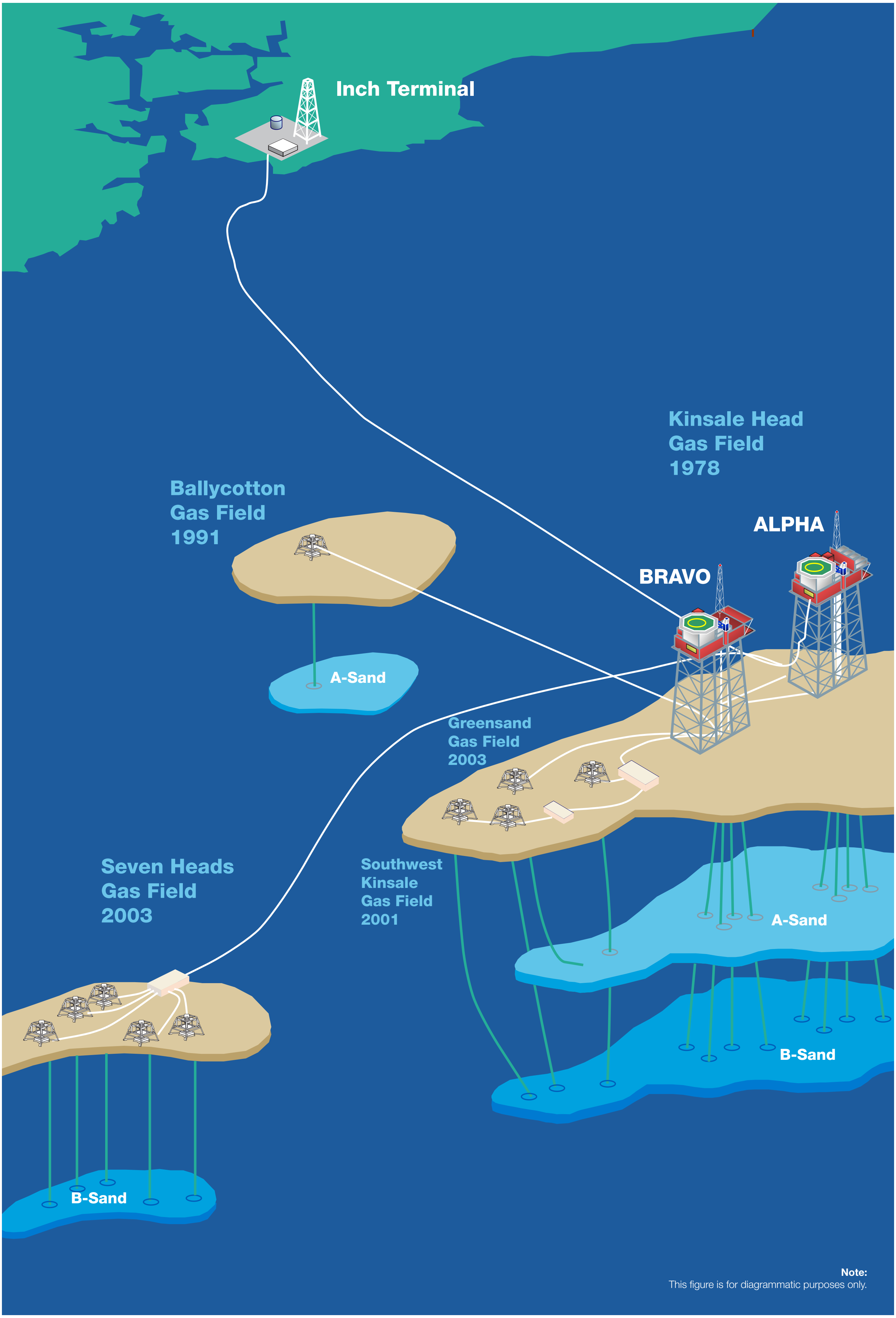
Term	Explanation
PFCs	Perfluorocarbons
Phytoplankton bloom	Plankton consisting of microscopic plants.
Piece Medium	Method of decommissioning the topside structures which involves the separating of the topsides into a number of medium size pieces for removal with a heavy lift vessel and transported to shore for further dismantling. Also known as 'reverse installation'.
Plankton	Small and microscopic organisms drifting or floating in the sea or fresh water
PLEM	Pipeline End Manifold
PLL	Potential Loss of Life
PLONOR	Pose Little or No Risk
PM_{10}	Particulate matter and smaller particulate matter of diameter less than or equal to 10 micrometers
Positive Effect	• Activity may contribute to recovery of habitats • Positive benefits to local, regional or national economy
PSV	Platform supply vessel
PUDAC	Permit to Use or Discharge Added Chemicals
Quaternary	The most recent major geological subdivision, encompassing the past ~2.6 million years up to and including the present day
RAMSAR	Intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
RF	Recovery Factor
Rigless intervention	A well-intervention operation conducted with equipment and support facilities that precludes the requirement for a rig over the wellbore
RMP	Record of Monuments and Places
ROV	Remotely Operated Vehicle: a small, unmanned submersible used for inspection and the carrying out of some activities such as valve manipulation
SAC	Special Area of Conservation: established under the Habitats Directive
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SEA	Strategic Environmental Assessment
Seafastening	Action of fastening/securing cargoes on ship with the aim of preventing them from movement while the ship is in transit
Semi-submersible rig	A floating mobile drilling rig supported on a number of pontoons, and typically anchored to the seabed while on station
Severe Effect	• Change in ecosystem leading to long term (10+ year) damage with poor potential for recovery to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites • Major transboundary effects expected • Major contribution to cumulative effects • Issue of acute public concern • Likely effect on human health • Long term, substantial loss to private users or public finance
SF	Sulphur hexafluoride

Term	Explanation
SFPA	Sea Fisheries Protection Authority
Shears	Cutting instrument in which two blades move past each other
Shelter	Place giving temporary protection from bad weather or danger
Shingle	a mass of small rounded pebbles
Shut-in	to close off a well so that it stops producing
Sidescan sonar	category of sonar system that is used to efficiently create an image of large areas of the sea floor
SO_2	Sulphur Dioxide
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area: established under the Birds Directive
Steel jackets	Structural sections made of tubular steel members, and are usually attached to the seabed using piles
Subcrop	Part of a geological formation that is close to the surface but is not a visible exposing of bedrock
Subsea manifold	Large metal piece of equipment made up of pipes and valves, designed to transfer oil or gas
SWK	South West Kinsale
TEG	Triethylene Glycol
Tidal Channel	Protion of a stream that is affected by ebb and flow of ocean tides, in the case that the subject stream discharges to an ocean, sea or strait
Tie-backs	Link between a satellite field and an existing production facility
TII	Transport Infrastructure Ireland
Topsides	The collective name for the many drilling, processing, accommodation and other modules which when connected together make up the upper section of the platform which rests on the installation jacket
TVD	Total Vertical Depth
UHO	Underwater Heritage Order
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKOOA	UK Offshore Operators Association
UNCLOS	UN Convention on the Law of the Sea
Umbilical	Cable and/or hose which supplies required consumables to an apparatus
VMS	Vessel Monitoring System
WDC	Western Drill Centre
WEEE	Waste Electrical and Electrical Equipment
Wet Gas	Any gas with a small amount of liquid present
WFD	Water Framework Directive

Kinsale Area Decommissioning Project

Section 4

Characteristics of the Marine Environment


Inch Terminal
Kinsale Head
Gas Field
1978
Ballycotton
Gas Field
1991
ALPHA
BRAVO
A-Sand
Greensand
Gas Field
2003
Seven Heads
Gas Field
2003
Southwest
Kinsale
Gas Field
2001
A-Sand
B-Sand
B-Sand
Note:
This figure is for diagrammatic purposes only.

4 Characteristics of the Marine Environment

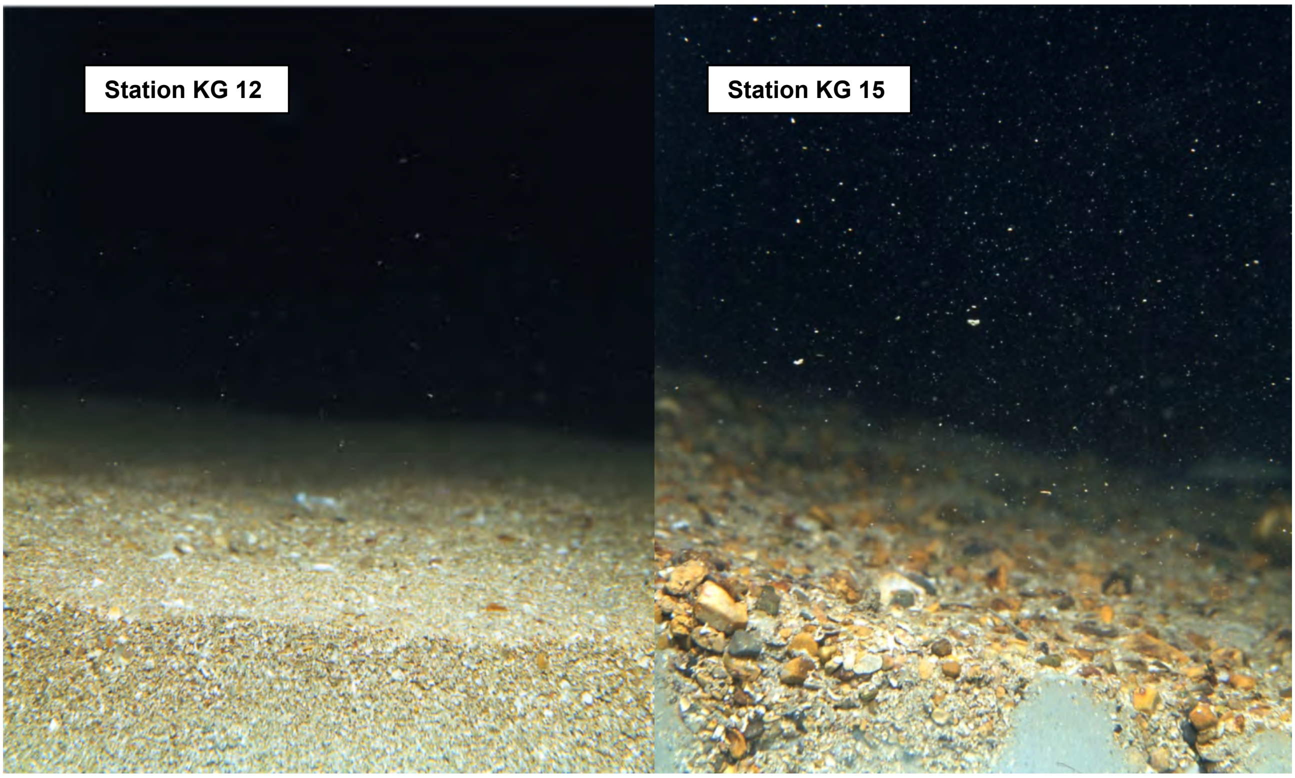
The characteristics of the marine environment in the vicinity of the Kinsale Area are detailed in this chapter. It has been prepared based on a desktop study, including a review of all seabed surveys, with the seabed survey coverage shown in **Figure 4.5**. **Appendix B** provides further details of seabed features and habitats in the vicinity of the Kinsale Area facilities.

4.1 Seabed Topography, Geology and Sediments

Water depths extend from the intertidal area at the main export pipeline landfall at Powerhead Bay, to approximately 90m across the Kinsale Head, Southwest Kinsale, Ballycotton areas and to 100m at the Seven Heads field (**Figure 4.2**).

The seafloor is generally flat in the area encompassing the Kinsale Area fields with gentle slopes across the region. Rig site and pipeline route surveys undertaken around the Seven Heads, SW Kinsale and Greensand developments (**Figure 4.5**) all showed mosaics of high and low reflectivity (AquaFact 2003, 2004). The high reflectivity was interpreted as gravelly sands with megaripples of up to 0.3m height and 1.5m wavelength. The low reflectivity areas comprised muddy sand (station KG 12 in **Figure 4.1** shows slightly muddy sand recorded from the 2002 survey). At the prevailing water depths of 90-100m, the megaripples are indicative of a high energy environment. Ribbons of mobile sands lie in a southwest to northeast orientation. Outcrops of hard substrate – the underlying Cretaceous chalk bedrock – are also exposed intermittently with a variable covering of muddy sands. A distinctive feature of the sediments in the Kinsale Area is the apparent frequent juxtaposition of clean sand with mud evident in the right hand sediment profile image of Station KG 15 from the 2002 survey as shown in **Figure 4.1**. This mixture of sediment types is reflected on the fauna present, so that a single sample may contain species characteristic of both muds and clean sands.

Figure 4.1: Seabed photographs illustrating typical sandy and gravelly sediments in the Kinsale Area



There have been a series of seabed baseline and monitoring surveys undertaken in the Kinsale Area since 2002 associated with exploration wells, field and pipeline developments and operations e.g. Aquafact (2003), Hartley Anderson (2003), Aquafact (2005), Marine Institute (2010), Ecoserve (2011), Gardline (2015) and Marine Institute (2017).

Together with geophysical mapping undertaken as part of rig site and pipeline route surveys, these surveys provide a good understanding of the seabed topography, sediments and their dynamics, fauna and contaminant status which are summarised in this section.

According to the EUNIS habitat classification, the underlying habitat is circalittoral coarse sediment (**Figure 4.4**). These are characteristically found in tidal channels of marine inlets, along exposed coasts and offshore and particle sizes range through coarse sands, gravel and shingle. Deep circalittoral sand is defined as fine sands or non-cohesive muddy sands which are likely to be more stable due to their depth. Existing seabed surveys of the area (**Figure 4.5**) generally support the EUNIS habitat descriptions and mapped distribution in the area. The dynamic nature of the sedimentary environment of the area presents a range of relatively impoverished heterogeneous benthic habitats.

Sidescan sonar records from the Kinsale Area indicate the presence of distinctive Holocene sand, together with exposures of older Quaternary sand and gravel linear patches, all within spatial scales of a few hundred metres.

A total of 24 development wells (14 platform wells and 10 subsea/other wells) are either producing or have been shut-in in the Kinsale Area. There are also 4 previously abandoned exploration wells. The nature of the produced hydrocarbons (dry gas), the fact that Oil Based Muds (OBMs) were only used in the drilling of one well (the cuttings from which were not discharged to sea) and the absence of cuttings piles (see **Appendix B**) has limited the potential for large hydrocarbon releases or persistent contamination of sediments from the Kinsale Area.

Results from the 2017 pre-decommissioning environmental survey of the Kinsale Area (see **Table 4.1** and **Figure 4.3)** (Marine Institute 2017) indicate that for most samples the concentrations of hydrocarbons and metals are at or below background assessment concentrations (BAC) as defined by OSPAR (mean concentrations significantly below the BAC are said to be near background i.e. “natural” concentrations). As further context **Table 4.1** includes Effects Range Low (ERL) values, these were developed by the USEPA/NOAA; concentrations below the ERL are considered rarely to cause adverse effects in marine organisms. In a few samples elevations in concentrations of some determinands were noted (e.g. copper, lead and zinc), although typically these did not show correlations between determinands within a sample nor with proximity to installations and are considered to reflect natural variability in the area.

Figure 4.2: Bathymetry in the vicinity of the Kinsale Area

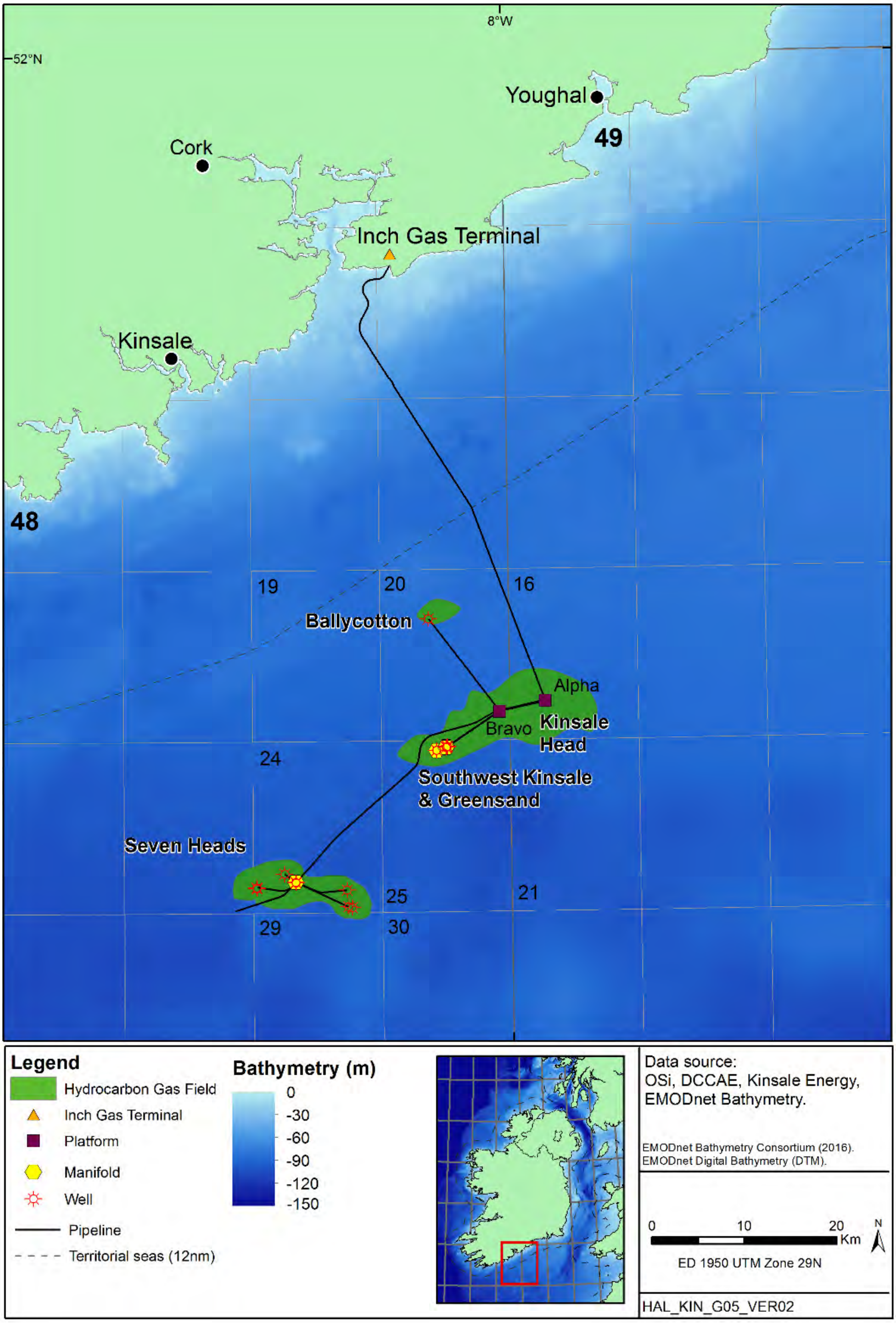


Table 4.1: Summary of sediment and contaminant sample analyses, 2017 survey

Station	Mud in Sediment (%)	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	Aluminium (mg/kg)	Barium (mg/kg)	Iron (mg/kg)	Lithium (mg/kg)	Total Oils (µg/kg)	Total n-alkanes (ng/kg)
S1	27.4	7.3	0.4	73.4	423.2	168.2	0.06	21.7	41.2	161.2	19800	348	13600	17.9	14966.8	524
S2	0.5	12.5	0.2	12.5	7.5	179	0.02	5.6	28.3	105.7	5750	112	10300	8	1553.8	55
S3	21.3	22.7	0.7	13.1	4.3	501.2	0.01	8.9	43.6	175.7	8040	121	13100	9.96	4968.2	154
S4	12.7	24.9	1.1	22.9	6.7	1545	0.02	11.5	50.9	294.9	14100	142	16800	14.2	4345.3	164
S5	0.9	7.4	<0.1	12.9	9.3	26.3	0.02	6.7	27.7	51.1	8050	847	9400	8.44	2192.1	70
S6	5.2	23.7	<0.1	23.5	6.6	15.5	0.01	14.9	53	49.3	16500	251	19400	14.5	492	69
S7	0.6	28.2	0.1	14.2	3.3	9.5	0.01	9.6	48.1	29.9	11800	104	13300	10.7	1812.8	90
S8	0.6	28.7	<0.1	14	3.9	9.3	0.01	9.6	48.3	29.1	11600	107	13500	10.9	1150.8	35
S9	1.3	8.6	0.1	16.7	3.8	5.5	0.01	8.1	33	28.5	10900	80	10300	11.2	1618.6	78
S10	0.6	9	0.1	12.6	3.3	6.2	0.01	6	32.2	27.3	7610	66.7	9800	8.18	1639	65
S11	11.8	6.4	0.2	18.6	6.6	18.8	0.04	8	33.6	50.9	12200	106	9530	12.3	3766.3	184
S13	0.2	19.5	0.3	17.4	19.8	60.8	0.04	12.9	42.6	102.4	8120	89	14000	8.61	3943.3	117
S14	1.1	7.7	0.2	15.1	10	30.1	0.03	7.4	28.6	77.4	7310	107	8620	7.83	10692	462
S15	0.1	19.5	0.1	18.3	4.1	9.9	0.01	10.2	48	43.4	10800	150	15600	9.18	2528.7	74
S16	0.3	6.1	0.1	9.8	2.7	6.4	0.01	4.8	24.6	25.5	5270	52.9	6330	6.28	3541.5	81
S17	0.2	21.1	0.1	18	5	16.7	0.01	10.3	50.5	73	10800	72.6	15800	11	1615.3	81
S18	5.9	17.9	<0.1	11.8	3	10.1	0.01	7.1	39.8	31.7	7720	69	12800	7.81	6334.3	187
S19	0.2	17.7	<0.1	11.3	3.5	10.6	0.01	7.1	39.4	30.9	7060	53.9	11700	7.48	2588.2	74
S20	0.1	10	0.2	23.2	21	43.5	0.04	10.8	35.6	652.6	10500	83.9	14900	9.7	3763.5	131
S21	7.1	6.8	<0.1	29.4	41.8	55.1	0.03	12.7	34	311	19500	211	14500	16.8	10390.8	218
S22	6.4	3.8	<0.1	11.1	6.7	28.1	0.02	5.7	20.9	47.6	10300	100	7760	10.1	9426.7	156
S23	5.4	11.6	<0.1	9.9	2.9	33.4	0.01	5.1	27.7	43.7	6150	47.6	9890	6.73	2525.8	61
S24	19.3	4.5	<0.1	15	13.8	66.6	0.02	8	25.5	61.6	11400	145	10400	12.1	7958.7	224

Station	Mud in Sediment (%)	Arsenic (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	Aluminium (mg/kg)	Barium (mg/kg)	Iron (mg/kg)	Lithium (mg/kg)	Total Oils (µg/kg)	Total n-alkanes (ng/kg)
S25	1.5	8.1	<0.1	10.7	5.6	67	0.02	5.5	26.6	35.7	6970	61.9	10600	6.89	904	59
S26	1.1	7.5	<0.1	12.6	8.9	23.1	0.03	6.3	24.3	151.3	7180	191	10200	7.64	6520.7	144
S27	0.9	15.7	<0.1	18.4	3.9	10	0.01	9.3	41.1	33.4	13000	85.1	15800	11.6	6246.7	161
S28	3.4	12.7	<0.1	13.9	28.6	4.5	0.01	8.2	28.6	39.6	16200	100	20000	15.2	3730.6	63
S29	3.4	12.5	<0.1	11.6	10.8	13.1	0.01	6.7	29.3	25.6	9020	72.6	13800	10.9	2455.5	95
S30	8.4	4.9	<0.1	10.3	2.7	6	0.01	5.1	22.2	19.7	7530	58	7520	8.44	7802.6	196
S31	3.7	14.4	<0.1	8.9	2	6	0.01	5.3	28.7	17	7460	64.4	12200	8.61	1622.5	59
Minimum	0.1	3.8	0.1	8.9	2	4.5	0.01	4.8	20.9	17	5270	47.6	6330	6.28	492	35
Maximum	27.4	28.7	1.1	73.4	423.2	1545	0.06	21.7	53	652.6	19800	847	20000	17.9	14966.8	524
BAC		25	0.31	81	27	38	0.07	36		122						
ERL		8.2	1.2	81	34	47	0.15	21		150						

Source: Marine Institute (2017), OSPAR (2014)

Figure 4.3: Sampling locations referenced in Table 4.1

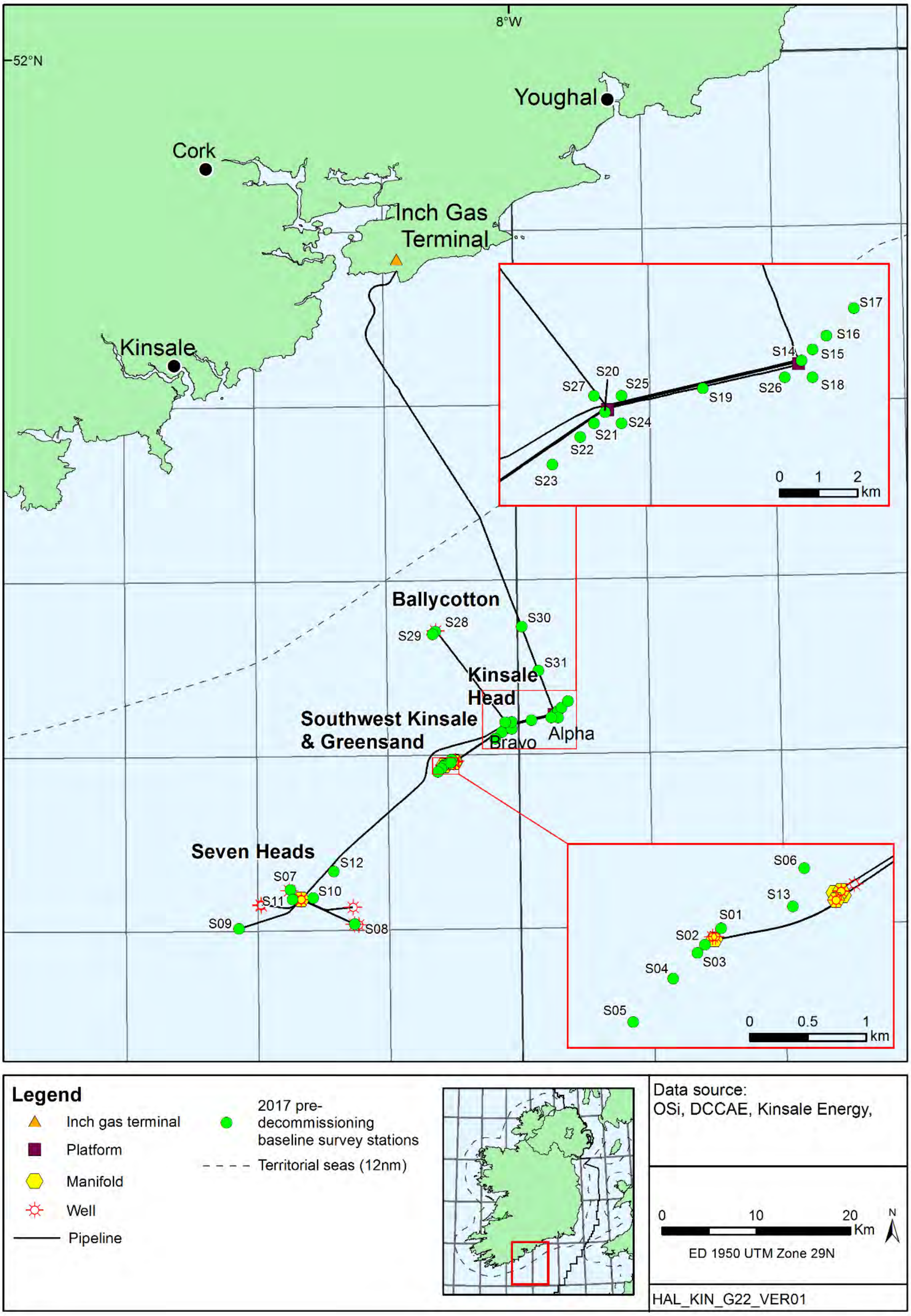


Figure 4.4: Predicted seabed habitats

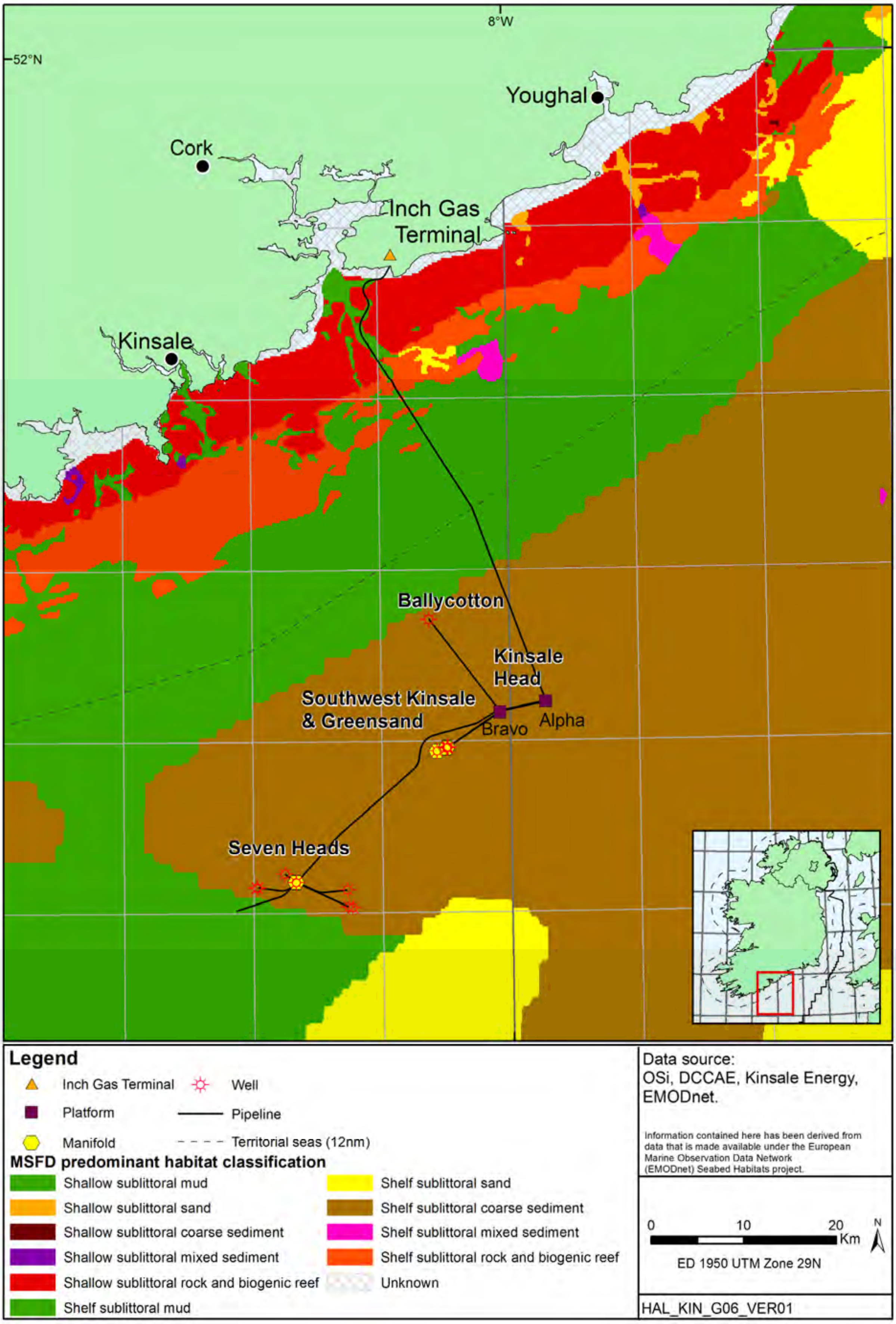
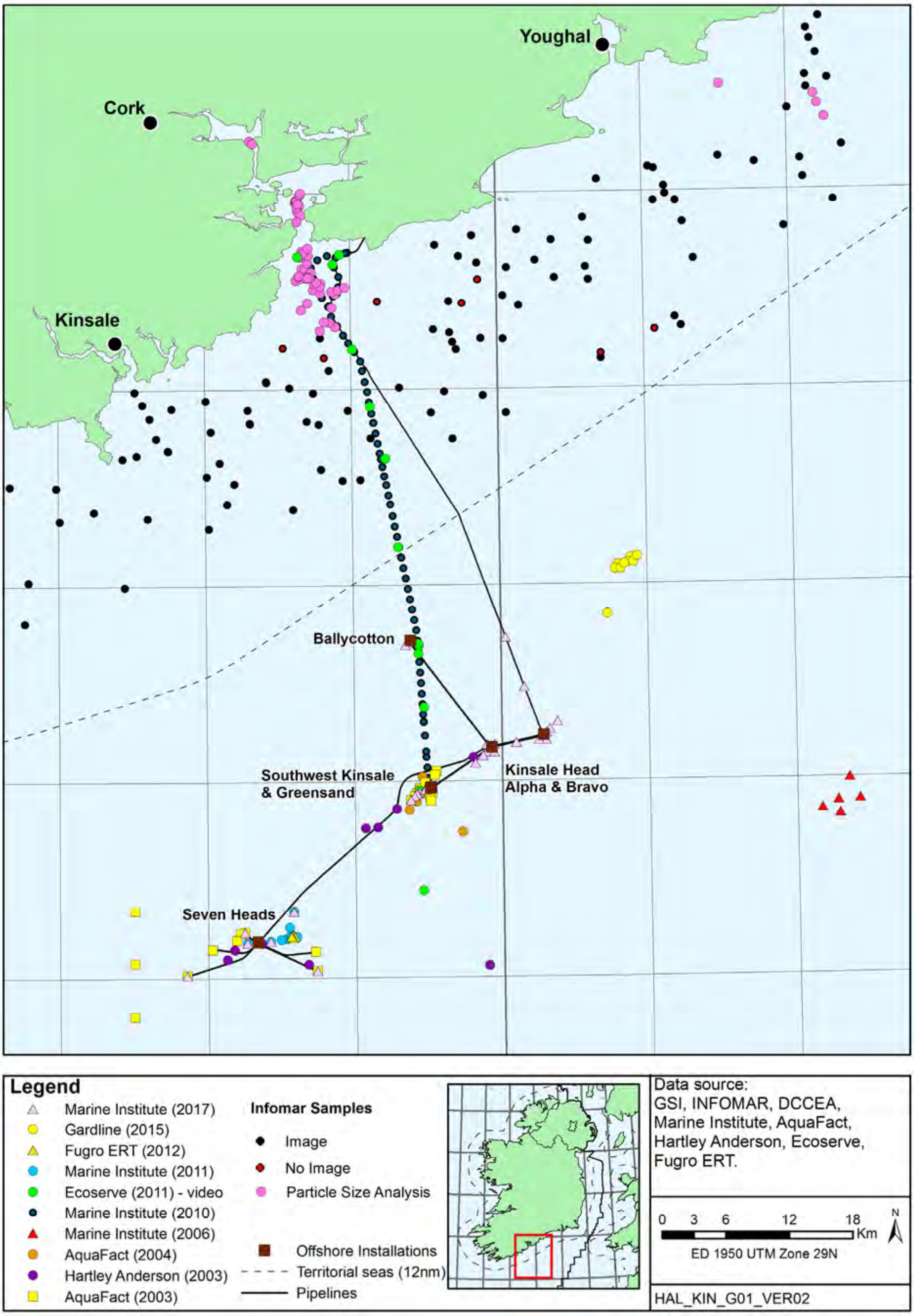


Figure 4.5: Existing seabed survey coverage



4.2 Climate, Meteorology and Air Quality

The area has a mild maritime climate with mean air temperatures varying between approximately 6-9°C in winter to 15-16°C in summer (seasonal mean temperatures for 1981-2010, Walsh 2012 and M5 Wexford Coast buoy observations 2004-2016, Met Eireann website). The predominant winds over the open waters south and west of Ireland are from the west and southwest (DCENR 2011). In the open ocean, winds of greater than 8m/s are experienced on 70-80% of occasions in winter (October to March) and 30–35% in summer (April to September) (Irish Coast Pilot 2006). Gales (17-20m/s) occur on approximately 20-30% of winter days and less than 2% of summer days (Irish Coast Pilot 2006). Coastal wind data from Cork Airport for the period between 1981 to 2010 show mean winter winds (October to March) of 5.9m/s and mean summer winds (April to September) of 4.9m/s. Gales occurred at Cork Airport an average of 1.6 days per month over winter and 0.2 days in the summer (Met Eireann website[2]). Sea fog is most frequent in summer, and most commonly associated with warm moist air blowing over a relatively cold sea with winds between southeast and southwest.

Ambient air quality monitoring at Monkstown, Cork Harbour (air quality zone D – rural background area) between August 2007 and March 2008 indicated that concentrations of carbon monoxide, nitrogen dioxide, sulphur dioxide, benzene and lead were below their respective lower assessment thresholds. Concentrations of PM_{10} exceeded the upper assessment threshold for this pollutant (EPA 2009), most likely due to residential solid fuel emissions in rural areas (O'Dwyer 2016). Similar patterns were observed in the 2015 data for Cork City (air quality zone B), with PM_{10} exceedance attributed to traffic emissions (O'Dwyer 2016).

4.3 Oceanography, Hydrography and Water Quality

The Celtic Sea is particularly susceptible to rough seas due to strong to gale force southwesterly winds. The highest frequency of rough to high seas over the open ocean to the south is associated with winds between south-south-east and north-west (UKHO 1997).

Swell distributions are dominated by swells from a south-west and west direction throughout the year, with mean significant wave heights varying between 1-1.5m in summer to 3m in winter (data for 15 July 2016 and 15 January 2016 respectively from Marine Institute monthly model means[3]). Estimates of 100 year extreme metocean conditions for the Kinsale Area indicate a significant wave height of up to 13.8m, a maximum wave height of 24.7m, and a current speed of 1.13m/s, all from a southwesterly direction (Fugro 2015).

Semi-diurnal tidal components dominate short-term current velocities at the Kinsale Area, with typical spring velocities of around 0.5m/s and a north-easterly flood and south-westerly ebb orientation (UKHO 1997).

The general pattern of transport of water into the Celtic Sea was reviewed by Pingree & Le Cann (1989), who identified a weak, variable but persistent flow, with typical mean speeds of 0.03m/s, moving northwards along the Brittany coast and across the mouth of the English Channel. North of the Scilly Isles, part of this flow diverges to the west and is deflected southwards around the south coast of Ireland, and there is generally a strong clockwise flow around the Irish coast caused by easterly winds and the Irish Coastal Current (Fernand *et al.* 2006). See **Figure 4.6** for a schematic of the currents in the Kinsale Area.

Surface water temperatures range from 8-10°C in winter to 15-16°C in summer, while bottom temperatures show less variation and remain at around 8-10°C throughout the year (Connor *et al*. 2006). Thermal stratification of the water column develops in spring, with a thermocline between warm surface waters and colder deeper waters. Stratification breaks down to an extent through autumn, although the area remains frontal throughout winter (Connor *et al*. 2006). Mean sea surface salinity at the Kinsale Area during the summer is 34.75‰ increasing in winter to 35.10‰, reflecting stratified and mixed conditions respectively (BODC 1998).

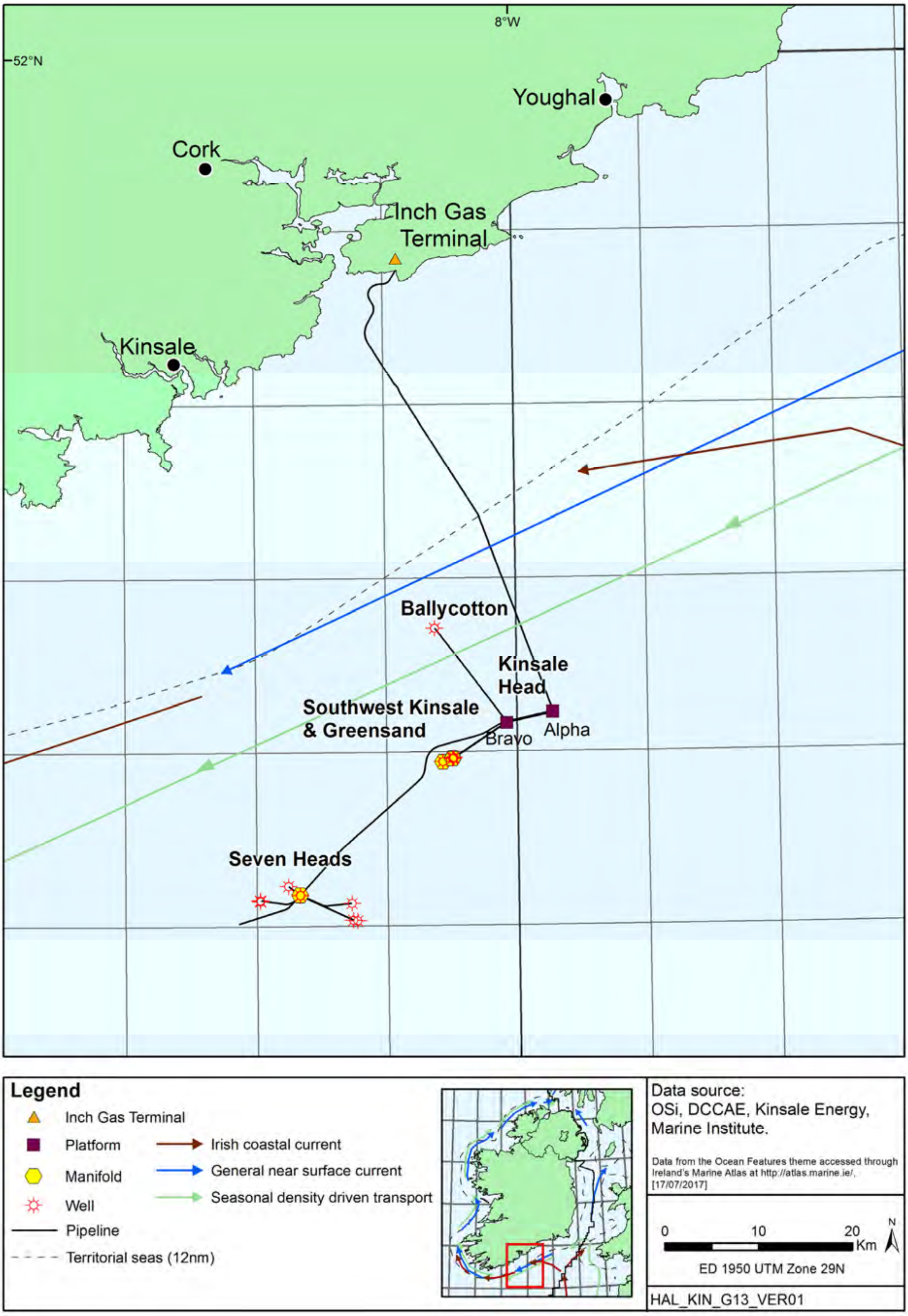
The Marine Framework Strategy Directive (MFSD) initial assessment (Marine Institute 2013), provides an overview of water quality in the Irish marine environment. Monitoring results of water sampling (in addition to sediment and organism sampling) indicate that the concentrations of monitored non-synthetic chemicals (e.g. trace metals, hydrocarbons) and synthetic contaminants (e.g. PCBs, flame retardants, TBT) are within internationally acceptable ranges or standards and at levels unlikely to cause adverse effects on marine life.

[2] http://www.met.ie/climate-ireland/1981-2010/cork.html
[3] http://data.marine.ie/Dataset/Details/20956#

The OSPAR Intermediate Assessment 2017 provides an assessment of the eutrophication status of NE Atlantic waters, drawing on data from 2006-2014 (OSPAR 2017). Results for Republic of Ireland waters are very similar to previous assessments, with the vast majority (> 99.9% by area) of assessed areas classified as non problem areas for eutrophication. Problem (n = 20) and potential problem (n = 16) areas are restricted to small inshore and coastal areas; these include some estuaries and embayments on the south coast of Ireland. Offshore waters, such as the Kinsale Area, do not show elevated nutrient concentrations (OSPAR 2017).

The status of inland and coastal waterways adjacent to the Kinsale Area, in relation to the Water Framework Directive, is summarised in Section 5.4.2. The status of relevant bathing waters is provided in Section 4.8.

Figure 4.6: Currents in the Kinsale Area



Net movement of material from the St George's and Bristol Channels dominates sediment transport in the Celtic Sea. From these channels, outgoing tidal streams carrying fine sediment fan out in a south west direction across the Celtic Sea. From the erosion areas of coarse material in the two channels, Holocene sediments are deposited progressively, as the stream weakens from zones of shelly gravel, to large zones of sandwaves up to 18m high and to sheets of fine sand and mud (Pantin 1991). Suspended sediment concentrations are seasonally variable at between ~5mg/l in January and <1mg/l in July (Cefas 2016).

4.3.1 Ambient underwater noise

Ambient (or background) noise is made up of contributions from many sources, both natural and anthropogenic. In the marine environment, these include natural physical sources (e.g. waves, precipitation), biological sources (e.g. fish, crustaceans) and anthropogenic sources (e.g. commercial shipping, aggregate extraction, sonar, offshore energy activities).

Under conditions of low wind speeds and no precipitation, noise from commercial shipping is likely to be the dominant component of ambient underwater noise (Hildebrand 2009). Shipping noise is most evident in lower frequencies of 50-300Hz, where the sounds of multiple distant ships may merge into a background continuum (Harland & Richards 2006). Closer to passing ships, sound levels are greater and with components of slightly higher frequencies arising from rotating machinery and water displacement. Seismic surveys produce high energy pulses of sound, the low frequency components of which can be audible over large distances and prevalent in ambient noise (Hildebrand 2009).

Biological sources of ambient noise are generally dominated by snapping shrimp, fish and marine mammal vocalisations. With the exception of very low frequency baleen whale calls, the medium to high frequencies of most biological noise sources are rapidly attenuated and contribute to ambient noise levels only on local scales.

Ambient noise exhibits considerable spatial and temporal variability, and accurate characterisation requires location-specific measurements. However, a consideration of the dominant noise sources in the region provides insight as to the likely characteristics of the area's ambient noise spectrum. The Kinsale Area is a high-energy environment which experiences frequent strong winds in winter and considerable precipitation; as such, natural physical noise from waves and precipitation will be important components of ambient underwater noise in the area, dominating the medium frequencies and particularly in winter. Moderate levels of noise from commercial shipping are to be expected, with notable contributions from passing vessels (≥750 per annum; mostly cargo) transiting to/from Cork and support vessels servicing the Kinsale platforms (DCENR 2011). Operations on the Kinsale platforms will also contribute to the ambient noise, generally emitting continuous wide-spectrum and tonal sounds (e.g. from rotating machinery such as turbines, generators, compressors) which are qualitatively similar to those from ships (DECC 2016). Noise from fishing vessels (e.g. propellers, winches, sonar, trawled gear in contact with the seabed) will also contribute to anthropogenic ambient noise in the area.

A comparative study of low frequency (up to 500Hz) ambient noise in the Celtic Sea, Southern and Northern North Sea revealed the Celtic Sea site to be the least influenced by anthropogenic noise (Merchant *et al.* 2016, also see Beck *et al.* 2013). While the site was positioned off the North Cornwall coast, far from the Kinsale Area, the findings are indicative of the lower overall vessel traffic and anthropogenic sources of ambient noise in the Celtic Sea compared to busier UK and Irish waters (e.g. Irish Sea, Southern North Sea, English Channel) (DECC 2016). Monitoring programmes for marine noise are being developed as part of the implementation of the MSFD in Irish waters, including the establishment of a noise register of known activities, with new noise sources identified at the consenting stage (Marine Institute & the Department of Housing, Planning and Local Government (2015).

4.4 Biodiversity

4.4.1 Plankton

The waters of the Celtic Sea are seasonally stratified, with greater mixing in shallower areas. There is a heavy terrestrial influence, but also an important oceanic influence from the Atlantic. In waters off the south of Ireland a phytoplankton bloom typically occurs every spring, usually from mid-April, as increasing light levels and the development of the thermocline in the stratified water column lead to an increase in phytoplankton biomass (O'Boyle & Silke 2010).

Early in the season, the phytoplankton community largely comprises diatoms such as *Thalassiosira spp*. (the most frequently recorded phytoplankton taxa), *Skeletonema spp.* and *Chaetoceros spp*., with *Rhizosolenia spp.* and *Ceratulina spp*. increasing in abundance as the bloom develops (Pybus 1996, Johns & Wootton 2003). As stratification increases into the summer months, opportunistic diatom species decline, and dinoflagellate species such as *Ceratium spp.*, *Protoperidinium spp.* and *Dinophysis spp.* become dominant within the community. The bloom declines as summer progresses and nutrients deplete, although occasional, smaller autumn blooms may occur. There has been an increase in the numerical abundance of both diatoms and dinoflagellates in Irish waters since 1998 (Marine Institute 2009).

The zooplankton acts as a trophic link between the producers (phytoplankton) and the higher predators within the ecosystem. Zooplankton communities in the Celtic Sea are dominated by copepods. Small copepods such as *Acartia spp*., *Oithona spp*., *Centropages typicus*, *Paracalanus spp*. and *Pseudocalanus spp*. are abundant in the region, along with euphausiids, cladocerans and meroplankton such as echinoderm larvae. Amongst the calanoid copepods, the warm-water species *Calanus helgolandicus* is considerably more numerous than *Calanus finmarchicus* (Johns & Wootton 2003), and there has been a general movement north of *C. helgolandicus* and an increase in abundance off the coast of southwest Ireland (Marine Institute 2009). Jellyfish in the area include *Rhizostoma octopus*, found in extremely large summer aggregations at the entrance of Wexford Harbour (some 150km to the east of the Kinsale Area facilities) and nearby waters between 2003 and 2006 (Marine Institute 2009), as well as *Aurelia aurita*, *Chrysaora hysoscella* and *Cyanea lamarckii*, the hydrozoans *Physalia physalis* (the Portuguese man-o-war) and *Velella* (Pikesley *et al*. 2014). *Pelagia noctiluca*, an oceanic water-water species, may be carried into Irish waters by the shelf edge current (Marine Institute 2009).

4.4.2 Benthos

Benthic biota is usually considered as two groups: infauna and epifauna. The infauna live within the seabed sediment, and represent the most commonly surveyed and well-known benthic community. Epifauna live on the surface of the sediment and hard substrates, are generally larger than infauna, and may be sessile, such as sponges and hydroids; or mobile, such as echinoderms and crustaceans.

The dynamic nature of the sedimentary environment of the Seven Heads and Kinsale Head Gas Fields has led to heterogeneous benthic habitats. According to the EUNIS habitat classification, the main habitat is circalittoral coarse sediment (**Figure 4.4**). This habitat, as with shallower coarse sediments, can be characterized by robust infaunal polychaetes, mobile crustaceans and bivalves (Connor *et al.* 2004). Prior to oil and gas exploration in the area, the benthic communities of the Celtic Sea were studied by Hartley and Dicks (1977), Hartley (1979) and Cabioch, *et al.* (as reported in Boelens *et al*. 1999).

In the sediment types present around the Kinsale Area, Hartley & Dicks (1977) found that many species characterising boreal offshore muddy sand and offshore gravel associations had overlapping distributions. Muddy sand associations were characterised by the molluscs *Turritella communis*, *Aporrhais pes-pelicani*, *Phaxas pellucidus* and the brittlestar *Amphiura filiformis*; gravel associations by the mollusc *Spisula elliptica* and the echinoderms *Asterias rubens*, *Echinocyamus pusillus* and *Spatangus purpureus*.

Benthic sampling (2002-2012), to inform various exploration and development activities within the proposed Kinsale Area are summarised below. These include the pipeline route between Seven Heads and Kinsale Bravo (Hartley Anderson 2003), the Barryroe well (Marine Institute 2011, Fugro ERT 2012) and the pipeline route between Inch and the gas fields of Ballycotton and SW Kinsale (Marine Institute 2010).

In the Seven Heads field and along the pipeline route to the Kinsale Head field, Hartley Anderson (2003) described the seabed as a mosaic of rippled gravelly sands interspersed with areas of muddy sand; and the benthic epifauna as consisting of common and widely distributed species consistent with previous academic surveys in the region (Hartley & Dicks 1977, see Boelens *et al*. 1999). They noted a well-developed fauna on all hard substrates which ranged through cobbles, boulders and larger rock outcrops, with particular emphasis on two identified rock outcrops. The infauna of this same area was investigated by AquaFact (2003) and found to be low in species and individuals; it was ascribed to an *Ophelia*-type grouping. When comparing the species data with the expected *Amphiura/Chamelea* grouping identified in the area by Boelens *et al*. (1999), AquaFact found only small numbers of amphiurids at a few stations and no *Chamelea* were found. Other faunal elements of the *Amphiura/Chamelea* grouping such as *Notomastus, Melinna, Thyasira* and *Abra* sp., were either absent from some samples or were only rarely recorded. The dominant species throughout the Seven Heads area was found to be *Spiophanes kroyeri with* other characteristic taxa being *Magelona alleni, Ophelia rathkei* and *Echinocyamus pusillus*. Hence the faunal grouping was considered to be of the *Ophelia*-type.

Seabed images obtained close to the Seven Heads field (Barryroe well; Marine Institute 2011) depict a muddy/sandy seabed with little visible fauna (occasional burrowing anemones, hydroids and bryozoans on cobbles, hermit crabs); however, abundant worm tubes, *Nephrops* burrows and the clear reworking of sediments all provide evidence of bioglogical activity. Grab samples from 11 stations identified only 92 taxa (predominantly polychaetes); thus the infauna was considered to be relatively impoverished and typical of the sediment heterogeneity.

At a smaller geographic scale, video observations within 150m of a single well (48/24-10) (Fugro ERT 2012) showed evidence of faunal tracks and burrows with sparse occurrences of mobile epifauna including *Cancer pagurus* (edible crab), Paguridae spp. (hermit crabs), *Octopus vulgaris* (common octopus), *Asterias rubens* (common starfish) and *Luidia ciliaris* (seven armed starfish). *Nephrops* burrows, polychaete burrows and Actiniidae species (possibly Dahlia anemone) were also observed. The area was described as showing a high level of homogeneity, with a range of sediments (from coarse to fine sands) interspersed with occasional pebbles and bedrock outcrops; sand ripples aligned north-south were also present, indicative of east–west currents. The single biotope identified was offshore circalittoral sand SS.SSa.OSa (EUNIS A5.2 (Connor *et al*. 2004) with no attributed species associations.

Grab sampling and seabed video data acquired by Ecoserve (2011) in support of the Marine Institute's (2010) environmental baseline assessment for a proposed pipeline route from the Inch landfall out to Ballycotton, SW Kinsale and Greensand summarised the area as being relatively diverse with 280 taxa identified from 13 stations. The number of species per station ranged from 42 to 68. Eleven of the 16 most abundant taxa were polychaetes, in particular *Scalibregma inflatum*, *Lumbrineris sp.*, *Magelona mirabilis*, and to a lesser extent *Magelona filiformis* and *Chaetozone setosa*; abundant non-polychaete species were the brittlestar *Amphiura filiformis*, the bivalve *Abra nitida* and the burrowing urchin *Echinocardium cordatum*.

A total of seven biotopes were described from video material, but the positional relationship between these and the grab sampling stations is not clear. However, a theme of mixed sediments and patchiness is emphasised and the overall description of the pipeline area is 'diverse'.

The Marine Institute (2017) KADP pre-decommissioning survey sampled 31 stations with the sediments found being predominantly very coarse sand and very fine gravel, with typically little mud (silt and clay particles) present. However, at a few stations an appreciable proportion (up to 27%) of mud was present in addition to the coarse sands. The benthic fauna (sampled at 28 of the 31 stations) had a low to moderate abundance and species richness, with many species being found across the surveyed area. Multivariate analyses of the faunal data indicated three relatively weak clusters of stations which were geographically spread across the survey area and with some overlapping characteristic species. The characteristic species from the clusters included the polychaetes *Spiophanes kroyeri*, *Lumbrineris aniara*, *Mediomastus fragilis*, *Goniadella gracilis*, *Glycera lapidum*, and *Amphitrite cirrata*, the anemone *Edwardsia* sp., unidentified Nematoda and Nemertea, and the echinoderms *Amphiura filiformis* and *Echinocyamus pusillus*. This suite of species is similar to those recorded in previous surveys and is believed to reflect the nature of the sediments on the area; no species indicative of contamination or organic enrichment were recorded.

All recent benthic sampling and photographic surveys in the Kinsale Area have been consistent in reporting no indication of sensitive species or habitats which would be subject to protection under the EU Habitats Directive (92/43/EEC) i.e. Annex I habitats. Ramboll (2017a & b) noted the possible presence of the cold water coral *Lophelia* on some of the Kinsale Area subsea infrastructure. As such colonies would be of conservation interest, various areas with possible *Lophelia* were investigated by ROV during the 2017 pre-decommissioning surveys. All colonies of possible *Lophelia* inspected proved to be colonies of the serpulid polychaete *Filograna implexa*, a common and widespread species.

4.4.3 Cephalopods

Cephalopods frequently recorded in the Irish and Celtic Seas include the long-finned squid *Alloteuthis subulata* and *Loligo forbesii*, which are typically found in coastal waters, the short-finned squid *Illex coindetii* and *Todaropsis eblanae*, typically found further offshore, the cuttlefish *Sepia officinalis*, the octopuses *O. vulgaris* and *Eledone cirrhosa* as well as a number of sepiolid species (DCENR 2015, Jereb *et al*. 2015).

A. subulata is the most abundant cephalopod in the Celtic Sea. It is common throughout the area, particularly at depths of less than 50m (Collins *et al*. 1995). Distribution of this species is linked to physical factors in spring and autumn with peak abundance observed in the warmest waters in March and October (Jereb *et al*. 2015). The demographic structure of the population in the region is seasonal, with mature animals dominating in spring and summer and juveniles dominating in autumn (Jereb *et al*. 2015).

L. forbesii is typically found in shallow, coastal waters and continental shelf areas. It tends to avoid waters cooler than 8.5˚C and is the largest and most northerly distributed of the long-finned squids (Oesterwind *et al*. 2010). There is a single extended breeding period from December to May, and squid lay their eggs in batches before dying (Rocha *et al*. 2001). Research suggests that individuals migrate inshore from deep waters in the winter months during the peak of spawning (Stowasser *et al*. 2004).

4.4.4 Fish and Shellfish

Pelagic Fish

Pelagic species, including herring (*Clupea harengus*), mackerel (*Scomber scombrus*), sprat (*Sprattus sprattus*) and horse mackerel (*Trachurus trachurus*) are abundant in the Celtic Sea, and move widely between feeding and spawning grounds (Heessen *et al*. 2015).

Mackerel are widely distributed around the north-east Atlantic where they tend to shoal in large schools. Mackerel undergo extensive migration between over-wintering grounds in the northern North Sea and spawning grounds to the west and south of Ireland (Boelens *et al*. 1999). Horse mackerel is a schooling fish, particularly abundant to the south and west of Ireland. Adults form large shoals in coastal areas with sandy sediments, where they feed on fish, cephalopods and crustaceans.

Herring are widespread throughout the north-east Atlantic, although they reach the southern limit of their range to the south of Ireland and the UK (Heessen *et al*. 2015). Spawning usually takes place at depths of between 15-40m, when herring deposit their sticky eggs on coarse sand and gravel. The dependency of herring on these specific substrates largely limits herring distribution to the shelf region and makes the species susceptible to disturbance at these sites. Young herring occur in dense shoals in inshore waters, and are often found in mixed shoals with sprat (Heessen *et al*. 2015). Sprat are usually found in shallow water close to shore, where they can tolerate low salinities. Spawning mainly occurs in the summer months, near the coast or up to 100km out to sea, at depths of 10-20m (Gordon 2006). The Celtic Sea Herring Acoustic Surveys in autumn 2016 and 2017 (O'Donnell *et al*. 2016, 2017) identified aggregations of herring at or near to the seabed; the bulk of the stock was observed within the cooler waters of the Celtic Deep in 2016, while major aggregations in both the Celtic Deep and coastal waters were observed in 2017. Higher proportions of immature fish were present in inshore waters in 2016. In both 2016 and 2017, sprat were widely distributed throughout the survey area, while several shoals of tuna (most probably *Thunnus thynnus*) were observed at the surface in offshore waters.

Results from the DCCAE ObSERVE Programme of aerial surveys indicate summer and winter presence of the largest known bony fish, ocean sunfish (*Mola mola*) in the Kinsale Area, with peak abundance in summer (Breen *et al*. 2017), presumably coinciding with invasions of jellyfish medusae, salps and ctenophores which are important food sources for sunfish.

Demersal fish

The most common species in the Celtic Sea are haddock (*Melanogrammus aeglefinus*), poor cod (*Trisopterus minutus*), Norway pout (*Trisopterus esmarkii*) and whiting (*Merlangius merlangus*) (Marine Institute 2012), while cod (*Gadus morhua*), monkfish (*Lophius piscatorius*), hake (*Merluccius merlucius*), plaice (*Pleuronectes platessa*) and dab (*Limanda limanda*) are also abundant (Heessen *et al*. 2015). Areas of sandy sediment tend to support flatfish and sandeels (*Ammodytes spp.*), while gobies, blennies, wrasse, John dory (*Zeus faber*) and large gadoids are more abundant over rockier regions (Boelens *et al*. 1999).

Gadoids are important components of the fish community of the north-east Atlantic. Cod are distributed throughout Irish waters, where they are found from the shoreline down to depths of 600m, but reach the southern limit of their range in the Celtic Sea (DCENR 2015). Cod are omnivores, feeding on a variety of invertebrates and fish. Adult cod aggregate in loose shoals and generally remain within the continental shelf area (Heessen *et al*. 2015). Haddock are found close to the seabed, typically over sandy and muddy substrates and are abundant in the northern half of the Celtic Sea (Heessen *et al*. 2015). Adults congregate to spawn, with the Celtic Sea one of several spawning areas around the coasts of Ireland and the UK (DCENR 2015). Whiting are widespread around European coasts at depths of 10-200m over sandy or muddy ground. Whiting spend their first 2-3 months near the surface, often associating with *Cyanea* jellyfish blooms (Hay *et al*. 1990), after which they adopt a demersal way of life. Hake are most abundant along the continental slope to the west of Ireland. They feed nocturnally in mid-water, returning to the bottom during the day, while juveniles aggregate in nursery areas over muddy sediments (DCENR 2015). A number of smaller gadoid species such as poor cod and Norway pout can be very abundant in places and may be ecologically important as prey for other species. Poor cod is widespread around the Irish coast, mainly in waters >70m deep, and population densities in the Celtic Sea can be much greater than those in the North Sea (Heessen *et al*. 2015). Poor cod has undergone a significant decrease in abundance off the south of Ireland, while increasing in the north and may be considered a climate indicator species (Marine Institute, 2009). Norway pout is mainly found in open, deeper water (>80m) over muddy bottoms and, although abundance is low in the southern half of the Celtic Sea, they are abundant in waters off the south coast of Ireland (Heessen *et al*. 2015).

Plaice are found to depths of 200m, mainly on soft sediments. They live on mixed substrates at depths of up to 200m (although generally in much shallower waters), with older individuals generally found in deeper water (Whitehead *et al*. 1986). Plaice have a complicated life cycle, with each life stage having a specific set of habitat requirements. Larvae and juveniles rely on transport by currents to move them from spawning grounds to nursery areas (Heessen *et al*. 2015). Dab are spring and summer spawners which mature at 2-3 years to produce pelagic eggs and larvae. Dab are typically found in shallower water, where they feed on small benthic invertebrates (Amara *et al*. 1998). Other important flatfish species in the area include sole (*Solea solea*), especially on finer sandy and muddy seabeds to around 120m, including estuarine areas and the megrim (*Lepidorhombus whiffiagonis*), which occurs over mud and sand sediments across the south and west coasts of Ireland (DCENR 2015).

Two similar species of monkfish, white-bellied (*Lophius piscatorius*) and black-bellied (*L. budegassa*) are found in Irish waters ranging from shallow, inshore waters down to depths of 1,100m, with the white-bellied the most abundant. Monkfish are ambush predators, enticing prey towards their mouths with a lure that extends from the top of their head (Fariña *et al*. 2008). Spawning is thought to take place in deep water, with each female thought to produce just one batch of eggs (in a large, buoyant and gelatinous ribbon) in winter and spring (Laurenson *et al*. 2008). Juvenile monkfish descend to the seabed after and are generally found in shallower water than adults.

Elasmobranchs

A number of elasmobranch species are present in the Celtic Sea, including the spurdog (*Squalus acanthias*) and the lesser spotted dogfish (*Scyliorhinus canicula*) (Marine Institute 2012). The lesser spotted dogfish, like the poor cod, has decreased in abundance off the south of Ireland, while increasing in the north and may be considered a climate indicator species (Marine Institute 2009). Skates and rays that may be found in the region include the thornback ray (*Raja clavata*), cuckoo ray (*Raja naevus*), shagreen ray (*Raja fullonica*) and the rare common skate (*Dipturus batis*), listed as “Critically Endangered” on the IUCN Red List (Ellis *et al*. 2004), and now known to consist of two species, both rare (Iglésias *et al.* 2010). Oceanic sharks such as blue (*Prionace glauca*), thresher (*Alopias vulpinus*) and mako (*Isurus oxyrinchus*) sharks may make occasional, seasonal visits to the region. The southern Irish coast is an area where basking sharks are particularly common, with numerous sightings reported annually in the summer months (Solandt & Chassin 2014). Sightings of basking and blue sharks have also been reported in the area by the Celtic Sea Herring Acoustic Surveys (Cronin & Barton 2014, O’Donnell *et al*. 2016, 2017), while satellite tagging of basking sharks in the Celtic Sea revealed evidence of migration between the west of France and the Irish coast (Marine Institute 2013, Sims *et al*. 2005).

Diadromous fish

Diadromous species are those which migrate between marine and freshwater as part of their lifecycle. Salmonids, including Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*) undertake extensive migrations out to sea to feed, before returning to “home” rivers to spawn. Spawning takes place in shallow gravelly areas in clean rivers and streams. After a period of up to 5 years the young salmon migrate downstream to the sea as smolts (DCENR 2015), where they are thought to migrate northwards up the west coast, and then towards Greenland and the Norwegian Sea via the Faroe-Shetland Channel (Hansen & Jacobsen 2003). Salmon have a homing instinct and spawn in the river of their birth after 1-4 years at sea (Heessen *et al*. 2015). The River Lee, flowing into Cork Harbour, contains populations of salmon and trout which migrate to spawning locations up-river. The Blackwater River, approximately 40km to the east of Cork Harbour, is a designated SAC (Special Area of Conservation – see Section 3.2.8), with Atlantic salmon as a qualifying feature.

The Blackwater River SAC also contains populations of sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and twaite shad (*Alosa fallax*). Lampreys are eel-like, jawless fish which migrate up rivers to spawn and spend the larval stage buried in muddy substrates in freshwater. Both species need clean gravel for spawning, and silt or sand for the burrowing juveniles (JNCC website). Once metamorphosis takes place, the adults migrate to the sea. Sea lampreys are thought to venture further out to sea and spawn in lower reaches of the rivers than the river lampreys (Heessen *et al*. 2015). Shads are clupeids, or herring-like fish. They feed in estuaries before moving upstream to spawn between April and July. Juveniles are thought to remain in freshwater for up to two years, before returning to the sea (Maitland & Hatton-Ellis 2003). There are several other riverine SACs supporting nationally important populations of migratory fish along the south coast.

The European eel (*Anguilla anguilla*) is recorded in rivers throughout Ireland (DCENR 2015).

They spend most of their lives in freshwater or inshore coastal waters, before migrating across the Atlantic to the Sargasso Sea to spawn in late summer (McCleave & Arnold 1999). The larvae drift north-east with the Gulf Stream and after about 6-8 months reach the Irish coast from December into spring (Moriarty 1999) where they transform into transparent elvers (glass eels). Glass eels gather in river estuaries and wait for the river water to reach 10-12°C, before swimming upstream and migrating into inland waters. Eels spend between 2 and 20 years in rivers and other inland waters, before mature fish migrate seawards to the Sargasso Sea, where they spawn and die.

Shellfish

There are important *Nephrops norvegicus* (Norway lobster, scampi) grounds to the south of Cork (Lordan *et al*. 2015) including the Kinsale Area. Other common shellfish species in the area include edible (brown) crabs, lobster (*Homarus gammarus*), spider crabs (*Maja squinado = brachydactyla*), green (*Carcinus maenas*) and velvet (*Necora puber*) crabs, whelks (*Buccinum undatum*), cockles (*Cerastoderma edule*), mussels (*Mytilus edulis*), periwinkles (*Littorina littorea*), razor clams (*Ensis* spp.) and brown shrimp (*Crangon crangon*).

Spawning and nursery areas

The Kinsale Area is primarily within the International Council for the Exploration of the Sea (ICES) Rectangle 31E1 but extends into 31E2 and 32E1 (**see Figure 4.7**). These rectangles are within spawning areas for herring, sprat, cod, whiting, plaice, lemon sole and *Nephrops* (Coull *et al*. 1998), as well as haddock, megrim, mackerel and horse mackerel (Marine Institute data). Mackerel, cod, whiting, lemon sole, blue whiting (*Micromesistius poutassou*), ling (*Molva molva*), European hake and *Nephrops* all use the area as a nursery area at low intensity, while the area is a high intensity nursery area for monkfish (Ellis *et al*. 2012). The Marine Institute has also identified nursery grounds for herring, haddock, megrim and horse mackerel, in addition to whiting and mackerel. The Kinsale Area is not located within any known elasmobranch spawning grounds, but was identified within low intensity nursery grounds for spurdog and common skate (Ellis *et al.* 2012). **Figures 4.7 and 4.8** combine information from Coull *et al*. (1998), Ellis *et al*. (2012) and the Marine Institute (2012) to show the known spawning grounds and nursery areas that overlap with the Kinsale Area. Fish spawning can vary temporally and spatially; spawning areas are not rigidly fixed and fish may spawn earlier or later in the season.

The high density of spawning and nursery grounds around the south and west coasts of Ireland, and particularly those of hake, were a key factor in the establishment in 2003 of the Irish Conservation Box (or Biologically Sensitive Area), an area of 100,00km^2 extending out from Waterford Harbour along the 200m depth contour to Slyne Head on the west coast within which fishing restrictions are in place (see https://www.marine.ie/Home/site-area/areas-activity/fisheries-ecosystems/biologically-sensitive-area-0). **Figure 4.7** and **Figure 4.8** illustrate spawning and nursery areas of selected species in the Kinsale Area. The species represented are those mapped by the Marine Institute, based on data layers produced by ICES (2009) as part of their assessment of the importance of the Irish Conservation Box. Additional data layers are derived from Coull *et al*. (1998). Spawning or nursery areas of those species present in **Table 4.2**, but not represented in **Figure 4.7** and **Figure 4.8** may be assumed to be generally present throughout the area mapped. Spawning and/or nursery areas for several species, notably herring, whiting and cod are closely associated with coastal waters. Herring spawning, in particular, is restricted to areas of coarse sand or gravel substrates.

Table 4.2: Spawning and nursery grounds in the Kinsale Area

Species	Spawning grounds	Nursery grounds	Spawning period
Herring (a,c)	✓	✓	January - March
Sprat (a)	✓	-	May - August
Mackerel (b,c)	✓	✓ (low)	March - July

Species	Spawning grounds	Nursery grounds	Spawning period
Horse mackerel (c)	✓	✓	March - August
Blue whiting (b)	-	✓ (low)	-
Cod (a,b,c)	✓	✓ (low)	January - April
Haddock (c)	✓	✓	February – May
Whiting a,b,c)	✓	✓ (low)	February - June
Hake (b,c)	-	✓ (low)	-
Ling (b)	-	✓ (low)	-
Plaice (a)	✓	-	December - March
Lemon sole (a)	✓	✓	April - September
Megrim (c)	✓	✓	January - March
Monkfish (b,c)	-	✓ (high)	-
Spurdog (b)	-	✓ (low)	-
Common skate (b)	-	✓ (low)	-
Nephrops (a)	✓	✓	January - December

Sources: a = Coull et al. (1998), b = Ellis et al. (2012), c = Marine Institute (2012) – spawning period detail taken from Coull et al. (1998) and Ellis et al. (2012)

Figure 4.7: Spawning sites of selected species in the Kinsale Area

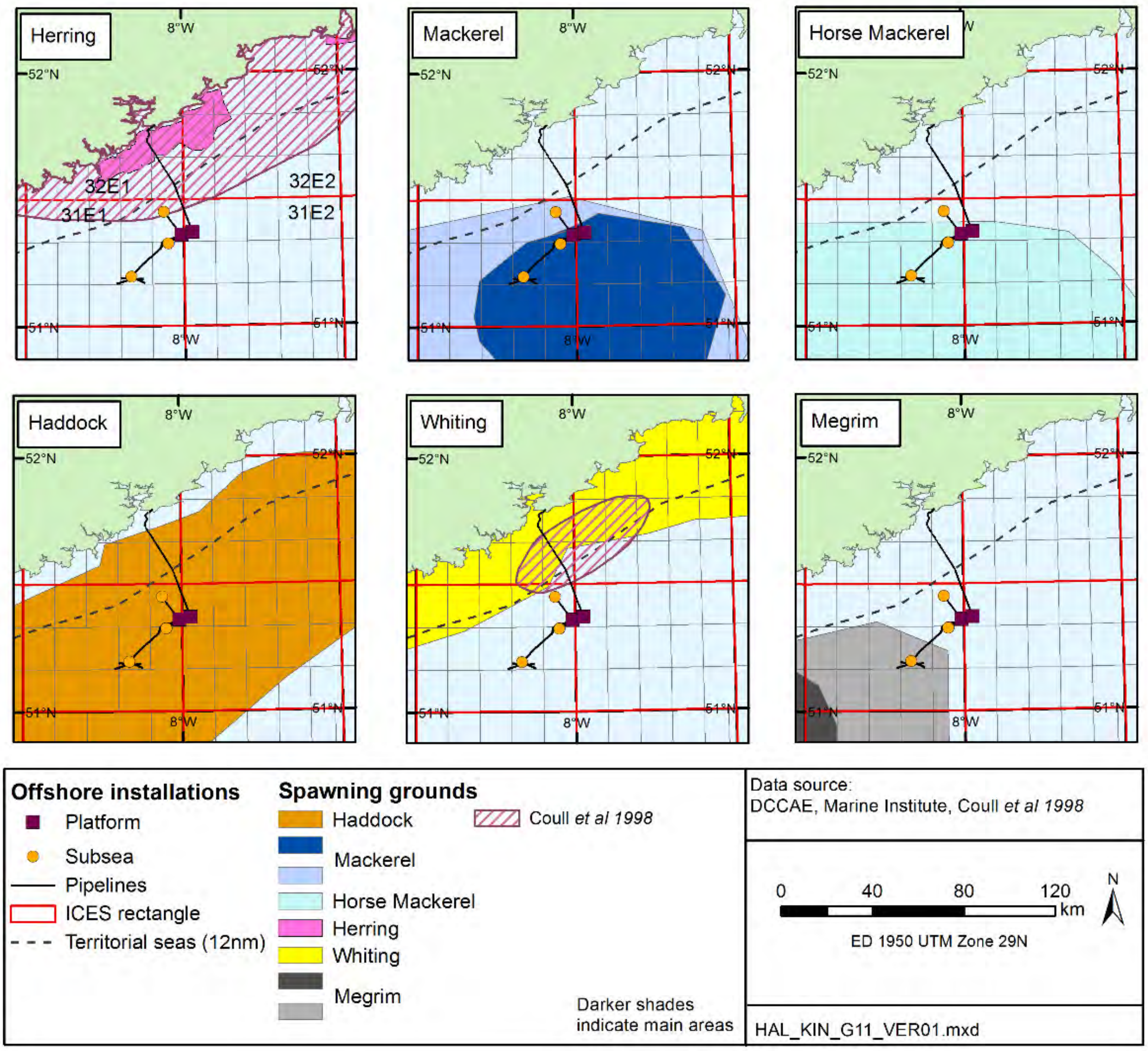
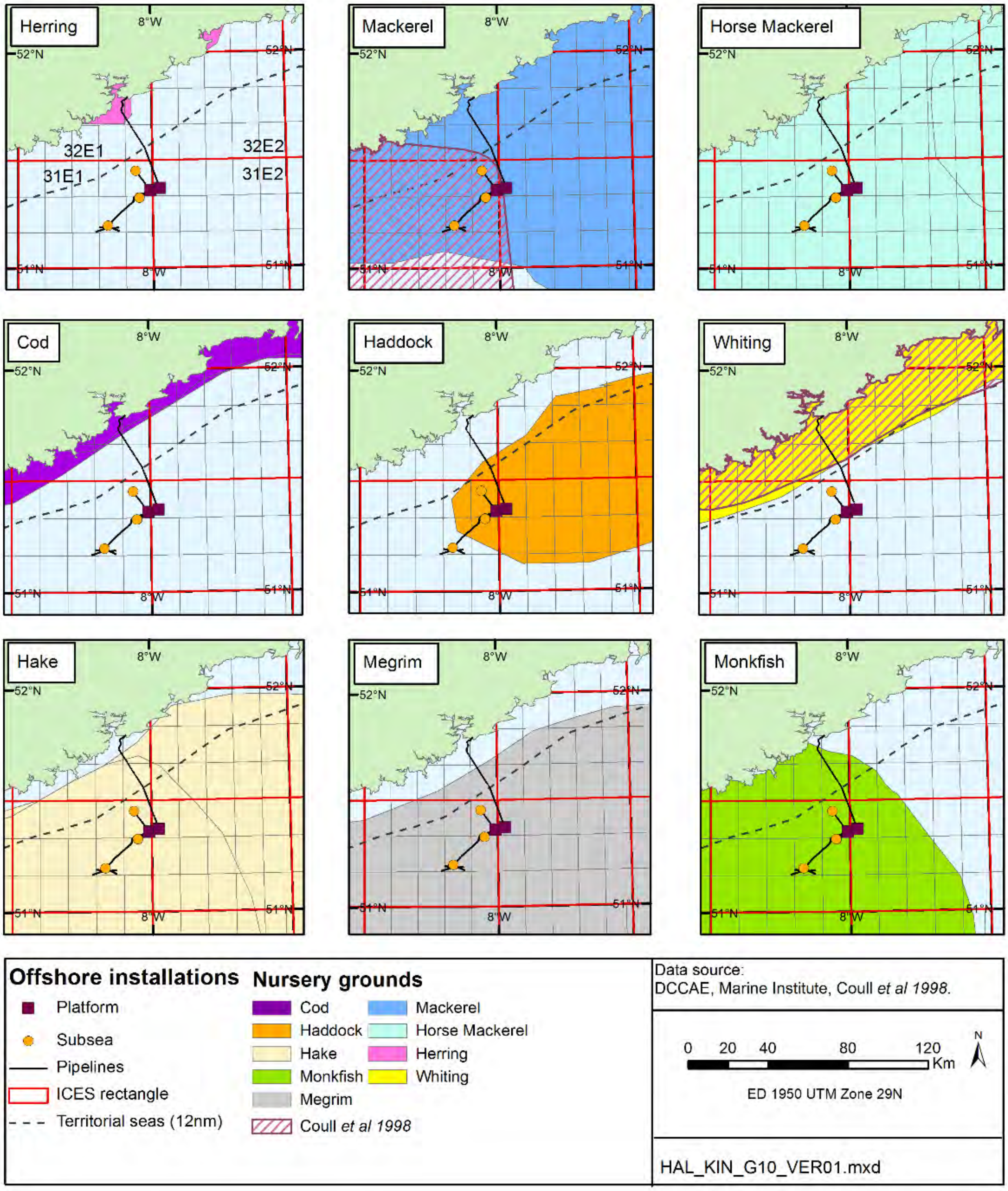


Figure 4.8: Nursery sites of selected species in the Kinsale Area



Irish Wildlife Trust (2018) list a number of marine species, primarily fish and shellfish, within Irish waters which are threatened, including those on the IUCN Red list and also a number for which there is evidence of decline or that have very localised populations.

These include elasmobranchs[4], the European eel[5], and a range of species which are also listed in the Habitats Directive including, Atlantic salmon, sea and river lamprey, common sturgeon and shad.

4.4.5 Marine Reptiles

There are seven species of marine turtle, of which five species have been recorded in the seas around Ireland and the UK: leatherback turtle (*Dermochelys coriacea*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*). The leatherback turtle is the largest of the marine turtles and is the only species of turtle to have developed adaptions to cold water (Goff & Stenson 1988). The species is covered under Annex IV of the Habitats Directive.

A significant majority of turtle sightings recorded in Irish waters are of the leatherback turtle (King & Berrow 2009), which migrates into the waters of the Celtic and Irish Seas in response to the distribution of the gelatinous zooplankton which make up their favoured diet (Doyle *et al*. 2008, Fossette *et al*. 2010). Tagging studies show that they migrate across the Atlantic from the eastern American mainland and the Caribbean (Hays *et al*. 2004, Doyle *et al*. 2008). Sightings in the wider region are concentrated off the south and west of Ireland, the southwest of England and the west coast of Wales. Most sightings occur in the summer, peaking in August (Penrose & Gander 2016). The 2014 Celtic Sea Herring Acoustic Survey (Cronin & Barton 2014) made four sightings of leatherback turtle, three of them approximately 70km south of Cork Harbour, although none were recorded in the 2016 or 2017 surveys (O'Donnell *et al*. 2016. 2017).

4.4.6 Birds

The south coast of Ireland provides numerous habitats for seabirds, with rocky cliffs and productive seas supporting a variety of gulls, auks, terns and shearwaters. Seabird distribution is influenced by the distribution of prey species, which in turn is affected by a range of physical factors. Sandeels, herring, sprat and small gadoids are among the prey items favoured by most seabirds, and there are several spawning and nursery areas for these in the area. Each summer, over half a million seabirds, from 24 species, search for suitable breeding sites on the cliffs and islands of the south coast of Ireland. In addition, over 50 species of waterbirds arrive on migration either on passage or to over-winter (https://www.npws.ie/research-projects/animal-species/birds/wintering-waterbirds). There are numerous SPAs (Special Protection Areas) along the coast which offer protection to species or aggregations of seabirds and waterbirds (see **Section 4.4.8**). Key sources of information on the distribution of birds in the Celtic and Irish seas include Webb *et al*. (1990) and Stone *et al*. (1995). In addition, various surveys, including the Celtic Sea Herring Acoustic Surveys (O'Donnell *et al*. 2016, 2017) have recorded seabird sightings around the Kinsale Area.

Seabirds

Gulls commonly found in the Kinsale Area include herring gull (*Larus argentatus*), lesser black-backed gull (*Larus fuscus*), great black-backed gull (*Larus marinus*), black-headed gull (*Chroicocephalus ridibundus*) and black-legged kittiwake (*Rissa tridactyla*). Most gulls are resident to the area, and are frequently recorded along the coast throughout the year. Also resident along the south coast of Ireland are a number of auks, including guillemot (*Uria aalge*), razorbill (*Alca torda*), Atlantic puffin (*Fratercula arctica*) and the black guillemot (*Cepphus grylle*). Razorbill, guillemot and black guillemot are generally found in coastal waters, although Atlantic puffin is more of an oceanic species, often found offshore off the Porcupine Seabight, or around small islands off the south coast or in the Irish Sea. The Old Head of Kinsale is the largest seabird colony on the south coast, between the Saltee Islands on the southeastern point and the Bull Rock on the southwestern point. The colony it supports has nationally important populations of black-legged kittiwake and guillemot, as well as significant populations of herring gull, razorbill, Northern fulmar (*Fulmarus glacialis*) and European shag (*Phalacrocorax aristotelis*) (https://www.npws.ie/research-projects/animal-species/birds/seabirds). Great Cormorants (*Phalacrocorax carbo*) and European shag also tend to remain closely associated with the coast, largely as a result of their plumage which is less water resistant than many other seabirds. Key sites for Great cormorants and European shags include Helvick Head, the Keeragh Islands, the Saltee Islands and the Sovereign Islands (see **Figure 4.9** for locations).

---

[4] Also see Clarke *et al.* (2016). Ireland Red List No. 11: Cartilaginous fish [sharks, skates, rays and chimaeras].

[5] Note that Council Regulation (EC) No 1100/2007 establishing measures for the recovery of the stock of European eel is implemented through eel management plans for Ireland.

Northern Gannets (*Morus bassanus*) are found in large colonies, from which they forage up to 480km offshore, along the shelf edge (DCENR 2015). Highest densities occur off the south coast in spring and summer, with the breeding season starting in April and May. Great Saltee Island, to the east of the Kinsale Area, is the site of one of the largest gannetries in Ireland, with 2,446 pairs recorded there in 2004 (NPWS website).

Seasonal visitors to the area include various terns, skuas and shearwaters. Terns arrive in the summer months at inshore areas to breed. Tern species regularly sighted in coastal waters of the Kinsale Area include the common tern (*Sterna hirundo*), the Arctic tern *(Sterna paradisaea*), the Sandwich tern (*Sterna sandivicensis*) and the little tern (*Sternula albifrons*). Lady's Island Lake to the south of Rosslare supports nationally important populations of common, Sandwich, Arctic and roseate terns which breed on the islands in the lake (NPWS website). Predatory Arctic skuas (*Stercorarius parasiticus*) also tend to be summer visitors, with high densities recorded along the Celtic Sea coast from July to September although the great skua (*Stercorarius skua*) is a resident which breeds in the west of Ireland (DCENR 2015), and is occasionally recorded in the Celtic Sea. The highly pelagic petrels and shearwaters, including the Northern fulmar -, the storm petrel (*Hydrobates pelagicus*) and the Manx shearwater (*Puffinus puffinus*), a species of which the Celtic and Irish Seas have particularly high densities, are all most abundant in spring and summer.

Many seabirds forage considerable distances from their breeding habitats. Thaxter *et al*. (2012) presented a review of representative foraging ranges during the breeding season, based on surveys conducted over breeding colonies across Europe (including Northern gannets on Saltee Island). Species such as Northern fulmar, Northern gannet, guillemot, lesser black-backed gull and black-legged kittiwake, which have maximum foraging ranges in excess of 100km, may be present in the Kinsale Area. The 2016 and 2017 Celtic Sea Herring Acoustic Surveys (O'Donnell *et al*. 2016, 2017) surveyed coastal and offshore waters from Mizen Head eastwards to the Irish Sea, each taking place over 2-3 weeks in October[6].. The 2016 survey sighted a total of 26,429 individual seabirds representing 27 species. The most commonly recorded species were northern gannet (15,147 individuals), guillemot (3,293), lesser black-backed gull (1,901), black-legged kittiwake (928) and razorbill (763). The 2017 survey observed a similar species composition but the total number of individuals recorded on survey (6,939) was 61% less than in 2016; the majority of this reduction in numbers was attributable to almost 9,000 fewer gannet sighted in 2017[7].

Waterbirds

Waterbirds, a loosely defined category including seaducks, divers, herons, waders, geese and swans, are a major feature of the coastal habitats of Ireland, with resident, migratory and over-wintering populations present in the area. Ireland lies on some of the major migratory flyways of the east Atlantic, with many species not only overwintering in the area, but also using the UK as a stopover during spring and autumn migrations. The rivers, estuaries, bays and other coastal areas of southern Ireland are of great importance to wintering and passage wildfowl, as well as for breeding waders and other waterbirds; several SPA sites are designated for such features in the region (see **Section 4.4.8**).

4.4.7 Marine Mammals

Irish waters are among the most important in Europe for cetacean species, with 25 species having been recorded in the region, and, in 1991, the government declared Irish waters a whale and dolphin sanctuary[8]. Eighteen of these species are regularly observed, while the remaining seven might be classed as vagrant species (NPWS 2014). The combination of shallow waters, deep oceanic areas with complex bathymetry and the productive shelf edge provide a range of habitats and feeding opportunities.

There are several key data resources on the species composition and relative abundance of the marine mammal fauna in the Kinsale area and wider Celtic Sea. The annual Celtic Sea Herring Acoustic Surveys (CSHAS) cover waters off the south coast of Ireland, typically over a three week period each October and extends from 2-3km off the coast to over 100km offshore (e.g. O'Donnell et al. 2017). Dedicated marine

[6] The 2016 survey spanned 8-26 October; the 2017 survey spanned 15 October to 03 November.
[7] It was noted that while a similar amount of survey effort took place in 2016 and 2017, two major storms (Ophelia and Brian) occurred during the 2017 survey period.
[8] The Irish whale and dolphin sanctuary is not a legal entity, rather a statement of political will which has resulted in considerable public awareness and interest towards cetaceans in Irish waters. They are protected by national legislation (Whale Fisheries Act 1937 & 1982; Wildlife Act 1976), the EC Habitats Directive and several international conventions.

mammal observers recorded sightings when light and environmental conditions permitted; combined data from 10 years of surveys from 2008-2017 are provided in **Table 4.3**. **Table 4.3** also shows data extracted from the Irish Whale and Dolphin Group's (IWDG) Casual Cetacean Sightings database, which includes sightings submitted by IWDG members, researchers and the general public and validated by the IWDG (IWDG 2018). These extracted data include all sightings from January 2008 to December 2017 within an area approximately bounded by Ardmore in the east, Galley Head in the west and south to 51ºN (the typical offshore extent of the CSHAS) (Figures 4.9 and 4.10). The IWDG casual sightings data are not effort corrected, and are biased towards busier and more accessible coastal waters, and areas subject to research (e.g. Ryan *et al*. 2010, Whooley *et al*. 2011); but provide useful information on the composition and relative abundance of cetacean species of the area. Data from the IWDG casual database and other sources over the period 2005-2011 were synthesised by Wall *et al*. (2013), which includes an assessment of the seasonal occurrence of the most commonly sighted species.

The harbour porpoise (*Phocoena phocoena*), common dolphin (*Delphinus delphis*) and bottlenose dolphin (*Tursiops truncatus*) are the most common toothed cetaceans off the south coast of Ireland (**Table 4.3**), where they are sighted year-round (**Table 4.4**). Risso's dolphin (*Grampus griseus*) are occasionally seen in this region, primarily in summer, while a small number of killer whale (*Orcinus orca*) sightings have occurred close to the coast. Fin whales (*Balaenoptera physalus*) are the most commonly sighted baleen whale, most frequently and in the greatest numbers in late summer and autumn. Minke whale are also most frequently observed during late summer to autumn, albeit in apparently lower abundance. Small numbers of humpback whales also occur in this area, with sightings peaking from late summer through to JanuaryGrey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals are native to Irish waters and are found around the coast, although sightings off the south coast of Ireland and in the Kinsale Area are few.

Grey and harbour seal, harbour porpoise and bottlenose dolphin are listed on Annex II of the Habitats Directive and all cetaceans are listed on Annex IV, and their conservation status is noted in **Section 4.4.8**. The indicative seasonal occurrence of cetaceans is given in **Table 4.4**.

Table 4.3: Cetacean sightings recorded during the annual Celtic Sea Herring Acoustic Surveys and submitted to the IWDG Casual Cetacean Sightings database over 10 years from 2008-2017.

	Celtic Sea Herring Acoustic Surveys (CSHASs)		IWDG Casual sightings database
Species	Number of years observed (of a maximum of 10)	Total number of sightings (individuals)	Total number of sightings (individuals)
Toothed cetaceans			
Common dolphin	10	783 (11,138)	265 (15,858)
Harbour porpoise	7	40 (244) *	173 (568)
Bottlenose dolphin	5	7 (29)	136 (998)
Risso's dolphin	4	6 (14)	10 (108)
Killer whale	1	1 (3)	3 (11)
Unidentified dolphin	*na*	*71 (592)*	70 (814)
Baleen whales			
Fin whale	10	111 (202)	295 (1,232)
Minke whale	10	78 (89)	146 (368)
Humpback whale	5	17 (24)	49 (110)
Unidentified whale	*8*	*57 (73)*	*107 (244)*
Total	**na**	**1,184 (12,421)**	**1,254 (20,311)**

*Notes: See main text for a description of the two data sources. * Total harbour porpoise sightings in the CSHASs were heavily influenced by data from the 2016 cruise report where 22 sightings, representing 191 individuals, were reported in the Celtic Deep (>100km east of the Kinsale field).*

Source: Nolan et al. (2014), O'Donnell et al. (2008, 2011, 2012, 2013, 2015, 2016, 2017) Saunders et al. (2009, 2010), IWDG (2018).

Table 4.4: Seasonal occurrence of cetaceans in the Kinsale Area

Species	J	F	M	A	M	J	J	A	S	O	N	D
Harbour porpoise	2	2	2	3	3	2	2	2	2	2	2	2
Common dolphin	2	2	2	2	2	2	2	2	1	1	1	1
Bottlenose dolphin	3	3	3	3	3	3	3	3	3	3	3	3
Risso's dolphin	-	-	-	4	4	3	3	3	4	4	4	-
Minke whale	-	-	4	3	3	3	3	3	2	2	2	4
Humpback whale	3	4	-	4	4	4	3	3	3	3	2	3
Fin whale	4	4	-	-	4	4	3	3	3	2	2	3

Source: Wall et al. (2013) and S. Berrow, IWDG (pers. comm. May 2018) (see additional references provided in text below for additional further information)
Notes: Information on seasonal abundance of cetaceans is limited, so this table should be regarded as indicative of general trends. Abundance has been ranked from 1-4, where 1 is "very abundant" and 4 is "low abundance". '-' means no sightings were recorded in that month and/or abundance is considered likely to be extremely low.

Figure 4.9: Sightings of toothed cetaceans submitted to the IWDG Casual Cetacean Sightings database from 2008-2017.

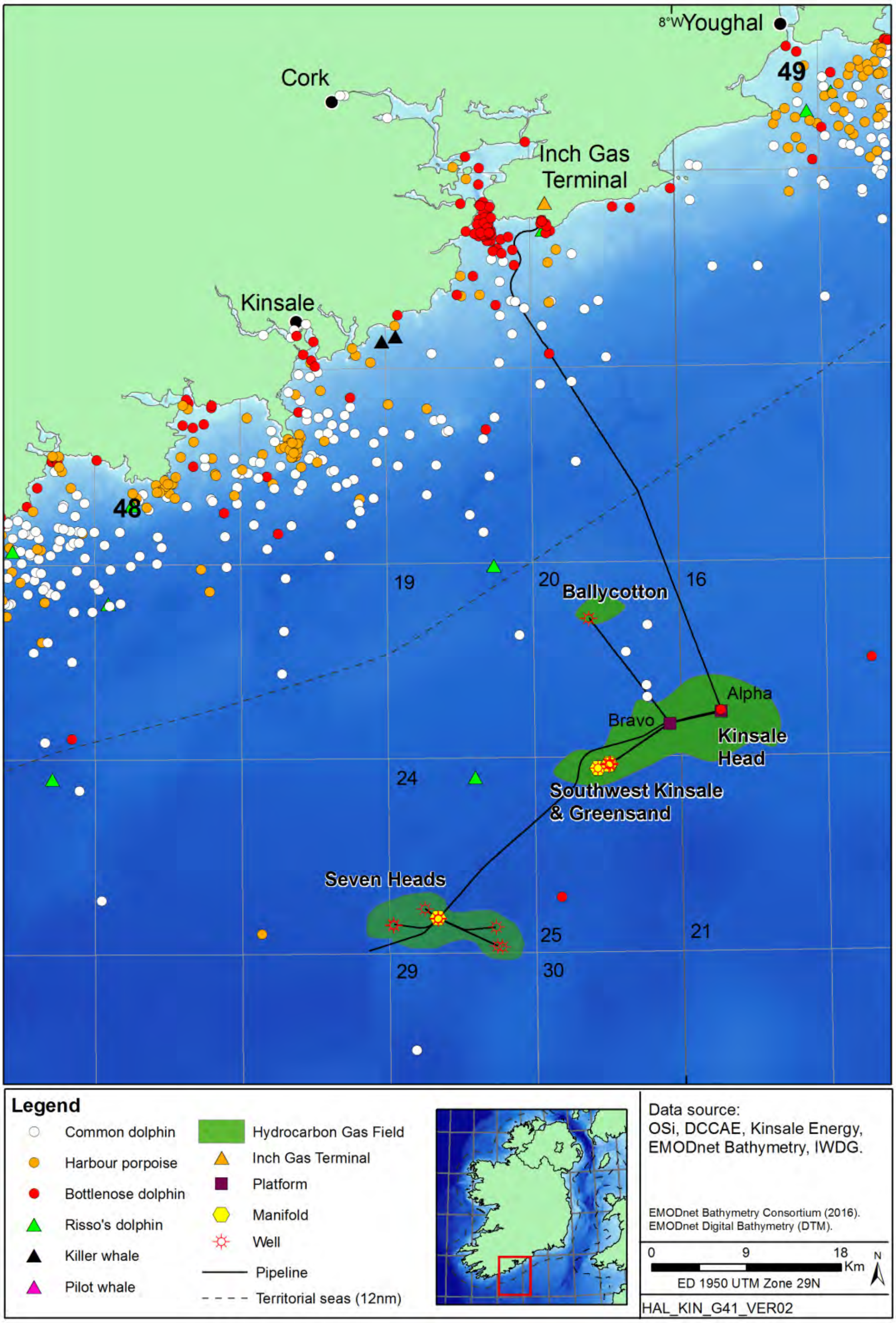
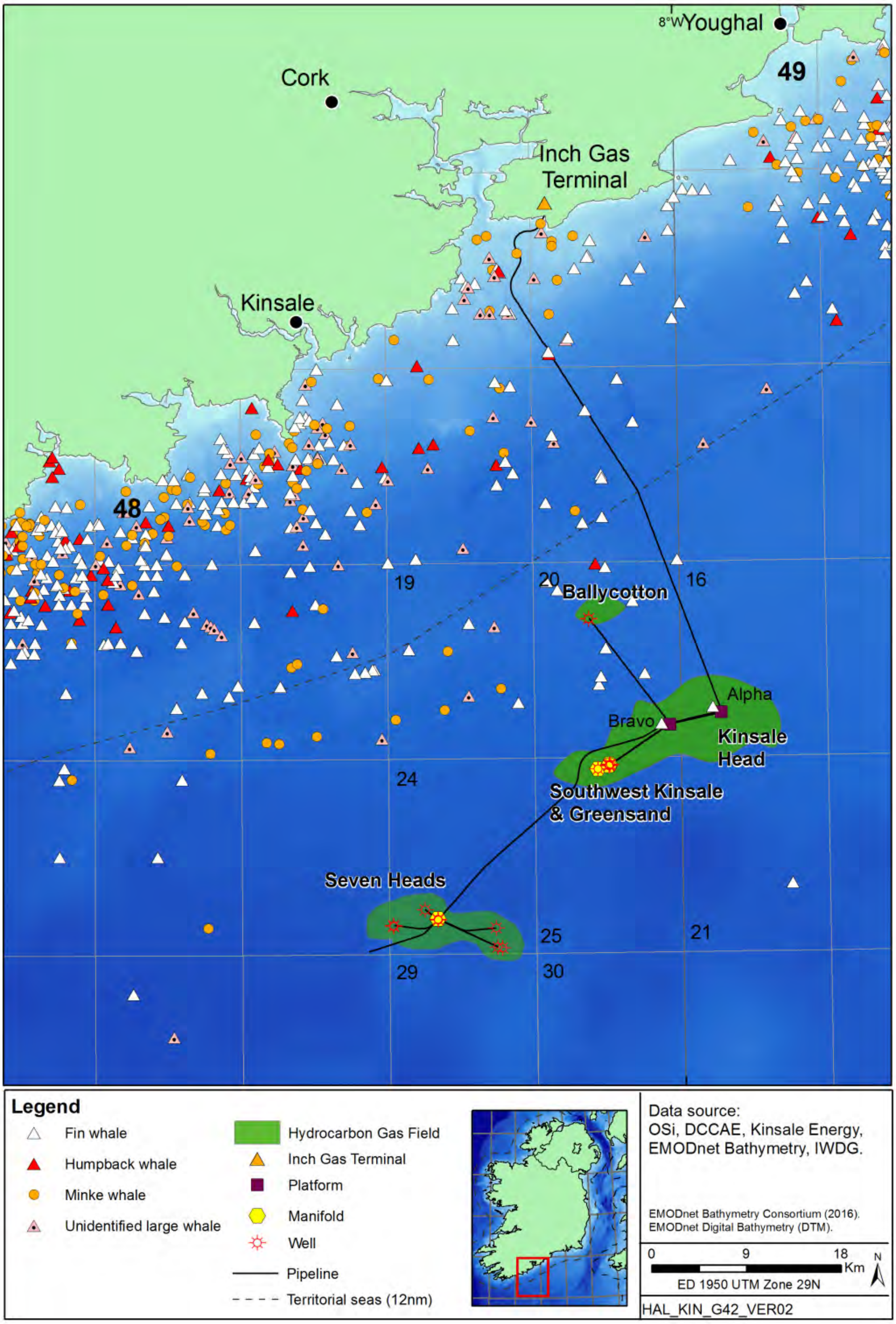


Figure 4.10: Sightings of baleen whales submitted to the IWDG Casual Cetacean Sightings database from 2008-2017.



Harbour porpoise

The harbour porpoise is the most abundant and widespread species occurring around the Irish coast, commonly seen in shallow coastal waters in the summer, although surveys suggest highest densities along the south coast occur in autumn (Marine Institute, 2013). They move further offshore in the spring; although the details of this migration are uncertain, it may be linked to calving (DCENR, 2015). Harbour porpoise are generally less often encountered in the Celtic Sea than in the Irish Sea, although it may be that this is a result of lower survey effort and higher sea states off the south coast (Wall *et al*. 2013). In both the CSHAS and selected IWDG casual sightings data (**Table 4.3**), harbour porpoise are the second most frequently sighted toothed cetacean, seen both close to shore and in offshore waters (**Figure 4.9**).

A comparison of the results of the broad-scale SCANS and SCANS-II surveys (SCANS-II 2008) indicate there has been a general shift to the southwest and an increase in the harbour porpoise population in the region over the period between the surveys. Harbour porpoise are a designated feature within the Roaringwater Bay and Islands SAC, 76km to the west of the Kinsale Area, with a population that has been consistently estimated at between 150-160 individuals (Berrow *et al*. 2014).

Common dolphin

The common dolphin is Ireland's most common dolphin species and it is most abundant off the south and southwest coasts, where they are often seen in very large groups. They tend to move east over the winter, with sightings off County Cork at their greatest between September and January (Berrow *et al*. 2010). Common dolphins were, by a large margin, the most frequently observed and numerous species during the recent CSHAS and in the IWDG casual sightings data extract. Sightings were widely distributed throughout the waters off the south coast of Ireland (**Figure 4.9**). Common dolphins typically move further offshore in the summer and are seen in large groups, moving to inshore waters in autumn, probably linked to the presence of large numbers of schooling pelagic fish (Marine Institute 2013).

Bottlenose dolphin

Bottlenose dolphins are present in the Celtic Sea and there is a small semi-resident population present at Cork Harbour, where six individuals have been repeatedly sighted (Ryan *et al*. 2010), with larger numbers visiting the area during the summer. The species is more commonly seen off the west coasts of the country, with sightings peaking in summer (Berrow *et al*. 2010). There are few CSHAS records of bottlenose dolphins in offshore waters off the south coast, although there are occasional opportunistic sightings of the species offshore, including around the Kinsale field (Wall *et al*. 2013, IWDG 2018). Photo-identification data from groups of bottlenose dolphins at several locations around the coast of Ireland have revealed movement of animals between sites separated by 130-650km over durations of 26-760 days, providing evidence that many individuals should be considered highly mobile and transient (O'Brien *et al*. 2009).

Other dolphins

Risso's dolphin are occasionally observed in the wider area, most commonly in the summer months and within a few kilometres of the coast (Wall *et al*. 2013). One Risso's dolphin was recorded outside Cork Harbour during the 2014 CSHAS (Nolan *et al.* 2014), while none were seen off the south coast of Ireland in 2016 or 2017. A small number of killer whales have been recorded off the south coast, primarily during summer (Wall *et al*. 2013). Records of other toothed cetacean species off the south coast (i.e. white-beaked dolphin *Lagenorhynchus albirostris* and long-finned pilot whale *Globicephala melas*) are very rare and these species would be highly unlikely to be present in the Kinsale area.

Baleen whales

Baleen whales are sighted along the south coast of Ireland primarily from late summer through autumn. Minke whales are observed in most months of the year, but is most frequently seenfrom April to November (Berrow *et al*. 2010). The larger fin and humpback whales are regularly observed in small numbers both close to the coast and further offshore, primarily in autumn and winter when these waters are a known foraging ground (Marine Institute 2013). Fin whales sightings peak in November (Berrow *et al*. 2010, Whooley *et al*. 2011), and they were the most frequently sighted and most numerous baleen whale in the CSHAS and IWDG casual sightings data (**Table 4.3**). Photo-identification data were collected from whale-watching vessels over 79 trips from 2003-2008, which resulted in the identification of 62 individual fin whales, of which 11 were sighted across multiple years (Whooley *et al*. 2011). Ryan *et al*. (2016) analysed several hundred humpback whale sightings from the IWDG casual database collected from 1999-2013, revealing an annual easterly movement along the southern coast; most sightings in the wider Kinsale Area occurred from October-December.

Grey seals

Grey seals occupy haul-outs along the Irish coast, to which they return to rest, breed and rear young. Breeding in Ireland generally takes place between September and December (Cronin *et al*. 2011). Grey seals favour exposed rocky shores, sand-bars or sea caves, with easy access to deep water for breeding and as such, the largest colonies are found on exposed islands off the west and southwest coasts. The closest major colony to the Kinsale Area is at Roaringwater Bay.

They are a designated feature of the Roaringwater Bay and Islands SAC, where a permanent population of up to 150 individuals is estimated (NWPS website). The total grey seal population of Ireland has been estimated at between 5,500 and 7,000 individuals (Ó Cadhla *et al*. 2008) and Duck & Morris (2013) estimated that 9% were present along the County Cork coast. Grey seals may forage at distances of up to 100km from their haul-out (Jones *et al*. 2015). Distances travelled by seals tagged on Great Blasket Island in County Kerry by Cronin *et al*. (2011) were variable. It was found that larger seals spent longer foraging at sea but travelled shorter distances, while smaller seals were found to travel as far as the Western Isles of Scotland, utilising haul-out sites along the way. The seals were found to spend more time at sea during the summer.

Marine usage maps for the UK and Ireland based on extensive tagging data suggest a very low occurrence of grey seals in the Kinsale Area, with animals present in waters around the south coast of Ireland focused off southwest Cork and southeast Wexford (Jones *et al*. 2015). Grey seals were observed in four of the ten annual CSHAS from 2008-2017, comprising 13 sightings of single seals, most of which were close to the coast (e.g. O'Donnell et al. 2017).

Harbour seals

Harbour seals are generally found in more sheltered areas, again predominantly along the west coast. Females pup in June or July, and the annual moult takes place in July and August, so harbour seals tend to be at or near haul-outs through the summer (Cronin *et al*. 2008, Rakka & Minto 2015).

Harbour seals rarely forage far from their haul-out, with surveys in southwest Ireland suggesting they generally stay within 20km of their haul-out (Cronin *et al*. 2008), although longer distances do occur and foraging behaviour seems to vary with geographical location.

The Irish population of harbour seal was estimated at 3,000-4,150 individuals (DCENR 2015) and Duck & Morris (2013) estimated 13% of the total population were present along the County Cork coast.

Marine usage maps for the UK and Ireland based on extensive tagging data suggest a very low occurrence of harbour seals in the Kinsale Area, with animals present in waters around the south coast of Ireland focused off southwest Cork and Kerry (Jones *et al*. 2015).

No harbour seals were sighted off the south coast of Ireland in any of the ten annual CSHAS.

4.4.8 Conservation Sites and Species

Conservation sites in proximity to the Kinsale Area include Natura 2000 sites (Special Areas of Conservation and Special Protection Areas), some of which are also OSPAR Marine Protected Areas or coincident with Ramsar designations (e.g. Cork Harbour, Ballycotton Bay and Blackwater Estuary) which are designated as wetlands of international importance. National designations along the coast include Natural Heritage Areas and proposed Natural Heritage Areas, which were created under the *Wildlife Amendment Act 2000* and are protected from damage, though they have largely terrestrial components.

The location of SACs and SPAs currently designated are shown in **Figure 4.11** for marine and coastal sites and for riverine and inland sites; only inland sites with features linked to the marine environment (e.g. breeding areas for birds which feed in coastal/marine habitats, freshwater pearl mussel, Atlantic salmon) are shown. Sites within 100km of Kinsale area facilities (wells, manifolds, pipelines or platforms), consistent with the Zone of Influence chosen for the accompanying Appropriate Assessment (AA) screening report. Further details on the specific features for each site are given in **Table 4.5**. Other conservation sites including Natural Heritage Areas, potential Natural Heritage Areas and Ramsar sites, are shown in **Figure 4.12.**

EU Member States are required to report on the conservation status of habitats and species every six years. The latest review of Irish habitats and species was submitted in 2013 and covers the period 2007-2012 (NPWS 2013). Knowledge is still improving for Annex II and Annex IV species of marine mammal which occur in the Celtic Sea and wider Irish waters, and hence certain parameters of assessment were indicated as unknown (e.g. range, population, habitat, future prospects and overall status), however for those categories considered, all were indicated to be favourable for marine mammals. Due to limited knowledge of the ecology of leatherback turtles, the overall status of this species was indicated to be unknown. In addition, the overall population and breeding range trends, and population trends for relevant qualifying species under the Birds Directive are reported by Ireland. The results for the period 2008-2012 are reported on the NWPS website[9].

[9] https://www.npws.ie/status-and-trends-ireland%E2%80%99s-bird-species-%E2%80%93-article-12-reporting

Table 4.5: Relevant SACs and SPAs, their features and the closest distance to Kinsale Area facilities

Site code	Site name	Closest distance (km)			Summary of features
		Subsea wells & other subsea structures	Offshore pipelines	Offshore platforms	
SACs					
002123	Ardmore Head	61	40	65	**Annex I Habitats:** Vegetated sea cliffs; Dry heaths
000077	Ballymacoda (Clonpriest & Pillmore)	84	17	58	**Annex I Habitats:** Estuaries; Tidal mudflats and sandflats; *Salicornia* mud and sand; Atlantic salt meadows; Mediterranean salt meadows
001040	Barley Cove to Ballyrisode Point	95	95	118	**Annex I Habitats:** Tidal mudflats and sandflats; Perennial vegetation of stony banks
002170	Blackwater River	58	26	64	**Annex I Habitats:** Estuaries; Tidal mudflats and sandflats; Perennial vegetation of stony banks; *Salicornia* mud; Atlantic salt meadows; Mediterranean salt meadows; Floating river vegetation; Old oak woodlands; Alluvial forests **Annex II Species:** Freshwater pearl mussel (*Margaritifera margaritifera*); White-clawed crayfish (*Austropotamobius pallipes*); Sea lamprey; Brook lamprey (*Lampetra planeri*); River lamprey; Twaite shad; Atlantic salmon; Otter (*Lutra lutra*); Killarney fern (*Trichomanes speciosum*)
000091	Clonakilty Bay	54	45	63	**Annex I Habitats:** Tidal mudflats and sandflats; Annual vegetation of drift lines; Embryonic shifting dunes; Shifting white dunes; Fixed grey dunes; Decalcified fixed dunes
001230	Courtmacsherry Estuary	51	32	55	**Annex I Habitats:** Estuaries; Tidal mudflats and sandflats; Annual vegetation of drift lines; Perennial vegetation of stony banks; *Salicornia* mud and sand; Atlantic salt meadows; Mediterranean salt meadows; Embryonic shifting dunes; Shifting white dunes; Fixed grey dunes
001058	Great Island Channel	48	8	59	**Annex I Habitats:** Tidal mudflats and sandflats; Atlantic salt meadows
000665	Helvick Head	76	57	79	**Annex I Habitats:** Vegetated sea cliffs; Dry heaths
000764	Hook Head	100	82	98	**Annex I Habitats:** Large shallow inlets and bays; Reefs; Vegetated sea cliffs

Site code	Site name	Closest distance (km)			Summary of features
		Subsea wells & other subsea structures	Offshore pipelines	Offshore platforms	
001061	Kilkeran Lake and Castlefreke Dunes	56	56	58	**Annex I Habitats:** Coastal lagoons; Embryonic shifting dunes; Shifting white dunes; Fixed grey dunes
000097	Lough Hyne Nature Reserve and Environs	69	78	79	**Annex I Habitats:** Reefs; Large shallow inlets and bays; Sea caves
002162	River Barrow & River Nore	115	91	114	**Annex I Habitats:** Estuaries; Tidal mudflats and sandflats; Reefs; *Salicornia* mud and sand; Atlantic salt meadows; Mediterranean salt meadows; Floating river vegetation; Dry heaths; Halophilus scrubs; Petrifying springs; Old oak woodlands **Annex II:** Desmoulin's whorl snail *(Vertigo moulinsiana)*; Freshwater pearl mussel; White-clawed crayfish; Sea lamprey; Brook lamprey; River lamprey; Twaite shad; Atlantic salmon; Otter; Killarney fern; Nore pearl mussel (*Margaritifera durrovensis*)
000101	Roaringwater Bay and Islands	74	74	94	**Annex I Habitats:** Large shallow inlets and bays; Reefs; Vegetated sea cliffs; Dry heath; Sea caves **Annex II Species:** Harbour porpoise; Otter; Grey seal
000671	Tramore Dunes and Backstrand	104	80	104	**Annex I Habitats:** Tidal mudflats and sandflats; Annual vegetation of drift lines; Perennial vegetation of stony banks; *Salicornia* mud and sand; Atlantic salt meadows; Mediterranean salt meadows; Embryonic shifting dunes; Shifting white dunes; Fixed grey dunes
002171	Bandon River cSAC	71	58	83	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*); *Margaritifera margarifera* (Freshwater Pearl Mussel); *Lampetra planeri* (Brook Lamprey)
SPAs					
004022	Ballycotton Bay	43	9	51	**Article 4 Species:** Teal (*Anas creca*); Ringed plover (*Charadrius hiaticula*); Golden plover (*Pluvialis apricaria*); Grey plover (*Pluvialis squatarola*); Lapwing (*Vanellus vanellus*); Black-tailed godwit (*Limosa limosa*); Bar-tailed godwit (*Limosa lapponica*); Curlew (*Numenius arquata*); Turnstone (*Arenaria interpres*); Common gull; Lesser black-backed gull; Wetland & Waterbirds

Site code	Site name	Closest distance (km)			Summary of features
		Subsea wells & other subsea structures	Offshore pipelines	Offshore platforms	
004023	Ballymacoda Bay	51	19	51	**Article 4 Species:** Wigeon (*Anas penelope*); Teal; Ringed plover; Golden plover; Grey plover; Lapwing; Sanderling (*Calidris alba*); Dunlin (*Calidris alpina*); Black-tailed godwit; Bar-tailed godwit; Curlew; Redshank (*Tringa totanus*); Turnstone; Black-headed gull; Common gull; Lesser black-backed gull; Wetland & Waterbirds
004028	Blackwater Estuary	59	34	65	**Article 4 Species:** Wigeon; Golden plover; Grey plover; Lapwing; Dunlin; Black-tailed godwit; Bar-tailed godwit; Curlew; Redshank; Wetland & Waterbirds
004081	Clonakilty Head	53	46	63	**Article 4 Species:** Shelduck; Dunlin; Black-tailed godwit; Curlew; Wetland & Waterbirds
004030	Cork Harbour	37	4	50	**Article 4 Species:** Little grebe (*Tachybaptus rufficolis*); Great crested grebe (*Podiceps cristatus*); Cormorant; grey heron (*Ardea cinerea*); Shelduck; Wigeon; Pintail; Shoveler (*Anas clypeata*); Red-breasted merganser (*Mergus serrator*); Oystercatcher; Golden plover; Grey plover; Lapwing; Dunlin; Black-tailed godwit; Bar-tailed godwit; Curlew; Redshank; Black-headed gull; Common gull; Lesser black-backed gull; Common tern; Wetland & Waterbirds
004219	Courtmacsherry Bay	42	32	53	**Article 4 Species:** Great northern diver (*Gavia immer*); Shelduck; Wigeon; Red-breasted merganser; Golden plover; Lapwing; Dunlin; Black-tailed godwit; Bar-tailed godwit; Curlew; Black-headed gull; Common gull; Wetland & Waterbirds
004032	Dungarvan Harbour	75	51	80	**Article 4 Species:** Great crested grebe; Light-bellied brent goose; Shelduck; Red-breated merganser; Oystercatcher; Golden plover; Grey plover; Lapwing; Knot; Dunlin; Black-tailed godwit; Bar-tailed godwit; Curlew; Redshank; Turnstone; Wetland & Waterbirds
004190	Galley Head to Duneen Point	53	48	64	**Article 4 Species:** Chough
004192	Helvick Head to Ballyquin	65	37	69	**Article 4 Species:** Cormorant; Puffin; Herring gull; Kittiwake; Chough
004193	Mid-Waterford Coast	84	55	87	**Article 4 Species:** Cormorant; Peregrine; Herring gull; Chough

Site code	Site name	Closest distance (km)			Summary of features
		Subsea wells & other subsea structures	Offshore pipelines	Offshore platforms	
004021	Old Head of Kinsale	34	25	46	**Article 4 Species:** Razorbill; Fulmar; Herring gull; Shag; Kittiwake; Guillemot
004191	Seven Heads	42	32	53	**Article 4 Species:** Chough
004156	Sheep's Head to Toe Head	65	65	84	**Article 4 Species:** Peregrine (*Falco peregrinus*); Chough
004124	Sovereign Islands	33	16	46	**Article 4 Species:** Cormorant
004027	Tramore Back Strand	104	87	103	**Article 4 Species:** Light-bellied brent goose; Golden plover; Grey plover; Lapwing; Dunlin; Black-tailed godwit; Bar-tailed godwit; Curlew; Wetland & Waterbirds

Figure 4.11: Special Areas of Conservation and Special Protection Areas

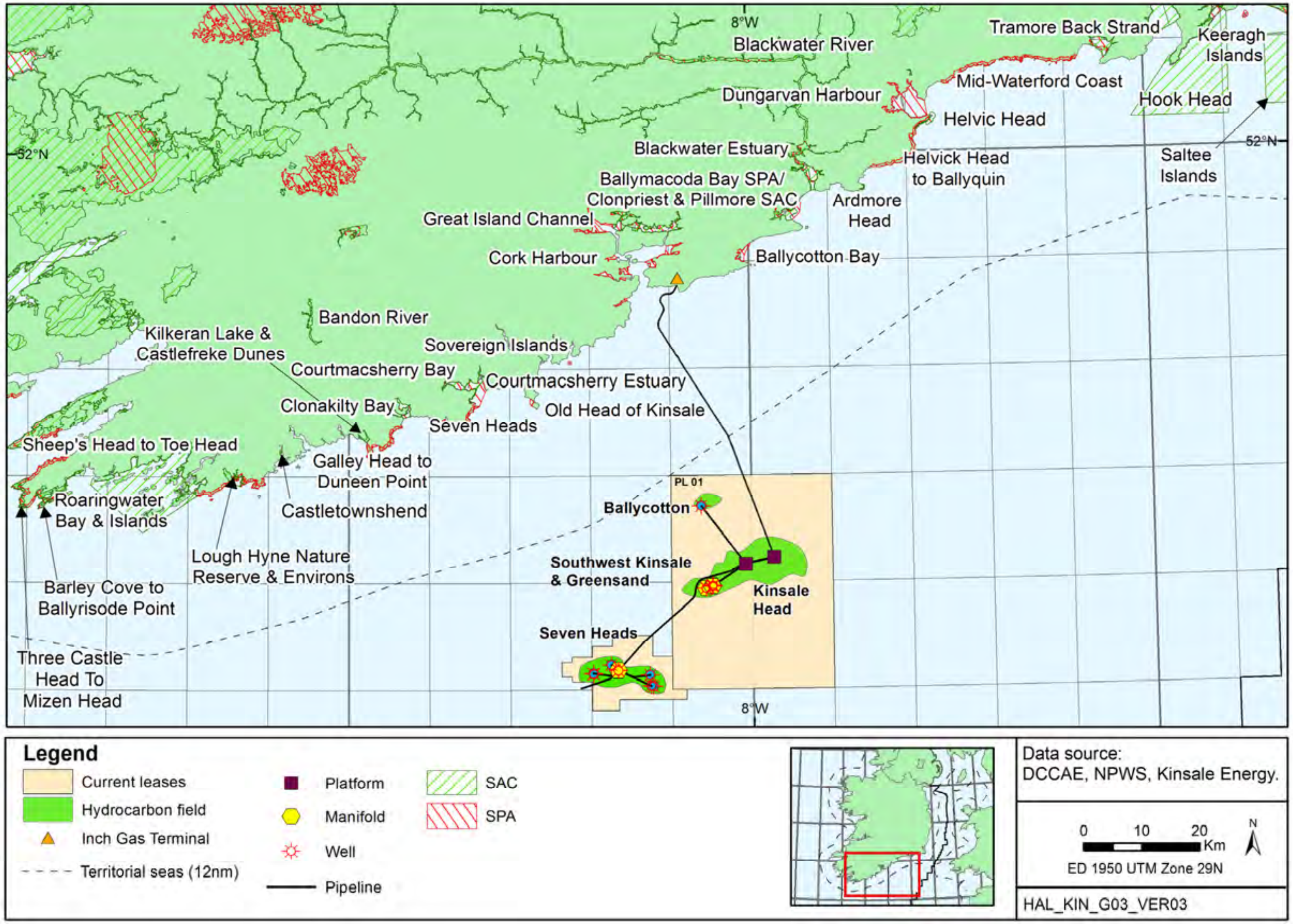
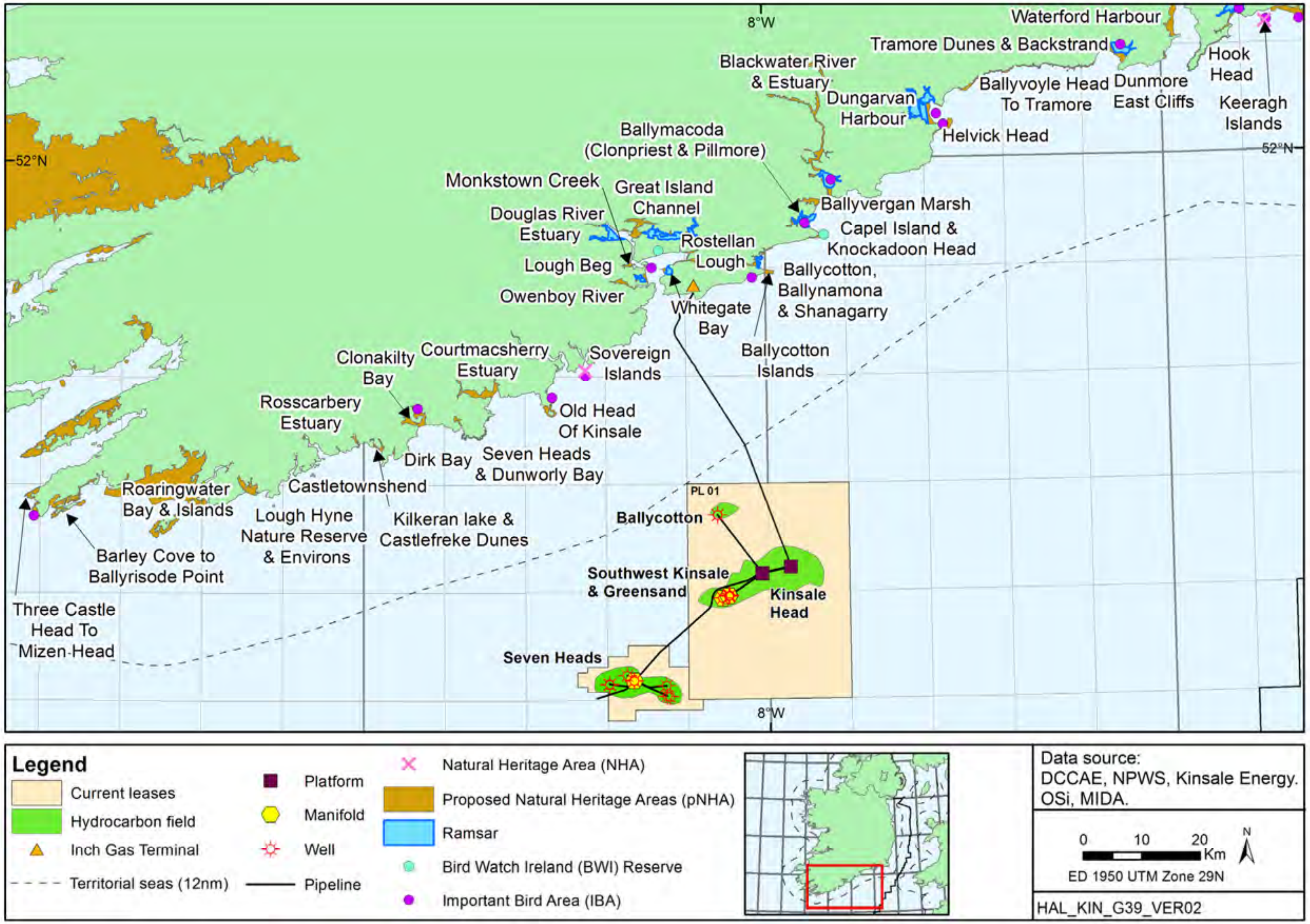


Figure 4.12: Other Conservation Sites



4.5 Other users of the sea

Other users of the sea are set out below. These have been assessed with reference to a wide range of information sources (referenced throughout) covering both the local area (e.g. Anatec 2017) and the wider Celtic Sea region (e.g. ABPmer & ICF International 2016, DCENR 2011, 2015). Following on from Harnessing Our Ocean Wealth: An Integrated Marine Plan for Ireland (Irish Government 2012), the objectives of marine planning and marine management of activities within the Celtic Sea, including relevant coexistence, will be documented in plans created under the European Union (Framework for Maritime Spatial Planning) Regulations 2016. The Regulations set out the basis for establishing marine spatial plans for Ireland on a 10 year cycle. Initially, a single plan covering all relevant areas of the Ireland's seas will be prepared, and regional plans may follow. The first plan is due to be finalised in 2020 and implemented thereafter[10].

4.5.1 Offshore Energy

No offshore wind farms are located within or in close proximity to the Kinsale Area, nor are any presently planned. The decommissioning activities will take place largely within the existing Kinsale Energy oil & gas licence areas and the infrastructure to be decommissioned represents the only oil and gas infrastructure in the area.

There are a number of standard exploration licence areas (e.g. EL1/11 and EL4/05) and licensing options (e.g. LO16/30) within oil & gas licensing quadrants 48 and 49 (**Figure 4.13**). Wells have been drilled in the exploration licence areas using semi-submersible rigs (i.e. involving anchoring and the drilling of surface holes with local seabed disturbance), and further exploration in these areas is possible.

4.5.2 Ports and shipping

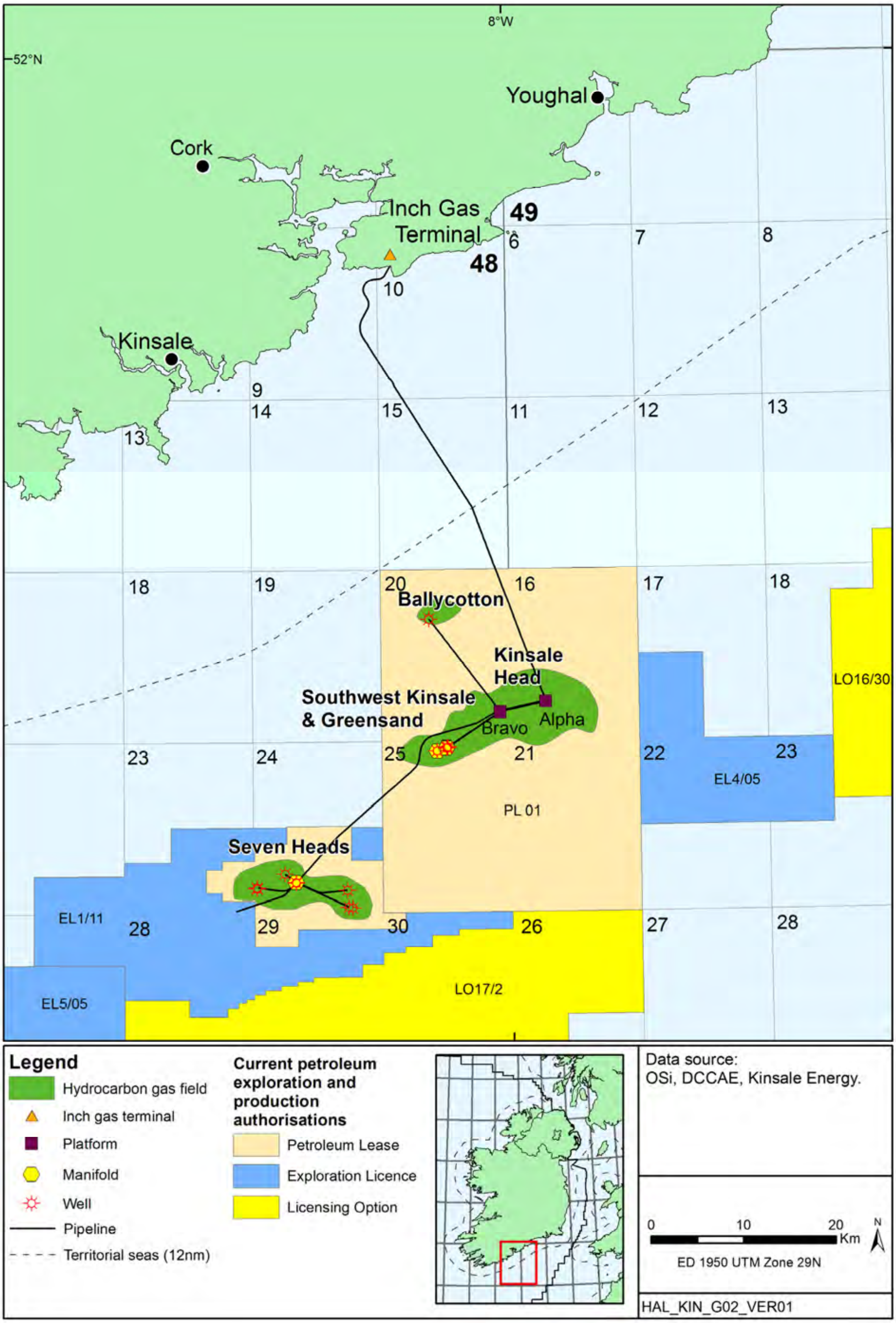
Ireland's shipping industry supports 7,200 jobs directly in port and maritime services, and sea-based transport accounts for 99% of all traded goods by weight (Irish Government 2012). A shipping study based on Automatic Identification System (AIS) data completed for IOSEA4 (DCENR 2011) indicated that up to 300-750 vessels per year were present in waters off the south coast of Ireland and in the vicinity of the Kinsale Area. Vessel traffic in the coastal regions of the Celtic Sea is generally moderate, and higher along routes connecting major ports in the south, including Cork and Waterford (DCENR 2011, 2015). These ports handled 9.7 and 1.5 million tonnes of goods in 2015 respectively, representing approximately 22% of goods handled by Irish ports. There were 1,174 and 437 vessel arrivals into Cork and Waterford in 2015 representing approximately 13% of Ireland's shipping by number and 9% by gross tonnage (CSO 2016). Planning permission was granted in 2015 for the redevelopment of port facilities at Ringaskiddy which are located within the wider Port of Cork area. This project recognises the strategic importance of Cork harbour and the need to maintain its competitiveness by accommodating increasingly larger vessels. Works proposed as part of the project include new container and multi-purpose berths (Ringaskiddy East), an extension to an existing deepwater berth which will include dredging works (Ringaskiddy West), road improvements, and also a public amenity area.

An anchorage area is present outside of Cork Harbour (see **Figure 4.15**) for vessels carrying hazardous cargoes, with an overall length greater than 110m to remain until they have permission to proceed to berth in the harbour (see Port of Cork Notice to Mariners No.1 of 2017[11]). Whilst not a formally charted anchorage, ships including tankers waiting to berth at Whitegate oil refinery set anchor in an area to the west of the export pipeline and generally to the north of Old Head of Kinsale. No International Maritime Organisation (IMO) routing measures are located in or close to the Kinsale Area.

[10] Towards a Marine Spatial Plan for Ireland: A Roadmap for the delivery of the national Marine Spatial Plan. http://www.housing.gov.ie/sites/default/files/publications/files/towards_a_marine_spatial_plan_for_ireland.pdf

[11] www.portofcork.ie/index.cfm/page/noticetomariners?twfId=1713&download=true

Figure 4.13: Current oil and gas licence and lease areas



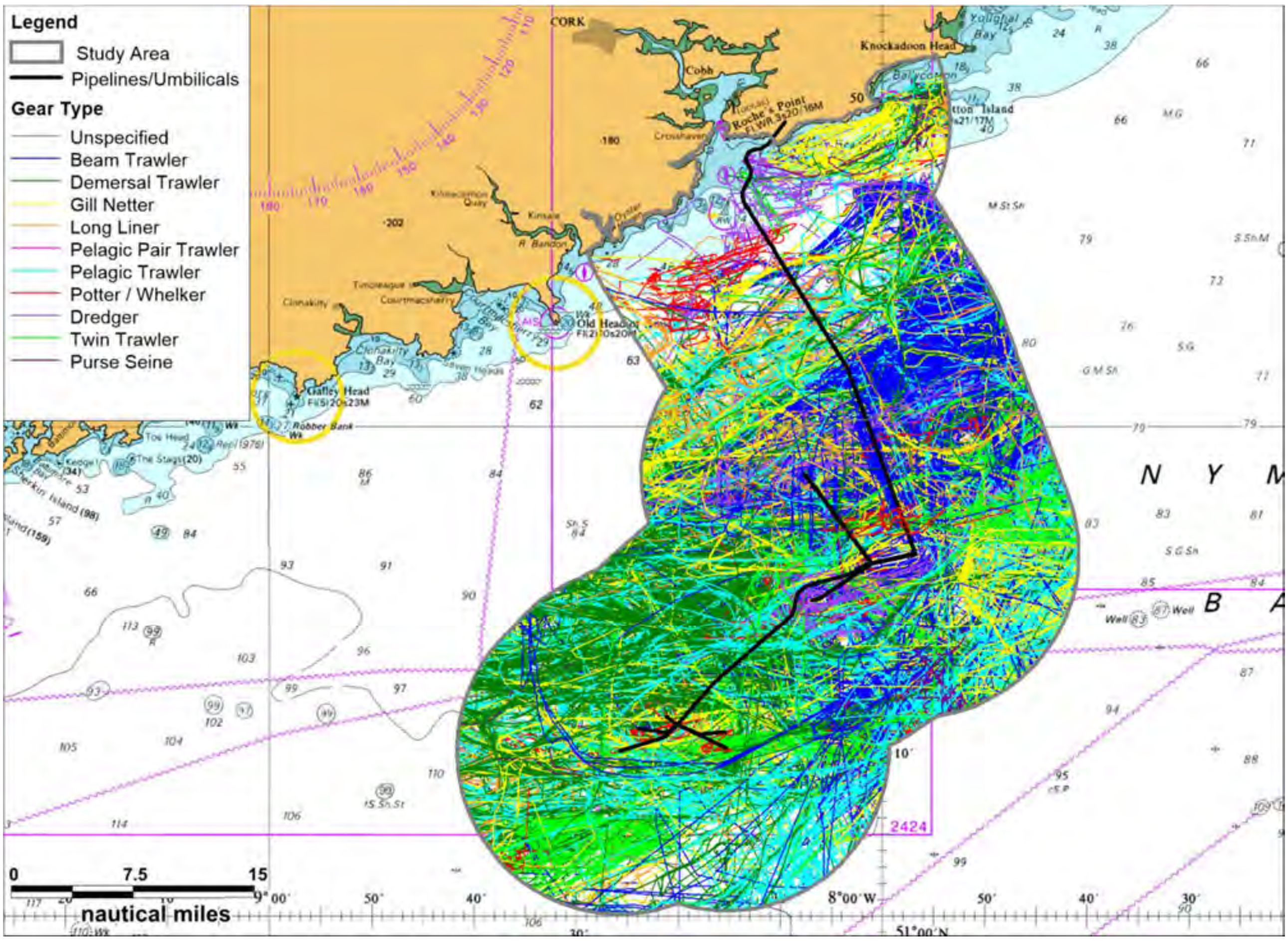
4.5.3 Commercial Fisheries

The seas around Ireland are among the most productive in EU waters and most fisheries resources come under the remit of the Common Fisheries Policy (CFP). In 2016, the Irish fleet had access to 216,261 tonnes of fish at a potential value of €201 million (Marine Institute 2016). The largest ports near the Kinsale Area are Castletownbere and Dunmore East, which are both among the top four ports (by landings) in Ireland (with Castletownbere landing the greatest value of catch in Ireland in 2015) (SFPA website). Of the more local ports, the most significant are Cobh (3,848 tonnes landed at a value of €6.4 million in 2015), Union Hall (2,286 tonnes, €6.7 million) and Kinsale (1,615 tonnes, €3.2 million) (SFPA website).

The dominant fishing method in the area is demersal (otter) trawling, which is, in the waters around the Kinsale Area, mainly used to catch *Nephrops*, haddock and whiting (Gerritsen & Lordan 2014). Other gears in use in the area include pelagic trawls (predominantly targeting herring in the area), seine nets (targeting haddock and whiting) and set nets (targeting pollack and hake) (Gerritsen & Lordan 2014). Anatec (2017) conducted a survey of fishing activity within the Kinsale Area. A monthly count of fishing vessels over 2014 and 2015/16 showed the busiest month to be February 2016, with 540 vessel-days recorded by 77 different vessels within the study area. The most common gear types were single demersal trawlers (30%), single pelagic trawlers (20%), gill netters (19%), beam trawlers (8%) and long liners (7%). Purse seines, twin trawlers (which may be demersal or pelagic) and dredgers all contributed 4%, while potters/whelkers contributed 2%, primarily in coastal waters. Over 90% of all vessels were Irish-registered, and 70% were registered to ports on the south coast.

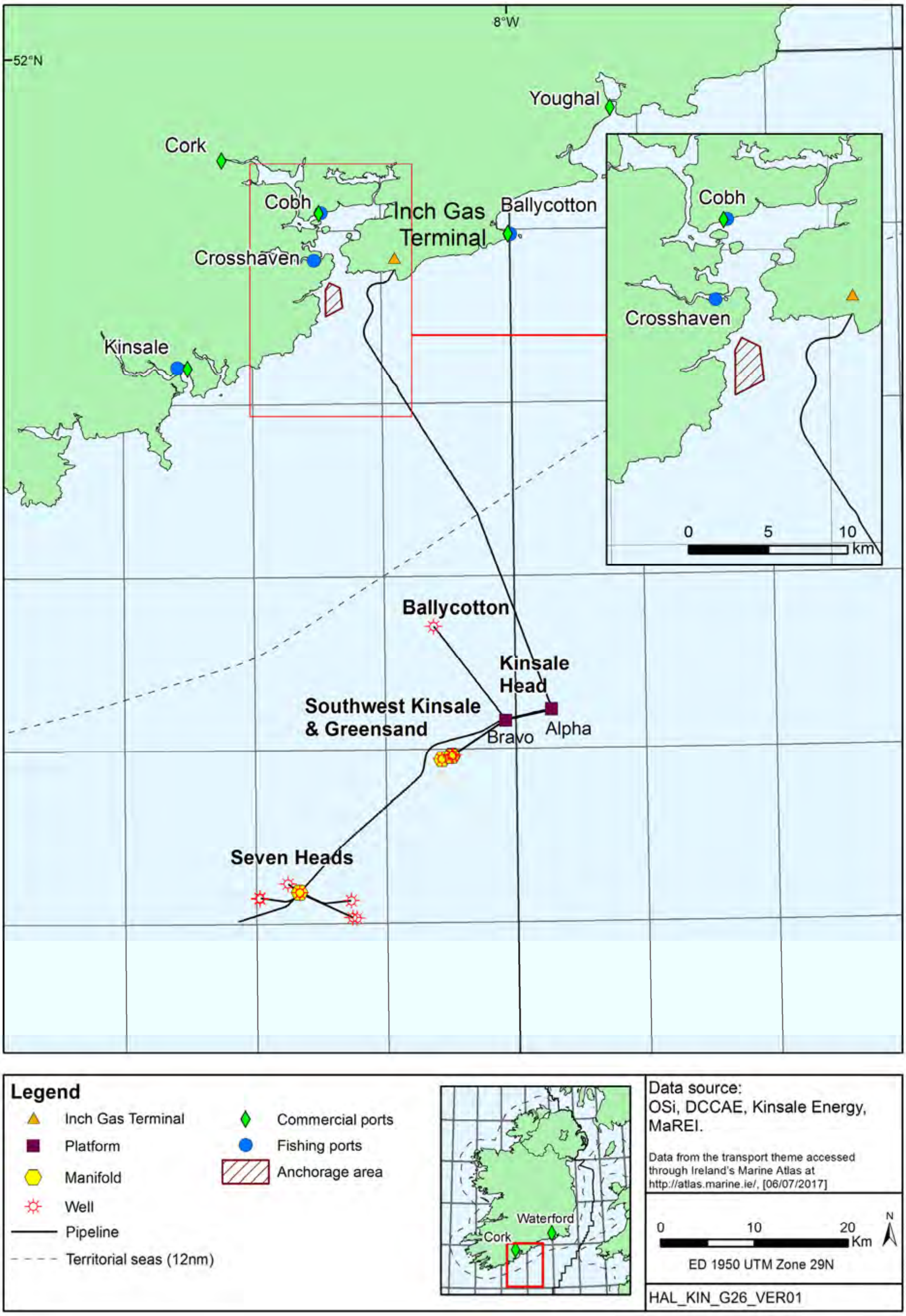
Vessels estimated to be actively fishing in the Kinsale Head area, colour-coded by gear-type, are presented in **Figure 4.14**, based on 18 months of AIS (Automatic Identification System) analysis. The majority of active fishing was from vessels with demersal gear (including single demersal trawlers, beam trawlers and dredger). On average there were approximately four demersal vessels per day actively fishing within the area highlighted on **Figure 4.14**.

Figure 4.14: Vessels estimated to be actively engaged in fishing (2014 & 2015/16)



Source: Anatec (2017)

Figure 4.15: Ports and anchorage areas in the Kinsale Area



The south coast of Ireland is of particular importance for smaller vessels (<15m), which tend to be local, fishing from, and landing at home ports. Between 2008 and 2012, the south coast of Ireland saw the highest catch rates of cod (with 20% of landings by vessels <15m), haddock (smaller vessels contribute 8% of landings), hake (smaller vessels contributed almost no landings) and herring (where smaller vessels operating inshore along the southern coast contributed 5% of landings). The southwest coast of Ireland was also of particular significance for ling, lemon sole, megrim, saithe, pollack, witch and whiting (Gerritsen & Lordan 2014). Fishing is restricted within the Irish Conservation Box (or Biologically Sensitive Area), within which vessels >10m must report their movements into and out of the zone, and record their catch every two hours.

ICES rectangles are used for fisheries data recording and management. **Table 4.6** lists the weight and value of landings from the Kinsale Area rectangles over the period 2014-2016.

Table 4.6: Weight and value of landings from ICES rectangles 31E1, 31E2 & 32E1, 2014-2016

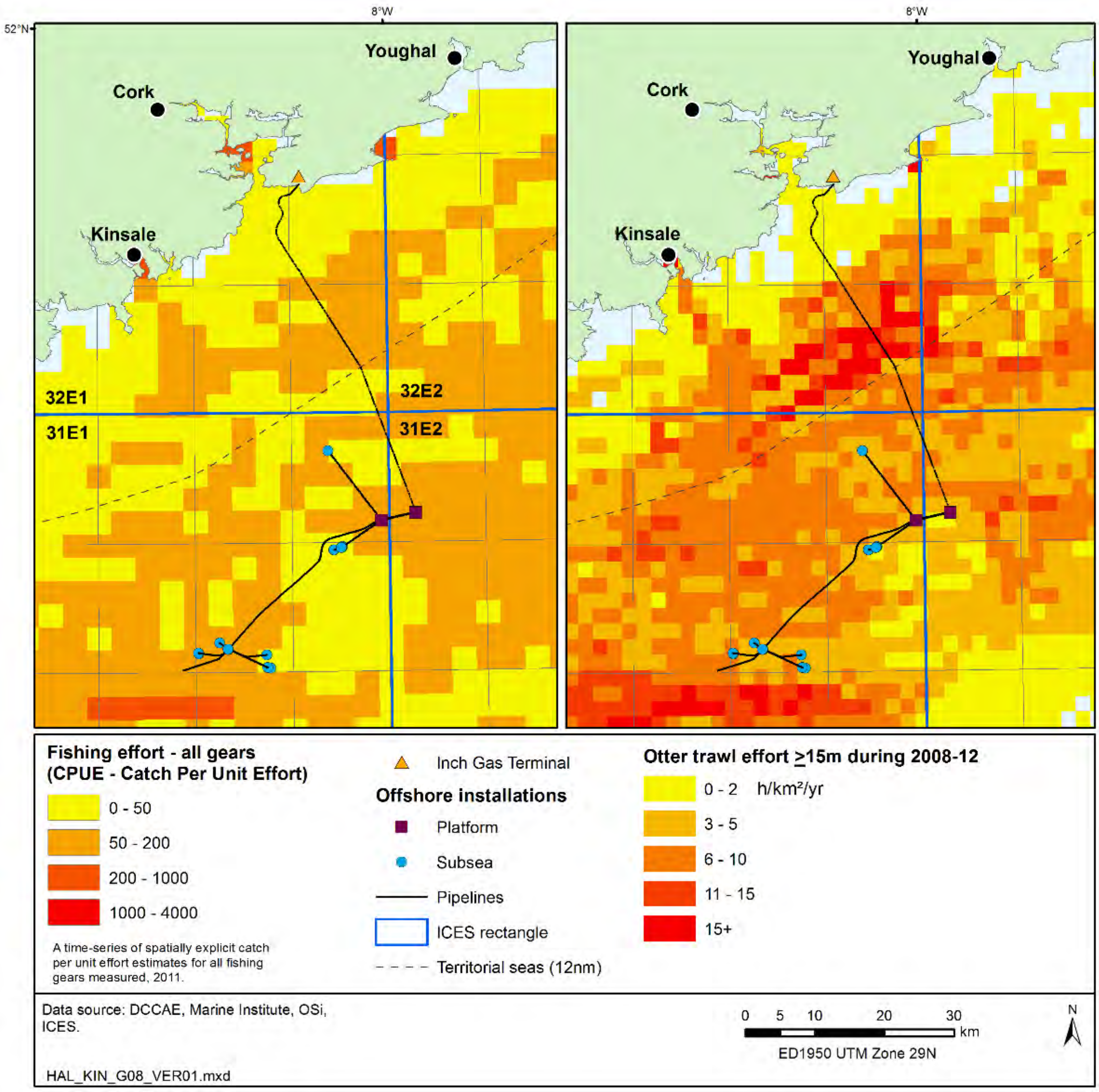
Species type	2014		2015		2016	
	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)	Live weight (tonnes)	Value (€)
31E1						
Pelagic	178	88,257	38	12,646	2	1,331
Demersal	1,407	3,127,042	1,993	4,429,025	2,244	4,866,119
Shellfish	103	705,903	128	878,350	172	1,185,287
Total	**1,689**	**3,921,201**	**2,159**	**5,320,021**	**2,418**	**6,052,738**
31E2						
Pelagic	5,458	1,779,804	1,706	558,566	84	27,951
Demersal	1,739	3,700,550	1,982	4,313,845	1,795	3,859,776
Shellfish	34	195,763	56	326,403	36	222,516
Total	**7,231**	**5,676,123**	**3,744**	**5,198,815**	**1,915**	**4,110,243**
32E1						
Pelagic	815	156,201	277	99,996	457	116,872
Demersal	511	1,152,666	325	785,269	368	817,341
Shellfish	138	950,196	130	890,759	134	875,031
Total	**1,463**	**2,259,063**	**732**	**1,776,024**	**959**	**1,809,244**
Grand Total	**10,383**	**11,856,387**	**6,636**	**12,294,859**	**5,291**	**11,972,224**

Source: Compiled from data supplied by Sea Fisheries Protection Authority (SFPA)

Over the period 2014-2016, reported landings from these rectangles were largely dominated by demersal fish species. Total landings have remained relatively similar across the three years, although there were very high catches of pelagic species (mostly herring) in ICES rectangle 31E2 in 2014 and 2015, a region where high abundances of herring and sprat are reported (O'Donnell *et al*. 2016). Lower total landings in 32E1 than in 31E1 and 31E2 may be attributed in part to the smaller available fishing area of this coastal rectangle (see **Figure 4.16**), as well as the predominance of smaller, inshore vessels in these areas. Pelagic fish are usually caught in large quantities, but at low value (a tonne of herring averages €326), while several demersal species and, particularly shellfish, attract high market values (cod may fetch €2,519/tonne, monkfish €3,326/tonne, *Nephrops* €6,920/tonne and lobster €13,781/tonne), and thus, with a slight increase in demersal landings over this period, the total value has remained very similar.

Figure 4.16 illustrates the fishing effort around the Kinsale Area. Clear areas of greater effort by otter trawl can be seen. These areas correlate with muddy sediments (**Figure 4.4**) where small but productive *Nephrops* grounds are located (Lordan *et al*. 2015, Marine Institute 2016).

Figure 4.16: Fishing effort (total and otter trawl) in the Kinsale Area, 2008-2012



The status of commercial fish and shellfish populations was considered in relation to MSFD Descriptor 3[12] in the Initial Assessment of Ireland's marine waters (Marine Institute 2013). Monitoring of commercial fisheries in Ireland for MSFD is based on data collected under the Common Fisheries Policy, with the Marine Institute (2017) indicating that for 2017, 23% (17) of fish stocks were overfished and 39% (29) sustainably fished, with the remaining stocks (28) having an unknown status. Following ICES advice on the assessment of Good Environmental Status (GES) for Descriptor 3 for 2017 it was considered that 46% (16) of relevant stocks achieved GES. Overall fishing pressure on commercial fish and shellfish stocks in the Celtic Sea have declined since a peak in 1998, and there has been a corresponding increase in stock biomass with gradual progress towards sustainability (Marine Institute 2017).

Aquaculture

Shellfish culture occurs within some sheltered inshore waters along the south coast of Ireland, along with a handful of small seaweed culture operations; aquaculture is more important off the west and southwest coasts.

[12] Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

On the coastline adjacent to the Kinsale Area (**Figure 4.20**), these include oyster/clam farms in the estuaries of the rivers Bandon and Stick, Cork Harbour and Youghal Bay. Mussel culture also occurs within Cork Harbour towards the River Ballynacorra. No finfish culture takes place off the southern coast of Ireland.

4.5.4 Military activity

There are a number of military installations and firing ranges along the Irish coast, the largest of these include the naval headquarters and base at Haulbowline in Cork Harbour. Of relevance to the Kinsale Area is the Danger Area D13 which is a military firing range[13] (**Figure 4.17**). The UK air force danger area D064A to the south east of the Kinsale Area is for air combat training and high energy manoeuvres (**Figure 4.17**).

4.5.5 Subsea Cables

A number of cables traverse the Celtic Sea, many connecting Europe and the United States via the Atlantic (**Figure 4.17**). The Seven Heads pipeline and umbilical cross the active Hibernia Atlantic "D"[14] and the disused PTAT telecommunications cables. A separate Hibernia Express[15] cable crosses over the Seven Heads pipeline and umbilical to the south of these (**Figure 4.17**).

Additionally, there is a proposed 600km 320kV HVDC interconnector (the Celtic Interconnector) between Ireland and France. Feasibility studies indicate that the best performing option is for the interconnector to connect to North Brittany via East Cork, with 5 potential landfall locations in East Cork and a connection point at the existing Knockraha substation. If constructed, the interconnector could cross the Kinsale Area and with the Inch Beach landfall option described in the feasibility studies, could come close to the Kinsale gas export line landfall[16]. EirGrid applied to the Department of Housing, Planning, Community and Local Government in June 2017, and in January 2018, for Foreshore Licences to facilitate further marine investigations off the coast of east Cork, seaward of three potential landfalls (Ballinwilling Strand, Redbarn Beach and Claycastle Beach)[17]. This is in addition to previous marine surveys of other potential cable routes and landfalls at Ballinwilling Strand and Ballycroneen Beach[18]. A final decision to proceed with construction of the interconnector will happen in 2020/21 and if the project goes ahead, the interconnector would go live in 2025/26[19].

The Ireland France subsea cable (IFSC) is another subsea cable project, currently in the permitting stage, developing a fibre optic cable connecting Ireland and France[20]. A Foreshore Licence application was made in April 2017 for seabed surveys to be undertaken from Ringaskiddy, Co. Cork to the 12nm limit[21]. If the project goes ahead, the current proposals are to have the cable in-service in summer 2019.

4.5.6 Aggregates

In general, no significant marine aggregate extraction takes place in Ireland (DCENR 2015), with areas identified to potentially supplement terrestrial aggregate sources identified in the western Irish Sea to the north (Sutton 2008).

[13] From ENR 5.1 Prohibited, restricted and danger areas of the Integrated Aeronautical Information Package - http://iaip.iaa.ie/iaip/IAIP_Frame_CD.htm
[14] http://www.hiberniaatlantic.com/pdf/hibernia_Brochure.pdf
[15] https://www.hibernianetworks.com/wp-content/uploads/2016/10/Express-data-sheet-May-2016-1.pdf
[16] http://www.eirgridgroup.com/site-files/library/EirGrid/194034-EirGrid-Celtic-Interconnector-Booklet.pdf
[17] http://www.housing.gov.ie/planning/foreshore/applications/eirgrid-plc-ballinwilling-strand-redbarn-beach-and-claycastle-beach
[18] http://www.housing.gov.ie/sites/default/files/migrated-files/en/Foreshore/ApplicationsandDeterminations/EirgridPLC-Cork/ApplicationForm/FileDownLoad%2C38003%2Cen.pdf
[19] http://www.eirgridgroup.com/the-grid/projects/celtic-interconnector/whats-happening-now/
[20] https://www.ifc-1.com/
[21] http://www.housing.gov.ie/planning/foreshore/applications/ireland-france-subsea-cable-ltd

4.5.7 Marine disposal

The EPA dumping at sea register[22] indicates that permits have been granted for the disposal of up to 1.8 million tonnes of dredged material from Ringaskiddy, Cork Port as well as the Haulbowline Naval Base to the Roche's Point disposal site (marked active in **Figure 4.17**) covering the period up to approximately 2021. This disposal site is approximately 5km to the east of the 24" export pipeline with no potential interaction with decommissioning activities.

4.5.8 Recreation and tourism

The coastal landscape of Ireland supports well-kept beaches, rugged cliffs, picturesque harbours and an abundance of wildlife. These natural and developed features possess significant amenity and recreational value for the local residents in addition to major opportunities for domestic and international tourism. In a review of water-based activities in Ireland, the Marine Institute (2006) identified the most popular water-based leisure activities, relating to coastal and sea areas, as beaches, diving, marinas and sailing/boating/water sports centres, sea angling, coastal walking, whale and dolphin watching and marine-themed visitor centres (DCENR 2011).

Marine-based tourism and leisure is a large contributor to the Irish ocean economy and has historically been an important sector for the Irish coastal economy (Vega *et al.* 2015). The tourism industry contributed an estimated €7.5 billion in 2015 to the Irish economy (Fáilte Ireland 2016). Fáilte Ireland estimates that marine tourism accounts for 10% of the overall value of the tourism sector in Ireland[23] (see Vega *et al*. 2015).

With respect to the Kinsale Area, the most relevant activities are sea angling, sailing/boating and whale and dolphin watching, primarily from Cork Harbour and Kinsale, as well as other smaller centres along the Cork coast.

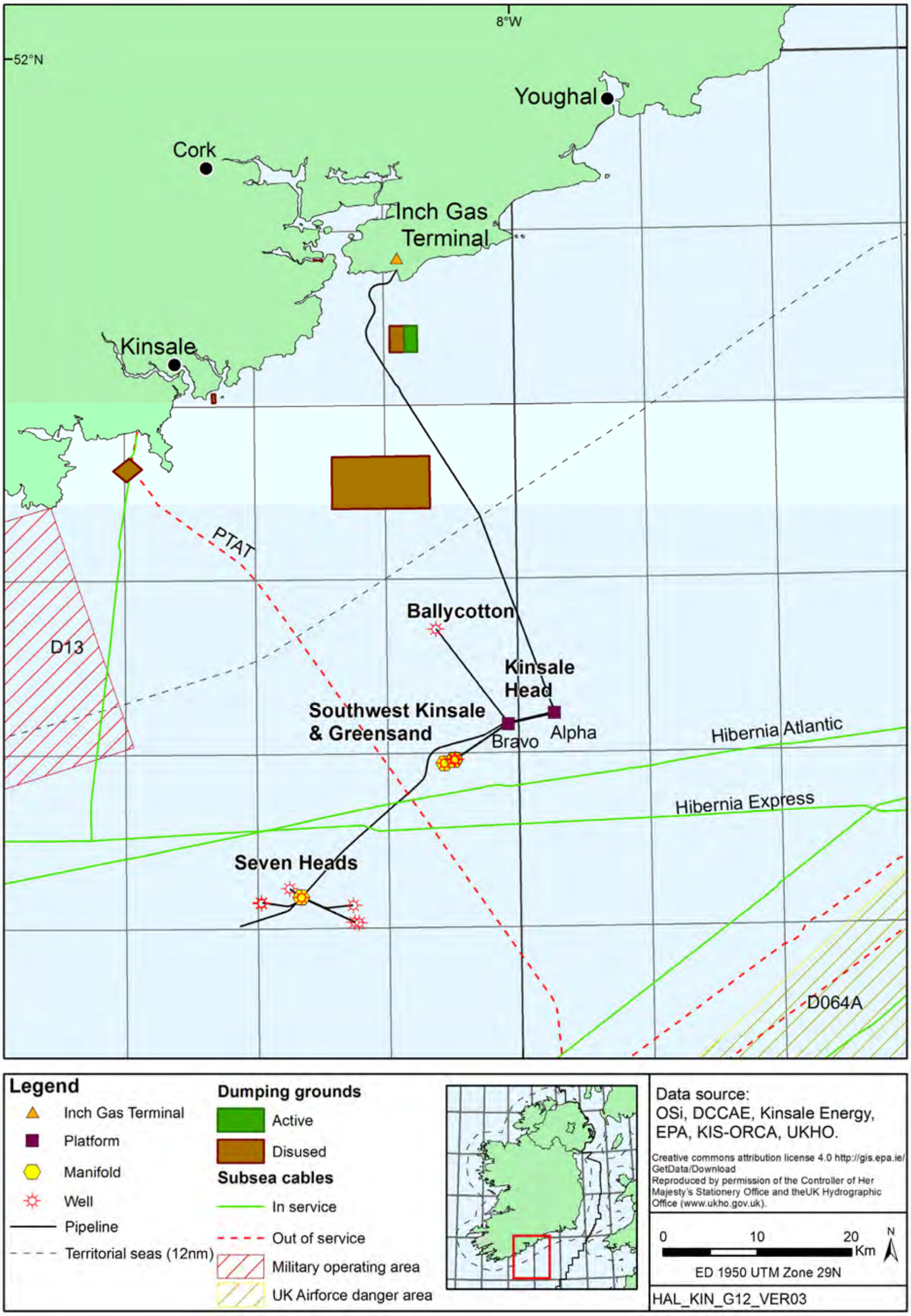
An online review of sea angling charter operators in the region (see Ramboll 2017a, b) indicated that most offered half-day to one-day trips (i.e. angling, wreck, reef and shark angling) and were generally licensed to operate within a 30 nautical mile (56km) radius of the harbour, with only a few companies with a licence to operate up to approximately 40 nautical miles (74km). However, Angling Ireland indicates that most offshore angling trips are likely to be within 32km of the coast[24].

Sailing is a major coastal activity in the south of Ireland (DCENR 2011). The Irish Sailing Association indicates that there are a number of sailing clubs and centres associated with Cork Harbour (6) and the Kinsale (4) region[25] with the number of moorings within the Cork Harbour area in 2009 estimated at just over 1,000 with another 1,000 berths proposed (The Port of Cork Company 2009). As part of an assessment of coastal recreational activity and capacity for increased boating in Cork Harbour (Kopke *et al.* 2008), a 'spill out area' was estimated to take account of boats that left the harbour on day trips. It was estimated that an average boat travelling at 6-7 knots (3.1-3.6m/s) under favourable conditions and with the desire to return to the harbour the same day, could travel a distance of approximately 24km.

Whale, dolphin and seal watching tours are also available in Kinsale and the wider County Cork area, however the trip duration tends to be limited to three to four hours and they tend to run along the coast (Ramboll 2017a, b).

[22] http://www.epa.ie/pubs/forms/lic/das/dumpingatsearegister.html
[23] Fáilte Ireland estimates for marine tourism in Ireland, 2011-2020, using the wide definition of marine tourism, which refers to marine and coastal tourism water based activities as well as the activities and services adjacent to the coastline
[24] http://www.fishinginireland.info/sea/index.htm
[25] https://www.sailing.ie/map/?clubs

Figure 4.17: Telecommunication cables, military activity areas and dumping sites



4.6 Cultural Heritage

Wrecks over 100 years old and archaeological objects found underwater are protected under the *National Monuments (Amendment) Acts 1987* to *2004*. Significant wrecks less than 100 years old can be designated by Underwater Heritage Order (UHO) on account of their historical, archaeological or artistic importance as was the case with the wreck of the *RMS Lusitania* lost off the Old Head of Kinsale in 1915 and located over 20km to the west of the Ballycotton field. UHOs can also be used to designate areas of seabed to more clearly define and protect wreck sites and archaeological objects[26].

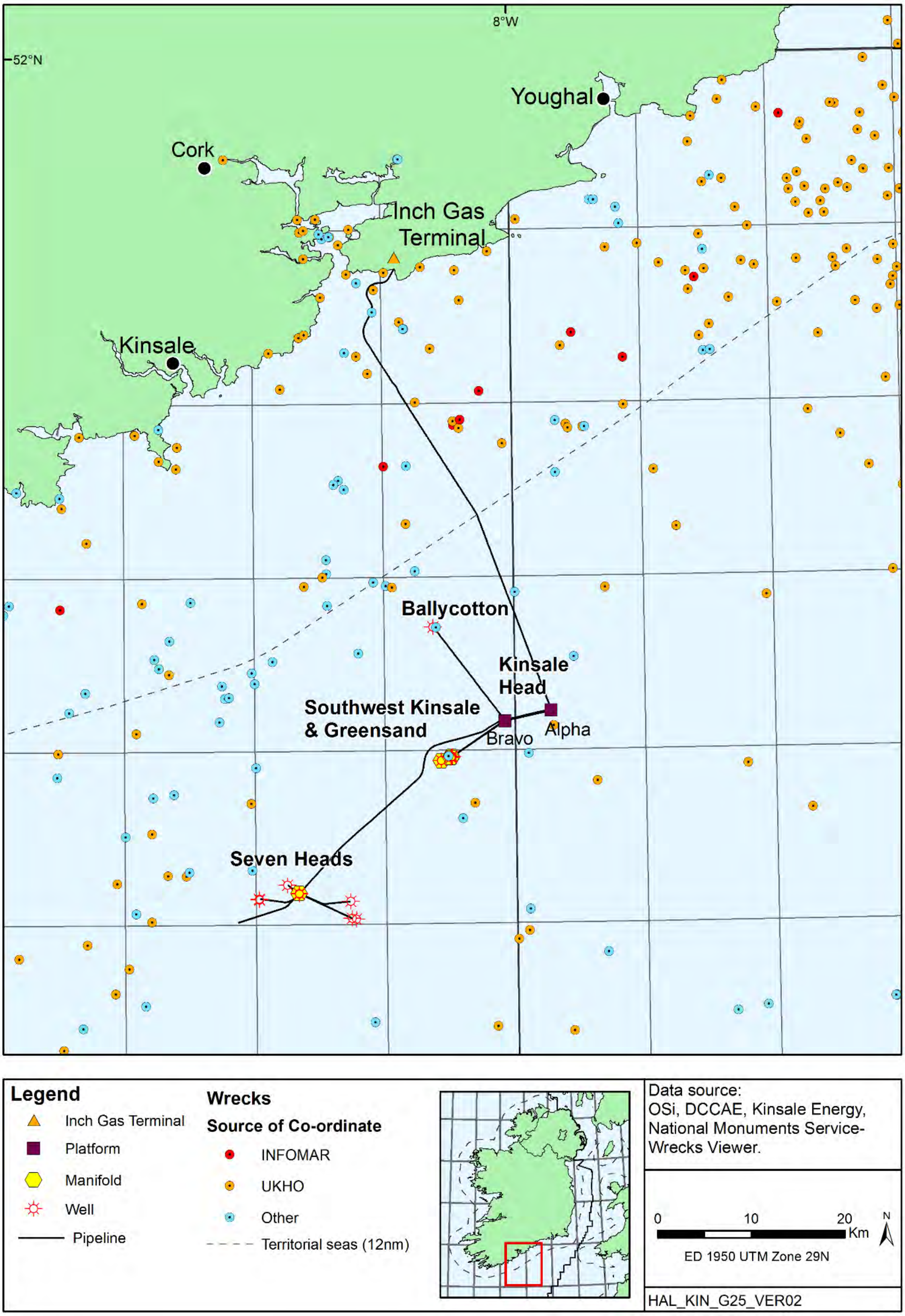
A number of ship wrecks are known in the area, particularly in coastal waters and at the mouth of Cork Harbour, including two sunken U-boats (UC42 and U-58) which were highlighted by the INtegrated Mapping FOr the Sustainable Development of Ireland's MArine Resource (INFOMAR) (http://infomar.ie/) survey (Figure 4.18). The closest of these wrecks is UC42 which is designated by UHO and located within 200m of the export pipeline to the Inch Terminal and 5.5km south east of Roches Point[27]. The shipwreck of the Elizabeth Jane, sunk in 1916, is also noted to be located approximately 560m from the export pipeline (Ramboll, 2017b). Additionally, a number of other charted shipwrecks are located throughout the wider Celtic Sea area, as are a number of other wrecks, the positions of which are approximate[28]. No prehistoric or archaeological remains are known in the immediate vicinity of the Kinsale Area infrastructure.

The Kinsale Area Decommissioning Project (KADP) involves the decommissioning of the existing Kinsale area installations and does not involve the addition of any new facilities to the already developed footprint of the various sites. All of the facilities, which were installed between 1977 and 2003, were approved and permitted under the Petroleum and other Minerals Development Act 1960 and were subject to the appropriate assessment at the time of construction. As part of the installation planning and construction works, and as part of ongoing field inspection activities, the seabed of the fields and pipeline routes has been the subject of several previous geophysical investigations using side scan sonar, sub-bottom profiler, swathe bathymetry and magnetometer. These surveys were targeted at identifying surface and subsurface features of relevance to drilling rig location, pipelaying and other subsea facility installation. Shipwrecks and other features of note would have been expected to be identified during the interpretation of survey results. A list of all previous offshore surveys and development plan submissions is contained in **Appendix B2**. Given the shallow depth of sediments overlying bedrock over much of the KADP site, evidence from existing extensive seabed mapping and other investigations of the seabed carried out during previous developments, it is not regarded that there is any significant potential for archaeological remains. Proposed offshore activities resulting in seabed disturbance will take place within areas of previous installation and construction works.

The Pleistocene period (2.58 million-11,700 years before present, BP) was characterised by successive glacial and interglacial periods. During glacial periods, sea levels were substantially lower than in interglacial periods (like the present day) due to the amount of water from the world's oceans being held as ice in terrestrial environments (Fairbanks 1989, Long & Roberts 1997, Long et al. 2004, Brooks et al. 2011). The Celtic Sea would have been largely beneath the British and Irish Ice Sheet (BIIS) during the last glacial maximum, but following ice retreat, which began approximately 20,000 years ago, a low-lying and intermittent sub-aerial exposure of the Celtic Sea between Britain and Ireland would have taken place (Brooks *et al.* 2011), existing until approximately 15,000 years ago (Brooks *et al.* 2011, Montgomery *et al.* 2014). This exposure would not have formed a land-bridge, with the coast unlikely to have been more than 30km from its present position (Brooks *et al.* 2011) making the precise route by which people reached Ireland obscure (Westley & Edwards 2017). Exposed areas are likely to have been only a few metres above its contemporary sea level and would have been flooded quickly by glacial meltwater (Lambeck & Purcell 2001, Brooks *et al.* 2011). Therefore the age and location of potential finds are therefore likely limited to those of Palaeolithic and later by the extent of the BIIS during the last glacial maximum (however the potential for earlier finds should not be entirely discounted, see Flemming *et al*. 2012), and by the high energy conditions in the area (Westley & Edwards 2017). This suggests that there is limited scope for prehistoric submerged archaeology to be present in the Kinsale Area.

[26] https://www.archaeology.ie/underwater-archaeology
[27] http://www.infomar.ie/data/Shipwrecks/Box37/pdfs/UC42_Final.pdf
[28] https://www.archaeology.ie/underwater-archaeology/wreck-viewer

Figure 4.18: Shipwrecks relevant to the Kinsale Area and vicinity



4.7 Land and seascape

The Cork County Draft Landscape Strategy (2007) identified three landscape character types of relevance to the coast adjacent to the Kinsale Area (**Figure 4.19**), all of very high landscape value and sensitivity.

Landscape character type 1: City harbour and estuary. The landscape of Cork city and harbour area comprises a mix of rural and intensely urban areas, combined with a large expansive harbour. To the south of the city, the western side of the harbour supports major industrial development, while on higher ground telecommunication masts or water storage towers punctuate the skyline. The rural areas around much of the greater harbour area are now characterised by a prevalence of infrastructure such as roads, bridges and electricity power lines and some urban sprawl. Population increase is associated with this landscape type and this has been especially true in Metropolitan Cork, a central hub for employment, entertainment, education and retail.

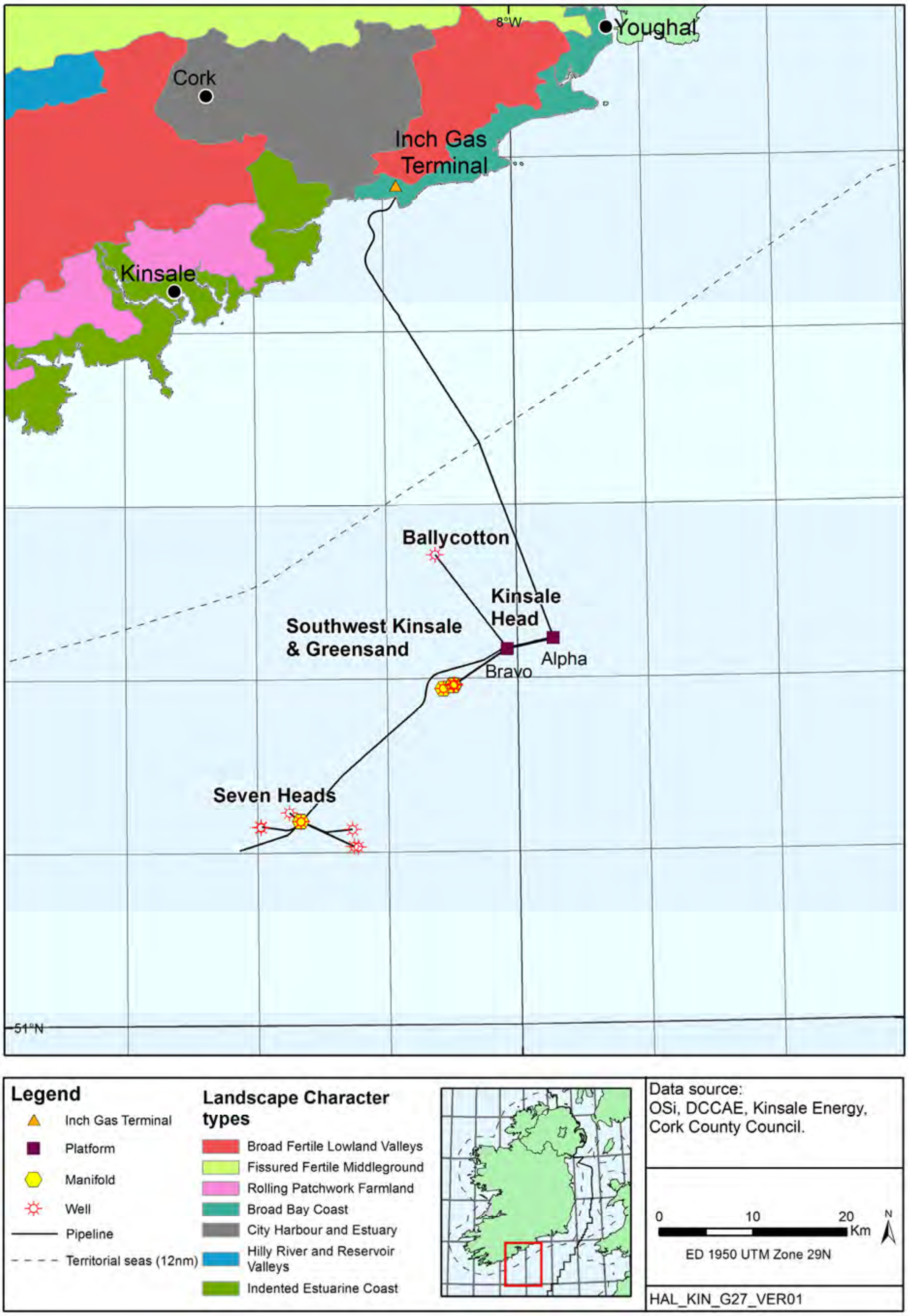
Landscape character type 2: Broad bay coast. This landscape type stretches along the coast from the mouth of Cork Harbour in the west to the eastern boundary of County Cork at Youghal. The coastline sweeps in broad bays flanked by low promontories, terminating along the shore with low cliffs, and a combination of rocky shores and long crescent shaped bays, such as Ballycotton Bay and Youghal Bay. The tourist industry has long been associated with this landscape due to the natural beauty and plentiful supply of beaches and there is pressure on the landscape from tourist related development including caravan parks, hotels and holiday homes.

Landscape character type 3: Indented estuarine coast. This landscape type stretches from Baltimore in the west to the mouth of Cork Harbour, in the east. It comprises gently undulating topography incised by shallow river estuaries or 'drowned' valleys formed by glacial activity. The coastline is punctuated by a series of these promontories, such as Old Head of Kinsale, Seven Heads, Galley Head and Toe Head, which recede to bays, such as Kinsale Harbour. While many of the areas along this landscape type are remote, the presence of a viable tourist industry has sustained and steadily increased the population.

A seascape assessment as part of the Strategic Environmental Assessment (SEA) of the Offshore Renewable Energy Development Plan in the Republic of Ireland (AECOM & Metoc 2010), reviewed landscape character types in the context of their relationship with coastline and sea to formulate seascape types with shared dominant characteristics. The seascape type proposed for the relevant coastal area between Toe Head and Crosshaven, County Cork is described below.

Seascape type 4: Low-lying coastal plain and coastal estuarine landscape, low lying islands and peninsulas. The seascape is diverse and changeable, ranging from large to medium scale. The seascape is exceptionally flat and often exposed with generally wide, open views extending far out to sea, often with a high degree of intervisibility between sea and land.

Figure 4.19: Landscape types of relevance to the Kinsale Area



4.8 Population and human health

The World Health Organization definition of health is “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.” (http://www.who.int/about/mission/en/). A health outcome is a change in the health status of an individual, group or population which is attributable to a planned activity, and determinants of health are the range of personal, social, economic and environmental factors which determine the health status of individuals or populations. The offshore elements of the KADP are not visible or audible from land, and do not entail the use of hazardous or noxious materials (those e.g. present in topsides structures are subject to strict identification, handling and disposal requirements, see **Section 7.7**).

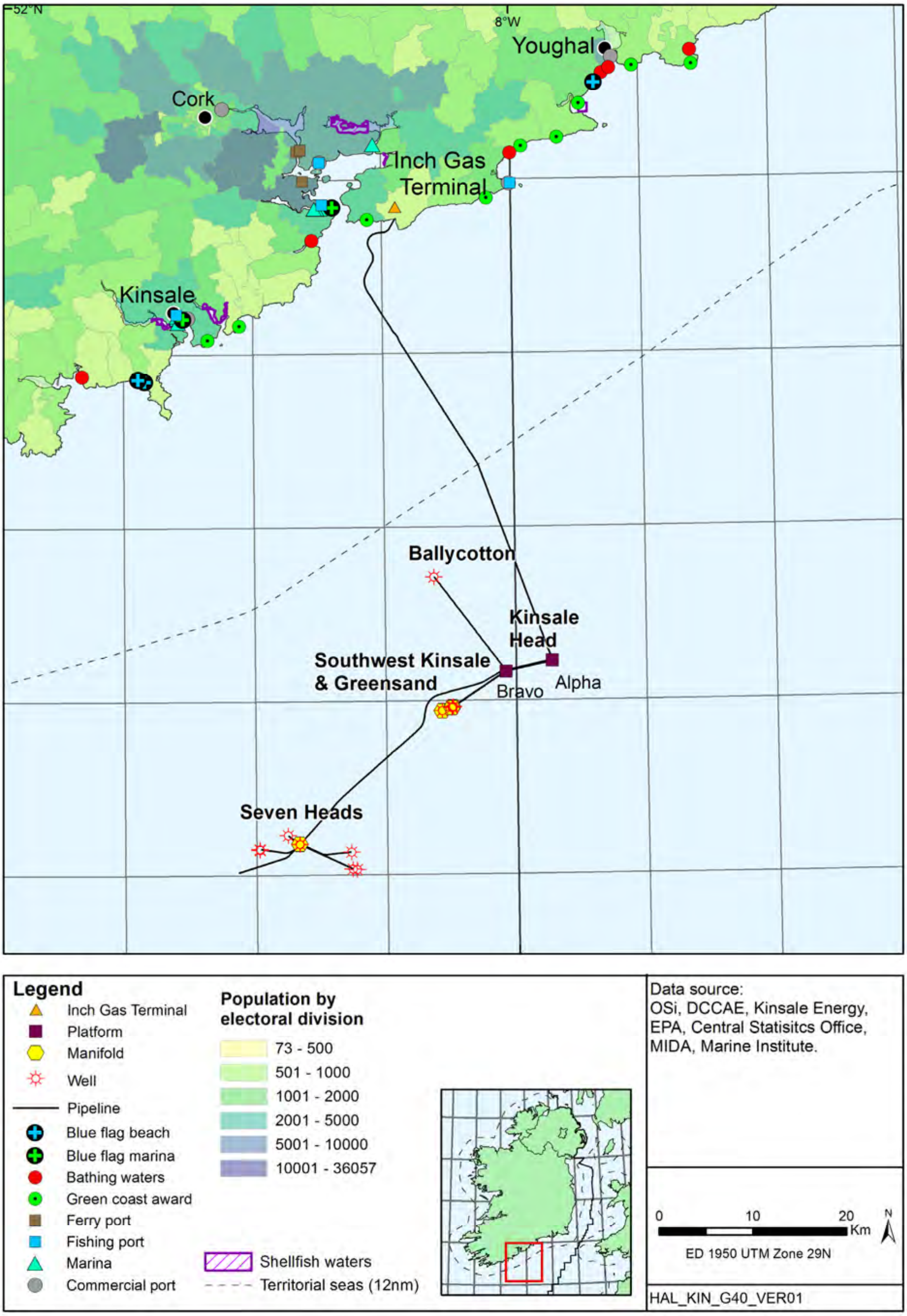
Preliminary results for the 2016 Census estimated a population of 542,196 for Cork County as a whole, a 4.5% increase on the 2011 Census figure. Excluding Cork city (population of 125,622), the 2016 population of the county area was estimated at 416,574, an increase of 4.2% on the 2011 Census figure (http://www.cso.ie/en/releasesandpublications/ep/p-cpr/censusofpopulation2016-preliminaryresults/copc/). In general, the coast adjacent to the Kinsale Area is rural and of low population density (**Figure 4.20**). Refer to **Section 5.10** for further details on population and human health in the vicinity of the Kinsale Area.

In terms of relevant aspects of human health, Section 4.2 indicated that air quality metrics for 2015 (e.g. NO_2, particulates) for rural coastal areas (zone D) and Cork city (zone B) were within EU limit values (O’Dwyer 2016) and are therefore unlikely to represent a significant health risk.

The ecological status of the western Celtic Sea waterbody covering surface waters along much of the Cork coast was described as high for 2010-2012 (EPA 2015c). Other relevant coastal waterbodies were of good (e.g. Kinsale Harbour, Outer Cork Harbour) or moderate (Courtmacsherry Bay, Clonakilty Bay) ecological status (EPA 2015c). The water quality status of identified bathing waters (**Figure 4.20**) adjacent to the Kinsale Area in 2015 was generally described as sufficient (e.g. Coolmaine, Fountainstown), good (e.g. Garretstown) or excellent (e.g. Garrylucas White Strand), with only Youghal Front Strand Beach described as poor (EPA 2016). Blue Flag beaches in the area include Garretstown, Garrylucas and Redbarn (**Figure 4.20**).

Relevant shellfish production areas (**Figure 4.20**) are for oysters and mussels and have a B classification (http://www.sfpa.ie/Seafood-Safety/Shellfish/Classified-Areas) implying that shellfish should undergo purification in a class A area before being placed on the market or be cooked by an approved method (SFPA 2017).

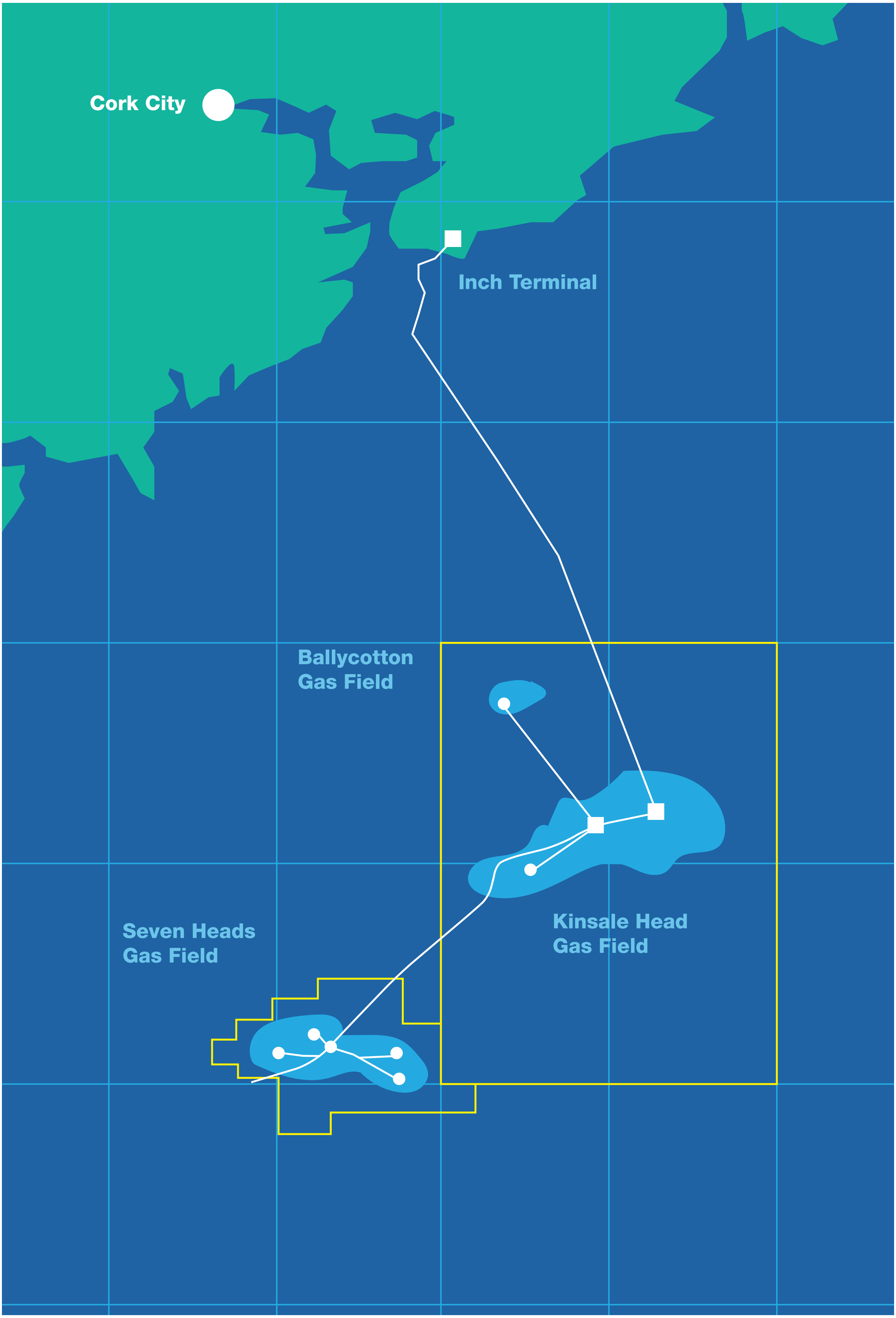
Figure 4:20: Population of electoral districts (2011), blue flag beaches and shellfish waters



Kinsale Area Decommissioning Project

Section 5

Characteristics of the Terrestrial Environment


Cork City
Inch Terminal
Ballycotton
Gas Field
Seven Heads
Gas Field
Kinsale Head
Gas Field

5 Characteristics of the Terrestrial Environment

While most of the project comprises works in the marine environment, the KADP also includes elements of decommissioning work onshore at Inch terminal. This section describes the characteristics of the terrestrial environment in the vicinity of the proposed works.

5.1 Location

The Inch terminal is located at Inch, Co. Cork. Inch is a small townland located in the East Cork Municipal District, approximately 4.3km southeast of the village of Whitegate and 22km southeast of Cork city centre. The location of the Inch Terminal site is shown in **Figure 5.1 and Figure 5.2**. An aerial photo illustrating the extent of the on-shore study area is outlined in **Figure 3.9.**

Figure 5.1: Site Location (Site indicated with red place mark. Source: www.osi.ie)

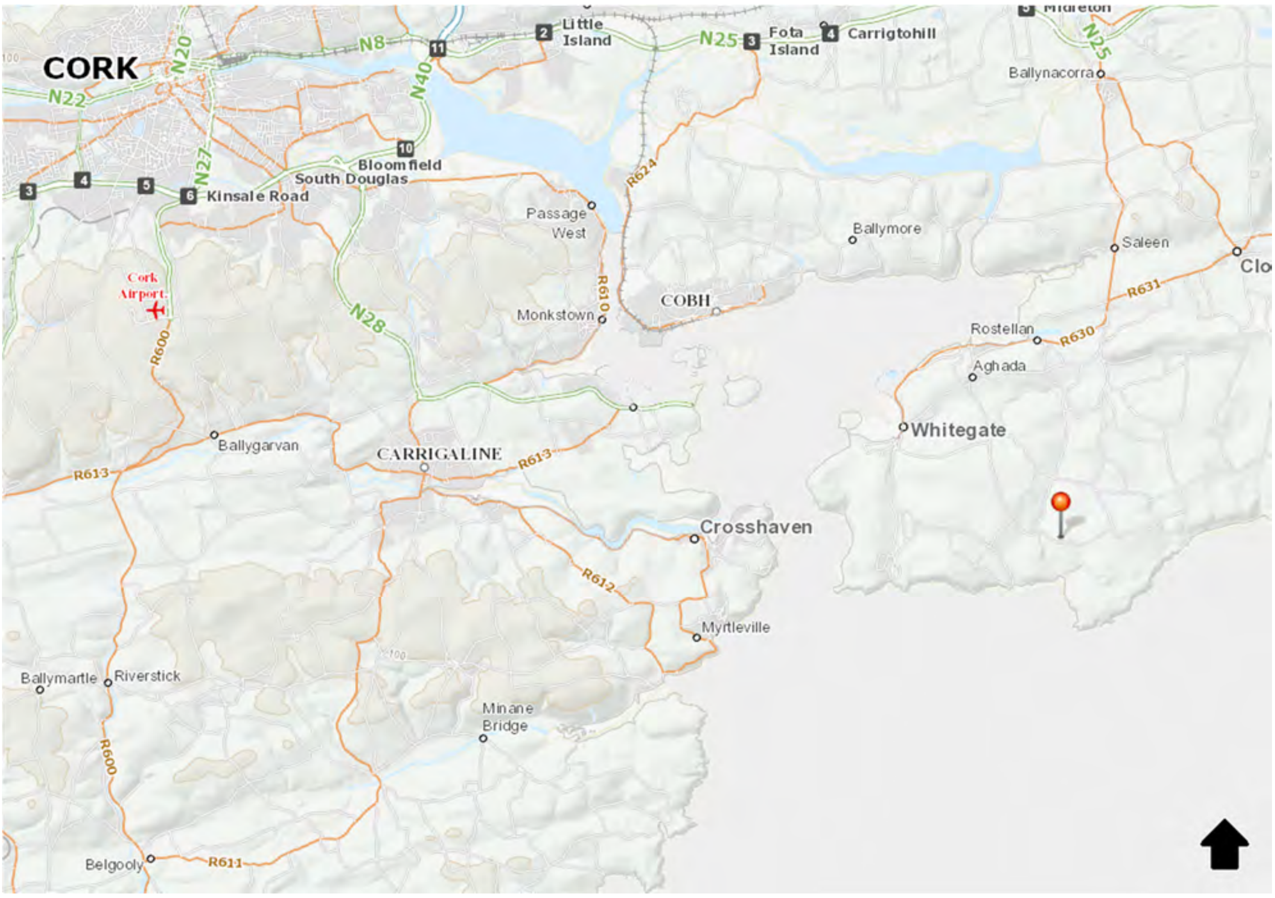
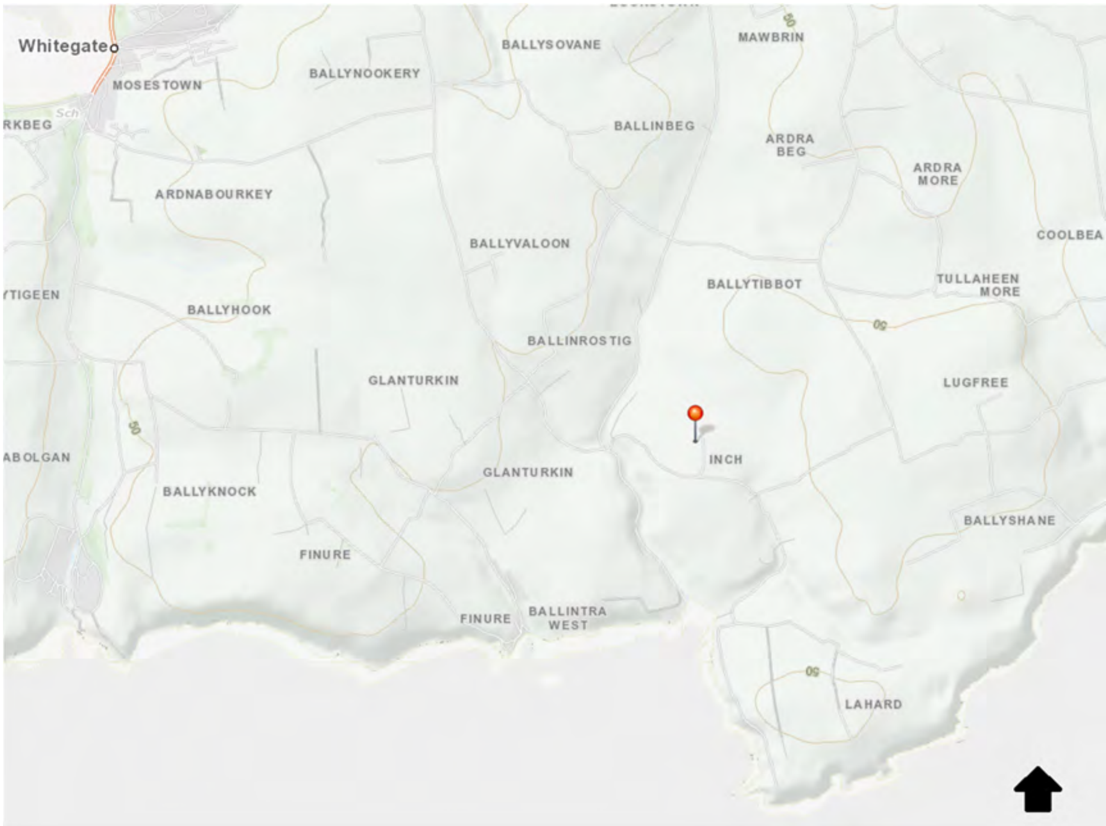


Figure 5.2: Site Location (Site indicted with red place mark. Source: www.osi.ie)



5.2 Material assets

This section provides an overview of the existing material assets at the Inch Terminal site.

As outlined in Section 3.2.6 and Table 3.7, the Inch terminal site includes a number of buildings, onshore gas terminal equipment, as well as supporting infrastructure including a main access road, internal access roads, a communications tower, an unused helipad, a groundwater well, in addition to a vent stack, tanks and drainage infrastructure.

Inch Terminal is serviced with three-phase mains (ESB) supply to its main electrical distribution board. The main distribution board supplies the terminal with 415VAC, 3 Phase, 50 Hz. In the event of a failure of the ESB mains supply the terminal is fitted with a 35 kvA emergency diesel electrical generator.

An EIR telecommunications cable connects to the terminal facility. The electrical and telecommunications supply will be disconnected prior to mobilisation of the demolition contractor.

Potable water is provided to the terminal from the on site groundwater well, which is also used for firewater. This water supply will be plugged and capped as part of the demolition scope of works.

5.3 Land and Soils

This section provides an overview of the existing soils and sub-soils, bedrock geology, geological heritage and other land uses at the Inch Terminal site.

5.3.1 Soils and Sub-Soils

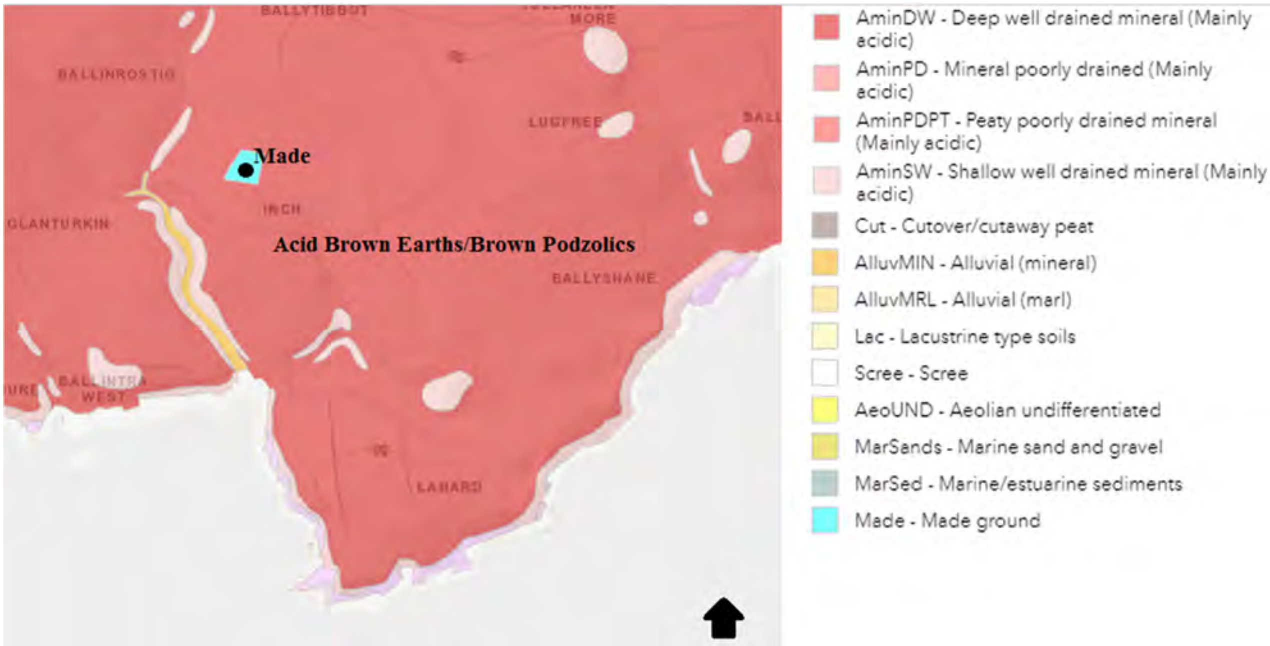
According to the Teagasc soils map, EPA (2009), Made Ground dominates the Inch Terminal site, which is consistent with the presence of the terminal at this location.

Other subsoils in the region which are likely to underlie the made ground, include Acid Brown Earths/ Brown Podzolics.

Most Acid-Brown Earth soils occur on lime-deficient parent materials and are therefore acidic in nature, relatively mature and well drained. Brown Podzolics are usually formed from calcareous parent material which counteracts the effects of leaching and can be light to heavy textured.

This soil type generally provides a mix of productive and moderately productive soils enabling grassland and crop production with the main agricultural use being grassland and cereal crops. Refer to **Figure 5.3** for details of the underlying soils at the Inch terminal site.

Figure 5.3: Soils Map (Site indicated as black dot. Source: Geological Survey of Ireland (2017))



5.3.2 Bedrock Geology

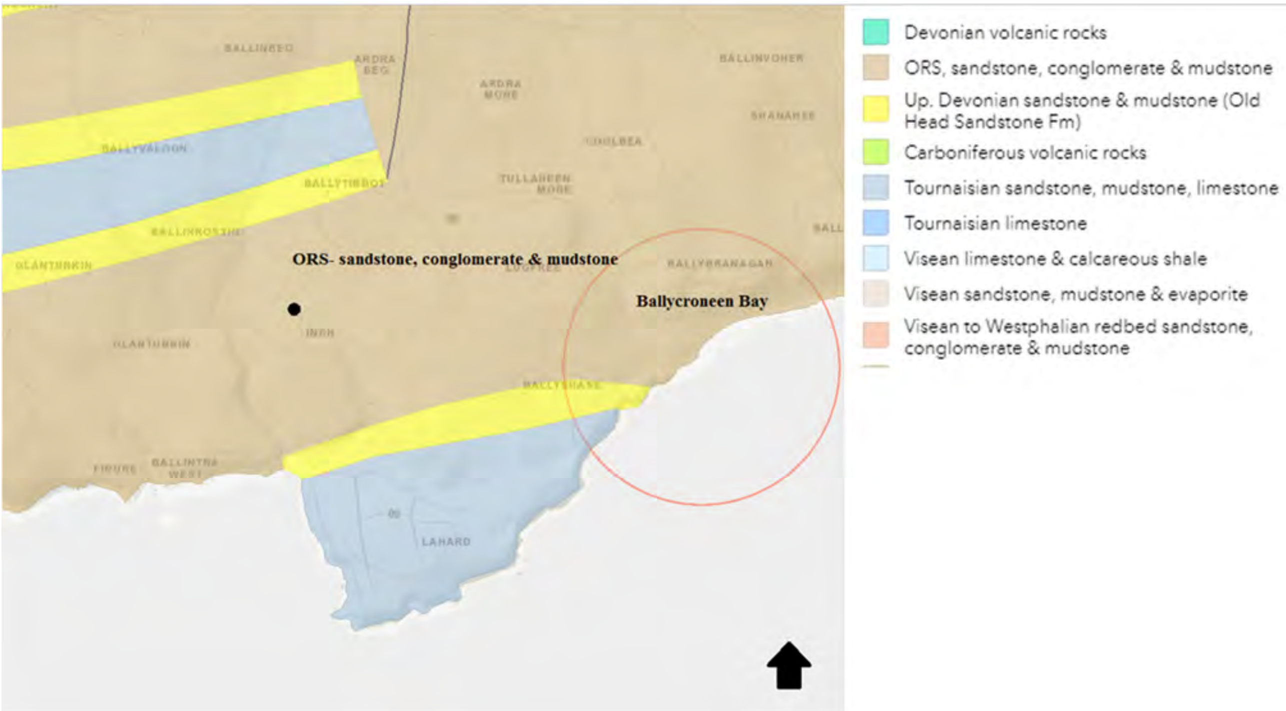
The study area is underlain by Old Red Sandstone, which is comprised of sandstone, conglomerate & mudstone. Refer to **Figure 5.4** for details of the underlying bedrock geology.

Old Red Sandstones, which constitutes the oldest rock of this district, consist of alternating bands of sandy and clayey composition, of which the prevalent tints are various shades of dull red, brown and green.

The Old Red Sandstone Formation stretches over the greater part of County Cork, where it forms the Magillicuddy Reeks and the mountainous tracts of the Iveragh promontory in County Kerry. It also forms the hilly ground lying between Kenmare River and Bantry Bay, and the minor promontories, which in Cork extend south-westward into the Atlantic.

The Formation is usually described in two divisions, namely Lower and Upper Old Red Sandstone. The reason for the distinction is not obvious in the County of Cork however, as throughout the county the rocks form a continuous series which passes up by regular sequence into the strata of the Carboniferous system.

Figure 5.4: Bedrock Geology Map (Site indicated as black dot, source: Geological Survey of Ireland (2017))



5.3.3 Geological Heritage

There are 143 sites of geological heritage interest in County Cork which are afforded protection under the County Development Plan. Some of these sites are also designated as Natural Heritage Areas under national legislation.

There are no geological heritage sites located within the study area. The closest geological heritage site is located approximately 2km to the east - Ballycroneen Bay. Refer to **Figure 5.4.** Ballycroneen Bay is designated for its widely occurring till deposited by the Irish Sea glacier.

5.3.4 Other Uses of the Land

Land use in the area surrounding the Inch Terminal site comprises a variety of uses, as illustrated in **Figure 5.5**. The site is located in a rural area of large farms in pasture and tillage, with dispersed farms and dwellings.

The CORINE Land Cover (CLC) inventory is a Pan-European landuse and landcover mapping programme. It supplies spatial data on the state of the European environmental landscape and how it is changing over time. CORINE Land Cover mapping classifies land cover under various headings. Land use in the vicinity of the Inch Terminal site is illustrated on **Figure 5.6.** According to the CORINE inventory, the main land-use in the study area is ‘pastures’ and ‘non-irrigated land.’

The tourist industry has long been associated with the study area due to the natural beauty and plentiful supply of beaches associated with the coastal landscape. These natural and developed features possess significant amenity and recreational value for the local residents in addition to major opportunities for domestic and international tourism. Inch beach is used for bathing in summer and, year round, for surfing. Swell Surf School is located on Inch Beach, which is approximately 1.14km from the Terminal site.

The study area continues to be in demand for tourist related development including caravan parks, hotels and holiday homes. Inch Hideaway, which is an Eco Sustainable camping facility is situated <1km from the Terminal site.

Figure 5.5: Land Use at the Study Area (Site indicated as red dot. Source: www.google.ie)

Figure 5.6: CORINE Land Use (Site indicated as black dot. Source: EPA (2017b) http://www.envision.ie/)

5.3.5 Zoning

The Cork County Development Plan 2014 came into effect on 15th January 2015. It is expected to remain in force (subject to any interim variations that the Council may make) until late 2020.

It is a six year development plan that attempts to set out, as concisely as possible Cork County Council's current thinking on planning policy looking towards the horizon year of 2022. The plan also sets out the overall planning and sustainable development strategy for the county which must be consistent with the National Spatial Strategy 2002-2020 and the South West Regional Planning Guidelines 2010-2022.

The Development Plan is the county's principle strategic planning policy document. Detailed land-use zoning maps for the main settlements of the county are contained in the Electoral Area Local Area Plans and the Special Local Area Plans. The Inch Terminal site and area surrounding are located within the Greater Cork Ring Strategic Planning Area as outlined in the Bandon/Kinsale Local Area Plan.

The Inch terminal and surrounding area is not currently designated zoning in the Development Plan or the Local Area Plan for any particular land use.

As outlined under Objective ZU 2-3: Land Use Zoning of Other Lands in the Cork County Development Plan 2014:

"Where lands have not been explicitly zoned, in either the adopted Local Area Plans or the adopted Special Local Area Plans, the specific zoning shall be deemed to be that of the existing use of the lands (if such a use is not an unauthorised use under the Planning Acts) or, if such a use is unauthorised, that of the most recent authorised use of the lands"

The land surrounding the Inch Terminal is currently being used as agricultural land.

5.4 Water

This section provides an overview of the existing hydrology, water quality and hydrogeology within the study area surrounding the Inch terminal site and onshore pipeline.

5.4.1 Hydrology

Since 2000, Water Management in the EU has been directed by the Water Framework Directive 2000/60/EC (WFD). The second River Basin Management Plan (RBMP) which was launched on 17th April 2018 outlines the new approach that Ireland will take as it works to protect its rivers, lakes estuaries and coastal waters over the next four years. Building on the lessons learned from the first river basin management planning cycle, the government is now planning on the basis that Ireland is defined as a single River Basin District. This is due to the fact that the structure of the multiple River Basin Districts did not prove effective, either in terms of developing the plans efficiently or in terms of implementing those plans (River Basin Management Plan 2018-2021, 2018).

Surface water features in the vicinity of the Inch Terminal site are shown on **Figure 5.7.**

Figure 5.7: Water features in the Study Area (Site indicated as black dot. Source: EPA (2017b) http://www.epa.ie/)

5.4.2 Water Quality

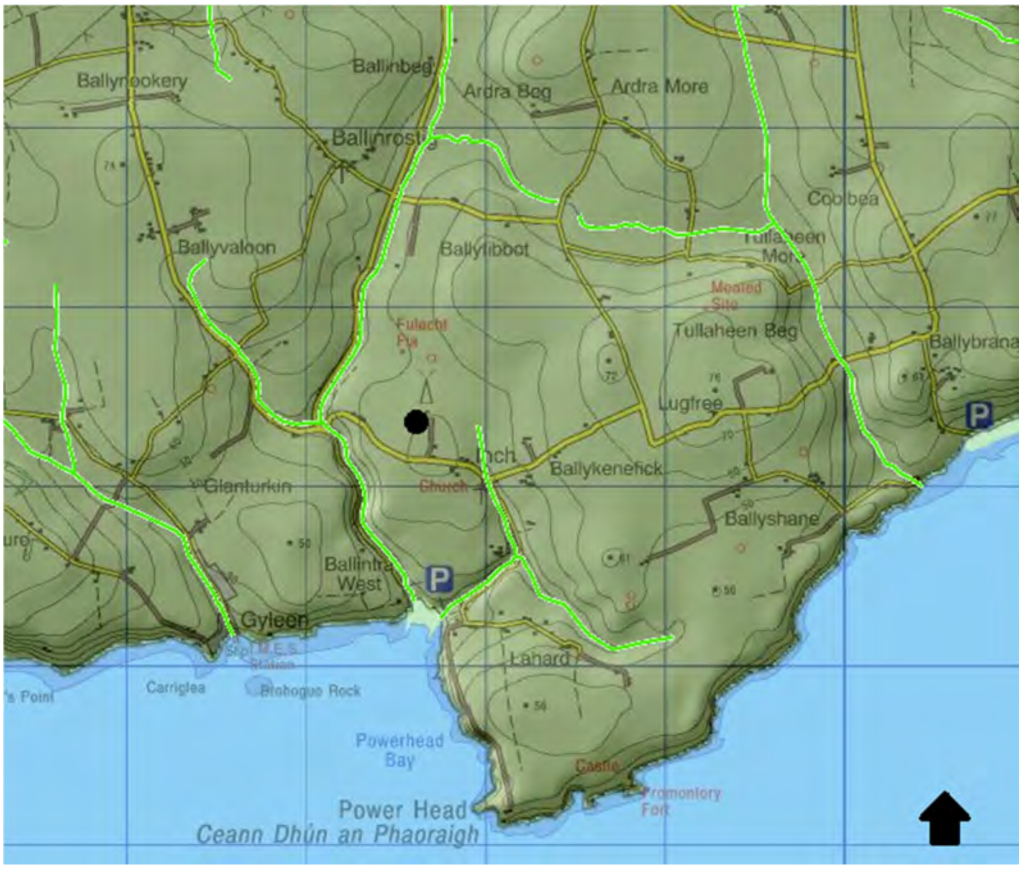
The WFD has been transposed into Irish legislation by the European Communities (Water Policy) Regulations 2003 (SI No. 722 of 2003). The WFD requires that all member states implement the necessary measures to prevent deterioration of the status of all waters - surface, ground, estuarine and coastal - and protect, enhance and restore all waters with the aim of achieving good status by 2015.

As part of the implementation of the WFD, a baseline risk assessment was completed of the water bodies within the vicinity of the Inch Terminal site. These assessments were made using water pollution indicators, point and diffuse pollution sources, water abstractions and detail on commercial activities. The risk assessment assigned a water quality status to each waterbody and indicated a risk status namely, whether the water body would meet the criteria for “good status” or would be considered “at risk” of not meeting the standards by 2015.

The West Ballintra River and the Lahard Stream, which are located in close proximity to the Inch Terminal site have been classified as having an ‘unassigned’ WFD water quality status. They are however classed as “not at risk” of not achieving “good status” by 2015 under the WFD risk score system in 2010. The WFD Risk Status for river water bodies within the study area is shown on **Figure 5.8**.

There are no ‘Nutrient Sensitive’ rivers identified near the terminal site. Nutrient Sensitive Waters comprise nitrate vulnerable zones designated under the Nitrates Directive (91/676/EEC) and areas designated as sensitive under the Urban Waste Water Treatment Directive (91/271/EEC).

Figure 5.8: WFD Risk Scores within the Study Area (Site indicated as black dot. Source: EPA (2017b))



Note: "Not at Risk" is indicated by the green waterbody features.

5.4.3 Hydrogeology

The Inch Terminal site is underlain by a bedrock aquifer which is classified by Geological Survey Ireland (GSI) as a 'locally important' aquifer, which is 'moderately productive only in local zones.' The WFD risk status for groundwater quality in the aquifer is of 'good status.'

Groundwater vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability in the study area is classified as being of 'extreme' vulnerability by the GSI. The Extreme vulnerability class is defined by a soil thickness of 1–3 m.

Groundwater aquifers in the vicinity of the study area are shown in **Figure 5.9** and groundwater vulnerability in the vicinity is shown in **Figure 5.10**.

A groundwater abstraction well is located on the terminal site which is currently used to supply drinking water to the terminal.

Figure 5.9: Groundwater aquifers (Site indicated as black dot. Source: Geological Survey of Ireland (2017))

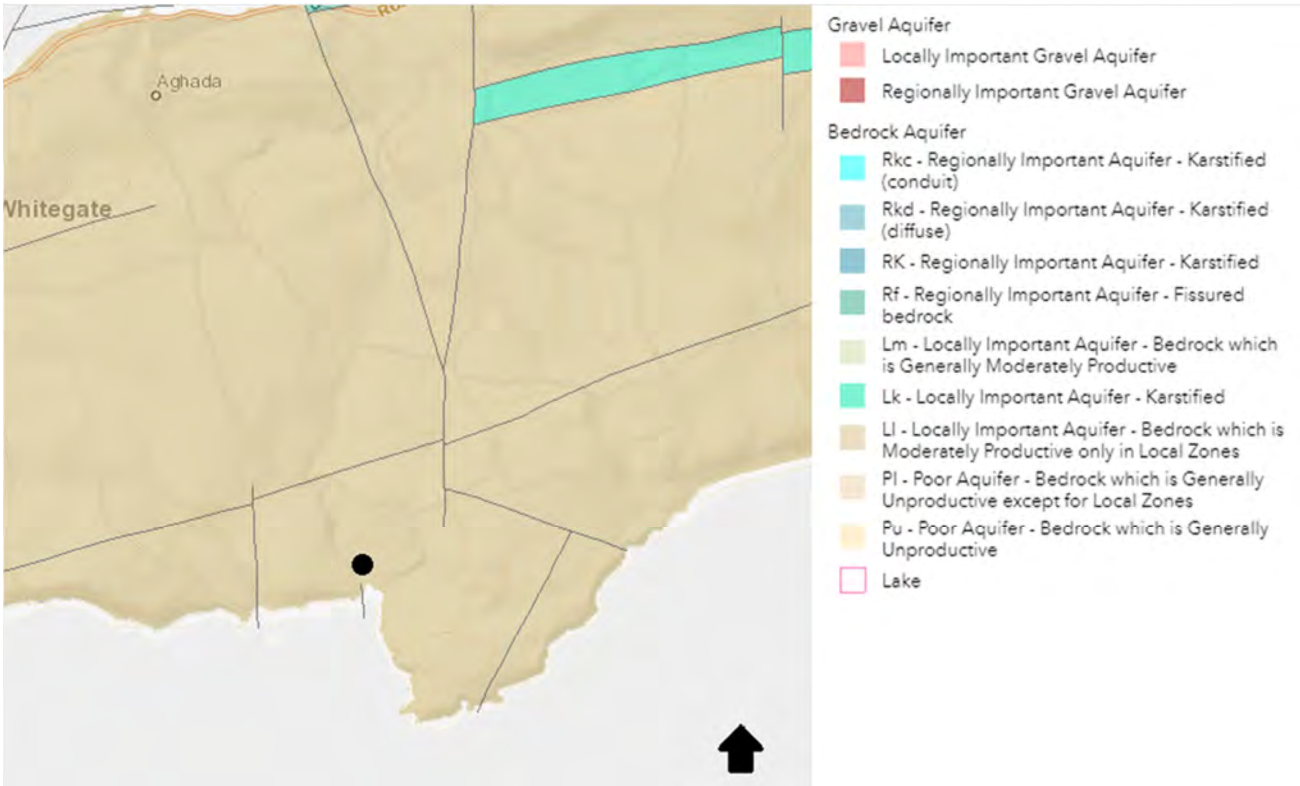
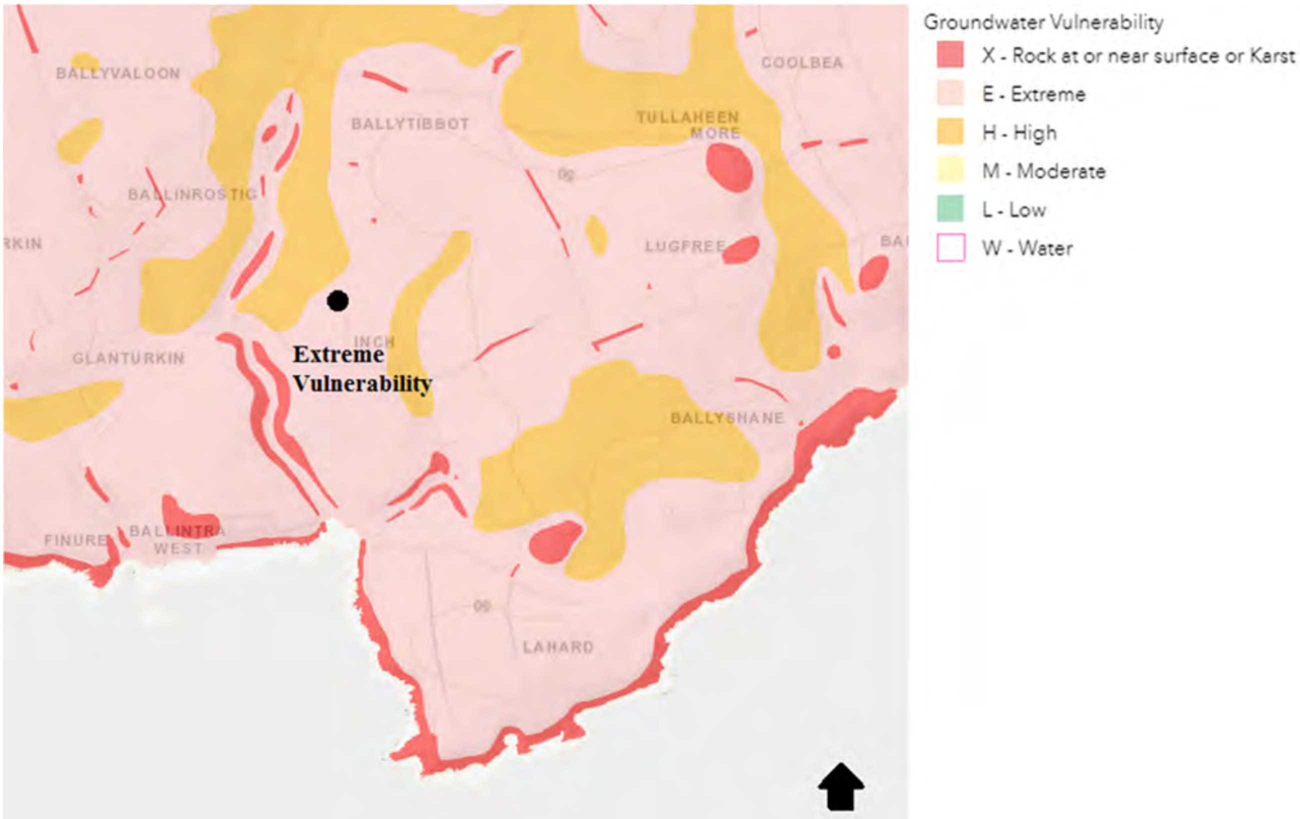


Figure 5.10: Groundwater Vulnerability (Site indicated as black dot. Source: Geological Survey of Ireland (2017))



5.5 Air Quality and Climate

This section provides an overview of the existing air quality and climate in the vicinity of the Inch Terminal site.

5.5.1 Air Quality

The Environmental Protection Agency (EPA) measures the levels of a number of atmospheric pollutants throughout Ireland in order to measure compliance with Air Quality Standards Regulations, 2011 (S.I. No. 180 of 2011). For the purposes of monitoring in Ireland, four zones are defined in the Regulations:

- Zone A: Dublin Conurbation;
- Zone B: Cork Conurbation;
- Zone C: Other Cities and Large Towns; and
- Zone D: Rural Ireland which is the remainder of the State excluding Zones A, B and C.

The study area is located in Zone D. **Table 5.1** outlines the monitoring data provided by the EPA for Zone D during the years 2013-2015, EPA (2015d).

Table 5.1: Annual Average Pollutant Concentrations 2013 – 2015 for Zone D

Pollutant / Year	NO2 (µg/m3)	NOx (µg/m3)	PM10 (µg/m3)	PM2.5 (µg/m3)	CO (Mg/m3)	Benzene (µg/m3)
2013	11.0	13.0	5.0	16.0	0.3	0.5
2014	5.5	10.3	5.0	7.5	0.5	0.1
2015	6.3	12.3	8.0	7.3	0.5	0.1
Average	7.6	11.9	6.0	10.3	0.4	0.2
Air Quality Standard	40	30	40	20	10	5

All baseline levels measured in Zone D are in compliance with air quality standards set by the EPA.

5.5.2 Climate

According to the Met Éireann Monthly Data (2015-2018), the mean temperature at Roche's Point meteorological station (the nearest meteorological station to the Terminal site at approximately 5km away) is 6.8˚C in January and 15.6˚C in July. The mean temperature annual average is 10.7˚C. The mean annual rainfall is 976mm. The mean annual wind speed is 6.3m/s.

The study area has a mild maritime climate with mean air temperatures varying between approximately 6-7°C in winter and 15-16°C in summer (seasonal mean temperatures for 1981-2010, Walsh S (2012)). Wind direction is predominantly from the southwest, particularly in winter and summer, although wind direction is more variable in spring and autumn, UKHO (1997). The frequency of days experiencing gale force winds per month is approximately 25% in January, dropping to 2-5% in July. Sea fog is most frequent in summer, and most commonly associated with warm moist air blowing over a relatively cold sea with winds between southeast and southwest.

National climate observations identified in the National Adaptation Framework (DCCAE, 2018) highlight historic changes and trends in aspects of the Irish climate including:

- Temperatures have increased by about 0.8°C since 1900, an average of 0.07°C per decade;
- The number of annual frost days has decreased whilst the number of warm days has increased;
- Average annual national rainfall has increased by approximately 60mm or 5% in the period 1981 to 2010, when compared to the 30-year period 1961 to 1990;

- Concentrations of greenhouse gases including methane (CH4), nitrous oxide (N2O) and carbon dioxide are significantly high;
- Increasing annual mean river flows have been observed at 40 measurement sites around the country; and
- The growing season is occurring more than a week earlier than it was in the 1970s which is linked to a rise in average spring temperature.

The National Adaptation Framework (DCCAE, 2018) has also drawn on regional climate modelling to develop mid-century climate projections (for the period 2041 -2060 in comparison to a baseline period of 1981 – 2000) for Ireland. The climate projections include the following:

- Mean annual temperatures will increase by 0.90 - 1.7°C, with the largest increases seen in the east of the country;
- Hot days (i.e. the top 5% maximum daily temperature) will get warmer by 0.7 – 2.6˚C;
- Cold nights (i.e. the bottom 5% of minimum daily winter temperature) will get warmer by 1.1-3.1°C;
- The number of frost days (i.e. a day when the minimum temperature is less than 0°C) is projected to decrease by over 50%;
- The average length of the growing season will increase by over 35 days per year;
- Precipitation: results show significant projected decreases in mean annual, spring and summer precipitation amounts by mid-century. The projected decreases are largest for summer, with reductions ranging from 0% to 20%;
- Heavy rainfall events will increase in winter and autumn;
- The energy content of the wind is projected to decrease during spring, summer and autumn. The projected decreases are largest for summer, with values ranging from 3% to 15%;
- The frequency of storms will decrease but the intensity of storms will increase;
- Increased incidences of high and low flow periods are likely for surface water bodies;
- Regional sea level rise (allowing for isostatic components) , of c.40cm south west Ireland estimated by c.2080- 2100 and;
- Coastal erosion and flooding currently pose a serious risk to coastal areas. Key impacts include inundation of coastal areas, increase in the intensity of cyclones which will result in more extreme storm activity and an increase in coastal erosion.

5.6 Noise and Vibration

The Inch Terminal site is located in a very rural area, with low ambient noise levels. The nearest sensitive receptor (i.e. residential property) is approximately 200m to the south of the Inch terminal site, adjacent to the main site access road.

5.7 Biodiversity

This section provides an overview of the existing flora and fauna at the Inch Terminal site.

5.7.1 Habitats

A site inspection was carried out on 14 June 2017 by Dixon Brosnan Environmental Consultants to identify the habitats, flora and fauna present at the site. The survey consisted of walking systematically through the Inch Terminal site and surrounding area within Kinsale Energy's ownership (as illustrated in **Figure 5.12**) and recording habitats, plant species and fauna.

The terrestrial and aquatic habitats were classified using the classification scheme outlined in the Heritage Council publication *A Guide to Habitats in Ireland* (Fossitt, 2000) and cross referenced with Habitats Directive Annex 1 Habitats where required. No notable species were identified, nor are they expected to occur given that the habitats within the study area are generally common and modified. Habitat mapping was carried out in line with the methodology outlined in the Heritage Council Publication, Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011).

Habitat maps are included as **Figure 5.11 and Figure 5.12** and the habitats recorded on site are described below. The ecological value of habitats has been classified in accordance with the classification scheme outlined in the Guidelines for Assessment of Ecological Impacts of National Road Schemes (National Roads Authority, 2009).

Habitats identified within the terminal site consist of:

- Buildings and artificial surfaces (BL3) – Local importance (Lower value)
- Spoil and bare ground (ED2) – Local importance (Lower value)
- Recolonising bare ground (ED3) – Local importance (Lower value)
- Amenity grassland (improved) (GA2) – Local importance (Lower value)
- Hedgerows (WL1) – Local importance (Moderate value)
- Treelines (WL2) – Local importance (Lower value)

A large proportion of the site has a gravel aggregate covering, which has resulted in a highly modified habitat with low species diversity. Species identified include Willowherb (*Epilobium spp*.), Scarlet Pimpernel (*Anagallis arvensis*), Prickly Sow-thistle (*Sonchus asper*), Ragwort (*Senecio jacobaea*), Daisy (*Bellis perennis*), Dandelion (*Taraxacum officinale agg*.) and Spear Thistle (*Cirsium vulgare*) along with sapling Sycamore (*Acer pseudoplatanus*) and Cotoneaster (*Cotoneaster spp*.).

Situated around the perimeter of the site is a narrow band of amenity grass. This is an example of a highly modified habitat with limited value for local wildlife. A small treeline of Common Alder (*Alnus glutinosa*), Sycamore (*Acer pseudoplatanus*) and Maple (*Acer spp.*) is found along the eastern boundary of the terminal site. The entire complex is bordered by hedgerow habitat from adjoining agricultural fields with a small section of a coniferous treeline within the northern boundary.

The habitats identified within the Inch terminal site are predominately man-made artificial habitats which are of negligible ecological value. No invasive species were recorded. The terminal site consists of solid concrete buildings along with steel frame platforms, metal piping and tanks and a large metal telecommunication tower. Large areas of the site are covered in a loose gravel aggregate, with both internal and external perimeter and security fencing.

Figure 5.11: General overview of habitats recorded within the Inch Terminal site.

Kinsale Energy owns a number of the surrounding fields and also an area of deciduous woodland in the vicinity of the terminal site (**Figure 5.12**). Other habitats identified within the adjoining land owned by Kinsale Energy are as follows:

- Scrub (WS1)
- Mixed deciduous woodland (WD1)
- Eroding river (FW1)
- Arable crops (BC1)
- Dry meadows & grassy verges (GS2)
- Ornamental/non-native shrub (WS3)
- Amenity grassland (improved) (GA2)
- Treelines (WL2)

These surrounding fields are cultivated and managed for Barley (*Hordeum vulgare L*.). Bounding each of these fields are hedgerow habitats. The majority of these hedgerows are of a similar form and composition. Species noted include Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinose*), Gorse (*Ulex europaeus*), Bramble (*Rubus fruticosus agg*.), Bracken (*Pteridium aquilinum*), Cleavers (*Galium aparine*), Nettle (*Urtica dioica*), Creeping Buttercup (*Ranunculus repens*), Docks (*Rumex obtusifolius & crispus*), Hedge Woundwort (*Stachys sylvatica*), Cut-leaved Crane's-bill (*Geranium dissectum*), Thistles (*Cirsium arvense & vulgare*), Hedge Bindweed (*Calystegia sepium ssp. Sepium*), Honeysuckle (*Lonicera periclymenum*), Bush Vetch (*Vicia sepium*), Alexanders (*Smyrnium olusatrum*), Hogweed (*Heracleum sphondylium*), Prickly Sow-thistle (*Sonchus asper*), Foxglove (*Digitalis purpurea*) and Silverweed (*Potentilla anserine*).

An area of deciduous woodland (WD1) exists to the west of the terminal site. The structure of the woodland is relatively poor and it generally lacks large mature trees and a diverse ground flora. Species noted within the woodland include Ash (Fraxinus excelsior), Common Alder (*Alnus glutinosa*), Italian Alder (Alnus cordata), Sycamore (*Acer pseudoplatanus*), Hawthorn (*Crataegus monogyna*) and Willow (*Salix spp*.).

Figure 5.12: General overview of habitats within Kinsale Energy land ownership boundary

5.7.2 Aquatic Ecology

The terminal site is not located in close proximity to any prominent surface water features. The site is located east of the West Ballintra River, and northwest of the Lahard Stream in the Farrannamanagh Sub-Catchment. Surface water features in the vicinity of the Inch Terminal site are shown on **Figure 5.7.**

A small stream is located 85m north of the terminal site, and flows in a westerly direction through a woodland and agricultural land (See **Figure 5.12**). The stream is heavily shaded in sections and primarily composed of glides and riffles with some pools. It was approximately 60cm in width and 10cm in depth, during the time of the survey. The stream bed substrate is largely composed of gravel in areas of riffles but other areas are heavily silted with high levels of sediment and organic debris. The stream has minimal fish potential.

5.7.3 Birds

Sea birds

The south coast of Ireland provides numerous habitats for seabirds, with rocky cliffs and productive seas supporting a variety of gulls, auks, terns and shearwaters. Seabird distribution is influenced by the presence of prey species, which in turn is affected by a range of physical factors. Sandeels, herring, sprat and small gadoids are among the prey items favoured by most seabirds, and there are several spawning and nursery areas for these in the area.

Each summer, over half a million seabirds, from 24 species, search for suitable breeding sites on the cliffs and islands of the south coast of Ireland. In addition, over 50 species of waterbirds arrive on migration either on passage or to over-winter (https://www.npws.ie/research-projects/animal-species/birds/wintering-waterbirds). There are numerous SPAs (Special Protection Areas) along the coast which offer protection to species or aggregations of seabirds and waterbirds, however, none are in close proximity to the Inch Terminal site (see **Section 4.4.8**). Key sources of information on the distribution of birds in the Celtic and Irish seas include

Webb *et al*. (1990) and Stone *et al*. (1995). In addition, various surveys, including the Celtic Sea Herring Acoustic Surveys (O'Donnell *et al*. 2016) have recorded seabird sightings in the area.

Details of the seabirds and waterbirds found in the area are provided in **Section 4.4.6.**

Terrestrial birds

A bird survey was carried out in conjunction with the habitat survey in June 2017. Birds species listed in Annex I of the Birds Directive are considered a conservation priority. No such birds were recorded. BirdWatch Ireland and the Royal Society for the Protection of Birds have identified and classified bird species by the rate of decline into Red and Amber lists. Green listed species are regularly occurring bird species whose conservation status is currently considered favourable. Three Amber Listed species (*Erithacus rubecula* (Robin), *Carduelis cannabina* (Linnet), *Larus argentatus* (Herring Gull)) and three Red Listed species (*Anthus pratensis* (Meadow Pipet), *Carduelis chloris* (Greenfinch), *Hirundo rustica* (Barn Swallow)) were recorded during the site survey. These species were recorded within the surrounding area within KEL's ownership (and not within the Inch terminal site). The birds noted during site surveys, which are generally common in the Irish landscape, are listed in **Appendix C.1**.

A large telecommunication tower exists within the terminal site. The tower was inspected for bird usage, particularly nesting peregrines or gull species. No signs of past or present bird usage of the tower were identified.

Overall, the terminal site is of minimal value for birds. The landownership area is of local value for terrestrial bird species that are relatively common in the Irish countryside. A number of these species were recorded breeding in the area; however none were recorded breeding within the terminal site or in its immediate vicinity.

5.7.4 Mammals

Badgers

Badgers and their setts are protected under the provisions of the Wildlife Acts 1976 and 2000. It is an offence to intentionally kill or injure a protected species or to wilfully interfere with or destroy the breeding site or resting place of badgers. The density of badgers in Ireland is approximately one social group per km^2 in lowland areas with a high component of pasture. In upland areas where feeding is scarce, badgers are generally found at lower densities. Badger setts are formed by a complex group of interlinked tunnels and therefore works in proximity to setts can potentially cause considerable damage. The presence of badgers can be recognised by feeding signs, paths, latrines and setts.

Dixon Brosnan Environmental Consultants surveyed the Inch Terminal area in August 2010 and recorded feeding activity and latrines at one location within the surrounding area within KEL's ownership and a potential sett was located, though not confirmed. No signs of badger were recorded during the site visit in June 2017.

Bats

Bats are protected by law in the Republic of Ireland under the Wildlife Act 1976 and subsequent amendments. In addition to domestic legislation, bats are also protected under the EU Habitats Directive (92/43/EEC) with all bat species listed in Annex IV of the Habitats Directive. Lesser Horseshoe Bat are also listed on Annex 2 of the Habitats Directive. For all bats it is an offence to disturb, injure or kill bats or disturb or destroy their roosts. The Irish government is a signatory to the 1979 Bonn Convention (Convention on the conservation of migratory species of wild animals) and the 1982 Bern Convention (Convention on the conservation of European wildlife and natural habitats), and has a commitment to the 1991 Eurobats agreement (Agreement on the conservation of bats in Europe).

The external walls of the buildings within the terminal site were inspected for any signs of bats. Evidence of bat activity associated with potential roost sites includes bat droppings, urine staining, feeding remains, scratch marks and dead/alive bats. Indicators that potential roost locations and access points are likely to be inactive include the presence of cobwebs and general detritus within the apertures. Upon inspection no evidence, or indicators of bats, were recorded nor were any potential roost sites identified within the concrete and metal structures within the terminal site.

Otters

Otters, along with their breeding and resting places are protected under the provisions of the Wildlife Act 1976, as amended by the Wildlife (Amendment) Act, 2000. Otters have additional protection because of their inclusion in Annex II and Annex IV of the Habitats Directive which is transposed into Irish law in the European Communities (Natural Habitats) Regulations (S.I 94 of 1997), as amended. Otters are also listed as requiring strict protection in Appendix II of the Bern Convention and are included in the Convention on International Trade of Endangered species (CITES).

No evidence of otters was found in the Inch Terminal site and it was determined that no suitable habitat exists within the landownership boundary. Potential habitat for otter may exist in the streams to the east and west of the site and in the coastal habitats to the south.

Other Protected Mammals

The National Parks and Wildlife service has records for six terrestrial mammal species (Fallow Deer, Hedgehog, Otter, Stoat, Red Squirrel and Pymy Shrew) from grid square W86, within which the Terminal is located. Red squirrel occur at a density of 0.2 per hectare of deciduous woodland, where the species are present. Sufficient area of habitat may be present within the landownership area, however the available habitat is suboptimal. No signs of red squirrels were observed. Hedgehog, stoat and pygmy shrew are widely distributed and could occur within the wider landownership area. No evidence of these species were recorded. Similarly no evidence of Fallow Deer was recorded.

Evidence of Irish Hare was recorded in June 2017 in proximity to the Inch terminal and Irish Hare were also recorded during previous surveys in 2010. The Irish hare is listed on Appendix III of the Bern Convention, Annex V(a) of the Habitats Directive and as an internationally important species in the Irish Red Data Book, Wildlife Service Ireland (1988). Irish Hares usually prefer semi-natural grassland with tussocks of rushes or similar cover vegetation and occasionally will shelter in hedgerows.

A stoat track was recorded at the edge of an arable field to the south of the terminal. Irish stoats occur in most habitats with sufficient cover, including urban areas.

Reptiles and amphibians

The common newt and common frog are protected species under the Wildlife Act 1976 and 2000. Neither species have been observed at the terminal site.

5.7.5 Conservation Sites and Species

Details on the conservation sites in proximity to the Kinsale Area are outlined in **Section 4.4.8**.

5.8 Cultural Heritage

This section provides an overview of the existing archaeology and architectural and cultural heritage at the Inch Terminal site.

5.8.1 Archaeology

5.8.1.1 Archaeological and Historical background

Cartographic and placename evidence is included in **Appendix C.2.1.** Details of the archaeological and historical background is provided in **Appendix C.2.2.**

5.8.1.2 Record of Monuments and Places

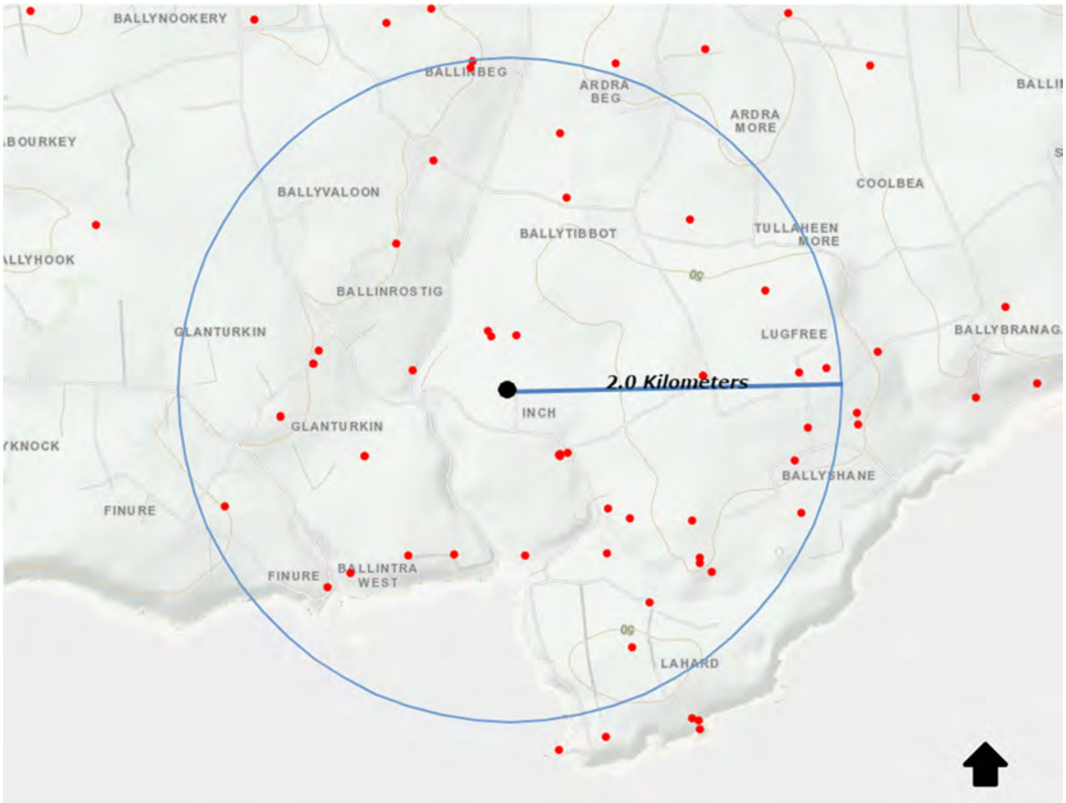
A record of archaeological heritage is maintained on the 'Record of Monuments and Places' (RMP) which was established under Section 12 of the National Monuments (Amendment) Act, 1994 (No. 17 of 1994). Structures, features, objects or sites can be listed in the RMP.

The RMP comprises a list of recorded monuments and places and accompanying maps on which the listed items are shown for each county. The National Monuments Service of the Department of Culture, Heritage and the Gaeltacht advise on the protection applying to any particular monument or place under the National

Monuments Act by reason of it being listed in the RMP and should be consulted if there is any doubt as to the status of the site.

According to the database, the terminal site and onshore pipeline is located in an area of high archaeological significance, with a number of listed items in the RMP present in the area, including two fulacht fiadh and a ringfort. There are also numerous listed items on the RMP present within 2km of the study area, as illustrated in **Figure 5.13**. **Appendix C.2.3** details all the listed items on the RMP present within 2km of the terminal site. The chronological range and diversity of these sites appears to indicate that the area has been subject to continuous occupation since Mesolithic times. The nature and form of sites vary from prehistoric flint scatters found at Lahard, Inch and Ballykenefick to vernacular houses and a Coastguard Station at Ballinrostig and Ballintra East, respectively. This large variety of sites also includes seven ringforts, one medieval castle, an Iron Age promontory fort and a church and graveyard.

Figure 5.13: Recorded Monuments within 2km of the Inch Terminal Site | Source: www.myplan.ie | Not to scale



5.8.2 Architectural and Cultural Heritage

As defined by the Heritage Act, 1995, 'architectural heritage' includes all structures, buildings, traditional and designed, and groups of buildings including street-scapes and urban vistas, which are of historical, archaeological, artistic, engineering, scientific, social or technical interest.

The National Inventory of Architectural Heritage (NIAH) is a state initiative under the administration of the Department of Culture, Heritage and the Gaeltacht established on a statutory basis under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999.

The purpose of the NIAH is to identify, record, and evaluate the post-1700 architectural heritage of Ireland, uniformly and consistently as an aid in the protection and conservation of the built heritage. NIAH surveys provide the basis for the recommendations of the Minister for Culture, Heritage and the Gaeltacht to the planning authorities for the inclusion of particular structures in their Record of Protected Structures (RPS).

According to the NIAH, there are no protected structures in the immediate vicinity of the terminal site. There are eight protected structures within 2km of the terminal site, as indicated in **Figure 5.14** below.

Figure 5.14: Protected structures within 2km of the Inch Terminal Site | Source www.myplan.ie | Not to scale

5.9 Landscape

This section provides an overview of the landscape character types, views, prospects and scenic routes in the vicinity of the Inch Terminal site.

5.9.1 Landscape Character Type

Section 4.7 of this report outlines three landscape character types of relevance in the area of Inch, all of very high landscape value and sensitivity. One of these Landscape Character Types covers the Inch Terminal site; Landscape Character Type 2: Broad Bay Coast (Refer to **Figure 5.15**). This is defined in **Section 4.7**. According to the Draft Landscape Strategy, Cork County Council (2007), Landscape Type 2 is classified as 'Very High Value Landscape' with regards the value and sensitivity. Landscape Character Type 2 is also classified as being of 'County Importance.'

This Landscape Character Type is characterised by a sweeping coastline flanked by low promonotories, rocky shores and low cliffs at the seaside whilst further inland moderately sized fertile fields are bounded by hedgerows. Isolated cottages are also common in this part of the landscape character type.

Specifically, there are three Landscape Character Areas within Landscape Type 2 and the Inch Terminal site is located in Landscape Character Area 22 - Power Head (Undulating Fertile Patchwork Coastline).

Figure 5.15: Landscape Character Area 2: Broad Bay Coast (Site indicated as black dot. Source: Cork County Draft Landscape Strategy (2007)

5.9.2 Views, Prospects and Scenic Routes

County Cork contains many vantage points from which views and prospects of great natural beauty may be obtained over both seascape and rural landscape. This scenery and landscape is of enormous amenity value to residents and tourists and constitutes a valuable economic asset. The protection of this asset is therefore of primary importance in developing the potential of the County. The Cork County Development Plan 2014-2020, Cork County Council (2014), identifies specific 'Scenic Routes' consisting of important and valued views and prospects within the County.

There is one Scenic Route located in close proximity to the Inch Terminal site- '**S50** Road between Inch and Aghada', which is illustrated in **Figure 5.16**.

It is an objective of the Cork County Development Plan to:

'*protect the character of those views and prospects obtainable from scenic routes and in particular stretches of scenic routes that have very special views and prospects identified in this plan.'*

With regards development along Scenic Routes, it is also an objective of the County Development Plan to:

'*a) Require those seeking to carry out development in the environs of a scenic route and/or an area with important views and prospects, to demonstrate that there will be no adverse obstruction or degradation of the views towards and from vulnerable landscape features. In such areas, the appropriateness of the design, site layout, and landscaping of the proposed development must be demonstrated along with mitigation measures to prevent significant alterations to the appearance or character of the area.*

b) Encourage appropriate landscaping and screen planting of developments along scenic routes which provides guidance in relation to landscaping.'

Figure 5.16: Scenic Routes in the Study Area (Site indicated as black dot. Source: Cork County Council (2017))

5.10 Population and Human Health

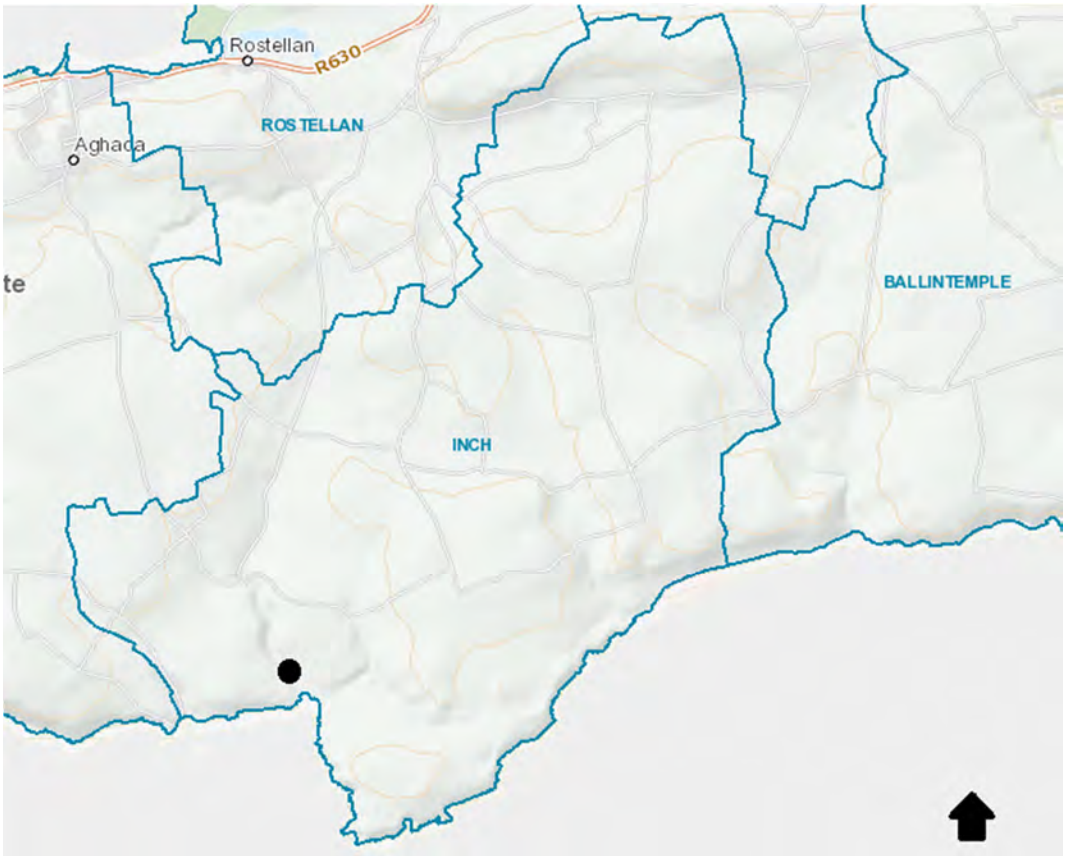
This section provides an overview of the population and human health in the vicinity of the Inch Terminal site.

5.10.1 Population

Preliminary results for the 2016 Census estimated a population of 542,196 for Cork County as a whole, a 4.5% increase on the 2011 Census figure. Excluding Cork city (population of 125,622), the 2016 population of the county area was estimated at 416,574, an increase of 4.2% on the 2011 Census figure (CSO website).

The Inch Terminal site is located in Inch Electoral Division (ED), the boundary of which is outlined in **Figure 5.17.** According to preliminary 2016 Census data, Inch ED has population of 525 persons.

Figure 5.17: Inch Electoral Division Boundary



Whilst Inch is a rural sparsely populated area, it is located within commuting distance of Cork city, which is a central hub for employment, entertainment, education and retail. Thus population increase on the basis of the above is evident. The 2016 census data represents a population increase of 13.5% since 2011.

According to the preliminary 2016 census data, there are 225 dwellings in the Inch ED, including 16 vacant dwellings. The area is dominated by tourist related development and it is difficult to ascertain from a visual assessment if the majority of houses are occupied on a temporary or permanent basis. It is clear however, that there is a significant rise in visitor numbers evident during the summer months.

Tourist influxes during the summer months create pressure on public infrastructure and roads in a number of locations and can interfere with the residential amenity of the local population. However, the economic benefits are substantial and the influx of people can create a sense of energy that in turn can make towns and villages more desirable places to live and visit.

Analysis of Census 2016 data for the Inch ED indicates that labour force participation is relatively high. Specifically 59.6% of the labour force in the Inch ED are at work and unemployment is relatively low for the area at 3.8%. Agriculture is a key economic activity throughout the ED both in terms of direct farming of land and in food processing. Tourism, an oil refinery and power stations and other services together with more traditional manufacturing are also significant employers in the area. (census.cso.ie, 2016)

5.10.2 Human Health

Health in the local population is relatively good with 68.4% of the population in the Inch ED classifying their general health as ‘Very Good’ and a further 22% classifying their general health as ‘Good’.

In terms of relevant risks to public health, **Section 5.5.1** indicates that air quality metrics for 2015 (e.g. NO2, particulates) for rural coastal areas (zone D) and Cork city (zone B) were within EU limit values (O’Dwyer 2016) and are therefore unlikely to represent a significant health risk.

As detailed in **Section 5.4.2**, in terms of water quality and relevance to human health, the study area is underlain by a bedrock aquifer which is classified by the GSI as a ‘locally important’ aquifer, which is ‘moderately productive only in local zones.’ Groundwater quality in the aquifer is of ‘good status.

Kinsale Area Decommissioning Project

Environmental Impact Assessment Report

Volume 2

Main Text

Part 3 of 3

253993-00-REP-08 | 30 May 2018

Table of Contents

Page

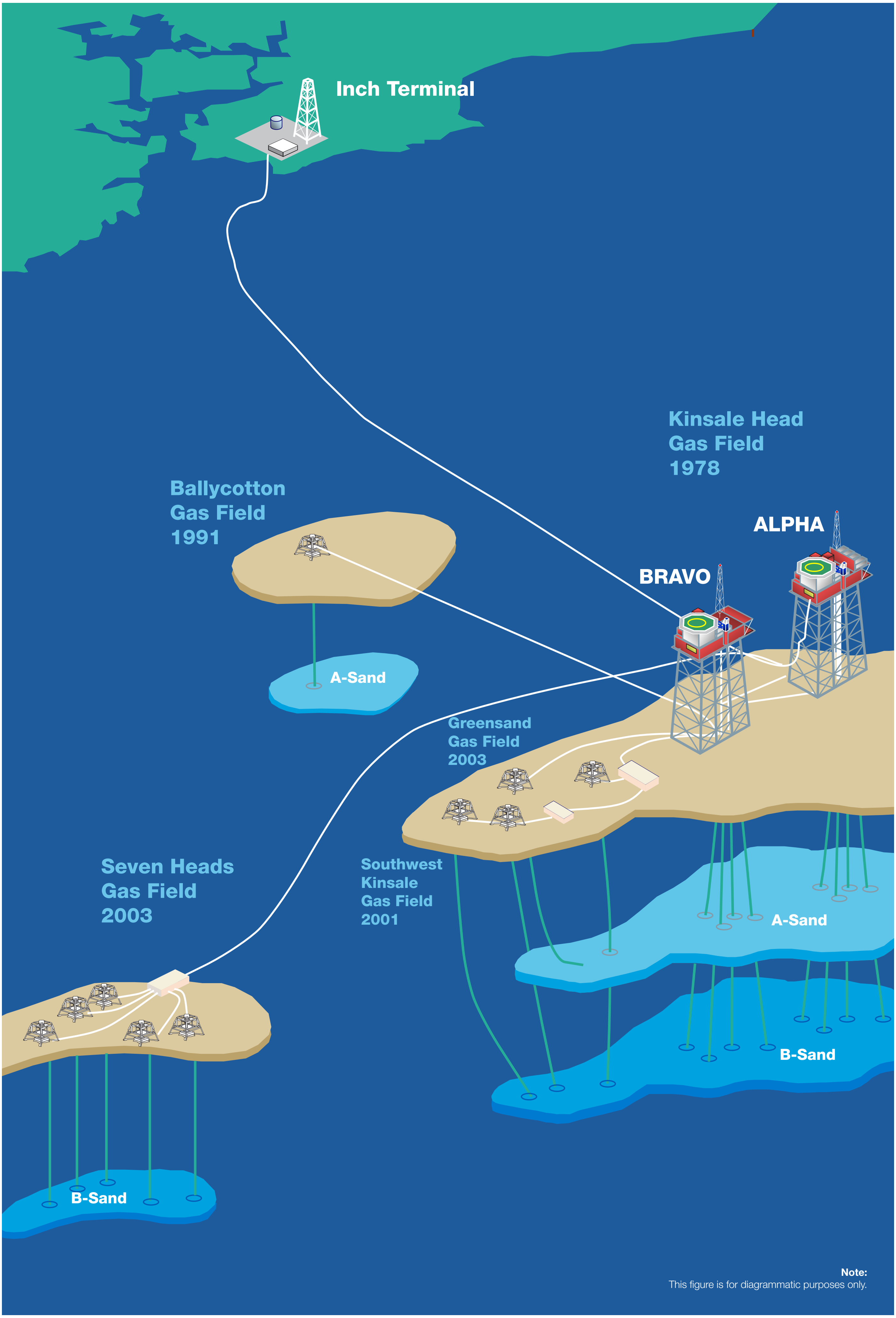
Tables

Figures

Appendices

Kinsale Area Decommissioning Project

Glossary of Terms


Inch Terminal
Kinsale Head
Gas Field
1978
Ballycotton
Gas Field
1991
ALPHA
BRAVO
A-Sand
Greensand
Gas Field
2003
Seven Heads
Gas Field
2003
Southwest
Kinsale
Gas Field
2001
A-Sand
B-Sand
B-Sand
Note:
This figure is for diagrammatic purposes only.

Glossary of Terms

Term	Explanation
AA	Appropriate Assessment
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
Bathymetry	Measurement of depth of water in oceans, seas, or lakes
Benthic Zone	Ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers
Biotope	Region of a habitat associated with a particular ecological community
Buoyancy tank	An enclosed air-filled section of a boat, ship or hovercraft designed to keep it afloat and prevent it from sinking
Bunker	Fill the fuel containers of a ship (refuel)
Bunkering	Supply of fuel for use by ships in a seaport
CA	Comparative Assessment
Cantilever	Structural element anchored at only one end to a support from which it is protruding
Caprock	Harder or more resistant rock type overlying a weaker or less resistant rock type
CCS	Carbon Capture and Storage
CRU	Commission for Regulation of Utilities Water and Energy
Cephalopods	Any member of the molluscan class Cephalopoda such as a squid, octopus or nautilus
CFP	Common Fisheries Policy
CH_4	Methane
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLC	CORINE Land Cover
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Concrete mattress	A series of concrete blocks usually connected by polypropylene ropes resembling a rectangular mattress, used for the weighting and/or protection of seabed structures including pipelines
CoP	Cessation of Production: the stage at which, after all economic development opportunities have been pursued, hydrocarbon production ceases.
CORINE	Co-Ordinated Information on the Environment
CSO	Central Statistics Office
CSV	Construction Support Vessel
DCCAE	Department of Communications, Climate Action and Environment
DCENR	Department of Communications, Energy and Natural Resources
DECC	Department of Energy & Climate Change (UK)

Term	Explanation
Decommissioning	Planned shut-down or removal of a building, equipment, plant, offshore installation etc.., from operation or usage offshore.
Demersal	Living close to the floor of the sea or a lake
Diesel	A low viscosity distillate fuel
DP	Dynamic Positioning: the use of thrusters and real time positional information to maintain the location of a vessel
Drill cuttings	Rock from the wellbore resulting from the mechanical action of the drill bit
DTTAS	Department of Transport, Tourism and Sport
DSV	Diving Support Vessel
ED	Electoral Division
EEMS	Environmental and Emissions Monitoring System
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
Epifauna	Animals living on the surface of the seabed or a riverbed, or attached to submerged objects or aquatic animals or plants.
EU28	Denotes the 28 member countries which make up the European Union
EUNIS	European Nature Information System
FBE	Fusion Bonded Epoxy
Flowline	Pipeline carrying unprocessed oil/gas within the oil or gas field area
Freespan	A free span on a pipeline is where the seabed sediments have been eroded, or scoured away leaving a void under the pipeline so that the pipeline is no longer supported on the seabed
GHG	Greenhouse gas
GNI	Gas Network Ireland
Grout	Particularly fluid form of concrete used to fill gaps, generally a mixture of water, cement, and sand
GWP	Global warming potential
HES	Health, Environment and Safety
HGV	Heavy Goods Vehicle
HFCs	Hydrofluorocarbons
HLV	Heavy-Lift Vessel
ICES	International Council for the Exploration of the Sea
IEMA	Institue of Environmental Management and Assessment
IMO	International Maritime Organisation
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's marine Resource, joint venture between the Geological Survey of Ireland and the Marine Institute.
In-Situ	In the original place.
Interconnector	Structure which enables energy to flow between networks, refers to international connections between electricity and natural gas networks

Term	Explanation
IOSEA	Irish Offshore Strategic Environmental Assessment
IPCC	Intergovernmental Panel on Climate Change
IRPA	Individual Risk Per Annum
Jacket	The structure comprising the “legs” of the offshore platform connected together by horizontal and diagonal trusses and usually made of welded tubular steel. The jacket is typically secured to the seabed by piles
Jack-up rig	A mobile floating drilling rig typically with three long triangular truss legs which can be lowered to the seabed to provide stability once on location
KA	Kinsale Alpha platform
KADP	Kinsale Area Decommissioning Project
KB	Kinsale Bravo platform
KPIs	Key Performance Indicators
km	Kilometre: 1,000m, equivalent to 0.54 nautical miles
L_{Aeq}	Sound levels that vary over time which results in a single decibel value which takes into account the total sound energy over the period of time of interest
LAT	Lowest Astronomical Tide
LCA	Life cycle assessment
Likelihood – Remote	Unlikely to occur
Likelihood – Unlikely	Once during decommissioning activity
Likelihood – Possible	Foreseeable possibly once a year
Likelihood – Likely	Once a month or regular short term events
Likelihood - Definite	Continuous or regular planned activity
LPP	Layer polypropylene
LULUCF	Land Use, Land Use Change and Forestry
LWIV	Light Well Intervention Vessel
Major Effect	• Change in ecosystem leading to medium term (2+ year) damage with recovery likely within 2 - 10 years to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites • Transboundary effects expected • Moderate contribution to cumulative effects • Issue of public concern • Possible effect on human health • Possible medium term loss to private users or public finance
Manifold	A pipe or chamber branching into several openings.
MARPOL	The International Convention for the Prevention of Pollution from Ships
Megaripple	An extensive undulation of the surface of a sandy beach or sea bed

Term	Explanation
Moderate Effect	• Change in ecosystem leading to short term damage with likelihood for recovery within 2 years to an offshore area less than 100 hectares or less than 2 hectares of a benthic fish spawning ground • Possible but unlikely effect on human health • Possible transboundary effects • Possible contribution to cumulative effects • Issue of limited public concern • May cause nuisance • Possible short term minor loss to private users or public finance
MODU	Mobile Offshore Drilling Unit
MPA	Marine Protected Area
MRCC	Marine Rescue Co-ordination Centres
Natura 2000 sites	Natura 2000 is a network of nature protection areas in the territory of the European Union. It is made up of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) designated respectively under the Habitats Directive and Birds Directive.
Negligible Effect	Change is within scope of existing variability but potentially detectable.
Nephrops	Genus of lobsters comprising a single extant species
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Statement
nm	Nautical Mile (1852m = 1 minute of latitude = 1/60 degree of latitude)
NMVOCs	Non-methane volatile organic compounds
None Foreseen (Effect)	No detectable effects.
NOx	Nitrogen Oxides
NPWS	National Parks and Wildlife Service
NTM	Notice to Mariners
NUI	Normally Unmanned Installation: an installation with minimal facilities which is not permanently crewed and is controlled from a remote location (e.g. other platform or shore)
OBMs	Oil Based Mud
OCNS	Offshore Chemical Notification Scheme
OECD	Organisation for Economic Co-Operation and Development
OGUK	Oil & Gas UK
OSPAR	Oslo and Paris Convention
OWF	Offshore Wind Farm
P&A	Plug and Abandon (wells)
PAD	Petroleum Affairs Division of the Department of Communications, Climate Action and Environment
Pelagic (fish)	Fish which live in the pelagic zone. The pelagic zone is any water in sea or lake which is neither close to the bottom nor near the shore.
PETRONAS	Petroliam Nasional Berhad

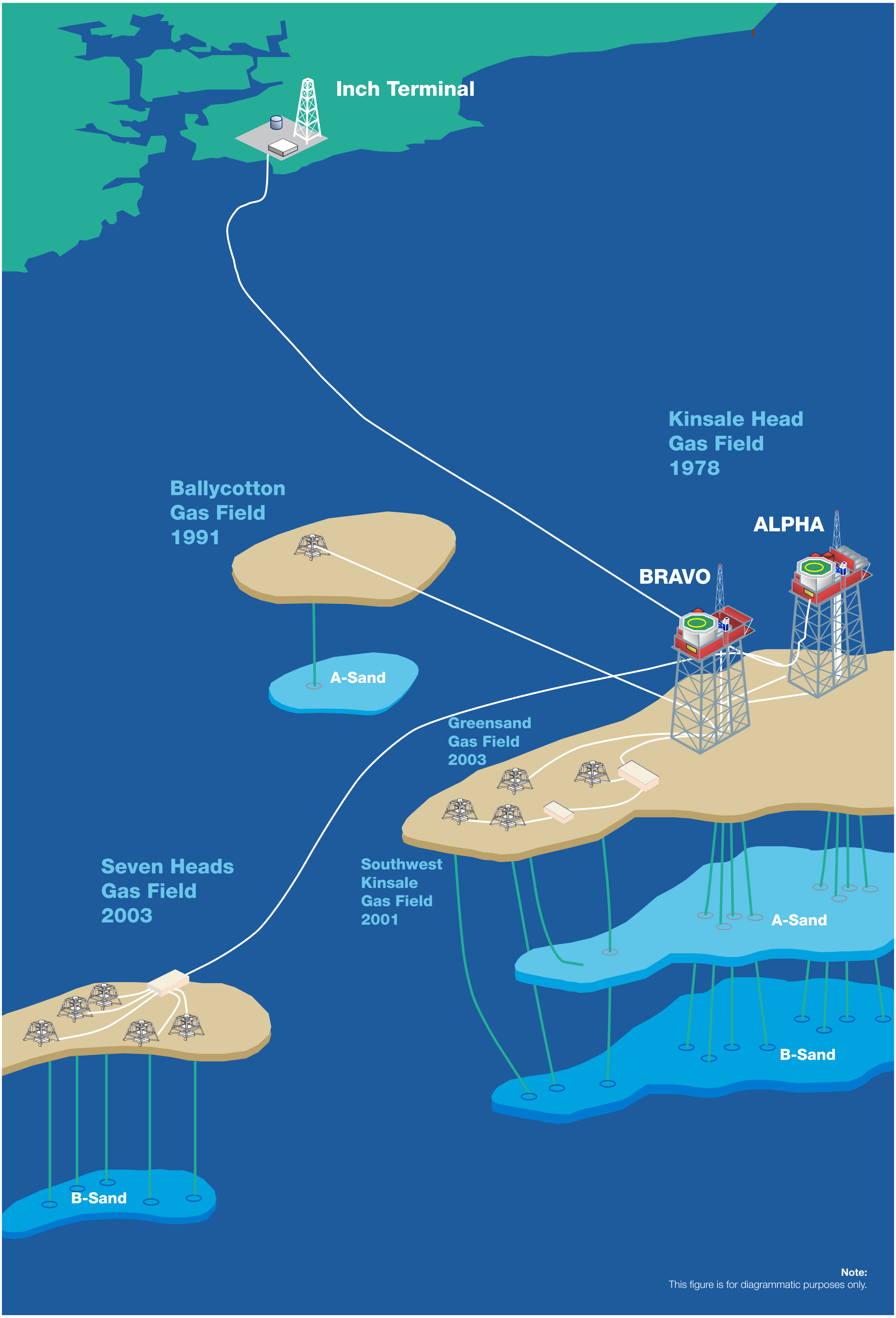
Term	Explanation
PFCs	Perfluorocarbons
Phytoplankton bloom	Plankton consisting of microscopic plants.
Piece Medium	Method of decommissioning the topside structures which involves the separating of the topsides into a number of medium size pieces for removal with a heavy lift vessel and transported to shore for further dismantling. Also known as 'reverse installation'.
Plankton	Small and microscopic organisms drifting or floating in the sea or fresh water
PLEM	Pipeline End Manifold
PLL	Potential Loss of Life
PLONOR	Pose Little or No Risk
PM_{10}	Particulate matter and smaller particulate matter of diameter less than or equal to 10 micrometers
Positive Effect	• Activity may contribute to recovery of habitats • Positive benefits to local, regional or national economy
PSV	Platform supply vessel
PUDAC	Permit to Use or Discharge Added Chemicals
Quaternary	The most recent major geological subdivision, encompassing the past ~2.6 million years up to and including the present day
RAMSAR	Intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
RF	Recovery Factor
Rigless intervention	A well-intervention operation conducted with equipment and support facilities that precludes the requirement for a rig over the wellbore
RMP	Record of Monuments and Places
ROV	Remotely Operated Vehicle: a small, unmanned submersible used for inspection and the carrying out of some activities such as valve manipulation
SAC	Special Area of Conservation: established under the Habitats Directive
SCANS	Small Cetaceans in European Atlantic waters and the North Sea
SEA	Strategic Environmental Assessment
Seafastening	Action of fastening/securing cargoes on ship with the aim of preventing them from movement while the ship is in transit
Semi-submersible rig	A floating mobile drilling rig supported on a number of pontoons, and typically anchored to the seabed while on station
Severe Effect	• Change in ecosystem leading to long term (10+ year) damage with poor potential for recovery to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites • Major transboundary effects expected • Major contribution to cumulative effects • Issue of acute public concern • Likely effect on human health • Long term, substantial loss to private users or public finance
SF	Sulphur hexafluoride

Term	Explanation
SFPA	Sea Fisheries Protection Authority
Shears	Cutting instrument in which two blades move past each other
Shelter	Place giving temporary protection from bad weather or danger
Shingle	a mass of small rounded pebbles
Shut-in	to close off a well so that it stops producing
Sidescan sonar	category of sonar system that is used to efficiently create an image of large areas of the sea floor
SO_2	Sulphur Dioxide
SOPEP	Shipboard Oil Pollution Emergency Plan
SOSI	Seabird Oil Sensitivity Index
SPA	Special Protection Area: established under the Birds Directive
Steel jackets	Structural sections made of tubular steel members, and are usually attached to the seabed using piles
Subcrop	Part of a geological formation that is close to the surface but is not a visible exposing of bedrock
Subsea manifold	Large metal piece of equipment made up of pipes and valves, designed to transfer oil or gas
SWK	South West Kinsale
TEG	Triethylene Glycol
Tidal Channel	Protion of a stream that is affected by ebb and flow of ocean tides, in the case that the subject stream discharges to an ocean, sea or strait
Tie-backs	Link between a satellite field and an existing production facility
TII	Transport Infrastructure Ireland
Topsides	The collective name for the many drilling, processing, accommodation and other modules which when connected together make up the upper section of the platform which rests on the installation jacket
TVD	Total Vertical Depth
UHO	Underwater Heritage Order
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKOOA	UK Offshore Operators Association
UNCLOS	UN Convention on the Law of the Sea
Umbilical	Cable and/or hose which supplies required consumables to an apparatus
VMS	Vessel Monitoring System
WDC	Western Drill Centre
WEEE	Waste Electrical and Electrical Equipment
Wet Gas	Any gas with a small amount of liquid present
WFD	Water Framework Directive

Kinsale Area Decommissioning Project

Section 6

Environmental Assessment Methodology and Identification of Potentially Significant Effects



Inch Terminal
Kinsale Head
Gas Field
1978
Ballycotton
Gas Field
1991
ALPHA
BRAVO
A-Sand
Greensand
Gas Field
2003
Seven Heads
Gas Field
2003
Southwest
Kinsale
Gas Field
2001
A-Sand
B-Sand
B-Sand
Note:
This figure is for diagrammatic purposes only.

6 Environmental Assessment Methodology and Identification of Potentially Significant Effects

6.1 Introduction

This Environmental Impact Assessment Report (EIAR) is intended to fulfil the requirements of the EIA Directive (2011/92/EU as amended by 2014/52/EU), providing an environmental appraisal of potentially direct and indirect significant effects of the KADP. The report provides the relevant information to allow the Competent Authority to undertake an Environmental Impact Assessment (EIA) and make a reasoned decision about approval of the KADP Decommissioning Plans.

Environmental issues were considered early in project planning, informed project design as part of the consideration of alternatives, and have informed the methodological options considered in this assessment. As noted in **Section 3**, decommissioning operations are also subject to a range of legally required standards and controls in respect of marine activities, all of which will be complied with.

The following environmental assessment allows for the identification (**Section 6.2**), description and assessment (**Section 7**) of the potentially significant effects of the project, along with the identification of mitigation measures (i.e. to avoid, prevent or reduce the significance of any effects), and any residual effects (**Section 8**) which would be taken forward into detailed project planning. The assessment is documented in **Section 7** and **Appendix D**, with mitigation measures described throughout as required. Responsibilities for ensuring compliance with legal standards and controls, environmental management commitments which form standard practice, and any proposed mitigation measures, are summarised in **Section 8**.

This is in accordance with the requirements of Article 3 of the EIA Directive as follows:

'1 'The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:

a. Population and human health;

b. Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC,

c. Land, soil, water, air and climate;

d. Material assets, cultural heritage and the landscape;

e. The interaction between the factors referred to in points (a) to (d).

2 The effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned.'

6.2 Effect Identification

Effects likely to arise from the activities associated with the KADP (relevant to those factors within the meaning of Article 3(1), above) have been identified on the basis of the nature of the project as described in **Section 3** (including its location, physical and operational characteristics, residues, emissions and wastes), considered against the description of the environment in **Sections 4** and **5** and the understanding of impact pathways from a range of sources, including:

- Regional and site specific environmental data, including an offshore pre-decommissioning environmental survey carried out in May 2017, and a site walkover at the Inch terminal site in June 2017
- Typical drilling rig and vessel specifications (e.g. for support, heavy lifts and rock placement)
- Estimates of materials and wastes arising from the decommissioning work
- Decommissioning planning studies and indicative information provided by decommissioning contractors and engineering consultants (refer to **Section 3.4**)

- Experience of relevant aspects and operations of analogous projects in the Celtic Sea, Irish Sea, North Sea and elsewhere
- Peer reviewed scientific papers describing the effects of specific and analogous interactions (cited throughout)
- Other publicly available “grey” literature
- The Irish Offshore Strategic Environmental Assessment (IOSEA) 4 Environmental Report and Irish Offshore Strategic Environmental Assessment (IOSEA) 5 Environmental Report
- Relevant conservation site designations, potential designations, and site advice etc.
- Applicable legislation, guidance and policies
- An Environmental Impact Assessment Report workshop involving Kinsale Energy and the report authors
- Input to the EIA process through consultation with relevant stakeholders (see **Section 1.8**).

6.2.1 Effect Categorisation

The process of identifying those environmental factors likely to be significantly affected by the KADP and associated results are documented in **Tables 6.1** and **6.2**. The identification of these factors, and an initial consideration of the significance of potential effects was carried out using defined severity criteria (**Table 6.1**), primarily based on a modified version of United Kingdom Offshore Operators Association (UKOOA) Environmental Impact Assessment Guidelines (UKOOA 1998), and taking account of Advice Notes for Preparing Environmental Impact Statements (EPA Draft September 2015) and on Information to be contained in an Environmental Impact Assessment Report (EPA Draft August 2017). It allows for the consideration of effect likelihood, scale, duration and frequency (**Table 6.2**), and forms the basis for those topics described and assessed in **Section 7**. Where effects are identified which are considerd to be minor and negligible, these are considered further in **Appendix D**.

The identification of potential effects (positive or negative) considered those which are direct and indirect, and which could lead to cumulative or transboundary effects. The vulnerability of the project to risks of major accidents and/or disasters of relevance has also been considered. While this includes a consideration of potential major accidents, as the Celtic Sea shows relatively little seismicity and is not prone to significant natural disasters, the potential for effects to be generated by such events has not been considered.

Table 6.2 is organised by those activities/sources of potential effect associated with the KADP; and the relevant consent applications for each activity/source of potential effect is indicated. These cover all the decommissioning activities irrespective of the final alternative methodologies selected (refer to **Section 3.5**). A summary of those activities and related sources of potentially significant effect are summarised in **Table 6.3a** and **b**.

Table 6.1: Criteria for the identification of potential effects from the Kinsale Area Decommissioning Project

Effect	Consequences
None Foreseen	No detectable effects
Positive	Activity may contribute to recovery of habitats Positive benefits to local, regional or national economy
Negligible	Change is within scope of existing variability but potentially detectable.
Moderate	Change in ecosystem leading to short term damage with likelihood for recovery within 2 years to an offshore area less than 100 hectares or less than 2 hectares of a benthic fish spawning ground Possible but unlikely effect on human health Possible transboundary effects Possible contribution to cumulative effects Issue of limited public concern May cause nuisance Possible short term minor loss to private users or public finance
Major	Change in ecosystem leading to medium term (2+ year) damage with recovery likely within 2 - 10 years to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites Transboundary effects expected Moderate contribution to cumulative effects Issue of public concern Possible effect on human health Possible medium term loss to private users or public finance
Severe	Change in ecosystem leading to long term (10+ year) damage with poor potential for recovery to an offshore area 100 hectares or more or 2 hectares of a benthic fish spawning ground or coastal habitat, or to internationally or nationally protected populations, habitats or sites Major transboundary effects expected Major contribution to cumulative effects Issue of acute public concern Likely effect on human health Long term, substantial loss to private users or public finance

Frequency with which Activity or Event Might Occur	Likelihood
Unlikely to occur	**Remote**
Once during decommissioning activity	**Unlikely**
Foreseeable possibly once a year	**Possible**
Once a month or regular short term events	**Likely**
Continuous or regular planned activity	**Definite**

	Likelihood				
Consequences	Definite	Likely	Possible	Unlikely	Remote
Severe	A5	A4	A3	A2	A1
Major	B5	B4	B3	B2	B1
Moderate	C5	C4	C3	C2	C1
Negligible	D5	D4	D3	D2	D1
Positive	E5	E4	E3	E2	E1
None foreseen					

(dark blue)	Potentially significant effects requiring assessment
(light blue)	Potential positive or minor or negligible effects
(white)	No likely effects

Notes:
1. The criteria to the left include consideration of issues of known public concern.
2. In addition to identification on the basis of these criteria, issues/interactions raised during stakeholder consultation are normally treated as requiring detailed consideration in the EIAR.

Table 6.2: Sources of potential effects, relevant environmental factors and related environmental receptors[1]

Environmental factor	Population & Human Health[2]	Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC[3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						Summary consideration
Activity/Source of Potential Effect		**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	
Consent Application 1																			
Platform well decommissioning[D]																			
Treated seawater and other well decommissioning related discharges			D4	D4							C4								Returns from wells are expected to be limited to excess cement, which is likely only as a contingency, and treated seawater. All returns will be treated on the platform prior to discharge and chemical use and discharge will be subject to a Permit to Use or Discharge Added Chemicals (PUDAC) in order to limit changes in water quality and any related effect on water column biota. See **Section 7.6**.
Power generation												C4							Minor, temporary contribution to existing atmospheric emissions, and global greenhouse gas concentrations. See **Section 7.8**.
Fugitive emissions from fuel & chemical storage												D4							Emissions include those from cement tanks and diesel storage and therefore have the potential to contribute to air quality effects. These are a minor, temporary increment to existing atmospheric emissions. See **Appendix D**.

[1] See **Sections 4** and **5** for a description of the receiving environment.
[2] This topic is largely considered in the context of other environmental factors, for example effects on air quality, climate, other users, landscape/seascape.
[3] Note that interactions between individual components of the biodiversity environmental factor have also been considered, for example effects on supporting habitats of species, or on prey species of other animals.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Solid & liquid wastes to shore	D4															C4		D4	Waste returns are limited but include conductors, surface casing sections, surplus cement chemicals and recovered surfactant. Materials returned to shore contribute to onshore activities such as materials processing and landfill, and may make a minor contribution to visual intrusion. See **Section 7.7**.
Platform surface noise & light							D2		D2										No significant change to current platform surface lighting (which could attract birds, for example on migration) or noise (e.g. from wireline unit). See **Appendix D**.
Mechanical cutting of and removal of surface casings		D4		D4	D4	C4	D4		C4	D4	D4								Underwater cutting will contribute to a temporary increase to overall KADP underwater noise, which is relevant to certain noise sensitive species including marine mammals. There will also be some discharge of millings to seabed. See **Sections 7.5 and 7.9**.
Removal of conductors		D4								C4	D4								Seabed disturbance and some sediment resuspension will result from the removal of the conductor and related casings to 10ft below seabed, with related interactions with benthic fauna. See **Section 7.4**.
Venting												D4							Small volumes of hydrocarbons are expected to be vented during the platform well abandonment campaign, which could contribute to localised air quality changes and global greenhouse gas loading. See **Appendix D**.
Subsea well decommissioning[D]																			
Drilling rig positioning		C4								C4	D4						C1		Seabed disturbance will be generated from anchor lay and catenary action of anchor chain, having interactions with seabed sediments and related benthic fauna. See **Section 7.4**.
Physical presence of drilling rig	C4					D4	D4						C4	D4	D4				Interactions with other users, particular fisheries, are limited by existing 500m subsea exclusion zones, though there will be the temporary presence of anchors and chain beyond these exclusion zones. See **Section 7.2**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						Summary consideration
Activity/Source of Potential Effect	Population & Human Health[2]	Benthic Fauna	Plankton	Fish & Shellfish	Marine Reptiles	Marine Mammals	Waterbirds & Seabirds	Onshore habitats/species	Conservation sites/species	Soils & Seabed[A]	Water Quality	Air & climate	Fisheries/aquaculture	Other Uses & Resources[B]	Shipping	Waste Treatment & Landfill resource onshore	Cultural Heritage[C]	Landscape/seascape	
Discharge of chemicals			D4	D4							C4								Limited returns from wells are expected. All chemical use and discharge will be subject to a PUDAC, in order to limit changes in water quality and any related effect on water column biota. See **Section 7.6**.
Drilling rig power generation				D4	D4	C4						C4							Contributes to overall KADP atmospheric emissions and global greenhouse gas concentrations. See **Section 7.8**. Power generation and drilling rig will contribute to overall KADP underwater noise, of most relevance to noise sensitive species including marine mammals. See **Section 7.5**
Fugitive emissions from fuel & chemical storage												D4							Emissions include those from cement tanks, mudpits, diesel storage and cooling/refrigeration systems and therefore have the potential to contribute to air quality effects. These are a minor contribution to overall KADP atmospheric emissions. See **Appendix D**.
Drainage, sewage, treated seawater and other well decommissioning related discharges from rig			D4	D4							D4								Rig discharges will contribute to local water quality changes, and associated interactions with water column biota. Returns from wells will be primarily of treated seawater, which will be discharged. All chemical use and discharge will be subject to a PUDAC. Rig discharges will include sewage and grey water from accommodation, and deck surface drainage. See **Appendix D**.
Solid & liquid wastes to shore	D4															C4		D4	Waste returns are mainly well heads, recovered casings, surplus cement and recovered surfactant. Materials returned to shore contribute to onshore activities such as materials processing and landfill, and may make a minor contribution to visual intrusion. See **Section 7.7**.
Rig surface noise & light							D4		D4										Incremental lighting and surface noise from the rig and any additional supply trips will be temporary and not significantly add to existing lighting or noise levels. See **Appendix D**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC[3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Mechanical cutting and removal of surface casings		D4		D4	D4	C4			C4	C4	D4								Underwater cutting will contribute to overall KADP underwater noise. See **Sections 7.5 and 7.9**. Some discharge of millings to seabed and seabed disturbance from the removal of the casings to 3m below seabed. See **Section 7.4**.
Venting												D4							Small volumes of hydrocarbons are expected to be vented during the subsea well abandonment campaign, which could contribute to localised air quality changes and global greenhouse gas loading. See **Appendix D**.
Offshore facilities preparation: topsides, pipeline degassing and displacement of umbilical contents																			
Flushing and cleaning of topsides			D2							D2	D2	D2				D2			A production history of dry gas limits the potential for significant hydrocarbon content or hazard of discharge (atmospheric or liquid), which could interact with the water column and related biota, or affect air quality. Inventories (e.g. diesel, chemical) will be retained and returned to shore. See **Appendix D**.
Removal of hazardous materials (e.g. asbestos, refrigerants)																C2			Certain wastes will require specific handling and disposal methods, and will represent a minor increase in the volumes of such material. Any materials returned to shore contribute to onshore activities such as materials processing and landfill, and may make a minor contribution to visual intrusion when in transit. See **Section 7.7**.Certain wastes will require specific handling and disposal methods, and will represent a minor increase in the volumes of such material.
Removal of WEEE																D2			

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	Population & Human Health[2]	Benthic Fauna	Plankton	Fish & Shellfish	Marine Reptiles	Marine Mammals	Waterbirds & Seabirds	Onshore habitats/species	Conservation sites/species	Soils & Seabed[A]	Water Quality	Air & climate	Fisheries/aquaculture	Other Uses & Resources[B]	Shipping	Waste Treatment & Landfill resource onshore	Cultural Heritage[C]	Landscape/seascape	Summary consideration
Displacement of contents of pipelines and umbilicals			D2	D2							D2								Pipeline contents and umbilical chemical lines will be displaced by seawater to subsea/platform wells. The 24" and potentially the 18" Seven Heads export pipelines will be initially filled with inhibited seawater and capped. No marine discharges will be associated with this activity (see **Appendix D**), however, the removal of spool pieces and umbilical jumpers, and release of inhibited seawater as part of other operations will result in limited discharges. These are considered against the relevant activities/sources of potential effect (subsea structure and jacket removal, legacy discharges) below.
Topsides removal[D]																			
Cutting, welding and rigging of structures to be lifted												D2							Minor, limited sources of temporary airborne noise and emissions undertaken at some distance from shore (at least 40km). See **Appendix D**.
Utilities preparation and temporary accommodation on KB											D2					D2			Limited and temporary increment to sources of domestic waste from increased personnel, which results in dischargers to sea and related interactions with water quality. See **Appendix D**.
Subsea structure decommissioning[D]																			
Mattress removal		C4		D4						C4	D4		D4			C4			Seabed disturbance and resuspension of sediment into the water column will be generated from the removal of protection materials to gain access to pipelines/umbilicals, and the cutting and lifting of spool
Cutting of spool pieces & umbilical jumpers (including at manifolds and valve skids)		C4		D4		D4			D4	C4	D4		D4						

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Removal of spools pieces		C4	D4	D4						C4	D4		D4			C4			pieces. Incremental underwater noise will be generated from the cutting of pipelines/umbilicals, resulting in potential impacts for noise sensitive species, however, these are likely to be cut by hydraulic shears rather than mechanical wire or abrasive water jet methods. See **Sections 7.4** and **7.5**. Chemical discharges to sea will include hydraulic fluids from umbilicals, and possibly a minor release of surfactants from pipeline cleaning during the facilities preparation works. See **Section 7.6**.
Removal of manifolds and wellhead protection structures		C4		D4						C4	D4		D4			C4			Seabed disturbance and resuspension of sediment into the water column will result from the removal of subsea structures including related protection blocks. Materials returned to shore contribute to onshore activities such as materials processing, and may make a minor contribution to visual intrusion when in transit. See **Section 7.4**.
Consent Application 2																			
Jacket decommissioning[D]																			
Mattress removal		C4		D4						C4	D4		D4			C4			Seabed disturbance and resuspension of sediment into the water column will be generated from the removal of protection materials to gain access to pipelines/umbilicals, and the cutting and lifting of spool pieces. Incremental underwater noise will be generated from the cutting of pipelines/umbilicals, resulting in potential impacts for noise sensitive species however, these are likely to be cut by hydraulic shears rather than mechanical wire or abrasive water jet methods. See **Sections 7.4** and **7.5**. Chemical discharges to sea will include hydraulic fluids from umbilicals, and possibly a minor release of surfactants from pipeline cleaning during the facilities preparation works. See **Section 7.6**.
Cutting of spool pieces & umbilical jumpers		C4		D4		D4			D4	C4	D4		D4						
Removal of spools pieces		C4	D4	D4						C4	D4		D4			C4			

Environmental factor	Population & Human Health[2]	Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						Summary consideration
Activity/Source of Potential Effect		**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	
Abrasive, high pressure water jet and other cutting (internal and external cuts)		D2		C2	D2	C2			C2	D2	D2								Cutting tools introduce a temporary source of underwater noise, additional to other sources from KADP and wider ambient noise from vessels most relevant to noise sensitive species including marine mammals. There is the potential for some seabed interaction at the cutting locations, and related disturbance. See **Sections 7.5** and **7.9**.
Excavation of piles/remediation of any stumps	C2	C2	D2	D2		C2				C2	D2		C2						Removal results in seabed disturbance, temporary sediment dispersal in the water column, and application of hard substrate (rock cover) should any pile stumps be left and require remediation. See **Sections 7.3** and **7.4**.
Marine growth removal	C2	D2	D2	D2		D2				D2	D2					C2			A quantity of marine growth will be removed offshore during cutting and lifting operations, or due to decay on transportation, however the majority will be disposed of onshore. The decay of marine growth at the yard location is likely to cause short-term deterioration in air quality (primarily odour). See **Section 7.6**.
Lift of jacket		C2	D2	C2						C2	D2		D2						The lift will generate seabed disturbance and temporary sediment dispersal in the water column. See **Section 7.4**.
Recovery of large items of debris from seabed post jacket removal		C2	D2	D2						C2	D2								Removal results in seabed disturbance and temporary sediment dispersal in the water column, See **Section 7.4**.
Physical presence of jackets in "lighthouse mode"													C4	C4	C4				The jackets may be left in "lighthouse mode" following topside removal for up to 10 years, and would retain their existing exclusion zones and be subject to aids to navigation and notices to mariners. The continued presence of the jackets, though well established, would have relevant effects for fisheries, shipping and other offshore users. See **Section 7.2**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Surface lighting							D5		D5										If placed in “lighthouse mode”, aids to navigation, including lighting, will be in place for up to 10 years, but will not add to existing light levels. Continued lighting maintains the potential for interactions resulting from bird attraction. See **Appendix D**.
Pipeline and umbilical decommissioning[D]																			
Remedial rock placement	C4	C4		D4		D4			D4	C4			C4	D4	D4				There will be a legacy of pipelines/umbilicals and rock cover on the seabed following decommissioning. See Section 7.3, along with the introduction of hard substrates (rock cover). See **Section 7.4**. These will generate localised impacts on seabed habitats, and also represent a source of potential interaction for other users, for which they are providing remediation and risk reduction. There will be a contribution to KADP underwater noise, which has the potential to impact on noise sensitive species. See **Section 7.5**.
Release of inhibited seawater from export pipelines			D2	D2							C2								The 24” and potentially the 18” Seven Heads export pipelines will be initially filled with inhibited seawater and capped as part of facility preparatory works. The removal of the seaward cap if no re-use option is identified will allow the inhibited water to gradually escape over time, or else it would be discharged at sea at a later date if re-used (refer to **Section 3.5.4.2**). This discharge at reuse will have local water quality impacts, and the potential for effects on certain water column biota are also considered. See **Section 7.6**.
Pipeline and umbilical exposure	B1												B1	C1	C1				Potential third party risks resulting from the snagging of fishing gear or vessel anchors. See **Section 7.3**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Pipeline and umbilical degradation	B1		D2	D2						C1	D2		B1	C1	C1				Pipelines and umbilicals are constructed of non-toxic and relatively inert materials (carbon steel, concrete, plastics). Potential future third party risks resulting from the snagging of fishing gear or vessel anchors. See **Section 7.3**. There will be some minor "legacy" discharges as pipelines and umbilicals degrade, but these are small in volume and would rapidly disperse (see **Section 7.6**).
Post-decommissioning survey[D]																			
Post-decommissioning survey	D2			D2	D2	C2	D2		C2				D2	D3	D2			D2	The survey would include the use of noise generating equipment; including side-scan sonar and MBES and therefore contribute to overall KADP underwater noise, and the potential for impact on noise sensitive species. The physical presence of the vessel has the potential for interaction/disturbance through physical presence, of birds and marine mammal species, and other users of the sea. See **Sections 7.5 and 7.9**.
Relevant to Consent Applications 1 & 2																			
Socio-economic effects	D5																		Loss of *ca*. 60 permanent jobs (on- and offshore) and related contributions to local economy. Adverse effects on population and human health not considered likely given the job opportunities in the expanding economic base of County Cork and Ireland. Positive short term effect through provision of jobs associated with offshore decommissioning and terminal demolition work.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Support and other vessels associated with the decommissioning																			
Presence in field of supply vessels, barge/ or heavy lift vessels.						C4	D4		C4				D4	D4	D4				Vessels will be present for a limited period of time, with much activity taking place in existing exclusion zones, limiting potential interactions with other users. There is the potential for interaction/disturbance through physical presence, of birds and marine mammal species. See **Sections 7.2** and **7.9**.
Transit of supply vessels, barge/ or heavy lift vessels, survey vessel and transport to shore	D4					C4	D4		C4				C4	C4	C4			D4	Vessels in transit have the potential to interact with other users and also generate temporary visual impacts. Vessels will follow established navigation routes. There is the potential for interaction with birds and marine mammals as above. See **Sections 7.2** and **7.9**.
Vessel positioning: Anchoring		C3								C3							C1		Limited anchoring envisaged, for example anchoring required for conventional HLV if used to remove platforms. Vessels will mainly use DP and therefore there will be limited seabed disturbance from anchor lay and catenary action of anchor chain. See **Section 7.4**.
Underwater noise from vessels including DP and rock placement				D4	D4	C4			C4										Vessels will contribute to overall KADP underwater noise, which has the potential to impact on noise sensitive species. See **Sections 7.5** and **7.9**.
Vessel and ancillary equipment power generation	D4											C4							Contributes to overall KADP atmospheric emissions, with the potential to impact local air quality and global greenhouse gas loading. See **Section 7.8**.
Drainage, sewage & other discharges			D4	D4							D4								Discharges from vessels will be subject to controls under MARPOL. No significant discharges. See **Appendix D**.
Litter					D4	D4				D4	D4								
Airborne noise and lighting	D4						D4											D4	Incremental lighting will be temporary and will not significantly add to existing lighting levels. Activity is concentrated at the Kinsale Head and Seven Heads locations at least 40km from shore. Helicopters will follow established routes. See **Appendix D**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Potential for introduction of alien species in ballast, or as external fouling growth		C1	C1																Ballasting will be undertaken in keeping with Ballast Management Plans under the Ballast Water Management Convention. Applies to vessels and drilling rig. See **Appendix D**.
Onshore aspects of decommissioning offshore structures																			
Offloading of structures	C4													D4	D4			D4	Structures will be transported to established yards where dismantling will represent an increment to existing activity rather than a new type of activity. There is the potential for interaction with other users, and transient visual impacts, during transport to shore. See **Sections 7.2** and **7.7**.
Storage/Dismantling of structures onshore	C3											C3		D3				D3	Potential for minor incremental air quality effects from noise, dust, odour and visual intrusion, though note above that this would be incremental to ongoing activity. See **Sections 7.6** in relation to marine growth removal and **7.7**.
Refurbishment and reuse												E4		D4		E4			Minor positive effect from material reuse, offsetting use of primary raw material and avoiding waste to landfill. See **Section 7.7** and **7.8**.
Materials recycling												E4		C4		E4			
Onshore waste treatment												C3				C3			All represent a minor increment to waste handling and disposal at existing licenced facilities, and to the transport of such material to these sites for which there may be minor visual intrusion. Disposal of certain wastes may take place outside Ireland. See **Section 7.7**.
Landfill of residual waste																C3		C3	
Road transport of waste/materials	C4											D4						D4	
Hazardous materials	C4															C4			
Accidental events																			
Dropped objects	B2									B2			B2						Depending on their nature dropped objects could have localized impacts on the seabed and represent a hazard to other users. Debris clearance to take place as part of decommissioning operations. See **Sections 7.3** and **7.10**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC[3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Accidental releases to atmosphere (including refrigerants and natural gas from well blowout)												B1							The decommissioning of relevant equipment, recovery of for example refrigerants and their subsequent treatment or disposal will be carried out by appropriately certified persons and facilities. The possibility of a well blowout is extremely remote because of low reservoir pressures and the well control procedures to be in place. See **Section 7.10**.
Vessel collision	B1												B1	C1	B1				There will be limited increment in vessel traffic to the Kinsale Area during decommissioning which have the potential to interact with other users when in transit or on location. Vessels will display navigational lighting, guard vessels may be used for certain activities (subsea well decommissioning), and all activities will be communicated through Notices to Mariners. See **Section 7.10**.
Accidental spills of fuel/lubricants	C1	B1	B1	B1	B1	B1	B1		B1	B1	B1	C1	B1	B1	C1	C1			Major spills have the potential to interact with a wide range of environmental factors by their potential to spread some distance from source. The only potential source of a large spill as part of the KADP would be from the diesel tanks of the rig and large vessels such as HLVs. Appropriate handling and bunkering procedures would be in place to minimise the risk of accidental releases of fuels. See **Sections 7.9** and **7.10**.
Hydraulic fluid loss from subsea tools and equipment			D2	D2							D2								Hydraulic fluid usage will be monitored. See **Appendix D**.
Chemical spills		D2	C2	D2						D2	C2								Appropriate chemical handling and storage procedures will be in place. All chemicals chosen will be subject to a PUDAC. See **Section 7.10**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC [3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	**Population & Human Health[2]**	**Benthic Fauna**	**Plankton**	**Fish & Shellfish**	**Marine Reptiles**	**Marine Mammals**	**Waterbirds & Seabirds**	**Onshore habitats/species**	**Conservation sites/species**	**Soils & Seabed[A]**	**Water Quality**	**Air & climate**	**Fisheries/aquaculture**	**Other Uses & Resources[B]**	**Shipping**	**Waste Treatment & Landfill resource onshore**	**Cultural Heritage[C]**	**Landscape/seascape**	**Summary consideration**
Covered in site planning permission; not relevant to Decommissioning Plan consent applications																			
Onshore (decommissioning of Inch Terminal)																			
Lighting and noise associated with dismantling works	D4							D4										D4	No nighttime working. Closest human receptor approx. 200m from main site. Compliance with TII noise limits. Site of low ecological value. See **Appendix D**.
Vehicle emissions and dust	D2							D2				D2							Closest human receptor approx. 200m from main site. Site of low ecological value Approx. 11 HGV movements per day considered negligible impact Standard construction dust minimisation plan. See **Appendix D**.
Road transport of waste/materials	D3											D2							Surrounding road network lightly trafficked Approx. 11 HGV movements per day considered negligible impact Standard demolition management plan – designated traffic routes, timing and parking arrangements. Only permitted waste hauliers used. See **Appendix D**.
Materials recycling/recovery												D2				D2			Only appropriate permitted and/or licensed waste facilities used. Demolition Resource and Waste Management Plan – segregate at source, etc. See **Appendix D**.
Landfill of residual waste																D2		D2	Only appropriate permitted and/or licensed waste facilities used. Demolition Resource and Waste Management Plan – segregate at source, etc. Only residual waste to landfill. See **Appendix D**.

Environmental factor		Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC[3]								Land, soil, water, air, climate			Material assets, cultural heritage and landscape						
Activity/Source of Potential Effect	Population & Human Health[2]	Benthic Fauna	Plankton	Fish & Shellfish	Marine Reptiles	Marine Mammals	Waterbirds & Seabirds	Onshore habitats/species	Conservation sites/species	Soils & Seabed[A]	Water Quality	Air & climate	Fisheries/aquaculture	Other Uses & Resources[B]	Shipping	Waste Treatment & Landfill resource onshore	Cultural Heritage[C]	Landscape/seascape	Summary consideration
Reinstatement to original land condition	E5																	E5	Positive long term impact. See **Appendix D**. With regard to the onshore elements of the KADP, there will be no physical disturbance to the land around the pipeline and there will be no works at Inch Beach. All works on the terminal site will be confined to within the boundary of the site and no works will go below the depth of the existing development. This will result in no likely effects on existing onshore cultural heritage.

Notes:

A. Includes natural seabed features.

B. Includes amenity, cables, oil and gas, aggregate and other dredging, military, renewables etc.

C. Includes underwater archaeology and wrecks

D. Vessels which could be used under all decommissioning methods noted in Section 3.5 are considered separately under the heading, "Support and other vessels associated with the decommissioning"

6.3 Potential Effects to be Considered Further

The potential for significant effects were identified in relation to environmental factors for a number of KADP activities (**Table 6.2**). The major sources of potentially significant effect have been grouped against those decommissioning activities identified as likely to, directly or indirectly, affect one or more relevant environmental factors (and interactions between these). These have been listed by consent application in **Tables 6.3a and 6.3b,** and are described and assessed in detail in **Section 7**.

Appendix D includes a summary description and assessment of those activities/sources of potential effect (positive or negative) which are identified to be minor and negligible (also identified in **Table 6.2**). This includes all of those impacts identified for the Inch Terminal decommissioning.

The potential for cumulative or transboundary effects associated with the KADP are considered in **Sections 7.11** and **7.12**, taking into account the assessment made in **Sections 7.2-7.10** and **Appendix D** of all potential effects (significant, minor, negligible; positive and negative).

Table 6.3a: Consent Application 1: Potential significant environmental effects described and assessed in Section 7

Environmental Factor	Activity/Source of Potential Significant Effect	Relevant Section
a. Population and human health	**Physical presence: decommissioning operations**: physical presence in field and in transit of supply vessels, barge/or heavy lift vessels.	7.2
	Waste: materials recycling, reuse and disposal: Offloading and storage/dismantling of offshore structures onshore, road transport and hazardous material handling.	7.7
	Accidental events: dropped objects, vessel collision, accidental spills of fuel/lubricants.	7.10
b. Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;	**Physical presence: decommissioning operations**: physical presence in field and in transit of supply vessels, barge/ or heavy lift vessels.	7.2
	Physical disturbance: drill rig positioning and vessel anchoring. Mattress removal, cutting of spool pieces and umbilical jumpers and their subsequent removal. Removal of manifolds and wellheads.	7.4
	Underwater noise: mechanical cutting and removal of surface casings. Rig and vessel noise, including DP.	7.5
	Discharges to sea: cementing and other chemicals associated with well abandonment operations. Hydraulic fluid release during umbilical cutting.	7.6
	Accidental events: accidental spills of fuel/lubricants and chemical spills.	7.10
c. Land, soil, water, air and climate;	**Physical disturbance**: drill rig positioning and vessel anchoring. Removal of well conductors and surface casings, mattress removal, cutting of spool pieces and umbilical jumpers and their subsequent removal. Removal of manifolds and wellheads.	7.4
	Discharges to sea: cementing and other chemicals associated with well abandonment operations. Hydraulic fluid release during umbilical cutting.	7.6
	Waste: materials recycling, reuse and disposal: storage/dismantling of structures onshore, onshore waste treatment.	7.7
	Energy use and atmospheric emissions: power generation (rig and vessel).	7.8
	Accidental events: dropped objects, accidental releases to atmosphere (including natural gas blowout), accidental spills of fuel/lubricants and chemical spills.	7.10

Environmental Factor	Activity/Source of Potential Significant Effect	Relevant Section
d. Material assets, cultural heritage and the landscape;	**Physical presence: decommissioning operations**: physical presence of drilling rig and vessels	7.2
	Physical disturbance: drill rig positioning and vessel anchoring.	7.4
	Waste: materials recycling, reuse and disposal: solid and liquid wastes to shore, removal of hazardous materials, materials recycling, onshore waste treatment, landfill of residual waste/materials, hazardous material handling.	7.7
	Energy use and atmospheric emissions: materials recycling.	7.8
	Accidental events: dropped objects, vessel collision, accidental spills of fuel/lubricants.	7.10
the interaction between the factors referred to in points (a) to (d).	**Physical presence: decommissioning operations**: none identified.	n/a
	Physical disturbance: effects on supporting habitats of species.	7.4
	Underwater noise: disturbance of prey species of other animals (including those which are subject to legal protection).	7.5
	Discharges to sea: none identified.	n/a
	Waste: materials recycling, reuse and disposal: none identified	n/a
	Energy use and atmospheric emissions: though emissions are minor, their addition to greenhouse gas loading is relevant to the issue of climate change which is relevant to all environmental factors.	7.8
	Accidental events: effects on prey species of other animals (including those which are subject to legal protection), effects on fisheries resulting from effects on commercially relevant species, possible loss of tourism income.	7.10

Table 6.3b: Consent Application 2: Potential significant environmental effects described and assessed in Section 7

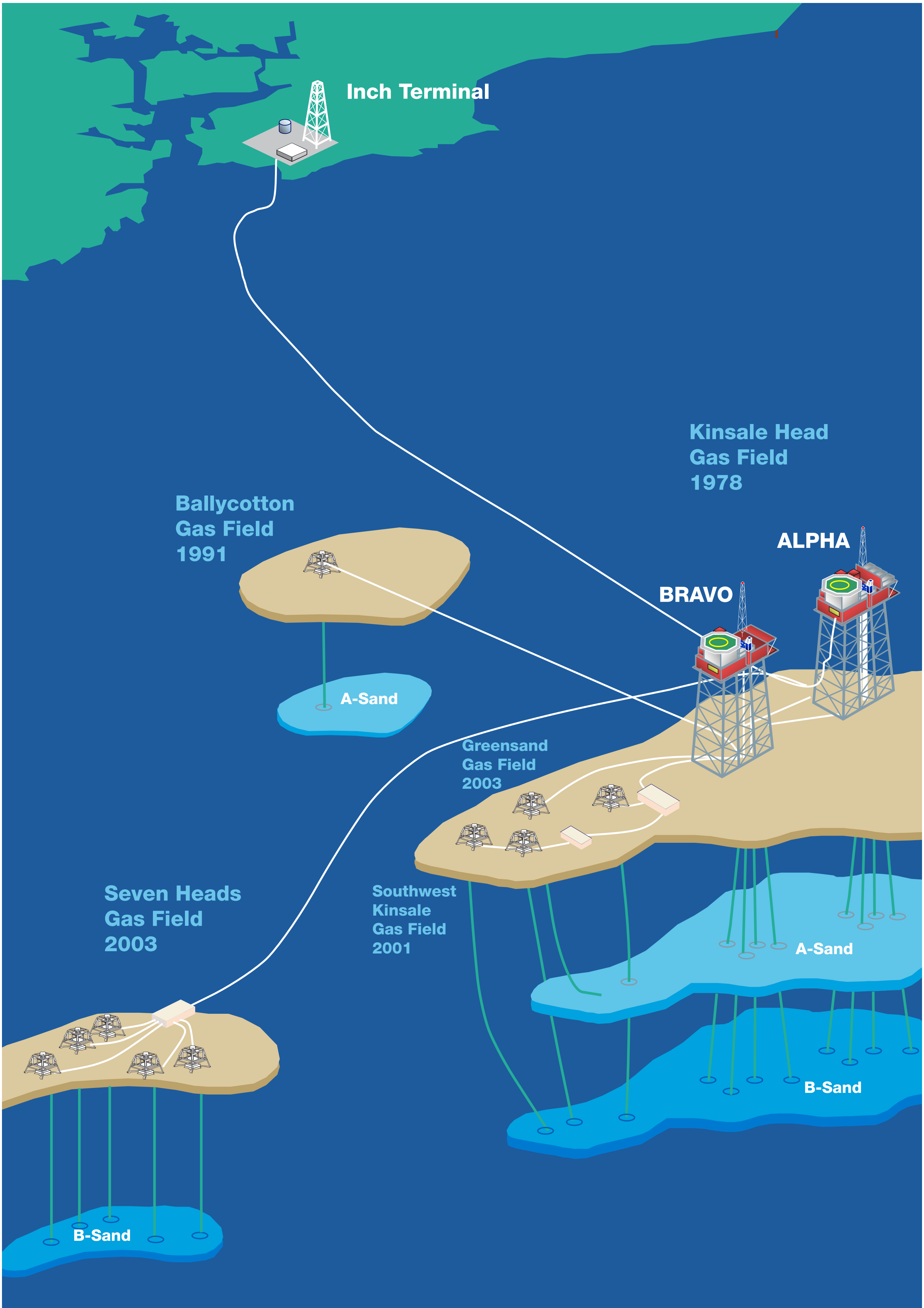
Environmental Factor	Activity/Source of Potential Significant Effect	Relevant Section
a. Population and human health	**Physical presence: decommissioning operations**: physical presence in field and in transit of supply vessels, barge/ or heavy lift vessels.	7.2
	Physical presence: legacy materials (left *in situ*): pipeline and umbilical exposure, pipeline and umbilical degradation	7.3
	Waste: materials recycling, reuse and disposal: Offloading and storage/dismantling of offshore structures onshore, road transport.	7.7
	Accidental events: dropped objects, vessel collision, accidental spills of fuel/lubricants.	7.10
b. Biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;	**Physical presence: decommissioning operations**: physical presence in field and in transit of supply vessels, barge/ or heavy lift vessels.	7.2
	Physical disturbance: Vessel anchoring. Excavation of jacket piles/leg stump remediation and lift of jacket. Recovery of large items of debris from the seabed. Remedial rock placement.	7.4
	Underwater noise: cutting of jacket legs and structural members. Vessel noise, including DP. Rock placement. Post-decommissioning survey.	7.5
	Accidental events: accidental spills of fuel/lubricants and chemical spills.	7.10

Environmental Factor	Activity/Source of Potential Significant Effect	Relevant Section
c. Land, soil, water, air and climate;	**Physical disturbance**: vessel anchoring. Excavation of jacket piles/leg stump remediation and lift of jacket. Recovery of large items of debris from the seabed. Remedial rock placement.	7.4
	Discharges to sea: release of inhibited seawater from export pipelines.	7.6
	Waste: materials recycling, reuse and disposal: storage/dismantling of structures onshore, onshore waste treatment.	7.7
	Energy use and atmospheric emissions: power generation (vessels).	7.8
	Accidental events: dropped objects, accidental spills of fuel/lubricants and chemical spills.	7.10
d. Material assets, cultural heritage and the landscape;	**Physical presence: decommissioning operations**: physical presence of vessels.	7.2
	Physical presence: legacy materials: Pipeline degradation and exposure, including freespans (left *in situ*).	7.3
	Physical disturbance: Excavation of jacket piles/leg stump remediation, remedial rock placement, vessel anchoring.	7.4
	Waste: materials recycling, reuse and disposal: materials recycling, onshore waste treatment, landfill of residual waste/materials.	7.7
	Energy use and atmospheric emissions: materials recycling.	7.8
	Accidental events: dropped objects, vessel collision, accidental spills of fuel/lubricants.	7.10
the interaction between the factors referred to in points (a) to (d).	**Physical presence: decommissioning operations**: none identified.	n/a
	Physical presence: legacy materials: none identified.	n/a
	Physical disturbance: effects on supporting habitats of species.	7.4
	Underwater noise: disturbance of prey species of other animals (including those which are subject to legal protection).	7.5
	Discharges to sea: none identified.	n/a
	Waste: materials recycling, reuse and disposal: none identified	n/a
	Energy use and atmospheric emissions: though emissions are minor, their addition to greenhouse gas loading is relevant to the issue of climate change which is relevant to all environmental factors.	7.8
	Accidental events: effects on prey species of other animals (including those which are subject to legal protection), effects on fisheries resulting from effects on commercially relevant species, possible loss of tourism income.	7.10

Kinsale Area Decommissioning Project

Section 7

Consideration of Potential Significant Effects



Note:
This figure is for diagrammatic purposes only.

7 Consideration of Potential Significant Effects

7.1 Introduction

The following section presents a description and assessment of those potential significant environmental effects identified in **Section 6**. The assessment has been undertaken on the basis of the chosen decommissioning alternatives, as described in **Section 3**. These include a worst case assessment (e.g. in terms of vessel timings and seabed interactions), such that those effects described below will not be exceeded, regardless of the final methodology selected.

The assessment makes reference to the relevant project consent application as appropriate, but concentrates on the effects of the project as a whole.

Environmental management actions (including proposed mitigation measures) and residual effects for the decommissioning activities are identified throughout the assessment and are summarised in **Section 8**.

7.2 Physical Presence: Decommissioning Operations

The key sources of physical presence effects associated with the decommissioning operations split by consent application are shown below, with reference to the relevant environmental factors detailed in the EIA Directive (see **Section 6.1**).

Facility	Activity/Source of Potential Effect	Relevant Environmental Factors
Consent Application 1		
Offshore facilities preparation	Presence in field of support/supply vessels, and transport to shore	*Population and human health; Biodiversity, Material assets, cultural heritage and the landscape*
Platform wells	Presence in field of support/supply vessels, and transport to shore	
Subsea wells	Physical presence of the drilling rig or LWIV Presence in field of support/supply vessels, and transport to shore	
Topsides removal	Presence in field of supply vessels, barge and HLV Transit of supply vessels, barge and HLV, and transport to shore of topsides	
Subsea structures	Physical presence in field and in transit of vessels, and transport to shore of subsea structures, protection materials, spool pieces and umbilical jumpers	
Consent Application 2		
Jackets	Presence in field of supply vessels, barge and HLV Transit of supply vessels, barge or HLV, and transport to shore of jackets, protection materials, spool pieces and umbilical jumpers	*Population and human health; Biodiversity, Material assets, cultural heritage and the landscape*
Pipelines and umbilicals	Physical presence in field and in transit of vessels, mainly rock fall-pipe vessel and post-decommissioning survey vessel	

The potential for effects from physical presence were identified in **Section 6** for the broad environmental factors; population and human health, biodiversity (including conservation sites and species) and material assets, cultural heritage and landscape (**Tables 6.3a** and **6.3b**). More specifically, the potential for effects was identified for fish, marine mammals and birds, other users of the sea (including fisheries, shipping and recreational boating) and landscape (and by association population and human health). A description and assessment of the potential effects is provided below.

7.2.1 Potential effects on other users

Regardless of the alternative methodologies selected to decommission the Kinsale Area offshore facilities, there will be rig, supply and other vessel presence/movements (e.g. HLV, barge, tugs, AHV, CSV, guard vessel, survey vessel), including when in transit and when operating within the Kinsale Area. The timing of vessel operations, by consent application, is outlined in **Section 3.5** and an overall project schedule is provided in **Section 1.6**. The decommissioning programme of works is expected to take 12-18 months to complete. However, these operations may not be continuous with an overall schedule of up to 10 years for all the work to be completed.

The physical presence of the vessels has the potential to affect other users of the sea through disruption of their activities, including shipping, fishing and recreational boating. The scale of the effect on shipping and recreational boating is limited by the nature of shipping traffic in the area (to/from Cork), the bulk of which passes to the northeast of the Kinsale Area (DCENR 2011, also see **Section 4.5**), and despite coastal waters being popular for recreational angling and sailing off the south of Ireland (**Section 4.5.8**), the Kinsale Area is beyond the daily operational radius of most such vessels from adjacent harbours such as Kinsale and Cork. Occasional yachts in passage are likely to be the only recreational vessel movements in the wider Kinsale Area and significant effects on these users is therefore not predicted. The Kinsale Area represents an area of high use and importance to Irish commercial fisheries (see **Section 4.5.3**). There are no foreseeable impacts or effects on military practice and exercise areas and International Maritime Organization ship routeing measures as there is no spatial overlap between KADP operations and these.

Potential effects on shipping and fishing activity are restricted to temporary spatial conflict, particularly in areas outside of existing exclusion zones, including when the vessels are in transit, and where vessels are involved in pipeline works (i.e. rock placement on exposed sections/freespans not within existing exclusion zones, and the post-decommissioning survey). All other activities are to take place within pre-existing surface or subsea exclusion zones (see **Section 3.2**) from which either shipping (surface zones) and fishing activity (surface and subsea zones) is prohibited. This includes platform (topsides and jackets) removal, well decommissioning (with the exception of previously abandoned wellhead removal, however statutory surface exclusion zones would apply for any rig involved in well decommissioning) and the removal of subsea structures. The jackets would retain 500m surface exclusion zones following topsides removal and implementation of "lighthouse mode" Aids to Navigation (AtoN) until their removal (within 1-10 years) under the second consent application. The potential for interactions with other users from jacket removal compared to their existing level of exclusion is limited to vessels in transit during removal operations.

Activity outside of exclusion zones (transit between subsea well locations for subsea well decommissioning, pipeline decommissioning for pipeline sections outside of exclusion zones and post-decommissioning survey) will represent a short-term increment in vessel presence (typically 3-6 vessels per operation) over that which the area normally receives through field operations (approximately one supply round trip every 28 days) and wider commercial shipping (see **Section 4.5.2**), and it is not considered that these minor and temporary impacts will result in a significant effect on other sea users.

Additionally, following decommissioning, former exclusion zones will be open to fisheries; initially an area of *ca.* 12.2km^2 on decommissioning of subsea structures (consent application 1) and a further *ca.* 0.2km^2 following jacket removal (consent application 2), representing a small increment in seabed area (in economic terms) which may be fished. Moreover, the removal of the topsides and jackets also removes these surface components of the Kinsale area facilities, and therefore any potential interaction with commercial or recreational shipping.

Visual intrusion from vessel presence will be limited to activities within viewable distance of the shore, which would only be associated with work on the export pipeline should any rock cover remediation be undertaken in the nearshore area (consent application 2), transiting vessels and shoreside offloading, storage and dismantling (following either consent application). There are locally important landscapes with which transiting vessels may interact (see **Section 4.7**) but this would be temporary, and minor within the wider context of existing moderate vessel traffic, and effects would not be significant. As noted above, the location of the offshore facilities are beyond the daily operational radius of most recreational angling and sailing vessels, however works may be visible from a small number of transiting yachts, though this is considered to be minor in the context of existing infrastructure and vessel presence, and the temporary nature of the works. The transport of materials to shore (including those from well abandonment, pipeline/umbilical and platform topside and jacket decommissioning) may be to yards beyond Irish waters, but the use of established yards would represent an increment to existing activity rather than a new type of intrusion affecting landscape or communities, and would therefore be within the normal scale of intrusion at such sites, such that effects are not considered to be significant.

7.2.2 Potential effects on sensitive species

7.2.2.1 Birds

The physical presence of vessels associated with the decommissioning activities may potentially cause displacement and/or other behavioural responses in birds (see **Section 4.4.6** for coverage of those considered). Most species from relevant Special Protection Areas (SPAs) within foraging range of the Kinsale Area have been judged to have a low to moderate sensitivity to disturbance by shipping traffic (e.g. gannet, fulmar, kittiwake, gulls, auks; Old Head of Kinsale SPA 25km distant; Saltee Islands SPA 116km distant; see Garthe & Hüppop 2004). Few SPAs designated for more sensitive species, e.g. divers, scoters which generally forage in coastal waters of ≤20m depth (Fox *et al*. 2003), are located near the Kinsale Area (e.g. Cork Harbour SPA and Courtmacsherry Bay SPA are between 37km and 42km distant from the KADP offshore works, see **Section 4.4.4.8**). Cork Harbour SPA is ~4km from the offshore export pipeline and contains cormorant, a coastal species judged to be highly sensitive to disturbance by shipping (Garthe & Hüppop 2004). However, the KADP will result in a small increase in vessel traffic within the Cork harbour and wider Kinsale Area and is anticipated to cause no more than temporary and localised disturbance, which is not predicted to result in significant effects. While rafting birds may move in response to vessels in transit, such effects are of low magnitude and short duration, and will represent negligible additional disturbance over routine vessel movements. Significant effects on bird species are therefore not considered to be likely.

7.2.2.2 Fish and marine mammals

In addition to potential disturbance to birds, the physical presence of the vessels may influence the distribution and movements of sensitive species in the water column, namely protected migratory fish and marine mammals. As hearing specialists, any displacement of marine mammals is most likely associated with acoustic disturbance, which is discussed in **Section 7.5**. There may also be responses from marine mammals and fish to the general physical presence of infrastructure and vessels (Sparling *et al.* 2015), along with the risk of collisions from vessels in transit.

Activities covered in the consent applications for the KADP will result in a small increase in vessel traffic within the wider Kinsale Area (typically 3-6 vessels per operation), being present during the programme of works over a 12-18 month period, though not necessarily continuously. The Kinsale Area is known to be frequented by several marine mammal species and its adjacent coast supports important habitat for migratory fish species (see **Sections 4.4.4-4.4.8**). However, the physical presence of the decommissioning activities, including large, slow-moving vessels around areas of existing activity, and the temporary presence of anchored barges/rigs, are anticipated to cause no more than temporary and localised low-level behavioural responses similar to those from normal operations, such that significant effects are not predicted.

7.2.2.3 Seabed habitats and species

The removal of the exclusion zones will result in an area being open to fisheries which was closed during field life (total area *ca.* 12.4km^2). Though pressures from fisheries (that is seabed disturbance from towed fishing gear) will be expected in these areas following their removal (as noted in Anatec 2017), the area is small relative to that widely fished in the Kinsale Area and Celtic Sea (see **Section 4.5.3**) and significant effects on seabed habitats and species are not considered to be likely. See Marine Institute & the Department of Housing, Planning and Local Government (2013) for a wider consideration of fisheries pressure in Irish waters.

7.2.3 Interactions between environmental factors

No foreseeable interactions were identified between the environmental factors for which potential effects associated with physical presence were identified in **Section 6** – see **Tables 6.3a** and **6.3b**.

7.2.4 Environmental management, mitigation and residual effects

The description and assessment of potential physical presence effects associated with decommissioning operations assumes that activities are undertaken in adherence to relevant legally required standards and controls, which include:

- Notices to Mariners will be issued to cover decommissioning work associated with each consent application to communicate the nature and timing of the activities to relevant other users of the sea. Guard vessels or standby vessels will be used during well abandonment to monitor statutory 500m zones and minimise the potential for interaction between decommissioning vessels and other users.

- All vessels used in the decommissioning operations will meet applicable national and international standards (e.g. in terms of signals and lighting).
- Lighting and marking of the jackets if left in "lighthouse mode", for a period, will be agreed with the Commissioners for Irish Lights to establish new AtoN to be installed until their removal. An up to date Navigational Risk Assessment with traffic analysis will be undertaken to inform the Commissioners of Irish Lights to set the AtoN requirements, all lighting and marking will comply with IALA Recommendation 0-139 on the Marking of Man-Made Offshore Structures (2013), and Notices to Mariners will communicate the new lighting and marking arrangements (see **Section 3.5.2.3**).

No further specific mitigation measures in relation to physical presence were identified, and any residual negative effects of vessel presence (visual or physical, either on other users or biodiversity) are considered to be **minor and temporary**. Environmental management commitments 1, 3, 4 are relevant to this topic and are described in **Section 8.2**.

7.2.5 Summary and conclusion

The majority of the decommissioning operations covered in both consent applications will be focussed in areas from which other vessels are already excluded (particularly fisheries) and therefore disruption of other vessels is only likely during transit and transport to shore of materials (consent applications 1 and 2), the decommissioning of previously abandoned subsea wells (consent application 1), and for pipeline works and post-decommissioning survey (consent application 2). The increase in vessel traffic associated with the decommissioning operations will be minor and temporary, and following the completion of decommissioning work, existing exclusion zones around subsea and surface structures will be opened to fisheries and shipping.

The nature of effects on other users is predicted to be minor and temporary, and no additional project-specific mitigation has been identified. Significant effects on marine fauna or sensitive bird species are not predicted.

7.3 Physical Presence: Legacy Materials Left *In Situ*

There are a number of aspects of the proposed decommissioning operations, which will result in legacy materials being left *in situ* with the potential for longer term effects.

The key sources of potential effect associated with legacy materials left *in situ* are shown below with reference to the relevant environmental factors detailed in the EIA Directive (see **Section 6.1**). These are long-term impacts following decommissioning, and relate to the activities proposed as part of consent application 2.

Facility	Activity/Source of Potential Effect	Relevant Environmental Factors
Pipelines and umbilicals	Third party interaction with pipelines when left *in situ*	*Population and human health; Material assets, cultural heritage and landscape*
	Long term degradation	
	Grout filling on onshore section of pipeline	
Jackets	Potential presence of jacket leg "stumps" if cutting below seabed level is not possible	

The potential for effects from physical presence of legacy materials were identified in **Section 6** for the broad environmental factors; population and human health, and material assets, cultural heritage and landscape (**Tables 6.3a and 6.3b**). More specifically, the potential for effects was identified for other users of the sea (fisheries and shipping), in terms of third party risks from leaving material *in situ*. Note that legacy discharges from pipelines and umbilicals (i.e. those which may take place gradually some time after decommissioning, resulting from losses from the open ends of pipelines/umbilicals, or as pipeline/umbilicals degrade) are considered in **Section 7.6**, Discharges to Sea. A description and assessment of these potential effects is provided below.

7.3.1 Potential effects associated with legacy materials: pipelines & umbilicals

Bottom trawling close to subsea facilities carries the risk of fishing gear snagging with potential loss of gear, or in extremely remote circumstances, the vessel. Snagging is considered to be the main potential effect of leaving the pipelines and umbilicals *in situ*. Vessels fishing the seabed include demersal trawlers, beam trawlers and dredgers, which make up almost half of all fishing vessels using the Kinsale Area (see **Section 4.5.3**). Snagging occurs when the trawl gear becomes "stuck" under the pipeline and this is most likely to occur where freespans have developed between the seabed and the pipeline, creating potential snags for trawl otter boards (of wood and/or steel and up to 1.5 tonnes each) used to hold open a demersal trawl net.

As noted in **Section 3.4.6**, the pipelines and umbilicals were subject to a Comparative Assessment (CA), a systematic review of safety, environmental, technical, social and cost criteria against a series of decommissioning options (alternatives). The preferred decommissioning option for the pipelines and umbilicals involves leaving these *in situ* with rock cover used to remediate freespans and pipeline ends, including over any concrete mattresses left on the remaining pipeline end sections to reduce future risks to third parties.

An alternative option to apply rock cover to all exposed sections of the pipelines and umbilicals (noting that the interfield pipelines are already largely buried, see **Section 3.2**) is also considered in this assessment in view of the conclusions of the CA that additional rock placement could be preferable for certain pipelines to further reduce 3rd party risks (see **Section 3.5.4,** and also **Section 3.2** which details the burial status of the pipelines). Note, this option would also have incremental effects on other environmental factors including biodiversity (from seabed disturbance, see **Section 7.4**) and land, soil, water, air and climate (from atmospheric emissions, see **Section 7.8**).

There have been two instances of anchors from large vessels dragging the 24" export pipeline in the vicinity of an area used for anchorage outside of the limits of the Port of Cork Authority (see **Section 4.5.2**). These occurred in 1994 and 2017 and rectification works have been undertaken. Vessel monitoring arrangements have been put in place with the Cork Port Authority while the pipeline remains operational. The risks to large vessels anchoring following decommissioning are considered to be remote as the pipeline will be gas free and filled with inhibited seawater.

7.3.1.1 Third party risk: fisheries

A fisheries study (Anatec 2017) was commissioned to understand the present level, type and crossing frequency of fishing activity within 10nm of the Kinsale Area subsea infrastructure. The study considered the fisheries activity against the current baseline situation (i.e. pipeline type and burial status as recorded in the most recent 2017 inspection survey) and a series of options broadly comparable to those being considered in this EIAR and in the CA.

The study used Automatic Identification System (AIS) data covering 18 months (April-September 2014 and May 2015-April 2016), with validation using Vessel Monitoring System (VMS) data[4]. The data was considered representative of current fishing activity for vessels meeting the requirements to carry AIS or VMS systems (those over 15m and 12m in length respectively). Fishing activity is dominated by demersal and pelagic trawlers, and gill netters, with the majority of the demersal vessels in the 20-23m size range. Vessels under 15m registered to south coast ports were factored into the analysis through consideration of vessel capabilities with respect to bottom trawling and the distance of their home port from the Kinsale area.

An estimation of snagging risk for each pipeline and decommissioning option, expressed as Potential Loss of Life (PLL), was made based on crossing frequency of the infrastructure, angle of crossing, and data relating to

[4] AIS refers to the vessel tracking system which is a requirement under International Maritime Organisation (IMO) regulations for all ships of >300 gross tonnage engaged on international voyages, all cargo ships of >500 gross tonnage and all passenger ships irrespective of size. Council Regulation 1224/2009 places a requirement on fishing vessels >15m to use AIS. VMS refers to a vessel tracking system specific to EC fisheries, and is presently required on vessels >12m in length.

the risk of accidents or fatalities from fishing gear snagging incidents on the UKCS. PLL represents the total risk associated with fishing activity on a particular pipeline, and is expressed as an annual fatality frequency.

The following two sections describe and assess the risk and effect from decommissioning large pipelines, and small pipelines and umbilicals respectively. The PLL frequencies for the various pipelines are presented in **Tables 7.1a** and **7.1b** which display the figures for the following cases:

- Base Case: The base case figures represent the current situation and include fishing exclusion zones in place (around the Kinsale Head Alpha and Bravo platforms, around the South West Kinsale and Western Drill Centre, the Ballycotton well, and Seven Heads manifold and subsea wells).
- Removal of Exclusion Zones: these figures represent the change in risk levels due to the effect of removing the exclusion zones, which would open the areas up to fishing.
- Decommissioning Options: these figures show the risk levels following implementation of rock placement options.

A subsequent Fishing Risk Assessment study (Anatec 2018) estimated the risk to fishermen in terms of Individual Risk Per Annum (IRPA) for each of the large diameter pipelines. These values are dependent both on the PLL described above, and on the number of fishermen exposed to the hazards (i.e. the decommissioned pipelines). The number of fishermen exposed was calculated taking into consideration the type of vessels and typical crew numbers for those vessels related to the crossings used to calculate the PLL values. Note that the average IRPA will vary for fishermen on different vessels. In addition, the IRPA values relate to a particular sea area and hazard (i.e. pipelines) and that the same fishermen will be exposed to other hazards during the course of their working year which are not considered in these calculations. The IRPA results are presented in **Table 7.1a**.By definition, the risk to any single individual in a year (IRPA) will be significantly lower than the PLL.

Large pipelines

Referencing the PLL data in Table 7.1a, the risk associated with the inter-platform pipelines was estimated to increase significantly following removal of the exclusion zones, without any remediation, due to the limited existing protection of these pipelines. The decommissioning options considered would reduce the risk levels, albeit with a more variable impact than for the smaller pipelines and umbilicals, due to the varying degrees of exposure and the presence of freespans on some but not all pipelines.

The preferred option of pipeline end and free span remediation would reduce PLL levels to between 2.66×10^{-4} to 1.29×10^{-3} compared to the baseline scenario following removal of the exclusion zones for all pipelines. Risk reduction for the 18” Seven Heads export pipeline however does not change. This can be accounted for by a lack of freespans on the 18” export pipeline to remediate which otherwise reduced PLL values for the other pipelines. The decommissioning option to rock cover all exposed sections of the 18” Seven Heads export pipeline would reduce the PLL further to 4.95×10^{-4}.

Average IRPA values range from 3.2×10^{-7} (less than one in three million) for the option to rock cover the ends and all exposed sections of the 12” inter-platform pipeline, to 8.1×10^{-6} (less than one in one hundred thousand) for the option to rock cover pipeline ends and freespans for the 18” export pipeline. As the IRPA values are averages, they will vary for fishermen depending on the vessel (e.g. one which fishes for a longer duration over a particular pipeline). Due to the nature of fishing activity over the 18” and 24” export pipelines (single individual vessels fishing for longer periods and therefore accounting for a substantial portion of the overall risk), “worst case” IRPA figures have been calculated for the 24” and 18” export pipelines. These range from a minimum of 3.9×10^{-6} for the option to rock cover the ends and all exposed sections of the 24” export pipeline to a maximum of 6.6×10^{-5} for the option to rock cover pipeline ends and freespans for the 18” Seven Heads export pipeline. Risks were more evenly distributed between vessels for the inter-platform pipelines.

Either decommissioning methodology will result in reductions in the risk (expressed either as PLL or IRPA) associated with the pipelines and umbilicals such that the potential risk of significant effects on fisheries is remote. The 18” Seven Heads export pipeline however requires the option to rock cover all exposed sections to generate further risk reduction, due to the lack of freespans on this line.

Table 7.1a: PLL and IRPA results for surface laid pipelines and proposed decommissioning options

Pipeline	Fishermen exposed*	Base case PLL	Removal of exclusion zones PLL	Decommissioning options considered by Anatec (2017, 2018)			
				Pipe ends and freespans rock covered		All exposed sections rock covered	
				PLL	Average IRPA	PLL	Average IRPA
12” Inter-platform	96	4.34×10^{-7}	4.05×10^{-4}	2.78×10^{-4}	2.9×10^{-6}	3.06×10^{-5}	3.2×10^{-7}
24” Inter-platform	96	2.32×10^{-6}	3.90×10^{-4}	2.66×10^{-4}	2.8×10^{-6}	3.97×10^{-5}	4.1×10^{-7}
18” Seven Heads export	160	1.09×10^{-3}	1.30×10^{-3}	1.29×10^{-3}	8.1×10^{-6}	4.95×10^{-4}	3.1×10^{-6}
24” Export	156	8.86×10^{-4}	9.05×10^{-4}	6.03×10^{-4}	3.9×10^{-6}	1.03×10^{-4}	7.0×10^{-7}

Source: Anatec (2017, 2018)

Note: for the purposes of calculating IRPA.*

Small pipelines and umbilicals

A summary of the PLL frequencies for the smaller pipelines (8-12”) and umbilicals which are currently buried or rock covered, is given in **Table 7.1b**. For the smaller diameter pipelines, the base case PLL figures presented are lower than for the larger diameter pipelines due to the shorter lengths and reduced exposure of these lines.

Following decommissioning, it is anticipated that there would be a minor increase in fishing activity within former exclusion zones, reflected in slightly increased PLL figures for some pipelines if no remedial options are implemented. However, the PLL figures following implementation of the preferred or alternative decommissioning options would be very low, ranging from 9.53×10^{-7} to 1.06×10^{-4}.

Table 7.1b: PLL results for smaller well protected pipelines and decommissioning options

Pipeline	Base case	Removal of exclusion zones	All exposed sections rock covered
12” South West Kinsale	1.69×10^{-5}	2.99×10^{-5}	2.06×10^{-5}
12” Western Drill Centre	4.64×10^{-7}	5.52×10^{-6}	4.11×10^{-6}
10” Greensand	1.63×10^{-5}	2.81×10^{-5}	1.94×10^{-5}
10” Ballycotton	5.79×10^{-5}	7.20×10^{-5}	2.36×10^{-5}
10” Ballycotton umbilical	9.29×10^{-5}	1.06×10^{-4}	8.08×10^{-5}
8” Seven Heads well 48/24-5A (A)[1]	5.31×10^{-6}	5.31×10^{-6}	2.00×10^{-6}
8” Seven Heads well 48/24-6 (B)	9.53×10^{-7}	9.53×10^{-7}	9.53×10^{-7}
8” Seven Heads well 48/24-8 (D)	1.33×10^{-5}	1.33×10^{-5}	3.93×10^{-6}
8” Seven Heads well 48/24-9 (E)	9.36×10^{-6}	9.36×10^{-6}	1.51×10^{-6}
8” Seven Heads well 48/23-2 (F)	2.26×10^{-6}	2.26×10^{-6}	2.26×10^{-6}

Source: Anatec (2017)

Note: [1]letters refer to the notation used in Anatec (2017) to allow for cross referencing

Comparing the range of PLL figures in **Table 7.1b** for small diameter pipelines to the PLL figures for the decommissioning options for larger diameter pipelines in **Table 7.1a**, it is evident that the IRPA to fishermen associated with the smaller diameter pipelines is lower (less risk) than that calculated for the large diameter pipelines.

Vessel Anchoring

In addition to fisheries, the two anchor snagging incidents associated with the 24” export pipeline noted above reflect the use of an inshore area to the west of the pipeline as an anchorage by large vessels waiting to berth. Whilst the application of rock cover in the area may deflect some anchors, this is not likely to be effective against embedded anchors[5]. The pipeline is a well charted feature, having been installed in 1977, and Admiralty Charts (sheet 1765) indicate that it is not advised to anchor or trawl in proximity to such pipelines. The risks to large vessels anchoring following decommissioning are assessed to be remote as the pipeline will be gas-free and seawater filled.

Other potential future uses in the area have also been identified, particularly subsea cables (see **Section 7.11**). Awareness will be raised about the proposed pipeline decommissioning options with relevant stakeholders which will include relevant marine authorities and fisheries organisations.

7.3.1.2 Offshore pipeline and umbilical degradation

The Kinsale Area pipelines and umbilicals are constructed of non-toxic and relatively inert materials (carbon steel, concrete, plastics). Carbon steel pipelines degrade at very low rates once cathodic protection has expired, at between 0.05-0.1mm/year when exposed directly to seawater or 0.01-0.02mm/year when buried, such that corrosion and collapse of the pipeline would likely take centuries (OGUK 2013). Where protective coatings are used, the degradation period may be longer; the coatings on the Kinsale Area pipelines variously include coal-tar epoxy and concrete, 3LPP and FBE (see **Table 3.4**).

OGUK (2013b) indicates that the primary source of degradation of the concrete coatings following decommissioning is likely to be internally from pipeline steel corrosion, and similarly, 3LPP coatings have a low degradation rate (1.1-10% breakdown over 30 years); polymers associated with these are likely to be persistent in the marine environment because of very slow degradation rates, though are non-toxic.

The potential for buried or rock covered pipelines in the Kinsale area to become exposed and to pose a risk to, for example towed fishing gear, is deemed minimal given that the degree of exposure of such pipelines has not changed significantly since their initial burial or rock covering.

The umbilicals contain polymers, including PP and PVC, steel in the form of armour wires and copper wire cores. The polymers and copper are highly resistant to degradation and corrosion, and the key mechanisms for the degradation of polymers (e.g. thermal, photodegradation, microbial biodegradation and mechanical damage) are limited as the umbilicals are buried in the seafloor (e.g. see Andrady 2015 and OGUK 2013b). The steel armour wires will degrade when exposed to seawater, and where this happens complete degradation within approximately 70 years is estimated.

The degradation of the pipelines and umbilicals (over decades to centuries) will eventually lead to minor releases of inhibited seawater, surfactants from pipeline cleaning or hydraulic fluid from umbilicals; this is assessed in **Section 7.6**, Discharges to Sea.

7.3.1.3 Onshore pipeline: grout filling

The onshore pipeline will be left *in situ* and initially filled with inhibited seawater as part of offshore preparatory works to maximise its potential for a possible future use; alternatively it will be filled with grout, see **Section 3.5.4.2**. When the pipeline is filled with inhibited seawater, this will be pumped through the pipeline from Kinsale Alpha, and the pipeline will be mechanically isolated at each end.

In the event that no re-use option for the pipeline is identified during the timeframe of decommissioning, any inhibited water would be discharged offshore (this would be a gradual release rather than a pressurised discharge **Section 7.6**) and the onshore section of pipeline will be filled with grout from within the terminal site,

[5] HSE (2009). Guidelines for pipeline operators on appropriate measures to protect against anchor damage.

with the grout transported in by road. No activity will take place within the footprint of the onshore pipeline section outside of the terminal area, and there are no foreseeable significant effects associated with its decommissioning.

7.3.2 Jacket legs

As indicated in **Section 3.5.2**, it is planned that the platform jackets will be cut from the pile foundations at seabed level using an internal pile cutting tool, however, in the worst case where internal cutting is not possible a short (< 1m) section of platform structure may be left exposed, and rock cover would be applied to reduce the potential for effects that could result from interaction of the remaining stumps with other sea users, including the snagging of fishing gear. For the purposes of the assessment, the worst case is that none of the legs can be cut internally resulting in eight short leg sections being left exposed at each jacket location. Rock cover remediation applied to each exposed leg section is likely to result in a small mound of *ca*. 1.5m in height and 6m diameter, occupying an area of *ca*. $60m^2$. The worst case scenario will therefore result in eight rock mounds under each platform occupying $480m^2$ ($\sim 0.0005km^2$).

The risk associated with the small sections of the platform legs that might remain under a worst case platform removal scenario were not assessed as part of the Anatec report. However, given their location, appropriate rock cover remediation and small seabed footprint they are considered to represent a low level of risk (see **Table 7.1a**) and there is no foreseeable significant effect.

7.3.3 Interactions between environmental factors

No foreseeable interactions were identified between the factors for which potential environmental effects from the physical presence of legacy materials were identified in **Section 6** – see **Tables 6.3a** and **6.3b**.

7.3.4 Environmental management, mitigation and residual effects

It is planned that rock cover remediation will be used to reduce the potential snagging risk associated with decommissioning pipelines and umbilicals left *in situ* (see **Section 7.3.1.1**) or with any potential protruding jacket leg stumps. The following measures will be implemented as part of the rock placement programme:

- The remediation of all pipeline/umbilical end sections and freespans using overtrawlable rock berms, with the option to rock cover all exposed pipeline sections to further reduce risks to third parties.
- Accurate rock-placement will be assured by the use of an ROV-guided fall pipe system on the rock-placement vessel.
- On-going consultation with fisheries representatives and maritime authorities.
- All infrastructure decommissioned in situ will be surveyed post-decommissioning to accurately record their location and status. This information will be included on navigational charts and also passed to representatives of the fishing community.
- Standard overtrawling surveys will also be undertaken where wellheads, spoolpieces etc., are removed to confirm the area is clear of debris and snagging hazards.

While all risk cannot be eliminated from leaving material *in situ*, the potential for significant negative effects on fisheries from legacy materials left *in situ* following the proposed decommissioning options, including mitigation, is assessed to be **minor, and significant residual effects are not predicted**. See environmental management commitments 1, 3, and 10, and mitigation measures 2 and 3 in **Section 8.2**.

7.3.5 Summary and conclusion

The Kinsale Area pipelines have been present on the seabed for between 14 and 40 years, are charted features, and to date there have been few offshore shipping related incidents (none resulting in vessel damage), and no fisheries related incidents. It has been estimated that the risk of snagging by fishing gear (expressed in PLL values above) can be reduced on decommissioning through the remediation of all pipeline/umbilical end sections and freespans using rock cover, with the option to rock cover all exposed pipeline sections needed to further reduce risk relating to the 18” Seven Heads export pipeline. The potential for significant effects on fisheries from legacy materials left *in situ*, following this mitigation, is assessed to be remote, and significant effects are not predicted. In the event that the jacket legs cannot be cut at the seabed, remedial rock placement would also be undertaken to mitigate the risk of these becoming a snagging hazard.

No significant environmental effects have been identified as a result of the gradual degradation of the legacy materials left *in-situ* over time.

The mitigation measures have been identified as part of project alternative considerations and therefore have been built into the options considered in the assessment (i.e. the application of rock cover to remediate areas of umbilical and pipeline to reduce risks to other users).

7.4 Physical Disturbance

The key sources of physical disturbance associated with the decommissioning operations split by project consent application are shown below with reference to relevant environmental factors detailed in the EIA Directive (see **Section 6.1**).

Facility	Activity/Source of Potential Effect	Relevant Environmental Factors
Consent Application 1		
Platform wells	Seabed disturbance from removal of conductors	*Biodiversity; Land, soil, water, air and climate; Material assets, cultural heritage and the landscape.*
Subsea wells	Seabed disturbance from removal of conductors Seabed disturbance from drilling rig positioning	
Topsides removal	Seabed disturbance from vessel positioning: Anchoring	
Subsea structures	Seabed disturbance generated by removal of manifolds and wellhead protection structures, mattress removal, cutting and removal of pipeline spool pieces & umbilical jumpers (including at manifolds and valve skids).	
Consent Application 2		
Jackets	Seabed disturbance generated by mattress removal, cutting and removal of pipeline spool pieces & umbilical jumpers Seabed disturbance from excavation of piles/remediation of any stumps, lift of jackets and vessel anchoring Seabed disturbance from recovery of large items of debris post jacket removal, if identified during the post-decommissioning survey	*Biodiversity; Land, soil, water, air and climate; Material assets, cultural heritage and the landscape.*
Pipelines and umbilicals	Seabed disturbance generated by remedial rock placement on freespans/exposed areas	

The potential for effects from physical disturbance were identified in **Section 6** for the broad environmental factors; biodiversity (including conservation sites and species), land, soil, water, and air and climate and material assets, cultural heritage and the landscape (**Tables 6.3a** and **6.3b**). More specifically, the potential for significant effects was identified for benthos, and soils and seabed with minor or negligible effects relevant to water quality and water column fauna (e.g. from sediment re-suspension). A description and assessment of these potential effects is provided below.

7.4.1 Potential effects associated with physical disturbance

7.4.1.1 Anchoring

Anchors will be used for the positioning of the semi-submersible rig over subsea wells, and also should an anchored HLV be selected for topsides and jacket removal. An indicative anchoring scenario for each of these vessels is 8-12 anchors with the number used and arrangement pattern subject to a detailed mooring study. Each will produce a linear scar on installation in the order of 50m length, with additional disturbance generated by surface scrape as a result of catenary contact of the anchor chain with the seabed. The total seabed area affected by semi-submersible anchoring is partly a function of water depth, for example an area of seabed 0.032km^2 was affected by anchoring a rig in ~140m of water (see BP 2010). The area to be affected at each deployment of the rig would be less than the above given the depths over the wells to be plugged and abandoned (*ca.* 90-100m). There are 10 subsea wells that may be decommissioned using a mobile drilling rig (refer to **Section 3.5.1**), which given their relative location is likely to require 8 rig moves (the rig can skid between the Southwest Kinsale and Greensand wells, and those at the Western Drill centre), and therefore a total physical footprint in the order of 0.26km^2 is expected. The footprint of anchoring the HLV will be considerably smaller (*ca*. 0.13km^2) given the need for up to 2 anchor placements at each of the KA and KB platforms for topsides and jacket removal, split between activities relating to both project consent applications.

7.4.1.2 Subsea structure removal

The *in situ* pipeline decommissioning options assume that concrete mattresses and grout bag materials are removed only when necessary to allow access to the tie-in facilities (e.g. to subsea structures and jackets) and to remove related pipeline spool pieces or umbilical jumpers underneath. Where mattresses or grout bags remain under or on top of pipeline or umbilicals sections which are not proposed to be removed, these will be left in place and remediated with rock cover. It is estimated that approximately 445 concrete mattresses will be removed across the Kinsale Area, 134 at the jackets and 311 at all other subsea structures (see **Sections 3.5.2.3 and 3.5.3.1**). The four kennel-type protection structures (assumed dimensions of 5x3m) which form a 20m tunnel over the Ballycotton tree tie-in spools will also be removed. Based on the largest mattress size (6x3m) and a contingency buffer of 2m around each mat (including kennel-type structures) to account for potential disturbance during their removal, an estimated seabed area of *ca*. 0.031km^2 will be disturbed during their removal.

Sections 3.5.2.3 and 3.5.3.1 indicate that for the purposes of assessment, spoolpiece and umbilical jumper sections will be recovered from a total distance of *ca*. 100m from platforms and 50m from all other subsea structure tie-ins. It is estimated that approximately 1.5km of pipeline will be recovered and if a contingency buffer of 3m either side of the pipeline is included, an estimated seabed area of *ca*. 0.009km^2 will be disturbed during their recovery.

The cutting and removal of tie-in spools and umbilical jumpers at the manifolds and platforms is likely to occur within the seabed area previously occupied by the concrete mattresses which protected them. Therefore, significant additional physical disturbance associated with their removal is unlikely.

Section 3.5.3 describes the subsea structures (e.g. manifolds, valve skids, wellhead protection structures) to be decommissioned and from information in **Table 3.6**, the total seabed area physically disturbed by the removal of the subsea structures and the associated concrete protection blocks would be *ca*. 0.0027km^2 (assuming a 3m contingency buffer around each structure to account for potential disturbance during their removal). If a 3m contingency buffer is also added to each of the other subsea wellheads to be decommissioned (i.e. those not protected by wellhead protection structures, but for which the wellheads and related surface casings will be removed), the total area of seabed disturbance would not increase appreciably (approximately 0.003km^2).

7.4.1.3 Jacket removal

The removal of the platform jackets will cause some seabed disturbance primarily within their physical footprint. Based on a contingency buffer of 3m around each jacket, it is estimated that a seabed area of up to *ca*. 0.008km^2 will be disturbed during their removal. This area is taken to cover any excavation that could be required associated with the cutting of jacket leg/piles should an internal cutting tool not be able to reach the seabed (see **Section 3.5.2.3 and 7.3.1**), and that which will be disturbed by the removal of platform conductors and related casings.

Following removal of the jackets, and informed by the post-decommissioning survey (see **Section 3.5.5**), any large items of debris located on the seabed will be removed using an ROV and grab. The removal of such items will represent a minor increment to seabed disturbance generated during jacket decommissioning.

7.4.1.4 Rock cover

As described in **Section 3.5.4.1**, rock cover remediation proposed as part of the *in situ* decommissioning options is estimated to impact between 0.023-0.312km^2 depending on the option selected (see **Table 7.2**).

Table 7.2: Seabed area affected by rock cover remediation associated with proposed *in situ* decommissioning options

Pipeline	Seabed area (km^2) affected by rock cover remediation	
	Pipe ends and freespans	All exposed sections
24" export pipeline	0.010	0.192
24" KA to KB pipeline & 12" KA to KB Pipeline	0.003	0.047
12" SW Kinsale pipeline & 12" Western Drill centre & 10" Greensand & 10" Ballycotton & all associated umbilicals	0.003	0.009
Seven Heads 18" export pipeline and main control umbilical	0.002	0.060
Seven Heads 8" flowlines & umbilicals to wells	0.005	0.005
Total (km^2)	**0.023**	**0.312**

Source: based on Fugro (2017)

7.4.1.5 Total seabed area affected

In light of the information presented above, it is estimated that decommissioning operations could collectively cause direct physical disturbance to between 0.46-0.75km^2 of seabed (**Table 7.3**), which represents 0.04-0.06% of the currently leased area (Petroleum Lease No 1 and Seven Heads) shown in **Figure 1.1**. Rig and HLV anchoring represents the largest potential source of impact (0.39km^2, or 51-85% of the total seabed area impacted depending on which pipeline decommissioning option is selected).

Table 7.3: Total seabed area estimated to be affected by decommissioning operations

Decommissioning operation	Estimated seabed disturbance (km^2)	
Relevant to consent application 1		
Anchoring of rig	0.256	
Removal of platform topsides (HLV anchoring)	0.064	
Spool pieces and umbilical jumpers recovered from distance of 100m from platforms and 50m from subsea structures	0.009	
Removal of concrete mattresses	0.031	
Removal of subsea structures	0.003	
Relevant to consent application 2		
Removal of platform jackets (HLV anchoring and disturbance from lift)	0.072	
Pipeline and umbilical decommissioning options	**Pipe ends and spans**	**All exposed sections**
Rock placement remediation	0.023	0.312
Total for both applications (km^2)	**0.458**	**0.747**

7.4.2 Assessment of effects

Physical effects of seabed disturbance may include mortality to benthic fauna as a result of physical trauma, smothering by re-suspended sediment, and habitat modification due to changed physico-chemical characteristics, including from the introduction and removal of hard substrates.

Anchor scars will be formed by the placement of a rig or HLV, but these are not expected to be persistent features with rapid recovery of the seabed habitat through natural mobility of the sandy/gravelly sediment. A combination of sediment type (sand and gravel thinly overlaying chalk bedrock), and weak to moderate near bottom water currents together with oscillatory currents during storm events, would cause periodic mobilisation of surface sediments which will infill the anchor scars over time.

Similarly, seabed habitats are expected to recover rapidly from the limited extent of surface abrasion associated with the removal of concrete mattresses and subsea structures, and also disturbance from removal of the jackets and wellheads.

Any sediment resuspension into the water column during anchoring, or on removal of protection material, pipeline ends/spools or wellheads would be expected to be short-lived and with rapid resettlement.

The duration of effects on benthic community structure are related to individual species' biology and to successional development of community structure. The majority of seabed species recorded from the European continental shelf are known or believed to have short lifespans (a few years or less) and relatively high reproductive rates, indicating the potential for rapid population recovery, typically between 1 to 5 years (Jennings & Kaiser 1998), such that any effect will be temporary. The relatively impoverished heterogeneous benthic habitats of the area reflect the dynamic nature of the sedimentary environment; such habitats have a low sensitivity to physical damage at the scale predicted. Moreover, multiple seabed surveys have reported no indication of Annex I or other sensitive habitats or species present. In all cases, the scale of changes to the seabed and its fauna are such that effects on higher trophic levels (e.g. fish and marine mammals), and any related effect on species of commercial interest are not predicted.

Surveys of the Seven Heads field and along the pipeline route to the Kinsale Head field reported well-developed fauna on hard substrates (Hartley Anderson 2003) and considerable marine growth is present on jacket structures. It can be expected that all introduced hard substrates (i.e. wellhead infrastructure, pipelines and protection materials) support epifaunal assemblages of various densities and compositions. While removal of these items will remove their associated fauna, this will represent the return of the area to conditions more representative of its natural state, and effects are predicted to be minor.

It is estimated that between 7,300m^3 and 84,900m^3 of rock cover remediation may be required over a seabed area of up to 0.3km^2 (representing 0.027% of the currently leased area) depending on the *in situ* decommissioning option (**Section 3.5.4**). Previous rig site and pipeline route surveys as well as the most recent 2017 survey indicate that the existing areas of rock cover and exposed concrete pipe have been colonised by a wide range of epifaunal species. It is likely that further introduction of hard substrate on the scale estimated will result in the modest expansion of these existing communities rather than the introduction of communities not already present in the area.

A common concern during the decommissioning of offshore facilities is the potential disturbance to the seabed associated with displacement of accumulated drill cuttings. Oil based drilling muds were not generally used in the drilling of wells in the Kinsale Area, and none were discharged, with all material being returned to shore. The seabed mapping undertaken in 2017 has shown cuttings piles are absent in the Kinsale Area. It is therefore considered that in the absence of historical OBMs discharges, there is no potential for persistent contamination of sediments in the Kinsale Area from cuttings. The 2017 pre-decommissioning survey results do not indicate accumulations of fine sediments at the base of the platforms or subsea wells associated with the discharge of drill cuttings. Consequently, decommissioning activities will not result in the resuspension of drill cuttings, contaminated or otherwise, or potential smothering of adjacent seabed habitats, and there are therefore no foreseeable effects.

A number of historic wrecks are known to be present in the vicinity of the Kinsale area, the closest of which is the U-boat UC42 lying 200m from the export pipeline, 5.5km south east of Roches Point. Other prehistoric or archaeological remains are not known to occur in the Kinsale Area (following extensive surveys). The decommissioning works will take place largely within the original footprint of disturbance of the wider Kinsale area field developments, and therefore significant effects on cultural heritage are not considered to be possible.

7.4.3 Interactions between environmental factors

Potential interactions from physical disturbance effects were identified between receptors within the biodiversity environmental factor in **Section 6** – see **Tables 6.5a** and **6.5b**, specifically, the potential for effects on supporting habitats of species. In light of the information provided above, any impact is considered to be negligible and temporary, and is not considered to result in significant effects on supporting habitats of species.

7.4.4 Environmental management, mitigation and residual effects

The decommissioning activities will result in some seabed disturbance (0.46-0.76km^2), the effects of which are considered to be minor and temporary. Mitigation is proposed to further reduce the significance of these effects and includes:

- the minimisation of rig and vessel movements which require anchoring where possible
- the use of dynamic positioning (DP) on most vessels where practicable to reduce anchor deployment, and the selection of decommissioning options which minimise interaction with the seabed (subject to wider environmental, safety, technical and economic considerations) – note that sensitive features such as wrecks or Annex I habitats have not been detected in previous surveys
- For each option/activity involving rock placement, efforts will be made to minimise the volume of rock deployed, subject to achieving the required technical function

In view of the above mitigation measures, the residual effect of physical disturbance is considered to be **negligible and short-term**. See environmental management commitments 1, 3 and 4 and mitigation measure 7 in **Section 8.2.**

7.4.5 Summary and conclusion

The area of physical disturbance generated by activities associated with the KADP is small (0.46-0.76km^2) in the context of the wider lease and Celtic Sea area (0.027% of the leased area), and the majority this disturbance will take place within the original footprint of development.

In view of the potential effects described and assessed in the context of the proposed mitigation and recovery potential of the seabed, significant effects from physical disturbance are not considered to be likely for activities associated with KADP consent applications 1 or 2, and are predicted to be negligible and short-term.

7.5 Underwater noise

The key sources of noise and vibration associated with the decommissioning operations split by project consent application are shown below, with reference to relevant environmental factors detailed in the EIA Directive (see **Section 6.1**).

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Consent Application 1		
Platform wells	Underwater noise associated with cutting and removal of casings Underwater noise from vessels, including DP	*Biodiversity*
Subsea wells		
Topsides removal	Underwater noise from vessels, including DP	
Subsea structures	Underwater noise from vessels, including DP	
Consent Application 2		
Jackets	Underwater noise from abrasive, high pressure water jet and other cutting (internal and external cuts) Underwater noise from vessels including DP	*Biodiversity*
Pipelines and umbilicals	Underwater noise from vessels including DP and rock placement	

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Post-decommissioning survey	Underwater noise from survey equipment	

The potential for effects from underwater noise were identified in **Section 6** for the broad environmental factor; biodiversity (including conservation sites and species) (**Tables 6.3a and 6.3b**), and more specifically, the potential for effects was identified for fish, diving birds, marine mammals, and relevant conservation sites and species. A description and assessment of these potential effects is provided below.

7.5.1 Description of potential effects of underwater noise

The following section provides a consideration of the characteristics of underwater noise that could be generated from the decommissioning activities, followed by an assessment of these against sensitive receptors in **Section 7.5.2**. A high level summary of the main noise source types is given in **Table 7.4**.

Table 7.4: Summary of indicative noise sources associated with the KADP

Noise source (relevant activities)	Approximate indicative broadband source level (dB re 1μPa@1m)	Indicative dominant frequency	Source	Relevant Consent Application	
				1	2
Vessels of 50-100m length (PSV, AHV, CSV, DSV; rock placement vessel)	165-180[a,b]	< 1,000Hz	OSPAR (2009)	✓	✓
Vessels of 100-300m length (HLV)	175-195[a,b]	< 200Hz	OSPAR 2009, McKenna *et al*. (2012) ; Veirs *et al*. (2016)	✓	✓
Diamond wire cutting tool (jacket structural members)	na; at 100m from source: ≤ 130dB re 1 μPa^2 per 1/3 octave band for all recorded frequencies from 5,000-40,000Hz[c]	> 10,000Hz	Pangerc *et al*. (2016)	✓	✓
Water jet lance tool (broadly indicative of abrasive water jet cutting e.g. jacket structural member cutting)	160.1-170.5	> 200Hz	Molvaer & Gjestland 1981	✓	✓
Side scan sonar (post-decommissioning survey)	223	114 or 440kHz	Based on Kongsberg dual frequency side scan sonar[6]	-	✓
Multibeam echosounder (post-decommissioning survey)	210	200-400kHz (300kHz normal operation)	Based on Kongsberg Maritime EM2040	-	✓

Notes: [a] Within the ranges provided, broadband source levels are generally higher for larger vessels of these categories. [b] Slight increases in broadband source levels anticipated during use of DP thrusters. [c] Generally indistinguishable above background noise at low frequencies; ca. 4 and up to 15dB re 1 μPa^2 per 1/3 octave band above background between 10,000-40,000Hz.

[6] Based on representative Kongsberg dual frequency side scan sonar: https://www.km.kongsberg.com/ks/web/nokbg0240.nsf/AllWeb/2D0C8EA035ABC7C6C12574C500512571?OpenDocument

No explosive cutting is proposed to be undertaken as part of any of the KADP decommissioning options.

7.5.1.1 Vessel movements/operations

Underwater sound radiates from a vessel as the combined effect of multiple sources and paths; the main sources are propeller/thruster cavitation and machinery noise, with additional sound generated as the hull moves through the water (hydrodynamic noise) or by sea-connected systems (e.g. pumps) (Spence *et al.* 2007, Abrahamsen 2012).

Propeller cavitation is a process involving bubble formation and implosion resulting from pressure fluctuations (above and below the saturated vapour pressure of water) generated by the rotating propeller blades when a given speed (cavitation inception speed) is reached or exceeded; noise is generated by the collapse of bubbles. Cavitational noise commonly arises at speeds between 8 and 12 knots and grows in amplitude with increasing speed; its frequency spectrum is broad with dominant frequencies above a few hundred Hz. However, cavitational noise mechanisms are varied and complex; in addition to vessels in transit, cavitational noise is important when vessels are operating under high load conditions (high thrust) and when dynamic positioning (DP) systems are in use (Spence *et al*. 2007, Abrahamsen 2012). The use of thrusters for DP has been reported to result in increased sound generation (>10dB) when compared to the same vessel in transit (Rutenko & Ushchipovskii 2015).

Shipboard machinery creates both vibrations and airborne noise which in turn can generate underwater sound radiation; most pronounced is the sound generated from propulsion machinery such as diesel engines or turbines and diesel generators. Machinery induced noise is generally tonal in nature and can span across a wide range of frequencies, from very low (below 10Hz) to several thousand Hz. Higher frequency tones are typically seen only at slow speeds i.e. in the absence of propeller cavitation but low frequency tones (<500Hz) tend to be predominant at all speeds (Spence *et al*. 2007, Abrahamsen 2012).

While the sources and paths of sound from vessels are well understood, predicting sound exposure on the basis of vessel information is complex; it depends on the design of the vessel, how it operates, its age (or time since regular maintenance), and also the characteristics of the environment in which it operates (OSPAR 2009).

Noise from vessels is predominantly low frequency and the global shipping fleet is recognised as the main contributor to ambient noise in the open ocean. The indicator being developed for ‘ambient noise’ as part of the implementation of the Marine Strategy Framework Directive focuses on two low frequency third-octave bands, centred at 63 and 125Hz; these bands are where the contribution of noise from shipping (relative to other sources, including natural – see **Section 4.3**) is likely to be greatest (Dekeling *et al*. 2014).

Several studies have described and reviewed underwater sounds from a variety of commercial ships in transit (e.g. OSPAR 2009, Bassett *et al*. 2012, McKenna *et al*. 2012, Veirs *et al*. 2016). In general, support and supply vessels (50-100m) are expected to have broadband source levels in the range 165-180dB re 1µPa@1m, with the majority of energy below 1kHz (OSPAR 2009). Larger vessels of 100-300m length, including tankers, bulk carriers and container ships, produce higher source levels generally in the range of c. 175-190 dB re1 µPa^2 (OSPAR 2009, McKenna *et al*. 2012). While most energy from these larger vessels is below 200Hz, median received levels above those of ambient levels (+ 5-13 dB) have also been reported at higher frequencies of 10,000-40,000Hz up to a distance of 3km from the source (Veirs *et al*. 2016).

7.5.1.2 Other sources of underwater noise

There are a range of underwater noise-generating activities associated with decommissioning activities, including the use of cutting tools and rock placement. However, evidence suggests that noise from associated vessels is commonly recorded as the dominant source during these activities. For example, measurements made by Nedwell & Edwards (2004) of a rock fall pipe vessel indicated that there was no discernible difference between normal vessel operating conditions and those during rock placement, suggesting that noise levels from this activity were dominated by vessel propellers and thrusters rather than the rock placement. Doppler Velocity Logs (DVL) or Ultra Short Baseline (USBL) sonar systems for use in positioning rock placement ROVs, which produce high frequency noise comparable to that of a ships’ single-beam echo-sounder, are not expected to be discernible from the broadband noise of associated vessels in the area. DVL systems generally emit noise at frequencies which are beyond the hearing range of relevant marine mammals (300-1,200kHz). While USBL systems operate at frequencies (20-40kHz[7]) which are

[7] Based on indicative manufacturers’ specifications (e.g. Tritech MicroNav, SonarDyne ROVNav 6).

audible to mid- and high-frequency cetaceans (see **Table 7.5**), they are designed for close-range transmission between features close to the seabed; source sound levels (e.g. indicative 187-196dB re 1μPa at 1m[5]) are less than those of Multi Beam Echo Sounders (MBES), significantly less than seismic survey, and will be rapidly attenuated to low levels within a few tens of metres of the source.

Similarly, noise from the cutting of the platform conductors, jacket members is not anticipated to significantly exceed that of vessel operations. Measurements of an ROV-operated diamond wire cutting tool on a platform conductor at 80m water depth found noise levels to be not easily discernible above background levels between 100-800m from the source, with associated increases of around 4dB and up to 15dB re 1 μPa2 per 1/3 octave band for some frequencies, mostly above 10kHz (Pangerc *et al*. 2016). The number of cuts required to remove the jackets will vary depending on the selected removal option, and in all cases these are not anticipated to generate noise levels exceeding that of the vessels involved in the jacket removal work. There is the potential for more than one cut to take place at the same time, though this is not considered likely to cumulatively increase the sound source levels associated with cutting significantly; for example, sound levels are expressed in dB i.e. using base-10 logarithms as a ratio relative to a reference value (the reference value for underwater sound is 1 μPa), and the addition of two identical sources results in an increase of 3dB, or just 10dB if ten simultaneous sources are considered.

Direct measurements of noise levels generated by non-impulsive underwater tools are limited, but where available they have been reported to generate sound of an amplitude that does not exceed those from average vessels. For example, Anthony *et al.* (2009), as part of a review of diver noise exposure, presents estimates of source levels of 148-180 dB re 1μPa@1m for several hand held tools (excluding impulsive stud/bolt guns). These include estimates of 160.1 and 170.5 dB re 1μPa@1m for water jet lances (most energy > 200 Hz; Molvaer & Gjestland 1981), which are likely to be broadly representative of noise emissions from abrasive water jet cutting tools (Molvaer & Gjestland 1981).

7.5.1.3 Post-decommissioning survey

A debris clearance and pipeline survey will be undertaken to confirm the completion of the decommissioning operations (see **Section 3.5.5**). As a minimum the survey area covered for debris clearance will include a 500m radius around any installation and a 100m corridor (50m on either side) along the length of any pipelines and umbilicals, the survey will be undertaken in approximately 5 days. Identification of debris would normally be conducted by side scan sonar and/or MBES with an ROV deployed to investigate and recover any potential hazards. Larger items of debris would be recovered by crane from a construction support vessel. A seabed clearance certificate will be issued by the survey contractor to confirm completion of the scope. Standard overtrawling surveys will also be undertaken where wellheads, spoolpieces etc. are removed to confirm the area is clear of debris and snagging hazards.

The offshore survey of the export pipeline will end at some 3km offshore of the landfall at Powerhead. Based on the landfall location, the area surveyed will be outside 1,500m from the inlet to the Cork harbour area (i.e. of any bay, inlet or estuary) as referred to in NPWS (2014). A separate inshore survey involving a smaller vessel will also be undertaken; both surveys would require a consent application(s) detailing the proposed survey methods and mitigation measures.

7.5.1.4 Summary of anticipated underwater noise sources from the KADP

Likely vessels to be used during decommissioning and their estimated duration of operations have been described in **Section 3.5**. The number, nature and days of operation of vessels will vary according to the decommissioning approaches selected and the vessels available. Whilst the operational schedule for discrete parts of the decommissioning programme have been estimated (see **Sections 3.5.1-3.5.5**), the total time taken to complete the offshore aspects of the KADP will be shorter due to parallel working and the potential for vessel synergies, though operations will also not be continuous. It is anticipated that offshore work will take approximately 12-18 months, though the total decommissioning programme covering activities associated with both project applications may extend over a period of up to 10 years.

The bulk of the activity will be carried out by medium-sized (80-100m length) support vessels[8], in addition to a rock-placement vessel(s); these will generate source levels of 165-180 dB re 1μPa@1m, with slightly increased levels expected during operations requiring DP. In the absence of vessel-specific or directly comparable data, it is assumed that as a precautionary approach the average broadband source levels of the

[8] Including PSV, AHV, CSV, and DSV.

HLV and drilling rig in transit would be taken as those of the loudest recorded container ship, in the region of 185-195 dB re 1µPa@1m (McKenna *et al*. 2012, Veirs *et al*. 2016).

Among each of the key phases of noise-emitting activity (subsea well decommissioning; platform topsides removal; jacket removal; pipeline decommissioning), there may be periods of up to one month where multiple (i.e. 3-6) vessels will be operational in the Kinsale Area, with the exception of the option to rock cover all exposed pipeline sections (see **Section 3.5.4.1**). Active rock placement could take up to 98 days, or 252 days (with 25% contingency) when accounting for remobilisation for additional rock and transit to the Kinsale area. Individual support vessels (i.e. CSV, PSV) and guard vessels may be present for longer periods of two-three months. Single lift options for decommissioning represent the lowest number of vessel days on-site and in transit.

Cutting (e.g. of well casings or jacket legs) and rock placement activities will periodically generate underwater noise of short duration, with source levels of up to 170 dB re 1µPa@1m which are unlikely to be readily discernible over the noise generated by associated vessels in the area.

Side scan sonar and MBES equipment are used routinely in surface geophysical surveys, and are proposed to be used in the post-decommissioning survey. There are a number of different systems on the market resulting in a variety of outputs in terms of power, frequency and directionality, but for those most commonly deployed on site surveys the expectation is that generated sound levels drop off very quickly with distance due to a combination of high frequency and high directionality (DECC 2016). Characteristics of sound generation are commonly modelled from estimated source levels based on manufacturers' specifications (Zykov 2013) but efforts are ongoing to obtain direct measurements of operating equipment in testing facilities and in the field (Crocker & Fratantonio 2016). The specific survey equipment to be used in the post-decommissioning survey are yet to be selected and so for the purposes of assessment it has been assumed that the sidescan sonar equipment will operate at dual frequency of 114 or 410kHz with a source sound level of ~223dB re 1µPa@1m, and that the MBES equipment will operate at a frequency of 200-400kHz (300kHz normal operation) with a source sound level of ~210db re1µPa@1m (see **Table 7.4**).

7.5.2 Effects assessment of noise sources on relevant receptors

Potential effects of anthropogenic underwater sound on receptor organisms (within the biodiversity environmental factor) range widely, from masking of biological communication and small behavioural reactions, to chronic disturbance, auditory injury and mortality. In addition to direct effects, indirect effects may also occur (e.g. via effects on prey species). Marine mammals and fish are considered to be the most sensitive receptors to underwater noise.

7.5.2.1 Marine mammals

Marine mammals, for which sound is fundamental across a wide range of critical natural functions, show high sensitivity to underwater sound. In terms of impact, anthropogenic sound sources have been categorised based on acoustic and operational features (Southall *et al.* 2007); the main distinction is between pulsed and non-pulsed sounds due to differences in the auditory fatigue and acoustic trauma they induce, with the brief, rapid-rise of impulsive sounds being potentially more damaging. Generally, the severity of effects tends to increase with increasing exposure to noise with both sound intensity and duration of exposure being important. A distinction can be drawn between effects associated with physical (including auditory) injury and effects associated with behavioural disturbance. With respect to injury, risk from an activity can be assessed using threshold criteria based on sound levels (e.g. Southall *et al.* 2007, Lucke *et al.* 2009, NMFS 2016). With respect to disturbance however, it has proved much more difficult to establish broadly applicable threshold criteria based on exposure alone (NPWS 2014).

In addition, auditory capabilities are frequency dependent and vary between species (Southall *et al.* 2007). Several species of marine mammals may be present in the Kinsale Area (see **Section 4.4.7**). **Table 7.5** provides details of the relevant species listed by functional hearing group, the relevant auditory bandwidth as defined by Southall *et al.* (2007) and NMFS (2016), and the broadband injury threshold sound pressure levels proposed by Southall *et al*. (2007) and Lucke *et al*. (2009).

Table 7.5: Marine mammal species relevant to the Kinsale Area and their auditory capabilities

Species which may be present in the Kinsale Area (by functional hearing group)	Hearing range	Proposed injury threshold criteria to non-pulsed sounds (SPL)
Low-frequency cetaceans Fin whale *Balaenoptera physalus* Minke whale *Balaenoptera acutorostrata* Humpback whale *Megaptera novaeangliae* Sei whale *Balaenoptera borealis*	7Hz to 22kHz [1] 7Hz to 35kHz [2]	230 dB re 1μPa [1]
Mid-frequency cetaceans Bottlenose dolphin *Tursiops truncatus* Common dolphin *Delphinus delphis* White-beaked dolphin *Lagenorhynchus albirostris* Atlantic white sided dolphin *Lagenorhynchus acutus* Risso's dolphin *Grampus griseus* Striped dolphin *Stenella coeruleoalba* Long-finned pilot whales *Globicephala melas* Northern bottlenose whale *Hyperoodon ampullatus* Killer whale *Orcinus orca*	150Hz to 160kHz [a,b]	230 dB re 1μPa [a]
High-frequency cetaceans Harbour porpoise *Phocoena*	200Hz to 180kHz [a] 275Hz to 160kHz [b]	200 dB re 1μPa [c]
Pinnipeds in water Harbour seal *Phoca vitulina* Grey seal *Halichoerus grypus*	75Hz to 75kHz [a] 50Hz to 86kHz [b]	218 dB re 1μPa [a]

Notes: Injury is defined as the level at which a single exposure is likely to cause onset of permanent hearing loss[1]. SPL = Sound Pressure Level. Sources: [a] Southall et al. (2007); [b] NMFS (2016); [c] Lucke et al. (2009).

As described above, sound from vessels has a wide frequency spectrum, but the dominant and most widely propagated frequency tends to be low (<200Hz). Therefore, while all marine mammal species which may occur in the Kinsale Area are expected in principle to be able to detect these sounds, it is low-frequency cetaceans and pinnipeds whose hearing ranges show the greatest overlap with noise generated by the KADP. With respect to injury thresholds and disturbance considerations, continuous underwater sound generated from vessels and cutting tools is understood to be relatively minor in comparison to impulsive sounds derived from high amplitude sources such as airguns during seismic surveys, impact piling or explosives (DECC 2016). Moreover, the estimated source levels of the decommissioning activities are below the proposed thresholds for injury to all functional hearing groups of marine mammals, limiting any effects to those of behavioural disturbance.

In terms of behavioural disturbance, it cannot be excluded that sound from vessels will in the short-term influence the behaviour of individual marine mammals within the vicinity of the operations. Given the very low occurrence of harbour or grey seals in the Kinsale area and ≥74km distance to the nearest designated conservation site for seals (Roaringwater Bay and Islands SAC: grey seal), the potential for disturbance to these species from underwater noise in the Kinsale Area is considered highly unlikely. Of those low-frequency cetaceans listed in **Table 7.5**, minke whale (summer) and fin whales (autumn/winter) are those most likely to be present in the Kinsale Area. The occurrence of these highly mobile species in this open, offshore habitat is likely to be of only limited duration as they traverse the wider Celtic Sea in search of foraging opportunities; as such, any disturbance associated with the KADP is considered highly unlikely to cause prolonged displacement from key habitat.

The hearing range of marine mammals has the potential to overlap with the high frequency sound generated by the sidescan sonar and MBES systems (particularly the lower frequency of 114kHz). Because of the high frequency, attenuation of sound intensity occurs efficiently in the water column. Thus based on the characteristics of the sound source, the hearing capabilities of marine mammals, and the overall duration and location of the survey, any risk of injury or disturbance are assessed as highly unlikely.

Overall, the likelihood that behavioural disturbance effects could become significant at the population level is considered to be extremely low due to a combination of source level characteristics, duration of activity, and the current understanding of marine mammals movement and behaviour in the relevant offshore area.

7.5.2.2 Marine reptiles

Available information on potential effects of underwater sound on marine turtles is very limited (Nelms *et al*. 2016). The hearing range of cheloniid species has been estimated as between 50-2,000Hz, with highest sensitivity below 400Hz (Popper *et al*. 2014). For leatherback turtles, measurements made on hatchlings suggested a similar low frequency sensitivity, with sound detection ranging between 50 and 1,200Hz when in water and between 50 and 1,600Hz in air (Dow Piniak *et al*. 2012). A variety of potential functions of hearing have been proposed for marine turtles, although the issue is poorly understood; they do not appear to vocalize or use sound for communication, but may use sound for navigation, locating prey, avoiding predators, and general environmental awareness (see Dow Piniak *et al*. 2012, Nelms *et al*. 2016 and references therein). While some authors have raised concerns over the potential for physical injury (including hearing damage) to marine turtles from seismic surveys (Nelms *et al*. 2016) and disturbance from increasing anthropogenic noise generally (Samuel *et al*. 2005), such potential impacts remain to be investigated, as do any subsequent ecological effects (Nelms *et al*. 2016).

Underwater noise generated by vessels during the decommissioning activities is likely to be detectable by leatherback turtles, although their low density and only seasonal presence in the area dictates that very few individuals are likely to be exposed to noise levels beyond that of the background for the region. The sound generated by the post-decommissioning survey is unlikely to be detectable by marine turtles; resultant injury and disturbance is therefore highly unlikely. Considering this low likelihood of exposure, the perceived limited sensitivity of the receptor, and the moderate intensity non-impulsive nature of the noise source, significant impacts on marine turtles are considered highly unlikely.

7.5.2.3 Birds

Direct effects from impulsive noise on seabirds could occur through physical damage, or through disturbance of normal behaviour. Diving seabirds (e.g. auks) may be most at risk of acute trauma but while this is theoretically possible, evidence is limited. Hearing sensitivity for species measured so far peaks between 1 and 3kHz, with a steep roll-off after 4kHz (Crowell *et al.* 2015).

Mortality of seabirds (see **Section 4.4.6** for coverage of those considered) has not been observed during extensive seismic operations in the North Sea and elsewhere, and the post-decommissioning survey proposed for the KADP will have noise sources significantly less than these.

While very high amplitude low frequency underwater noise may result in acute trauma to diving seabirds (i.e. with tens of metres of underwater explosions; Danil & St Leger 2011), their region of greatest hearing sensitivity suggests a low potential for disturbance due to vessel noise. As such, and given the short-term duration of vessel presence, including rock placement activities, in the context of many decades of shipping and fishing activity in the region, significant disturbance to diving seabirds is assessed as highly unlikely.

7.5.2.4 Fish

Many species of fish are highly sensitive to sound and vibration and broadly applicable sound exposure criteria have recently been published (Popper *et al.* 2014). While it is recognised that vessel and other continuous noise may influence several aspects of fish behaviour including inducing avoidance and altering swimming speed, direction and schooling behaviour (e.g. De Robertis & Handegard 2013), there is no evidence of mortality or potential mortal injury to fish from ship noise (Popper *et al.* 2014). Given the source level characteristics and the context of similar contributions to the ambient anthropogenic noise spectrum of the area over several decades, no injury or significant behavioural disturbance to fish populations is anticipated.

Studies of fish mortality or behavioural response to noise have tended to focus on geological seismic survey, and while the proposed post-decommissioning survey will generate significantly less noise than these (the methods deployed will involve seabed mapping using side scan sonar and/or MBES), these studies have relevance to the consideration of potential effects on fish and are therefore described here. Studies investigating fish mortality and organ damage from noise generated during seismic surveys are very limited and results are highly variable, from no effect to long-term auditory damage (reviewed in Popper *et al*. 2014).

On the other hand, behavioural responses and potential effects on fishing success ("catchability") have been reported following seismic surveys (Pearson *et al.* 1992, Skalski *et al*. 1992, Engås *et al*. 1996, Wardle *et al*. 2001). Potential effects on migratory diadromous fish is an area of significant interest for which empirical evidence is still limited, especially as salmonids and eels are sensitive to particle motion (not sound pressure) (Gill & Bartlett 2010). Atlantic salmon *Salmo salar* have been shown through physiological studies to respond to low frequency sounds (below 380Hz), with best hearing at 160Hz (threshold 95 dB re 1 μPa). Hence, their ability to respond to sound pressure is regarded as relatively poor with a narrow frequency span, a limited ability to discriminate between sounds, and a low overall sensitivity (Hawkins & Johnstone 1978, cited by Gill & Bartlett 2010).

Given the source level characteristics of rock placement, and the context of similar contributions (shipping and fishing) to the ambient anthropogenic noise spectrum of the area over several decades, no injury or significant behavioural disturbance to fish populations is anticipated.

7.5.3 Interactions between environmental factors

Potential interactions from underwater noise effects were identified between receptors within the biodiversity environmental factor in **Section 6** – see **Tables 6.3a** and **6.3b**, specifically, the potential for effects on prey species of other animals if those prey are subject to injury or disturbance which reduce their availability (for example effects on fish which may have a resultant effect on seabirds or marine mammals, which may include species which are subject to protection; see **Section 7.9**). In view of the nature and scale of potential noise sources associated with the KADP and related effects on fish noted above, it is not considered likely that there will be significant indirect effects on prey species and the potential for interactions is considered to be negligible.

7.5.4 Environmental management, mitigation and residual effects

Wherever possible, through careful activity phasing, the KADP will seek vessel synergies to minimise vessel days and associated noise emissions, and the post-decommissioning survey will be carried out in accordance with established guidelines (including NPWS 2014) as appropriate.

> Specific additional mitigation is not required, as the anticipated source level characteristics from vessels are low, the post-decommissioning survey has a minor source of effect and is temporary (5 days), and the use of explosive cutting was eliminated early in project design, such that residual negative effects are considered to be **minor and temporary**.

7.5.5 Summary and conclusion

The primary contributor to underwater noise from KADP activities relevant to both consent applications will be vessel activity, as subsea activities such as cutting and rock placement are not discernible above their associated vessel noise source. The increased vessel activity associated with the KADP will add to the overall ambient noise in the Kinsale Area; however, source level characteristics are well-below proposed injury criteria for marine mammals, and the continuous noise from vessels is not reported to result in injury to fish or marine turtles. Similarly, noise associated with the post-decommissioning survey is regarded to pose a low risk of significant effect on marine mammals, birds and fish.

The noise sources will be temporary and minimised by a phased approach to decommissioning such that vessel time in the field is minimised. While sound from vessels may result in some temporary influence on the behaviour of individual marine mammals within the vicinity of the operations, significant negative effects at the population level are not anticipated. No specific additional mitigation was considered necessary beyond application of established survey guidance.

7.6 Discharges to Sea

A range of discharges from operational and legacy sources were identified as requiring further consideration in **Section 6.** These are shown below, split by project consent application with reference to relevant environmental factors detailed in the EIA Directive (see **Section 6.1**). Each of these discharge sources is discussed below in **Sections 7.6.1-7.6.3**.

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Consent Application 1		
Platform wells	Discharges associated with well decommissioning: cementing and other chemicals.	*Biodiversity; Land, soil, water, air and climate.*
Subsea wells		
Topsides removal	n/a – none considered significant, see Appendix D.	n/a
Offshore facilities preparation	Displacement of contents of pipelines and umbilicals (hydraulic fluid from umbilical chemical lines)	*Biodiversity; Land, soil, water, air and climate.*
Subsea structures	n/a – none considered significant, see Appendix D	n/a
Consent Application 2		
Pipelines and umbilicals	Discharges associated with displacement of contents of export pipeline (including inhibited seawater) and legacy discharges	*Biodiversity; Land, soil, water, air and climate.*

The potential for effects from discharges to sea were identified in **Section 6** for the broad environmental factors; biodiversity (including conservation sites and species), land, soil, water, and air and climate (**Tables 6.3a** and **6.3b**). More specifically, the potential for significant effects was identified for water quality (with related minor effects of relevance to receptors within the biodiversity factor including plankton, fish and shellfish and marine mammals).

A description and assessment of these potential effects is provided below.

7.6.1 Potential effects from discharges to sea

7.6.1.1 Operational discharges

While the operations include the decommissioning of multiple wells and use of a mobile drilling rig, no well related drilling is planned (although some milling of concrete or steel casing may be necessary) and therefore, discharges will be limited to excess made cement (though only likely for contingency) and potentially treated seawater used to ensure a good bonding of the cement plugs in the wells. A filtration package will be used to treat any well returns prior to discharge to sea (note that the produced hydrocarbons from the Kinsale Area are gas, negating any substantial oil content).

Significant effects on water quality and related water column fauna (e.g. plankton, fish and shellfish, marine mammals, see **Section 4.4** for more details) are not considered to be likely, and any discharges associated with well decommissioning will be subject to a Permit to Use or Discharge Added Chemicals (PUDAC).

The 24" (and potentially the 18" Seven Heads) export pipeline will initially be filled with ~15,800m^3 (~21,500m^3 if both export lines) inhibited seawater from Kinsale Alpha to maintain the pipelines, including the onshore section to Inch. The seawater will be treated with a combination of corrosion inhibitor, oxygen scavenger and microbicide[9]. In the event that no reuse option is identified within the overall decommissioning programme timeframe, the seaward pipeline end (i.e. at the KA jacket) would be opened and the inhibited seawater would be gradually discharged to sea. If a reuse option is identified, the inhibited water would also need to be discharged to accommodate that use at a suitable time. The water depths at the discharge point (Kinsale Alpha) are ~90m, and dispersion of this discharge will be rapid. Additionally, surfactants may be used during the displacement of the other pipelines to seawater in order to maximise the removal of any residual hydrocarbons in these pipelines. Though this would be contained as part of the displacement to wells, a small quantity may be locally released on removal of spool pieces during subsea structure removal and jacket removal scope of works. Chemicals of low toxicity and bioaccumulation potential, and without substitution or other warnings, will be preferentially selected for use in the decommissioning operations. Final chemical selection would be made at the time of decommissioning and this would follow the principle of using the least

[9] Note that total chemical usage and discharge for this operation has been estimated using representative chemicals and concentrations (100-500ppm) to be in the order of 13.5m^3 (18.3m^3 if the 24" and 18" export lines are treated).

harmful chemicals for technical function, and their use and discharge would be subject to permitting via a PUDAC. Significant effects on water quality and related water column fauna are not predicted from pipeline related discharges.

For context, annual average operational discharges to sea from the Kinsale Area facilities (2010-2016) have been minor and include 1,313m^3 water of condensation (no connate water is produced with the gas), 21kg of oil associated with produced water, 7,471kg of triethylene glycol (TEG) and methanol and 3,911kg of hydraulic fluid losses. These discharges will cease following decommissioning.

7.6.1.2 Legacy discharges

Legacy discharges represent those which may take place gradually some time after decommissioning, resulting from losses from the open ends of pipelines/umbilicals, or as pipeline/umbilicals degrade. Other than the 24” export pipeline, all pipelines will be displaced to seawater and no discharge of residual hydrocarbons is expected, noting the nature of the produced gas. This seawater, and a small quantity of surfactants used in pipeline cleaning, will eventually be released as the pipelines degrade (see **Section 7.3**).

Prior to decommissioning, all of the chemical lines within the umbilicals will have been displaced with seawater, eliminating discharges to sea from this source during or after decommissioning activities. These lines contain methanol and TEG used for the prevention of hydrate formation. Both of these chemicals are in the Offshore Chemical Notification Scheme (OCNS)[10] group E (those considered to have the least potential environmental hazard), methanol is categorised to Pose Little or No Risk to the environment (PLONOR). It is proposed that the water based hydraulic fluid used in the subsea hydraulic control system will remain in the lines, all or part of which may be lost during decommissioning (removal of umbilical jumpers) and/or over time due to degradation of the umbilical, depending on the chosen options. The total volume of hydraulic fluid in all the Kinsale Area umbilicals is approximately 29.5m^3.

Any of the legacy discharges described above would, under the influence of local currents, rapidly disperse and dilute and are not considered likely to result in significant environmental effects.

7.6.1.3 Marine growth removal

The jackets of the two Kinsale Head platforms are each covered with an estimated 1,450 tonnes of marine growth. The growth comprises of a variety of hard- and soft-bodied organisms which commonly colonise hard structures in the temperate north-east Atlantic, including: various species of algae, bivalves (primarily *Mytilus edulis*), barnacles, hydroids, plumose anemones, and soft corals (e.g. *Alcyonium digitatum*). These species have a minor influence on the surrounding water column and seabed through the release of solid and dissolved metabolic products, of larvae, and detached biota.

The presence of the jackets and subsea structures and their associated marine growth also provide shelter and food for larger animals such as fish and marine mammals. As these structures are required to be removed under OSPAR Decision 98/3, the assessment only considers the effects of the removal of marine growth as structures are removed. BMT Cordah (2013) reviewed the relative performance of options for marine growth removal during the decommissioning of offshore facilities. Two approaches were considered: (1) removal at the onshore disposal yard and (2) removal offshore at the field location.

An advantage of offshore removal is the avoidance of two sources of potential impact associated with onshore marine growth removal: odour and waste disposal (BMT Cordah 2013). An identified disadvantage of offshore removal is longer vessel operations, resulting in extended physical presence, additional atmospheric emissions and increased costs. However, it is noted that BMT Cordah (2013) only considered removal of marine growth from the jacket *in situ* by ROV; removal of marine growth from a jacket already loaded on to an HLV or barge and/or as it is being removed, is anticipated to be more efficient.

Marine growth removal at an onshore disposal yard has the advantage of not adding time to offshore operations. Some marine growth will still be removed offshore in this scenario, for example to gain access to cut jacket members or legs, and a proportion will also fall off on transport to shore through desiccation (BMT Cordah 2013). Onshore removal of marine growth results in odours associated with decaying organisms, which may pose a nuisance to local settlements depending on their proximity to the yard and environmental conditions at the time. Yard operators implement odour management plans and can apply various measures to minimise the issue (e.g. applying odour suppressants; storing in covered skips), which is generally

[10] The OCNS is a management system used in the UK and Netherlands, in accordance with the OSPAR Harmonised Offshore Chemical Notification system.

successfully mitigated. Removed marine growth is typically disposed of at a landfill; composting or land (agricultural) spreading present alternative methods of disposal, but their availability may be limited.

It is assumed that all marine growth is to be removed onshore, as described, with the material being transported along with the jackets to a licensed disposal yard (see **Section 7.7**). Any negative effect predicted are minor and temporary in nature with no significant negative effects predicted.

7.6.2 Interactions between environmental factors

No foreseeable interactions were identified between those environmental factors for which potential environmental effects were identified in **Section 6** – see **Tables 6.5a** and **6.5b**.

7.6.3 Environmental management, mitigation and residual effects

The description and assessment of potential effects from discharges to sea has been undertaken assuming that activities are in accordance with regulatory and policy controls, these include:

- Existing operational controls for the management of routine marine discharges from the decommissioning activities (e.g. adherence to MARPOL standards).
- Chemicals selected for use and discharge for well abandonment will be subject to a PUDAC

All potential discharges associated with decommissioning the Kinsale Area facilities (e.g. from pipelines and well abandonment) are considered to be minor. Discharges from well abandonment will be minimal, subject to treatment/filtration, with chemicals being selected on the basis of the lowest hazard quotient for the required technical function.

Specific additional mitigation is not required as no significant negative effects from discharges to sea resulting from the KADP are predicted, with any residual effect being **minor and temporary**. See environmental management commitments 1, 2, 3, 4 and 7 in **Section 8.2**.

7.6.4 Summary and conclusion

Discharges from well abandonment will be risk assessed and subject to standard permitting controls, and the discharge of inhibited seawater from the 24” and 18” export pipelines is not predicted to result in significant effects. Consequently, no likely significant impacts are anticipated from marine discharges associated with the KADP, and residual effects are considered to be minor and spatially and temporally restricted.

7.7 Waste: Materials Recycling, Reuse and Disposal

Table 3.28 of **Section 3.5.7** summarises the estimated waste generated from the decommissioning of the KADP. The main structures of the fixed platforms in the Kinsale Gas Field are constructed of steel which is highly recyclable, as are the well protection structures and wellheads. During well decommissioning a quantity of steel and cement will be recovered from the removal of the casings to *ca*. 3m below the seabed. Other wastes present at the KA facilities are asbestos, refrigerants, fluorescent tubes (mercury), fire & gas detectors (radioactive waste), fire extinguishants, diesel and lubricating oils. The Inch terminal will be fully demolished with wastes arisings removed for recovery or disposal.

The key sources of potential effect from waste associated with the decommissioning operations split by project consent application are shown below with reference to relevant environmental factors detailed in the EIA Directive (see **Section 6.1**).

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Consent Application 1		
Platform wells Subsea wells	Solid & liquid wastes to shore Onshore waste treatment Landfill of residual waste	*Population and human health; Material assets, cultural heritage and the*

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Offshore facilities preparation	Removal of hazardous materials (e.g. asbestos, refrigerants)	*landscape;*
Subsea structures	Mattress removal Removal of pipeline spoolpieces and umbilical jumpers Removal of manifolds and wellhead protection structures Onshore waste treatment	*Population and human health; Land, soil, water, air and climate; Material assets, cultural heritage and the landscape;*
Consent Application 2		
Jackets	Onshore waste treatment	*Population and human health; Land, soil, water, air and climate; Material assets, cultural heritage and the landscape*
Planning Permission Consent		
Onshore (decommissioning of Inch Terminal)	Materials recycling/recovery – effect considered negligible (See **Appendix D** and **Section 7.11**)	n/a

The potential for effects from waste recycling, reuse and disposal were identified in **Section 6** for the broad environmental factors; population and human health, land, soil, water, air and climate and material assets, cultural heritage and the landscape (**Tables 6.3a and 6.3b**). More specifically, the potential for significant effects was identified for the generation and handling of waste.

A description and assessment of these potential effects is provided below.

7.7.1 Potential effects from waste recycling, reuse and disposal

All wastes returned to shore will be handled, recycled and disposed of in accordance with relevant waste legislation and the waste hierarchy such that the reuse and recycling of materials will be considered before disposal (e.g. to landfill). **Section 3.5.2.1** notes that topsides will be cleaned and all wastes including residual inventories will be collected for onshore disposal or use as appropriate.

All regulatory and company procedures for segregation, transport and disposal will be strictly adhered to and only fully permitted and licensed waste facilities will be used for recycling or disposal.

The dismantling yard for the offshore structures is yet to be selected, though it will be an established, licenced yard for the disposal of decommissioned offshore structures where the dismantling, transport and disposal of materials represent an increment to ongoing activities. Disposal of certain wastes may take place outside Ireland in accordance with the relevant legislation and requirements.

The overall significance of the impact of waste as a result of the decommissioning project is considered to be low. It is expected that there will be a minor positive effect from material reuse and recycling, offsetting the use of primary raw materials, including in relation to emissions (see **Section 7.8.2**), and wider environmental effects associated with raw material extraction and transport.

Potential effects on population and human health (e.g. through handling of hazardous materials) are considered to be low, through strict regulatory compliance, and the selection of established, licenced, facilities for which material from the KADP represents an increment to existing dismantling work.

7.7.2 Interactions between environmental factors

No foreseeable interactions were identified between the factors for which potential environmental effects related to waste were identified in **Section 6** – see **Tables 6.3a** and **6.3b**.

7.7.3 Environmental management, mitigation and residual effects

The decommissioning works shall be undertaken in a manner which maximises the potential for reuse and recycling, including source segregating waste where appropriate. Management of all waste will be undertaken in accordance with the relevant waste legislation and only permitted and licensed waste facilities will be used.

7.7.3.1 Outline Resource and Waste Management Plan

An outline Resource and Waste Management Plan has been developed to establish the minimum standards that the contractor must apply during the decommissioning phase. A detailed Resource and Waste Plan will be prepared by the contractor which will be submitted to KEL for approval prior to commencement of the decommissioning works.

The outline Resource and Waste Management Plan states the following:

- The KADP will comply with all relevant waste and resource management policy and legislation that applies (including International, European and Irish policy and legislation);
- All relevant obligations governing storage, transfer, treatment and disposal of all wastes arising from KADP will be complied with and the contractors will implement approved method statements and procedures for transporting and managing waste as part of their detailed Resource and Waste Management Plan;
- Resource and waste management objectives to be applied to the KADP to maximise the potential for reuse and recycling are:
  - Target 90% recycling rate by weight;
  - Minimise disposal of waste to landfill; and
  - Minimise environmental impacts of waste management.
- A fully detailed description of solid waste generation associated with each of the key elements of KADP will be provided in the detailed Resource and Waste Management Plan (estimate waste quantities have been calculated from detailed analysis of the waste arisings/material surpluses as outlined in **Section 3.5.7**);
- The contractor will put in place all relevant waste authorisations (detailing the name, address and authorisation details of proposed recovery and disposal facilities which will be used for all wastes generated from the decommissioning project) in advance of the removal of any waste and will maintain a register of resource and waste management information throughout KADP;
- Waste recovery and disposal will be undertaken at authorised waste facilities and the typical management methods for different waste streams associated with KADP are summarised below.

Waste Stream	Removal method	Waste management method
Platforms	Platform jacket legs will be cut at the top of footings at the seabed before removal. Topsides will be disconnected from jacket and removed. Materials will be transferred from the site on vessels to authorised waste facilities.	Steel will be brought to a dismantling facility and recycled where appropriate at authorised waste facilities. Concrete will be brought onshore for reuse and recycling at authorised waste facilities.
Wellhead Protection Structures	Wellhead Protection Structures will be dismantled and casings to 3m below the seabed removed to allow access to the wells	Steel and concrete will be brought onshore for reuse and recycling at authorised waste facilities.
Subsea protection materials	Concrete mattresses and grout bag materials will be removed only when necessary to allow access to the tie-in facilities underneath.	Steel and concrete will be brought onshore for reuse and recycling at authorised waste facilities.
Non-ferrous metals	Removed from platforms as part of the dismantling and removal of the topsides and jackets	Non-ferrous metals will be brought onshore for reuse and recycling at authorised waste facilities.

Waste Stream	Removal method	Waste management method
Asbestos	Protocols to be followed to remove asbestos and transfer into heavy gauge polythene bags for transfer. Asbestos will be brought onshore for disposal by authorised handlers	Asbestos and other hazardous materials will be handled by a licensed operator and disposed of at a licensed facility.
Routine wastes from the decommissioning vessels	Transferred onshore to port in line with European Communities (Port Reception Facilities for Ship-Generated Waste and Cargo Residues) Regulations 2003 (S.I. No. 117 of 2003) and MARPOL	Disposal will be undertaken in accordance with normal procedures. Waste will be recycled, reused and/or disposed of (depending on type) in appropriately licensed facilities.
Hazardous waste	Where practicable, hazardous waste will be removed from the platforms prior to dismantling and be transferred to appropriate waste facilities for treatment and disposal.	Chemicals, lubricants, hydrocarbon contaminated materials, diesel – disposed of to an appropriately licensed facility, if it cannot be reused or recycled.

The overall effect from waste generation relevant to project consent applications 1 and 2 is considered to be **minor and temporary**. See environmental management commitments 1, 3 and 8 in **Section 8.2**.

7.7.4 Summary and Conclusions

The waste activity will represent a minor increment to waste handling and disposal at existing licenced facilities, and to the transport of such material to these sites. In view of the proposed mitigation, the effects from waste generation is considered to be minor and temporary.

7.8 Energy Use and Atmospheric Emissions

Sources of atmospheric emissions from the Kinsale Area Decommissioning Project split by project consent application are shown below with reference to relevant environmental factors detailed in the EIA Directive (see **Section 6.1**).

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Consent Application 1		
Platform wells	Atmospheric emissions associated with plant power generation, fugitive emissions from fuel & chemical storage, and venting	*Land, soil, water, air and climate; Material assets, cultural heritage and the landscape*
Subsea wells	Atmospheric emissions associated with rig power generation, fugitive emissions from fuel & chemical storage, and venting	
Offshore facilities preparation	Vessel and ancillary equipment power generation Material recycling	
Topsides removal		
Subsea structures	Vessel and ancillary equipment power generation Material recycling (manifolds and pipeline spoolpieces and umbilical jumpers)	
Consent Application 2		
Jackets	Vessel and ancillary equipment power generation Material recycling	*Land, soil, water, air and climate; Material assets, cultural heritage and the landscape*
Pipelines and umbilicals	Vessel and ancillary equipment power generation Lost benefit of recyclable material left *in situ*	
Planning Permission Consent		
Onshore (decommissioning of Inch Terminal)	Vehicle emissions and dust - effect considered negligible (See **Appendix D** and **Section 7.11**) Materials recycling/recovery - effect considered negligible (See **Appendix D** and **Section 7.11**)	n/a

The potential for effects from energy use and atmospheric emissions were identified in **Section 6** for the broad environmental factors; land, soil, water, air and climate, material assets, cultural heritage and the landscape (**Table 6.3a and 6.3b**). More specifically, the potential for significant effects was identified for air quality and climate from emissions from power generation, and in relation to waste generated and its fate (e.g. re-use, recycling, leaving materials *in situ*).

A description and assessment of the potential effects is provided below.

7.8.1 Potential effects from energy use and atmospheric emissions

Anthropogenically enhanced levels of greenhouse gases (GHGs, principally CO_2) have been linked to global climate change (IPCC 2013). Predicted effects include *inter alia* an increase in global temperate (Kirtman *et al.* 2013, Collins *et al.* 2013), rising sea-levels (Lowe *et al.* 2009, Church *et al.* 2013, Horsburgh & Lowe 2013), changes in ocean circulation (Collins *et al.* 2013) and potentially more frequent extreme weather events (Woolf & Wolf 2013), and other effects including ocean acidification generated by enhanced atmospheric acid gas loading, deposition and exchange (see Bates *et al.* 2012). These effects, most recently summarised in the Intergovernmental Panel on Climate Change (IPCC) 5th assessment report (IPCC 2013, also see Dolan 2015), are the rationale on which global carbon dioxide reduction measures such as the Paris Accord and the EU (see EC 2011) target of a reduction of 80% CO_2 by 2050 on 1990 levels which forms the basis of Ireland's National Policy Position. The National Mitigation Plan (DCCAE 2017), a requirement of the *Climate Action and Low Carbon Development Act 2015*, was published in July 2017 and outlines where Ireland is in transitioning towards decarbonisation with a view to being regularly updated to provide sectoral (e.g. electricity generation, transport) mitigation options.

In addition to effects associated with atmospheric greenhouse gases, emissions also have the potential to have negative effects on air quality. Poor air quality can result in effects on human health, the wider environment and infrastructure. Reduction in local air quality through inputs of contaminants such as oxides of nitrogen (NO_X), volatile organic compounds (VOCs) and particulates (e.g. PM_{10}, $PM_{2.5}$), may contribute to the formation of local tropospheric ozone and photochemical smog, which in turn can result in human health effects (see WHO 2013, EPA 2017).

Monitoring of these and a range of other pollutants (e.g. SO_2, CO, benzene, heavy metals and PAHs) is undertaken in a number of zones across Ireland in order to understand air quality in relation to those limits set out in the Ambient Air Quality and Cleaner Air for Europe Directive (2005/50/EC). These pollutants were not observed to exceed EU limit values in the most relevant zone to the KADP (Zone B – Cork) in 2016 (EPA 2017).

7.8.1.1 Emissions associated with decommissioning operations

The principal GHG of concern is CO_2 as it constitutes both the largest component of global combustion emissions (generally ~80% of total GHG emissions), and has a long atmospheric residence time such that emissions made today continue to contribute to radiative forcing for some time[11]. Emissions of relevant gas species and their associated Global Warming Potential (GWP) have been estimated for activities associated with the decommissioning of the Kinsale facilities (covered in **Section 3.5**). This has involved the use of standard Environmental and Emissions Monitoring System (EEMS) conversion factors (DECC 2008) to estimate the relative quantity of each gas species from combustion for offshore works, and the most recent GWP metrics (Myhre *et al.* 2013, **Table 7.6**). The result is a value in tonnes of CO_2 equivalent (CO_2 eq.) based on the radiative forcing effect of each GHG species relative to CO_2 and the atmospheric residence time of each gas. The GWP factor therefore changes depending on the "time horizon" considered (see IPCC 2001, 2007, Myhre *et al.* 2013, and Shine 2009 for a synthesis and critical review). GWP factors for CO have previously been calculated as 1.9 at 100 years, and that for NO_x is considered highly uncertain (Forster *et al.* 2007), and these are therefore not generally calculated.

For the purposes of this assessment, a 100 year time-horizon has been used, in line with its adoption by the United Nations Framework Convention on Climate Change and use in the Kyoto protocol (Myhre *et al.* 2013), and nationally for the calculation of carbon dioxide equivalent emissions (Shine 2009). In view of the atmospheric residence time of the principal greenhouse gases and their overall contribution to global greenhouse gas loading, the emissions relevant to both consent applications are considered together.

Table 7.6: Emissions factors

Gas	CO_2	N_2O	CH_4	CO	NOx	SO_2	NMVOCs
Diesel (turbine)	3.22	0.00022	0.0000328	0.00092	0.0135	0.0040	0.000295
Diesel (engine)	3.22	0.00022	0.00018	0.0157	0.0594	0.0040	0.002
Aviation fuel (helicopter)	3.15	0.00012	0.00035	0.00953	0.012	0.0009	0.00306
GWP at 100 years	1	265	28	-	-	-	-

Source: IPCC (1996), DECC (2008), Myhre et al. (2013), AEA-Ricardo (2015)

It should be noted that the emissions calculations are based on a range of assumptions relating to vessel types and timings which are considered to be conservative and include a 25% contingency (see **Section 3.5**). Actual vessel use at the time of decommissioning will be informed by the final decommissioning options and detailed engineering design, though will not be greater than that calculated below.

[11] Figures vary widely from between 5-200 years (Houghton *et al.* 2001) to ~1,000 years (Archer 2005).

Operational emissions

Depending on the selection options for well decommissioning, platform removal and pipeline and umbilical[12] decommissioning, the total emissions from the KADP are estimated to be between 67,600tCO_2eq and 95,600tCO_2eq (see **Table 7.7**).

[12] As indicated in **Section 3.4.6**, in view of the conclusions of the Comparative Assessment, and that further evaluation of whether additional rock cover may be applied to certain sections of the pipelines to reduce 3rd party risk further (mainly in relation to those sections exposed >50%), it was considered that a worst case scenario of applying rock to all exposed sections should be considered. The two scenarios assessed here are therefore the preferred options as indicated in the Comparative Assessment and this worst case option.

Table 7.7: Summary of estimated emissions from decommissioning operations (tonnes)

	Decommissioning Options											Total (CO_2eq.) Application 1 & 2	
	Project Application 1						Project Application 2						
	Wells[a]		Subsea	Topsides			Jackets[b]			Pipelines[c]			
Gas	Rig	LWIV & Rig	Subsea structure removal	Reverse installation	Specialist HLV	Single lift (HLV)	Multiple lift	Specialist HLV	Single lift (HLV)	Rock cover ends and freespans	Extended rock placement	High	Low
CO_2	19,700	14,500	8,500	23,500	22,500	19,100	33,100	20,600	21,300	3,400	9,000	93,900	66,200
N_2O	1	<1	<1	2	2	1	2	1	1	<1	<1	1,600	1,300
CH_4	1	<1	<1	1	1	1	2	1	1	<1	<1	100	100
SO_2	24	18	11	30	30	20	40	30	30	4	10	-	-
CO	100	70	41	110	110	90	200	100	100	20	40	-	-
NO_X	400	300	160	400	400	400	600	400	400	100	200	-	-
VOC	12	9	5	10	14	12	20	13	13	2	5	-	-
											Total	**95,600**	**67,600**

Note:

[a] *figures include those for rigless platform well abandonment.*

[b.] *The use of flotation to remove jackets (see* ***Section 3.5.2.3****) is estimated to produce emissions of ca. 9,600tCO_2eq., compared to alternatives in the range 21,000tCO_2eq (specialist HLV single lift) and 33,000tCO_2eq. (multiple lift).*

[c] *emissions associated with generating new material for rock cover varies between 98tCO_2 and 1,146tCO_2. A post-decommissioning survey is required under all scenarios, and emissions associated with the vessel are incorporated into the totals above.*

Figures rounded following; >100, rounded to nearest 100; 10-100, rounded to nearest 10; <10, rounded to nearest whole number or indicated as <1.

From 2020, new IMO limits on SOx and particulate matter emissions (0.5% by mass) outside of Emission Control Areas (note the Celtic Sea is not within an ECA) will come into force. Note that ships at berth are already subject to controls on the use of fuels which should not exceed 0.10% SO_2 by mass.

Local effects on air quality from fuel combustion are mitigated through the remote location of most of the activities associated with the KADP (at least 40km from nearest land, unless the option to rock cover all exposed sections of the export pipeline is selected), away from any areas with air quality management plans (the closest being Dublin for NO_2). Given the development location and predominant air flow, the resulting atmospheric emissions will have, at most, negligible, temporary and local effects which are considered to be minor.

The removal of the Kinsale Area facilities and their operational emissions is undertaken in the context of Ireland's national objective to transition to a low carbon economy as set out in the *Climate Action and Low Carbon Development Act 2015*. The related National Policy Position has a long-term vision based on:

- an aggregate reduction in CO2 emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors
- in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

To place the CO_2eq. emissions from activities associated with the KADP in context, in 2015 the EU28 emitted a total of 4,452 million tonnes CO_2eq. greenhouse gases, excluding net CO_2 sequestrations through land use, land use change and forestry (LULUCF) (EEA 2017). In 2015, emissions of the basket of six greenhouse gases covered by the Kyoto Protocol from Ireland were estimated to be 59.88 million tonnes CO_2eq (provisionally 61.19 million tonnes CO_2eq in 2016). Emissions have generally fallen in Ireland since the economic downturn of 2008, however 2015 emissions were 3.7% higher than in 2014 (57.76 million tonnes), with the largest increases between 2014 and 2015 coming from the waste and industrial sectors, up 10.9 and 10.2% respectively (EPA 2017a), and are provisionally estimated to be another 3.5% higher in 2016, returning emissions to 2009 levels (EPA 2018, also see EPA 2017c).

The above emissions estimates resulting from KADP activities (Consent applications 1 and 2) would constitute between approximately 0.12 and 0.16% of 2015 Irish national emissions. Locally, annual average (2010-2016) operational emissions of CO_2 from the Kinsale Area were 35,700t, which will be eliminated on CoP. Therefore, though the KADP emissions may be considered as additive to these in the context of wider atmospheric GHG loading derived from Kinsale Energy emissions, the outcome of the operations is that there will be no further emissions from the Kinsale Area. Overall, it is considered that emissions associated with the KADP will have a minor negative effect resulting from small incremental GHG loading.

7.8.1.2 Emissions associated with material recycling

To provide a more complete indication of the emissions associated with the decommissioning of the Kinsale Area facilities, emissions from the recycling of their primary components to be removed have been estimated (note that re-use options have not been identified for the KADP facilities – see **Section 3.3**). These are primarily from steel and concrete associated with the platform topsides, jackets, terminal building (considered minor, see **Appendix D** and **Section 7.11**) and any recovered pipeline and umbilical materials (largely negligible given proposed methods of decommissioning) as well as concrete from recovered mattresses, with some other minor metal and plastic components.

Most materials to be recovered from the Kinsale Area are highly recyclable (e.g. steel, making up ~70% of the recovered materials, see **Table 3.27**) and therefore have a strong potential end-of-life benefit (i.e. through the displacement of virgin material in the wider steel supply chain (Hammond & Jones 2011, Weinzettel *et al.* 2009, Yellishetty *et al.* 2012)), which also has wider implications than just emissions. Conversely the leaving of components *in situ* results in a loss of future use of that material.

The emissions calculated below represent those that would be associated with the production of secondary materials (i.e. with a recycled content which will also include an element of primary raw materials, e.g. typical steel in the EU comprises an average of 59% recycled content). Additionally, the lost benefit from not recycling the pipelines and umbilicals left *in situ* is estimated based on the emissions using the carbon intensity of 100% virgin materials (i.e. due to the necessity to replace the materials which could have been recycled with new materials). Further detail with regard to the emissions from minor impacts, such as the Inch terminal decommissioning, is provided in **Appendix D**, and are also considered as a potential source of cumulative effect (see **Section 7.11**).

Total emissions relating to the production of recycled materials have been calculated based on the typical embodied carbon of materials to be returned for recycling (tCO_2eq./t), with factors largely based on those from Hammond & Jones (2011) and IoP (2000) (see **Table 7.8**). Emissions estimated to be generated from the recycling of materials associated with the KADP are 28,400tCO_2eq.

When considered in relation to the equivalent emissions using materials from primary sources (*ca.* 57,900tCO_2eq.), it can be estimated that there is a net emissions benefit of *ca*. 29,800tCO_2eq. from recycling the material that is returned to shore. Recycling of these materials may be taken to be either a benefit to the overall lifecycle emissions associated with the Kinsale area infrastructure, or may be considered as offsetting those emissions otherwise embodied in the extraction and transport of primary materials for use in new products. Additionally, wider environmental interactions associated with the extraction of virgin materials are also avoided.

Table 7.8: Emissions relating to the recycling of materials associated with the KADP (tonnes)

Activity	Material recovered (t)					Emissions (tCO_2eq.)
	Steel	Aluminium	Copper	PP	Concrete	
Topsides recycling	8,100	-	-	-	-	11,900
Jacket recycling	9,000	200	-	-	-	13,500
Pipeline & umbilical ends recycling	200	0.12	-	-	4,500	300
Subsea manifolds and WHPS	300	-	-	-	1,400	500
Recovered well casing and tubular sections	1,500	-	-	-	-	2,200
					Total	28,400
					Emissions estimated from production of equivalent material from primary sources	57,900
					Emissions avoided from material recovery	-29,800

Notes: values rounded to nearest 100t.

Emissions have been estimated for the production of replacement materials for those which are proposed to be left *in situ*. These are summarised in **Table 7.9** and are estimated to be *ca.* 93,200tCO_2eq. For the purposes of comparison, on the basis of emissions alone (i.e. not considering wider potential effects from seabed disturbance and additional risk relating to full pipeline and umbilical removal, as detailed in the Comparative Assessment), in view of those emissions estimates for the proposed decommissioning options (**Table 7.7 and 7.8**), and assuming that the entire emissions recycling benefit is attributed to the KADP, it is not regarded that there is a net emissions benefit to the recovery of the additional pipeline material (summarised in **Table 7.9**).

Table 7.9: Estimated total decommissioning emissions from operations and material recovery/replacement

Emissions component	Values incorporating pipeline/umbilical leave *in situ* options		Values incorporating pipeline/umbilical recovery	
	Low	High	Low	High
Emissions from decommissioning operations	67,600	95,600	193,100	215,300
Emissions from recycling recovered materials	28,400	28,400	73,400	73,400
Emissions from the production of new material to offset that left *in situ*	93,200	93,200	-	-
Emissions offset from avoided production of new materials	-30,600	-30,600	-77,400	-77,400
Net emissions	**158,600**	**186,600**	**189,100**	**211,300**

Notes: Values rounded to nearest 100t.

7.8.2 Interactions between environmental factors

While emissions associated with the KADP represent an increment to global GHG loading and therefore will contribute to the associated effects of climate change which are projected to affect all environmental factors to varying degrees (e.g. see IPCC 2013, Marine Institute 2009), the emissions are minor in a regional context and of short duration. In addition, further emissions from the Kinsale Area will be eliminated on completion of the decommissioning work. Emissions are therefore not considered to generate significant effects on a broader range of environmental factors than those identified above.

7.8.3 Environmental management, mitigation and residual effects

It is considered that there is limited scope for additional mitigation measures to reduce the residual effect on atmospheric GHG loading, or any local effects on air quality. There is the potential to minimise time in the field and associated vessel days and related emissions by making use of vessel synergies and careful activity phasing which would form part of standard programme management, and there is the potential to make further emissions reductions during contractor selection (e.g. those using modern efficient vessels); however neither of these are considered to significantly alter the predicted effect. Emissions from material flows will be minimised by using a waste hierarchy approach consistent with the Waste Framework Directive 2008/98/EC; establishing where there is scope for equipment and material re-use and recycling, with disposal only taking place where no feasible alternative is available.

Effects on any environmental factor from energy use and atmospheric emissions associated with the KADP are considered to be **negligible and temporary**. See environmental management commitments 1, 3, 4 and 9 in **Section 8.2**.

7.8.4 Summary and conclusion

Activities associated with the KADP covered by consent applications 1 and 2 will lead to emissions of gases which contribute both to localised and short-term increases in atmospheric pollutants, and to global atmospheric GHG concentrations. In the context of wider Irish emissions these effects are considered to be negligible, and there will be a minor positive benefit from the return of recyclable materials to shore which will have a future use and offset the extraction and transport of primary raw materials. On completion of the KADP, all current emissions from the Kinsale Area will be eliminated. Effects are considered to be negligible and temporary.

7.9 Conservation Sites and Species

There are a number of Natura 2000 sites located along the coast of south west Ireland, the closest site (Cork Harbour SPA) being within 6km of the export pipeline (see **Section 4.4.8**). With the exception of the export pipeline, the Kinsale Area facilities to be decommissioned are at least 25km from the closest site (Old Kinsale Head SPA), though the qualifying interests of certain sites e.g. seals, harbour porpoise (both on Annex II of the Habitats Directive) and seabirds may be present across the Kinsale Area at some distance from site boundaries. Relevant sites include Roaringwater Bay and Islands SAC (74km) for harbour porpoise and grey seal, Saltee Islands SAC (109km) for grey seal, and Old Head of Kinsale SPA (25km) and Saltee Islands SPA (116km) for seabirds including gannet, fulmar, kittiwake, gulls and auks (see **Section 4.4.8** for more details).

Additionally, protected species such as those listed on Annex II and IV of the Habitats Directive may also be present across the Kinsale Area. Annex IV includes all cetaceans (e.g. harbour porpoise, common dolphin, bottlenose dolphin, minke whale, fin whale and humpback whale) and the leatherback turtle.

Sources of effect on conservation sites and species from the Kinsale Area Decommissioning Project split by project consent application are shown below. Biodiversity (with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC) was the only environmental factor, as detailed in the EIA Directive (see **Section 6.1**), considered to be relevant to this topic.

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Consent Application 1		
Platform wells	Mechanical cutting of and removal of surface casings Accidental spills of fuel/lubricants	*Biodiversity*
Subsea wells		
Topsides removal	Presence in field of vessels Transit of vessels and transport to shore Underwater noise from vessels including DP Accidental spills of fuel/lubricants	
Subsea structures	Presence in field of vessels Transit of vessels and transport to shore Underwater noise from vessels including DP Accidental spills of fuel/lubricants	
Consent Application 2		
Jackets	Abrasive, high pressure water jet and other cutting (internal and external cuts)	*Biodiversity*
Pipelines and umbilicals	Presence in field of vessels Transit of vessels and transport to shore Underwater noise from vessels including DP and rock placement Accidental spills of fuel/lubricants	
Post-decommissioning survey	Underwater noise from survey equipment	

7.9.1 Assessment of potential effects

Noise from vessel activity associated with the decommissioning activities has the potential to contribute to existing noise levels in the area. It is indicated in **Section 7.5** that while it cannot be excluded that sound from vessels will in the short-term influence the behaviour of individual marine mammals within the vicinity of the operations, the risk that any effect could become significant at the population level is deemed to be extremely low due to a combination of sound characteristics, duration of activity, current understanding of marine mammals movement and behaviour in the relevant offshore area, and distance to the closest marine protected areas (Roaringwater Bay and Islands SAC) with relevant qualifying features (harbour porpoise, see **Section 4.4.8**). Additionally, noise from cutting (e.g. of the platform conductors, jacket members and risers) and rock placement is not anticipated to significantly exceed that of vessel operations. In view of the characteristics of the sound sources associated with the proposed post-decommissioning survey, the hearing capabilities of marine mammals, and the overall duration and location of the survey, any risk of injury or disturbance are assessed as highly unlikely with no predicted significant effects.

The physical presence, light and noise generated by rigs and vessels associated with decommissioning activities may potentially cause displacement and/or other behavioural responses in birds (see **Section 7.2.2**). The foraging ranges of a number of seabirds associated with nearby colonies (some of which are also SPAs) could bring them to within the Kinsale Area. However, most of these species have been judged to have a low to moderate sensitivity to disturbance by shipping traffic (Garthe & Hüppop 2004). Only the cormorant, a coastal species and a feature of the Cork Harbour SPA and Sovereign Islands SPA, was judged to be highly sensitive to disturbance by shipping (Garthe & Hüppop 2004). However, the KADP will result in a small increase in vessel traffic within the wider Kinsale Area and is anticipated to cause no more than temporary and localised disturbance, which is not predicted to result in significant effects.

Accidental events, particularly spills, have the potential to result in significant impacts on conservation sites and species, however the nature of potential spills from the decommissioning operations and their low likelihood are such that significant effects are not predicted. Further information is provided in **Section 7.10**.

All recent benthic sampling and photographic surveys in the Kinsale Area (including the 2017 seabed survey) have been consistent in reporting no indication of sensitive species or habitats which would be subject to protection under the EU Habitats Directive (92/43/EEC) i.e. Annex I habitats.

7.9.2 Environmental management, mitigation and residual effects

No further residual effects following mitigation beyond that already indicated in **Sections 7.2-7.8** has been identified for conservation sites and species.

7.9.3 Summary and conclusion

The potential for significant effects to arise for qualifying features of sites of relevance to the Kinsale Area are considered to be minor (for example due to the lack of any significant impulsive noise sources). The KADP has also been considered in relation to the relevant Natura 2000 sites described in **Section 4.4.8** as part of a separate screening for Appropriate Assessment (AA), which considered the likelihood of potential significant effects on European sites from the proposed activities.

7.10 Accidental Events

Risk assessment of accidental events, including the risk of major accidents (i.e. as required under Article 3(2) of Directive 2011/92/EU, as amended), involves the identification of credible accident scenarios, evaluation of the probability of incidents and assessment of their ecological and socio-economic consequences. Given the nature of the activities which could take place as a result of decommissioning, the following potential sources of accidental events have been identified for each project consent application:

Facility	Activity/Source of Potential Effect	Relevant Environmental Factor
Consent Application 1		
Platform wells Subsea wells	Dropped objects Accidental releases to atmosphere (including refrigerants and natural gas from well blowout) Accidental spills of fuel/lubricants Chemical spills	*Population and human health; Biodiversity; Land, soil, water, air and climate; Material assets, cultural heritage and the landscape*
Topsides removal	Dropped objects Vessel collision Accidental spills of fuel/lubricants	
Subsea structures	Dropped objects Vessel collision Accidental spills of fuel/lubricants	
Consent Application 2		
Jackets Pipelines and umbilicals	Dropped objects Vessel collision Accidental spills of fuel/lubricants	*Population and human health; Biodiversity; Land, soil, water, air and climate; Material assets, cultural heritage and the landscape*

The potential for effects from accidental events were identified in **Section 6** for the broad environmental factors; population and human health; biodiversity (including conservation sites and species), land, soil, water, air and climate and material assets, cultural heritage and the landscape (**Tables 6.3a and 6.3b**). More specifically, the potential for significant effects was identified for water quality (with related potential significant effects of relevance to all marine biodiversity receptors (see **Section 4.4**), fisheries and other users of the sea.

A description and assessment of these potential effects is provided below.

7.10.1 Assessment of potential effects

7.10.1.1 Well decommissioning and topsides preparatory work

The platform topsides and pipelines will be cleaned prior to decommissioning work commencing (see **Section 3.5.2.1**), and due to the nature of the produced hydrocarbons (dry gas), there is not considered to be any risk from residual hydrocarbons which could lead to pollution. In advance of well abandonment, each well bore will be displaced to seawater. Extremely low reservoir pressures (~50-100psia at decommissioning) and well control procedures make the risk of a well blowout remote.

During the preparation and removal of topsides every care will be taken to minimise accidental releases to atmosphere of, for example, fluorinated greenhouse gases used as refrigerants. The decommissioning of relevant equipment and recovery of fluorinated gases will be carried out by appropriately certified persons (as specified by European Union (Fluorinated Greenhouse Gas) Regulations 2016 (Statutory Instrument. No. 658 of 2016). Systems containing refrigerants will be depressurised and recovered into dedicated cylinders for each refrigerant type, with the total quantity of such gases being ~90kg per platform. Refrigerants will be disposed of in accordance with relevant waste legislation and only permitted and licensed waste facilities will be used.

7.10.1.2 Vessel collision and accidental spills of fuel/lubricants

Relevant information detailing the risk of interaction with other users and mitigation measures (e.g. lighting, marking and Notices to Mariners, also see **Section 7.10.2**) has already been detailed in **Section 7.2**. In view of these measures, the risk of vessel collision is considered to be low.

The loss of the diesel fuel inventory from the semi-submersible rig or HLV (estimated to be *ca*. 1,000-1,500m^3, see HLV data sheet[13] for example) represents the main source of an accidental spill of oil associated with the decommissioning operations.

Diesel is a low viscosity distillate fuel with a significant proportion of light-ends, which means that evaporation is an important process contributing to the reduction in mass balance. Spilled diesel will spread rapidly on the sea surface and evaporate and dissolve within a few days. Evaporation can be enhanced by higher wind speeds, warmer water and air temperatures, and is likely to be rapid given the mild climate and relatively windy nature of the Kinsale Area (wind speeds > 8m/s are experienced on 70-80% of occasions in winter and 30–35% in summer (see **Section 4.2**)).

Of relevance to the KADP, stochastic oil spill modelling based on loss of diesel inventory from a drilling rig was recently completed for the Midleton Exploration Well 49/11-3, approximately 20km north-east of the Kinsale Head area (RPS 2015). The modelling indicated that in a worst case event of loss of the entire rig fuel inventory (800 tonnes/*ca*. 900m^3), there was <10% chance of any residue reaching coastal waters or crossing the Ireland/UK median line.

The model indicated that due to the relatively strong winds in the area and the chemical properties of the diesel (e.g. low viscosity, no emulsion formation), any fuel spilt either evaporated or was entrained in the water column within 24 hours, leaving very little on the surface and below levels to be of risk to wildlife or habitats, or detectable by visual inspection. From the modelling it was concluded that in the highly unlikely event of the loss of the entire rig fuel inventory, there was zero percent probability of beaching. It is expected that the worst case scenario of a large diesel spill from a rig or HLV during decommissioning operations would result in a similar outcome to that modelled for the Midleton Prospect given the similar environmental conditions and fuel properties, though noting that when operating, the HLV would be at a greater distance from the coast (*ca*. 45km compared to 36km for the Midleton Prospect).

Seabirds and marine mammals are generally considered the most vulnerable components of the ecosystem to oil spills in offshore and coastal environments, because of their close association with the sea surface. Benthic habitats and species may also be sensitive to deposition/sedimentation of oil although given the nature of the potential diesel spill and the water depths over the Kinsale Area, significant effects on the benthos are unlikely.

The effect of oil pollution on seabirds depends (amongst other factors) on the numbers of seabirds at sea around the site of the incident (Webb *et al.* 2016) and this is particularly true given the likely localised and transient nature of a diesel spill. **Section 4.4.6** indicates that a number of seabird species may be present in

[13] https://www.hansaheavylift.com//fileadmin/pdf/vessels/Vessel%20Data%20Sheet_P2%20800.pdf

the Kinsale Area. Of these, guillemot, razorbill, black guillemot, puffin and shag are the most sensitive to oil pollution as judged by their seabird oil sensitivity index (SOSI) (Webb *et al*. 2016). However, the majority of these species have a primarily coastal distribution. Those species that may be present in offshore areas relevant to where most of the decommissioning activities will take place have a moderate SOSI (e.g. fulmar, gannet, lesser black-backed gull and kittiwake).

Generally, marine mammals (which rely on blubber for insulation) are less vulnerable than seabirds to fouling by oil, but they are at risk from hydrocarbons and other chemicals that may evaporate from the surface of an oil slick at sea within the first few days. For a diesel spill this evaporation happens largely within the first 24 hours. In contrast to seabirds there is relatively little evidence of direct mortality associated with oil spills (Geraci & St. Aubin 1990, Hammond *et al.* 2003), although the aggregated distribution of some species (especially dolphins) may expose large numbers of individuals to localised oiling.

Hydrocarbon spills have the potential to affect fish and shellfish populations by tainting (defined as the ability of a substance to impart a foreign flavour or odour to the flesh of fish and shellfish following prolonged and regular discharges of tainting substances) caused by ingestion of hydrocarbon residues in the water column and on the sea bed, though the risk of such taint is low in deeper (>10m), open waters (Law *et al.* 2011). Possible effects on human consumers of seafood are also an issue of concern in relation to accidental spills and industrial discharges, and actual or perceived contamination may therefore result in economic effects on fishing and associated industries.

Given the information presented above, the environmental consequences of a large diesel spill are likely to be of a moderate nature. The complete loss of rig or HLV fuel inventory is only likely to occur following a severe accident such as a major collision, explosion or capsize. Accident statistics for mobile drilling units on the UKCS estimated annual average frequencies for these events of between $1.4x10^{-2}$ and $9.0x10^{-4}$ per unit year for the period 1990-2007 (Oil and Gas UK 2009). The remote likelihood of such an accident occurring in the Kinsale Area indicates that the overall significance of any effect is likely to be low.

7.10.1.3 Chemical spills

Chemical use as part of the decommissioning activities will be limited to the flushing and cleaning of topsides, pipeline displacement to inhibited seawater in the 24” and 18” export pipelines, and cementing activities as part of well decommissioning. Spills from drilling rigs and vessels, are largely preventable through provision of appropriate equipment, maintenance, procedures and training. The accidental discharge of these chemicals from the rig or vessels is unlikely to represent a significant effect given that chemicals with the best environmental profile, for example PLONOR (Pose Little or No Risk) chemicals, and those without substitution warnings and other labels will be preferentially selected as far as practicably possible.

7.10.2 Interactions between environmental factors

While there is the potential for interactions between effects on commercially exploited fish species (biodiversity) and socio-economic effects on fisheries (material assets and population and human health), the potential for such effects are considered to be remote in view of the likelihood of a significant hydrocarbon spill.

7.10.3 Environmental management, mitigation and residual effects

The description and assessment of potential effects from accidental events has been undertaken assuming that activities are in accordance with regulatory and policy controls, these include:

- Other users of the Kinsale Area, which include fisheries, shipping and other sea users such as recreational sailing and those involved in maritime activities such as survey, will be alerted to the decommissioning activities via publication of Notices to Mariners detailing rig and vessel positions, activities and timing and by full navigation lighting on the rig and vessels.
- A standby vessel will minimise the potential for interaction between the rig and other users, and much of the decommissioning activity will be within existing exclusion zones thereby further reducing the potential for interaction.
- All vessels and the rig to be used during decommissioning will be subject to audit and expected to adhere to Kinsale Energy HES policy. They will have in place the relevant, current Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL

and/or an oil spill contingency plan, which would be implemented in the event of an accidental event.

Kinsale Energy risk management measures and legislative compliance minimise the risk that an accidental event could occur (noting the already very low frequencies of such incidents relating to oil and gas activities), and therefore minimise the likelihood of any resultant significant effect. This includes measures which will be in place to avoid, as far as possible, spills from bunkering and supply operations, and general rig operations, including processes and procedures (e.g. bunkering procedures with reference to sea-state and daylight hours where practicable; procedure to be agreed with the Department of Transport, Tourism and Sport (DTTAS)), colour coding of hoses, storage of hoses in a safe area away from risk of physical damage, inspection of hose couplings, critical valves to be locked and controlled by permit, and general good housekeeping.

During the removal of topsides, jackets, wellheads, spool pieces and other associated infrastructure, every care will be taken to minimise dropped objects and the generation of debris. Any dropped objects will be recovered during decommissioning operations and an independent seabed debris clearance survey conducted once decommissioning operations have been completed to verify that debris clearance has been completed.

The likelihood of significant effects is considered to be low due to the nature of produced hydrocarbons (dry gas) and regulatory and policy controls associated with the decommissioning activities. See environmental management commitments 1, 3, 4, 5, 10 and 11 in **Section 8.2**.

7.10.4 Summary and conclusion

Mandatory control mechanisms and additional mitigation measures will be in place for activities associated with consent applications 1 and 2, which when considered in the context of the predicted behaviour of a potential diesel spill and the distance of the offshore field of operations to sensitive receptors, lead to the conclusion that there is a low risk of significant effects to any environmental factors from accidental events associated with the KADP (**Tables 6.3a and 6.3b**).

7.11 Cumulative Impacts

EIAR guidelines (EPA 2017b) define cumulative impacts as the addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects. Two main sources of cumulative effects are defined by IEMA (2011) as:

- Intra-project effects, those that occur between different environmental topics within the same proposal
- Inter-project effects, those that occur as a result of the likely effects of a proposal interacting with the impacts of other developments

Potential sources of these two types of cumulative effect are considered below, reflecting the available information on the nature and scale of other (i.e. not KADP related) activities, several of which are not yet consented and the activitiy timing and potential conditions of consent of these are not conjectured.

7.11.1 Intra-project cumulative effects

Significant effects have not been identified for any of the issues considered in **Sections 7.2-7.10** above or **Appendix D**. There is limited scope for intra-project interactions between the decommissioning of the offshore facilities and the Inch Terminal onshore (other than the additive contribution of greenhouse gas emissions), as no intertidal or nearshore work involving vessels together with machinery involved in coastal works for the respective aspects of the project are anticipated.

A summary consideration of intra-project cumulative effects is given in **Table 7.10** which includes both those sources of potentially significant effect assessed in **Sections 7.2-7.9** above, and those considered to be minor which are described in **Appendix D**. The shading in **Table 7.10** indicates those intra-project sources of effect that have the potential to interact with a receptor. The potential for cumulative effects described in Table 7.10 covers those activities proposed to be undertaken as part of the KADP. Accidental events (see Section 7.10) while possible, and with the potential to act cumulatively with almost all other sources of effect (other than waste and energy use) and almost all receptors associated with each environmental factor (excluding shipping, waste treatment and landfill resource, cultural heritage and landscape/seascape), are considered to be unlikely.

Effects associated with the two project consent applications are not distinguished in this section as all aspects of the project are considered together in terms of their potential cumulative effect. The potential for intra-project cumulative effects was considered to be small, and no likely significant effects were identified.

Table 7.10: Overview of intra-project cumulative effects

Environmental Factor		Broad sources of effect identified (see Section 6)						Description of potential intra-project effects
		Physical presence	Physical disturbance	Noise & vibration	Discharges to sea	Waste: materials recycling, reuse & disposal	Energy use & atmospheric emissions	
Population & Human Health								Waste processing at appropriate licensed facilities will minimise the potential for intra-project cumulative effects on local communities associated with the presence of material, and the noise and emissions (including odour) of its processing. Due to the relative location of the Inch Terminal to any dismantling yard, and the distance offshore of the major decommissioning works (at least 40km), the minor and temporary predicted effects on airborne noise, air and water quality from decommissioning operations (e.g. associated with vessel emissions and well abandonment related discharges), are not predicted to act cumulatively such that significant effects would be generated.
Biodiversity	Benthic fauna							A number of activities (rig or HLV mooring, removal of subsea structures and protection materials and rock cover remediation), add to disturbance and subsequent changes to seabed character. The cumulative nature of these interactions is spatially restricted and recovery is expected to be rapid. Marine discharges associated with decommissioning are not considered to be significant sources of cumulative effect when taken in combination with physical disturbance.
	Plankton							No intra-project cumulative effects identified.
	Fish & shellfish							Impacts identified as potential sources of effect on fish and shellfish (physical presence of vessels, seabed disturbance, noise, discharges) are spatially and temporally limited, with a potentially small spatial overlap at the KA and KB platforms (noise from cutting of platform legs and discharges to sea). Cumulative effects are not considered to be likely.
	Marine reptiles							No intra-project cumulative effects identified.

Environmental Factor		Broad sources of effect identified (see Section 6)						Description of potential intra-project effects
		Physical presence	Physical disturbance	Noise & vibration	Discharges to sea	Waste: materials recycling, reuse & disposal	Energy use & atmospheric emissions	
	Marine mammals							Noise was identified to be the only likely source of potentially significant effect for marine mammals. It is not considered likely that the cumulative noise generated by the multiple vessels and related activities (cutting, rock placement, post-decommissioning survey) involved in the decommissioning project will result in significant effects.
	Waterbirds & seabirds							Main noise sources (decommissioning vessels, cutting activities, post-decommissioning survey) and the bulk of activities will take place far from colonies, with the exception of vessel transits to shore and any nearshore survey, which will be planned to minimise disturbance. Cumulative effects not considered to be likely.
	Onshore habitats/species							Limited spatial and temporal nature of onshore works and lack of any potential overlap with the offshore aspects of the KADP are such that intra-project cumulative effects are not considered to be likely.
	Conservation sites/species							No intra-project cumulative effects identified.
Land, soil, water, air & climate	Seabed							A number of activities (rig or HLV mooring, removal of subsea structures and protection materials and rock cover remediation), add to disturbance and subsequent changes to seabed character. The cumulative nature of these interactions is spatially restricted and recovery is expected to be rapid.
	Water quality							All marine discharges are unlikely to have a significant spatial or temporal overlap with any sediment turbidity from seabed works, or be a source of cumulative effects.
	Air & Climate							The low likelihood of emissions from a well blowout, the preferential recycling of materials which may displace the use of primary materials, and the temporary nature of vessel, road traffic and demolition related emissions associated with the Inch Terminal (~110 tCO_2eq., some 0.05% on estimated offshore KADP emissions, see **Appendix D**) are such that cumulative effects are not considered likely.
Material assets, cultural heritage and	Fisheries							The presence of decommissioning vessels (including outside of existing exclusion zones and in transit) is spatially and temporally restricted (e.g. the programme of works is expected to take 12-18 months, however this will not involve continuous working across this period). No intra-cumulative effects identified.
	Other users & resources[14]							
	Shipping							
	Waste treatment & landfill resource onshore							No intra-project cumulative effects identified.
	Cultural heritage							No intra-project cumulative effects identified.

[14] Includes military activity, cables, marine disposal, recreation and tourism.

Environmental Factor		Broad sources of effect identified (see Section 6)						Description of potential intra-project effects
		Physical presence	Physical disturbance	Noise & vibration	Discharges to sea	Waste: materials recycling, reuse & disposal	Energy use & atmospheric emissions	
	Landscape/seascape							No spatial overlap and limited temporal overlap with onshore and offshore activities, which are not intervisible. No intra- project cumulative effects identified.

Sections 7.2-7.10 have considered the potentially significant effects of the KADP as a whole within the broad sources of effect identified in Table 7.10 above, such that cumulative effects within these categories (and relevant interactions between environmental factors) have already been considered for the major issues. When considered in combination with those minor issues described in **Appendix D**, no additional cumulative effects are considered to be likely.

7.11.2 Inter-project cumulative effects

Article IV(5e) of the EIA Directive requires that, "*the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources", are described.* Few existing or approved projects take place in the Kinsale Area, and no relevant projects were identified which were considered to be a source for potential cumulative effects in relation to Inch Terminal decommissioning. Those for which there is a possible interaction with the KADP include:

- Existing oil and gas lease areas and potential offshore oil & gas related exploration activity (see Section 4.5.1)
- The Hibernia Atlantic "D" and Hibernia Express subsea cables (see Section 4.5.5)[15]
- Marine dredge disposal authorisations relating to the Port of Cork and Department of Defence (see Section 4.5.7)
- Commercial shipping (see Section 4.5.2)
- Fisheries (see Section 4.5.3)

In addition to those existing/approved projects/activities, two proposed projects were identified which are yet to be formally approved:

- Ireland France subsea cable (see Section 4.5.5)
- Eirgrid Celtic interconnector (see Section 4.5.5)

These projects/activities are considered below against the broad sources of potential effect identified for the KADP in **Section 6.2**.

[15] Note that potential cumulative effects with the Hibernia cables (e.g. from survey noise, physical presence of vessels, seabed disturbance) would have already taken place on their installation. The KADP will not involve any further interaction with these cables and cumulative effects are not considered to be likely and so are not discussed further.

7.11.2.1 Physical presence

The presence of the rig, HLV and decommissioning vessels associated with the KADP will be of a temporary nature, and signify a small and transient incremental increase in the level of shipping in the Celtic Sea. Additionally, the jackets would continue to be present in the short-term should they be placed in "lighthouse mode", however this does not represent any increment to levels of physical presence with any other project (see Section 7.2). No other controls on access (e.g. strategic exclusions such as from International Maritime Organisation (IMO) routeing) are present in the area.

There are a number of current authorisations for oil and gas exploration in the Celtic Sea (**Figure 4.11**) which abut the Kinsale lease areas, or overlap these in the case of EL 1/11. While activity including the drilling of a well or seismic survey could take place within the terms of these licences, no activity is presently planned[16], and any activity would be likely to take place some distance from those involving the KADP. Any exploratory drilling would be subject to controls including the placement of a temporary exclusion zone, guard vessel and publication of activities through Notices to Mariners, and be subject to its own assessment. Such activity is also temporary in nature (perhaps lasting a few months). Significant cumulative effects with offshore exploration activities are therefore not considered to be likely. The Barryroe oil discovery is located within the EL 1/11 exploration licence area, with an associated appraisal well (48/24-10z) located ~3km from the nearest Kinsale Area facilities (Seven Heads manifold). The discovery has the potential to be developed in the future, but further appraisal is to take place and no firm development proposals have been made. Therefore the nature and scale of any development and its potential interaction with the KADP is uncertain.

Interactions with commercial fishing and shipping (which would include those involved in dredge disposal, and survey or installation activities associated with the proposed subsea cables) have already been considered in Section 7.2. In view of the minor and temporary increment to vessel presence that the KADP would represent, the significant potential for temporal separation of activities (e.g. there is uncertainty in timescales for any exploration activity, and installation activity associated with the potential Celtic interconnector is proposed for between 2021 and 2025), significant cumulative effects are not considered to be likely.

The KADP is not considered likely to lead to significant inter-project cumulative effects by the physical presence of the drilling rig (consent application 1) or vessel (consent applications 1 and 2), when taken together with the above projects.

7.11.2.2 Physical disturbance

There are a number of standard exploration licence areas (e.g. EL1/11 and EL4/05) and licensing options (e.g. LO16/30) within oil & gas licensing quadrants 48 and 49 (see **Section 4.5**). Wells have already been drilled in the exploration licence areas using semi-submersible rigs between 2005 and 2011 (i.e. involving anchoring and the drilling of surface holes with local seabed disturbance), and further exploration in these areas is possible as noted in 7.11.2.1. As project plans for additional exploration or any development are not known, and in view of the physical and temporal scale of any potential incremental disturbance, and the capacity for seabed recovery (see **Section 7.4**), no cumulative effects are considered to be likely.

Seabed disturbance at the Roche's Point dredge disposal site from the Ringaskiddy redevelopment and the Haulbowline Naval Base is unlikely to act in a cumulative manner given the spatial (at least 5km from the export pipeline, and potentially further from any KADP activity which could generate physical disturbance depending on the selection pipeline decommissioning option) and temporal separation of proposed activities (note that current disposal activities are permitted up to 2021 which is prior to planned subsea decommissioning operations). It should also be noted that the dredge disposal from these projects represents an increment to historical and ongoing disposal at the Roche's Point site, and any disturbance from the KADP, including from rock placement, is minor in this context (for example the Ringaskiddy port authorisation permits the disposal of up to 1.8 million tonnes of dredged material). Cumulative effects from the KADP are not considered to be likely.

Demersal fishing intensity is moderate, and probably represents the principal source of seabed disturbance in the wider Celtic Sea, although the Future trends in the Celtic Seas report (ABPmer & ICF International 2016) suggests that the area impacted by mobile demersal gears may be declining.

[16] https://www.dccae.gov.ie/en-ie/natural-resources/topics/Oil-Gas-Exploration-Production/environment/statuatory-consents/Pages/2017-Statutory-Assessments.aspx

Impacts from physical disturbance associated with the KADP are to take place largely within the existing footprint of the KADP infrastructure and also within exclusion zones presently closed to fisheries, with the exception of any pipeline remediation outside of these areas.

Seabed disturbance associated with the potential Celtic interconnector will be limited and given that installation could happen between 2021 and 2025 there is considerable scope to ensure there is limited overlap with decommissioning activities. One of the indicative routes for the Ireland-France subsea fibre optic cable crosses the 24" export pipeline in the nearshore area[17] and is proposed to be active in 2019, and therefore in advance of the decommissioning project, though this project is yet to be formally approved. Dialogue will be maintained with the developer to understand the nature of any crossing and the interaction of this with the pipeline decommissioning options.

The KADP is not considered likely to lead to significant inter-project cumulative effects by the physical disturbance generated by vessel or rig anchoring, subsea structure removal (consent application 1), and jacket removal and pipeline remediation (consent application 2), when taken together with the above projects.

7.11.2.3 Underwater noise

Noise sources associated with those existing projects/activities listed above are likely to be associated with vessels (e.g. shipping, fishing, oil and gas support and rig noise), or possibly seismic survey (i.e. associated with oil and gas exploration). Similarly, vessel noise and potentially surveys to provide seabed mapping (e.g. using side scan sonar and/or MBES) and seabed preparation for cable laying would be a feature of any work associated with the proposed projects identified, however a lack of firm project proposals or approvals limits their consideration here. **Section 7.5** indicated that while it cannot be excluded that sound from decommissioning will in the short-term influence the behaviour of individual marine mammals within the vicinity of the operations, the risk that any effect could become significant at the population level, when taking into account other relevant projects/activities, is deemed to be extremely low due to a combination of sound characteristics, duration of activity, and current understanding of marine mammal movements and behaviour in the Kinsale Area. The underwater noise associated with the KADP will represent a small and highly temporary increment to an area exposed to moderate levels of shipping (ambient noise in the area is described in **Section 4.3.1**), and following decommissioning, shipping associated with the Kinsale Area facilities (~one supply round trip every 28 days), permanent presence of standby vessel and any noise generated from platform operations (e.g. including helicopter traffic, ~2 flights per day), will cease.

As noted above, while there are a number of exploration licence areas in the vicinity of the Kinsale Area, project plans for additional exploration are not known or are uncertain, and therefore no cumulative effects are predicted at this time.

The KADP is not considered likely to lead to significant inter-project cumulative effects by the underwater noise generated by the rig (consent application 1), vessels (consent applications 1 and 2), cutting (consent applications 1 and 2) or post-decommissioning survey (consent application 2), when taken together with the above projects.

7.11.2.4 Discharges to sea

No significant impacts are anticipated from marine discharges associated with the KADP in-combination with other users such as wider shipping (which also includes that associated with the proposed subsea cable projects), discharges from other potential offshore oil & gas exploration activities (e.g. chemical discharges (which would be subject to a PUDAC), or of cuttings), and marine disposal of dredged material at the Roche's Point dredge disposal site. Decommissioning will also result in the cessation of small permitted discharges associated with the Kinsale platforms (see **Section 7.6**) and related support operations.

The nature of the decommissioning activities are such that marine discharges will be minor (e.g. from well decommissioning, subject to a PUDAC; consent application 1) and largely those associated with normal shipping operations (consent applications 1 and 2) for which there are adequate existing regulatory standards and controls. The KADP activities are temporary, have no long-term implications, and are not considered to be a source of potentially significant cumulative effect.

[17] http://www.housing.gov.ie/planning/foreshore/applications/ireland-france-subsea-cable-ltd

7.11.2.5 Waste: materials recycling, reuse and disposal

Unlike the North Sea, the Kinsale Area represents the only major offshore energy installation in the Celtic Sea, and therefore the only related decommissioning project of this kind. The overall significance of the impact of waste as a result of the decommissioning project is considered to be low, including a minor positive increment from material reuse, offsetting use of primary raw material. No cumulative waste-related effects can be identified with regards to those projects listed in **Section 7.11.2**.

The decommissioning works shall be undertaken in a manner which maximises the potential for reuse and recycling, including source segregating waste where appropriate. Management of all waste will be undertaken in accordance with the relevant waste legislation and only permitted and licensed waste facilities will be used.

7.11.2.6 Energy use and atmospheric emissions

The emission of greenhouse and other gases associated with the KADP resulting from offshore and onshore activities will be incremental to wider regional and global atmospheric gas loading – in the context of wider annual Irish GHG emissions these are marginal (approximately between 0.12 and 0.16%, which are based on conservative vessel timings and a 25% operational contingency). Given the KADP will eliminate continuing operational emissions from gas production and export (~35,700tCO_2 per year), no significant cumulative effects are predicted with other projects/activities, either ongoing or proposed, which will similarly contribute to emissions from vessel traffic.

7.11.2.7 Accidental events

The type of accidental events described in **Section 7.10** are not planned events and are considered to be highly unlikely. In the context of historical and ongoing leak reporting on the UKCS, including of major accidents (as reported in Dixon (2015)) the incremental risk of additional diesel and chemical spills from other vessels in the region are considered small.

7.11.3 Summary and conclusion

No significant intra-project cumulative effects were identified for any environmental factor, when major and minor potential effects were taken together. A limited number of potential interactions with other projects/activities, either consented or planned, were identified. No significant inter-project cumulative effects were identified due to the limited spatial and temporal nature of the major sources of effect of the KADP, and the limited scope for further interaction (Hibernia subsea cables), the spatial separation of the KADP work and certain projects (dredge material disposal) or potential activities (other oil & gas exploration activities), and the current uncertainty about the timing and routes of potential projects (Ireland France subsea cable and the Eirgrid Celtic interconnector).

7.12 Transboundary Impacts

Ireland has ratified the Convention on Environmental Impact Assessment in a Transboundary Context (the Espoo Convention) and thus an assessment is needed of the potential for the proposed KADP to result in significant transboundary effects[18] – the shortest distance to the nearest Median line is 75km (Ireland/UK). The likely nature and footprint of effects described above for seabed disturbance, physical presence, noise, discharges to sea and atmospheric emissions (alone and cumulatively), are regarded to be localised in extent, minor in a regional context, and are not regarded to pose a risk of transboundary effects to UK waters. It is regarded that there is a low potential for diesel to reach UK waters in the event of a worst case loss of fuel inventory from the rig or HLV due to its chemical properties leading to rapid evaporation, limiting the potential for effects (refer to **Section 7.10**).

Certain materials produced during the decommissioning project may be exported from Ireland for re-use, recycling, and/or treatment and disposal. Where materials are to be exported, and/or the selected dismantling yard is not located in Ireland, this will be undertaken in a manner consistent with the Waste Management

[18] Defined in the Espoo Convention as, "any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area ander the jurisdiction of another Party".

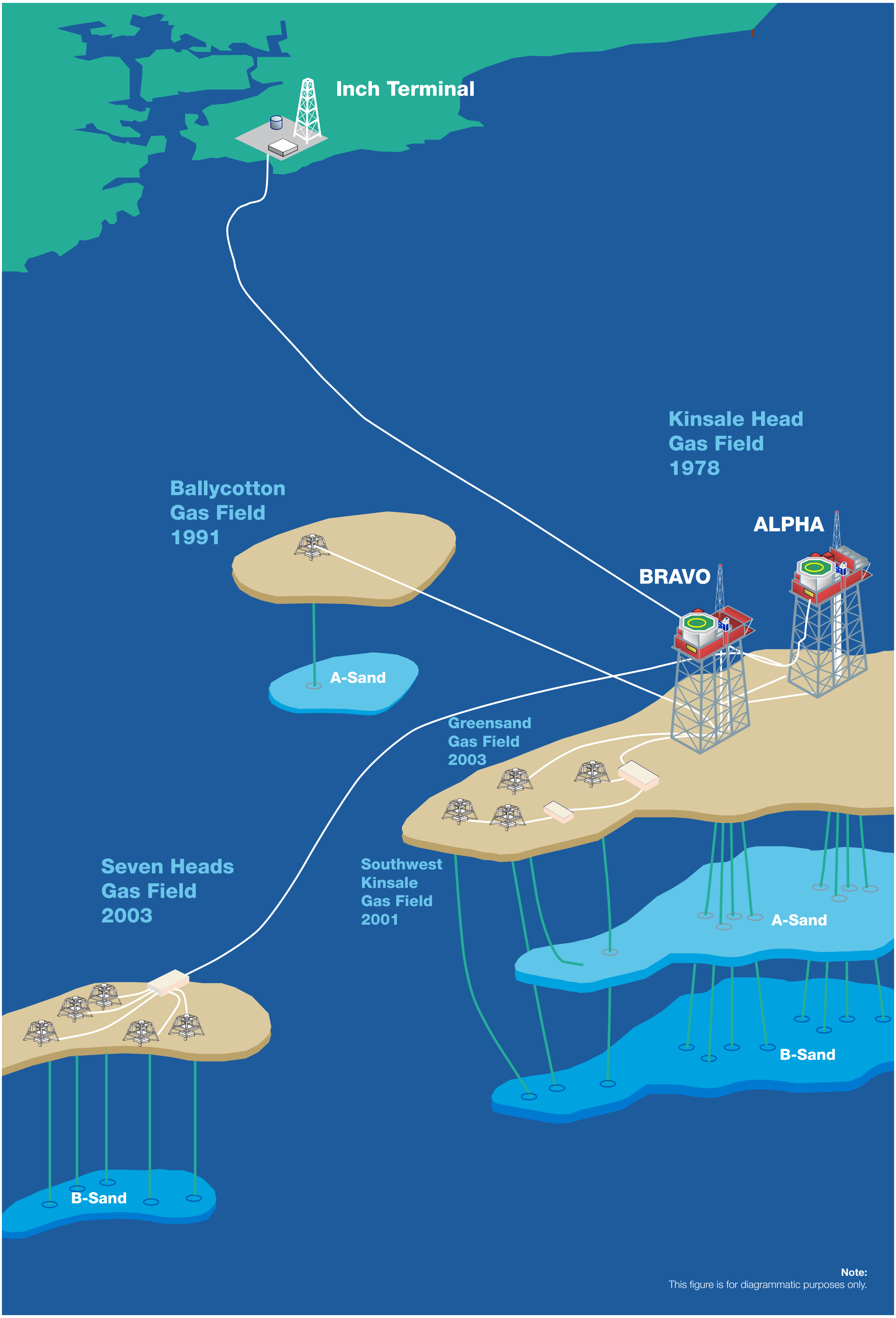
(Shipments of Waste) Regulations 2007, and is not regarded to represent a source of significant effect on the environment, or pose a significant risk to population and human health.

Atmospheric emissions contribute to global GHG loading and therefore represent a very minor addition to those gases which are related to the ongoing and projected impacts associated with anthropogenically induced climate change. As noted in **Section 7.8**, emissions are relevant at a global scale, as are their related effects. These are minor in view of wider emissions from Ireland and Europe, and operations are also temporary; on completion, further emissions from the Kinsale area will be eliminated.

Kinsale Area Decommissioning Project

Section 8

Management of Residual Effects and Conclusions



Note:
This figure is for diagrammatic purposes only.

8 Management of Residual Effects and Conclusions

8.1 Introduction

Through a systematic evaluation of the activities relating to the proposed KADP and their interactions with the environment, a variety of environmental effects were identified (**Section 6**), the majority of which were of limited extent and duration and considered minor. Those activities identified as being of potentially greater concern were described and assessed further in **Section 7**.

A number of potential effects are mitigated through mandatory requirements (e.g. as prescribed in legislation), to which non-adherence would constitute an offence. Compliance with these requirements will be ensured as part of Kinsale Energy's legal and environmental management commitments (**Table 8.1**), which will also include the audit and management of contractors. Additionally, environmental issues were considered early in project planning, and mitigation measures were incorporated into the project design.

A number of mitigation measures and environmental management actions were identified in **Section 7 and** are highlighted in **Section 8.2**, along with other environmental management commitments, to be taken forward into final project planning and execution.

8.2 Environmental Management Commitments and Mitigation Measures

Table 8.1: Summary of environmental management commitments and actions

Issue		Environmental management commitments to be taken forward into KADP planning and execution	Assessment topics of relevance	Relevant Application		Responsibility
				1	2	
1	Compliance assurance	Ensure management of the applications for and monitoring of compliance with the requirements of project environmental permits and consents.	All	✓	✓	KEL
2	Procurement	Ensure requirement to meet MARPOL standards included in procurement of vessels and rigs to be used in decommissioning operations.	7.6	✓	✓	KEL
3	Contractor management	All vessels and the rig to be used during decommissioning will be subject to audit. Contractor performance will be monitored throughout the decommissioning operations	All	✓	✓	KEL
4	Activity planning	Wherever possible, seek to minimise vessel days by making using of vessel synergies and careful activity phasing.	7.2, 7.4, 7.5, 7.6, 7.8, 7.10	✓	✓	KEL

Issue		Environmental management commitments to be taken forward into KADP planning and execution	Assessment topics of relevance	Relevant Application		Responsibility
				1	2	
5	Interaction with other users: decommissioning operations	Notices to Mariners will be issued to cover all phases of decommissioning work to communicate the nature and timing of the activities. All vessels used in the decommissioning operations will meet applicable national and international standards (e.g. in terms of signals and lighting) and would follow established routes to ports. Should the jackets be placed in "lighthouse mode" for a period of time following topside removal, navigational aids of a type agreed with the Commissioner of Irish Lights will be deployed. Consultation will take place with fisheries organisations and relevant marine authorities in accordance with legislation.	7.2, 7.10	✓	✓	KEL KEL/Contractor KEL KEL
7	Discharges to Sea	Ensure chemical risk assessment is undertaken as part of final well decommissioning chemical selection and apply for relevant chemical permits (Permit for Use and Discharge of Added Chemicals – PUDAC).	7.6	✓	-	KEL
8	Waste production	Implement a detailed Resource and Waste Management Plan which maximises the potential for reuse and recycling, including source segregating waste where appropriate. Management of all waste will be undertaken in accordance with the relevant waste legislation and only permitted and licensed waste facilities will be used.	7.7	✓	✓	KEL
9	Atmospheric emissions	As part of the decommissioning waste management plan (above), the benefit of materials returned to shore will be maximized through preferential reuse and recycling wherever possible.	7.8, 7.12	✓	✓	KEL/Contractor
10	Accidental events: dropped objects	All lifting operations will be risk assessed.	7.3, 7.10	✓	✓	Contractor
11	Accidental events loss of diesel inventories	Undertake audit of vessel bunkering procedures. Bunkering to be conducted in favourable sea states and during daylight hours so far as practicable. Procedure to be agreed with DTTAS.	7.10	✓	✓	Contractor

Table 8.2 Mitigation measures and residual effects

Issue		Mitigation measures to be taken forward into KADP planning and execution	Assessment topics of relevance	Relevant Application		Responsibility
				1	2	
1	Interaction with other users: decommissioning	Guard vessels will be used to minimise the potential for interaction between decommissioning vessels and other users.	7.2, 7.10	✓	✓	KEL/Contractor

	Issue	Mitigation measures to be taken forward into KADP planning and execution	Assessment topics of relevance	Relevant Application 1	Relevant Application 2	Responsibility
	operations	**Residual effect:** *The use of guard vessels would reduce the risk of other user interaction with certain activities associated with the decommissioning project (e.g. heavy lifts). However, as these would take place in existing and charted surface exclusion zones, with all vessels subject to mandatory lighting and marking controls, the addition of a guard vessel will result in a minor risk reduction to other users. The residual impact from interactions with other users is temporary and minor.*				
2	Interaction with other users: legacy materials left *in situ*	Rock cover remediation will be used to mitigate the potential snagging risk associated with decommissioning pipelines and umbilicals *in situ*, and the rock will be designed to be overtrawlable.	7.3	✓	✓	KEL/Contractor
		Residual effect: *On application of rock cover following removal of exclusion zones around relevant infrastructure, there remains a low risk to other users (primarily fishing) from interactions with pipelines and umbilicals. The option to rock cover all exposed pipeline sections would further reduce risks to third parties.*				
3		Pipelines and umbilicals will be surveyed post-decommissioning to establish their exact position and this information will be included into navigational charts	7.3	✓	✓	KEL/PAD
		Residual effect: *The post-decommissioning survey will confirm/update the position of the pipelines and umbilicals and inform any update to their charted location to ensure other users are aware of their accurate position, and therefore contribute to risk reduction from interaction.*				
4	Physical disturbance: sensitive seabed features	The minimisation of rig and vessel movements which require anchoring, and the use of dynamic positioning (DP) on most vessels, where practicable (Note that sensitive features (e.g. wrecks, Annex I habitats) have not been recorded in previous surveys within the working area). Pipeline decommissioning options (rock placement) which minimise physical disturbance will be selected subject to wider environmental, safety, technical and economic considerations. For each option involving rock placement, efforts will be made to minimise the volume of rock deployed.	7.4	✓	✓	KEL

Issue		Mitigation measures to be taken forward into KADP planning and execution	Assessment topics of relevance	Relevant Application		Responsibility
				1	2	
		Residual effect: *The measures have the potential to reduce the significance of effect by minimising seabed footprint of activities. The predicted effect of seabed disturbance is negligible and short-term.*				

8.3 Conclusion

The overall conclusion of the Environmental Impact Assessment Report is that, in view of the predicted scale, intensity and duration of the activities, with the implementation of the proposed mitigation, risk reduction measures and commitments in **Table 8.1** and **Table 8.2** (along with adherence to statutory requirements and guidance), the KADP will not result, directly or indirectly, in likely significant adverse effects on the environment, alone or cumulatively with other existing or approved projects.

Kinsale Area Decommissioning Project

Section 9

References

9 References

ABPmer & ICF International (2016). Future trends in the Celtic Seas, Baseline Report. Report produced for Celtic Seas Partnership, 110pp.

Abrahamsen K (2012). The ship as an underwater noise source. *Proceedings of Meetings on Acoustics, Acoustical Society of America* DOI: 10.1121/1.4772953

AEA-Ricardo (2015). Emissions Factors and Calorific Values for 2015. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/425887/2015_EUETS_CEFs_and_GCVs-April_2015_for_publishing.xls

AECOM & Metoc (2010). Strategic Environmental Assessment (SEA) of the Offshore Renewable Energy Development Plan (OREDP) in the Republic of Ireland. Environmental Report Volume 4: Appendix A Seascape assessment.

AGR (2017a). Wells Decommissioning – Basis of Design – Subsea Well Abandonment Study, Rev 1

AGR (2017b). Wells Decommissioning – Basis of Design – Kinsale Head Alpha and Bravo, Rev 1

Allseas (2012a). Kinsale Head A&B Platforms Removal Feasibility Study. Basis of Design - Topsides, Document No. 405020/KTDE10-01 Rev C.

Allseas (2012b). Kinsale Head A&B Platforms Removal Feasibility Study. Method Statement Kinsale A and B Topside Removals, Document No. 405020/KTEM60-01 Rev C.

Allseas (2012c). Kinsale Head A&B Platforms Removal Feasibility Study. Basis of Design - Jacket, Document No. 405020/KJDE10-01 Rev C.

Allseas (2012d). Kinsale Head A&B Platforms Removal Feasibility Study. Method Statement Kinsale A and B Jacket Removals, Document No. 405020/KJEM60-01 Rev C.

Amara R, Poulard JC, Lagardère F & Desaunay Y (1998). Comparison between the life-cycles of two Soleidae, the common sole, *Solea solea*, and the thickback sole, *Microchirus variegatus*, in the Bay of Biscay (France). *Environmental Biology of Fishes* **53**: 193-209.

Anatec (2017). Kinsale Decommissioning Fishing Risk Assessment. Prepared by Anatec Ltd on behalf of PSE Kinsale Energy Ltd, 75pp.

Andrady AL (2015). Persistence of Plastic Litter in the Oceans. Marine Anthropogenic Litter. *In: Bergmann M, Gutow L, Klages M (eds.) Marine Anthropogenic Litter. Springer*, pp57-72.

Anthony TG, Wright NA & Evans MA (2009). Review of diver noise exposure. Health and Safety Executive Research Report RR735, 62pp.

AquaFact (2003). Seven Heads and Kinsale Head Benthic Studies 2002/2003. Report to Ramco Seven Heads Ltd.

AquaFact (2004). Environmental monitoring of the seabed at Greensand Well. Document Number JN677. Report to Marathon oil Ireland Ltd.

Aqua-Fact (2005), Environmental Monitoring of the Seabed at Greensand Well. Report to Marathon Oil Ireland.

Archer D (2005). Fate of fossil fuel CO_2 in geologic time. *Journal of Geophysical Research* **110**: 6pp.

Bassett C, Polagye B, Holt M & Thomson J (2012). A vessel noise budget for Admiralty Inlet, Puget Sound, Washington (USA). *The Journal of the Acoustical Society of America* **132**: 3706-3719.

Bates NR, Best MHP, Neely K, Garley R, Dickson AG & Johnson RJ (2012). Detecting anthropogenic carbon dioxide uptake and ocean acidification in the North Atlantic Ocean. *Biogeosciences* **9**: 2509-2522.

Beck S, O'Connor I, Berrow S & O'Brien J (2013). Assessment and Monitoring of Ocean Noise in Irish Waters. Prepared for the Environmental Protection Agency by The Galway-Mayo Institute of Technology, 87pp.

Berrow S, Ronan H, O'Connor I & McGrath D (2014). Density estimates of harbour porpoise (*Phocoena phocoena*) at eight coastal sites in Ireland. *Biology and Environment, Proceedings of the Royal Irish Academy,* DOI: 10.3318/BIOE.2014.03.

Berrow SD, Whooley P, O'Connell M & Wall D (2010). Irish Cetacean Review (2000-2009). Irish Whale and Dolphin Group, 60pp.

Birdwatch Ireland (2017). http://www.birdwatchireland.ie/ (accessed June 2017)

BMT Cordah (2013). Decommissioning baseline study: Review of the management of marine growth during decommissioning, comparative assessment. Report to Oil & Gas UK Limited, 45pp.

BODC (1998). UKDMAP. An Atlas of the Seas Around the British Isles. Third Edition, Natural Environment Research Council.

Boelens RGV, Maloney DM, Parsons AP & Walsh AR (1999). Ireland's marine and coastal areas and adjacent seas: An environmental assessment. Marine Institute, 388 pp.

BP (2010). Clair Ridge Development Environmental Statement. BP Exploration Operating Company, Farburn Industrial Estate, Dyce, Aberdeen, UK.

Breen P, Cañadas A, Ó Cadhla O, Mackey M, Scheidat M, Geelhoed SCV, Rogan E & Jessopp M (2017). New insights into ocean sunfish (*Mola mola*) abundance and seasonal distribution in the northeast Atlantic. Scientific Reports 7: 2025 DOI:10.1038/s41598-017-02103-6

Brooks AJ, Bradley SL, Edwards RJ & Goodwyn N (2011). The palaeogeography of Northwest Europe during the last 20,000 years. *Journal of Maps* **7**: 573-587.

Bruinzeel LW & van Belle J (2010). Additional research on the impact of conventional illumination of offshore platforms in the North Sea on migratory bird populations, Final Report to the Ministry of Public Works, Rijkswaterstaat. Altenburg & Wymenga Ecologisch Onderzoek, Feanwâlden, 27pp.

Cefas (2016). Suspended Sediment Climatologies around the UK. Report for the UK Department for Business, Energy & Industrial Strategy offshore energy Strategic Environmental Assessment programme, 39pp.

Church JA, Clark PU, Cazenave A, Gregory JM, Jevrejeva S, Levermann A, Merrifield MA, Milne GA, Nerem RS, Nunn PD, Payne AJ, Pfeffer WT, Stammer D & Unnikrishnan A (2013). Sea Level Change. *In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V & Midgley PM (Eds.) Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 1137-1216.

Clarke M, Farrell ED, Roche W, Murray TE, Foster S & Marnell F (2016) Ireland Red List No. 11: Cartilaginous fish [sharks, skates, rays and chimaeras]. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. Dublin, Ireland, 142pp.

Collins M, Knutti R, Arblaster J, Dufresne J-L, Fichefet T, Friedlingstein P, Gao X, Gutowski WJ, Johns T, Krinner G, Shongwe M, Tebaldi C, Weaver AJ & Wehner M (2013). Long-term Climate Change: Projections, Commitments and Irreversibility. *In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V & Midgley PM (Eds.) Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 1029-1136.

Collins MA, Burnell GM & Rodhouse PG (1995). Distribution and demography of *Loligo forbesii* in the Irish Sea. *Biology and Environment: Proceedings of the Royal Irish Academy* **95B**: 49-57.

Connor DW, Allen JH, Golding N, Howell KL, Lieberknecht LM, Northen KO & Reker JB (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05. Joint Nature Conservation Committee, Peterborough, UK, 49pp.

Connor DW, Gilliland PM, Golding N, Robinson P, Todd D & Verling E (2006). UKSeaMap: the mapping of seabed and water column features of UK seas. Joint Nature Conservation Committee, Peterborough, UK, 107pp.

Cork County Council (2007). Cork County Draft Landscape Strategy. Planning Policy Unit, 128pp.

Cork County Council (2014). Cork County Development Plan 2014-2020.

Cork County Council (2017). www.http://corkcoco.maps.arcgis.com (accessed June 2017)

Cork County Council (2017b). Draft East Cork Municipal District Local Area Plan.

Coull KA, Johnstone R & Rogers SI (1998). Fisheries Sensitivity Maps in British Waters. Report to United Kingdom Offshore Operators Association, Aberdeen, 58pp.

Crocker SE & Fratantonio FD (2016). Characteristics of Sounds Emitted During High-Resolution Marine Geophysical Surveys. Naval Undersea Warfare Center Division-Newport, Technical Report 12,203.

Cronin C & Barton C (2014). Cetacean monitoring during the Celtic Sea Herring Acoustic Survey (CSHAS) October 2014. A report to the National Parks and Wildlife Service (NPWS), 24pp.

Cronin M, Jessop M & del Villar D (2011). Tracking grey seals on Ireland's continental shelf. A report to the National Parks and Wildlife Service (NPWS), 31pp.

Cronin M, Kavanagh K & Rogan E (2008). The foraging ecology of the harbour seal (*Phoca vitulina vitulina*) in southwest Ireland. Final report to the Marine Institute St/05/12, 145 pp.

Crowell SE, Wells-Berlin AM, Carr CE, Olsen GH, Therrien RE, Yannuzzi SE & Ketten DR (2015). A comparison of auditory brainstem responses across diving bird species. *Journal of Comparative Physiology A* **201**: 803-815.

CSA Ocean Sciences (2014). Quieting Technologies for Reducing Noise During Seismic Surveying and Pile Driving Workshop. Summary Report for the US Dept. of the Interior, Bureau of Ocean Energy Management BOEM 2014-061. Contract Number M12PC00008. 70 pp. plus appendices.

CSO (2016). Statistics of Port Traffic. CSO statistical release, 06 July 2016, 16pp.

CSO website. Cork County Population. http://www.cso.ie/en/releasesandpublications/ep/p-cpr/censusofpopulation2016-preliminaryresults/geochan/. (accessed July 2017).

CSO website. Statistics of Port Traffic 2015. http://www.cso.ie/en/releasesandpublications/er/spt/statisticsofporttraffic2015/ (accessed March 2017)

Danil K & St Leger JA (2011). Seabird and Dolphin Mortality Associated with Underwater Detonation Exercises. *Marine Technology Society Journal* **45**: 59-95.

DCCAE (2017). Draft National Mitigation Plan. Department of Communications, Climate Action & Environment, 92pp.

DCENR (2011). Fourth Strategic Environmental Assessment for Oil and Gas Activity in Ireland's Offshore Waters: IOSEA4 Irish and Celtic Seas. Department of Communications, Marine and Natural Resources, 353pp.

DCENR (2015). Irish Offshore Strategic Environmental Assessment (IOSEA) 5. Environmental Report, 210pp. + Appendices.

De Robertis A & Handegard NO (2013) Fish avoidance of research vessels and the efficacy of noise reduced vessels: a review. *ICES Journal of Marine Science* **70**: 34-45

DECC (2008). EEMS Atmospheric Emissions Calculations. Issue 1.810a, Oil & Gas UK and the Department of Energy and Climate Change, 53pp.

DECC (2016). Offshore Environmental Strategic Environmental Assessment 3 (OESEA3). Department of Energy & Climate Change, 612pp + appendices.

Dekeling RPA, Tasker ML, Van der Graaf, AJ, Ainslie MA, Andersson MH, André M, Borsani JF, Brensing K,Castellote M, Cronin D, Dalen J, Folegot T, Leaper R, Pajala J, Redman P, Robinson SP, Sigray P, Sutton G, Thomsen F, Werner S, Wittekind D & Young JV (2014). Monitoring Guidance for Underwater Noise in European Seas, Part II: Monitoring Guidance Specifications, JRC Scientific and Policy Report EUR 26555 EN, Publications Office of the European Union, Luxembourg, 2014, doi: 10.2788/27158.

Dixon T (2015). Annual survey of reported discharges and releases attributed to vessels and offshore oil and gas installations operating in the United Kingdom's exclusive economic zone (UKEEZ) 2014. Advisory Committee on Protection of the Sea (ACOPS), 42pp.

DMNR (1992). Licensing Terms for Offshore Oil and Gas Exploration, Development & Production. *http://www.dccae.gov.ie/documents/LicensingTermsforOffshoreOilandGasExplorationandDevelopment1992.pdf, accessed February 2017.*

DoEHLG (2003). Environmental Impact Assessment Guidance for Consent Authorities regarding Sub-threshold Development.

DoEHLG (2013). Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

DoHPCLG (2017). Myplan.ie - Inch, Co. Cork. http://www.myplan.ie/webapp/ (accessed June 2017)

Dolan P (2015). Ensemble of regional climate model projections for Ireland. Prepared for the Environmental Protection Agency by Irish Centre for High-End Computing and Meteorology and Climate Centre, School of Mathematical Sciences, University College Dublin, 68pp.

Dow Piniak WE, Eckert SA, Harms CA & Stringer EM (2012). Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. OCS Study BOEM 2012-01156. 35pp

Doyle TK, Houghton JDR, O'Súilleabháin PF, Hobson VJ, Marnell F, Davenport J & Hays GC (2008). Leatherback turtles satellite tagged in European waters. *Endangered Species Research* **4**: 23-31.

Duck C & Morris C (2013). An aerial survey of harbour seals in Ireland: Part 2 – Galway Bay to Carlingford Lough, August – September 2012. A report to the National Parks and Wildlife Service (NPWS), 28pp.

EC (1991a). Council Directive 91/676/EEC Concerning the Protection of Waters Against Pollution Caused by Nitrates from Agricultural Sources.

EC (2000). Directive 2000/60/EC for Establishing a Framework for Community Action in the Field of Water Policy.

EC (2008a). Directive 2008/56/EC Establishing a Framework for Community Action in the Field of Marine Environmental Policy.

EC (2008b). Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives.

EC (2009). Directive 200/147/EC of the European Parliament and of the Council on the Conservation of Wild Birds.

EC (2011). A Roadmap for moving to a competitive low carbon economy in 2050. Brussels, 8.3.2011. COM(2011) 112 final, 30pp.

EC (2015). Interpretation of Definitions of Project Categories of Annex I and II of the EIA Directive.

Ecoserve (2011). Environmental baseline report. Report to PSE Kinsale Energy Ltd, Kinsale Head Gas Storage Project, North Celtic Sea Basin. Ecological Consultancy Services, Dublin, 86pp plus appendices.

EEA (2017). Annual European Union greenhouse gas inventory 1990–2015 and inventory report 2017. Submission to the UNFCCC Secretariat. Technical report No 06/2017, 941pp.

EEC (1991b). Council Directive 91/271/EEC Concerning Urban Waste Water Treatment.

EEC (1992). Council Directive (92/43/EEC) on the Construction of Natural Habitats and of Wild Fauna and Flora, as amended by Directive 97/62/EC.

Ellis JR, Cruz-Martínez A, Rackham BD & Rogers SI (2004). The distribution of Chondrichthyan fishes around the British isles and implications for conservation. *Journal of NW Atlantic Fishery Science* **35**: 195-213.

Ellis JR, Milligan SP, Readdy L, Taylor N & Brown MJ (2012). Spawning and nursery grounds of selected fish species in UK waters. Science Series Technical Report, Cefas, Lowestoft, 147: 56pp.

Engås A, Lokkeborg S, Ona E & Soldal AV (1996). Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). *Canadian Journal of Fisheries and Aquatic Science* **53**: 2238-2249.

EPA (2002). Guidelines on the Information to be Contained in Environmental Impact Statements.

EPA (2003). Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.

EPA (2009). Ambient air monitoring at Cork Harbour, August 31st 2007 – 15th March 2008, 24pp.

EPA (2009). Teagasc-EPA Soils and Subsoils Mapping Project: Final report V.1

EPA (2015a). Draft Revised Guidelines on the Information to be Contained in Environmental Impact Statements.

EPA (2015b). Draft Advice Notes for Preparing Environmental Impact Statements. Draft September 2015.

EPA (2015c). Water quality in Ireland 2010-2012. Prepared for the Environmental Protection Agency by Aquatic Environment, 170pp.

EPA (2015d). Air Quality in Ireland 2015 – Key Indicators of Ambient Air Quality.

EPA (2016). Bathing water quality in Ireland - A report for the year 2015, 47pp.

EPA (2017). Air Quality Indicators in Ireland 2016. Indicators or Air Quality. Environmental Protection Agency, 34pp.

EPA (2017a). Draft guidelines on the information to be contained in Environmental Impact Assessment Reports. Draft August 2017, 89pp.

EPA (2017b). EPA Map Viewer - Inch, Co. Cork.
http://gis.epa.ie/Envision (accessed July 2017)

EPA (2017c). Ireland's final greenhouse gas emissions in 2015. April 2017, 10pp.

EPA (2018). Ireland's Provisional Greenhouse Gas Emissions: 1990-2016. Environmental Protection Agency, 12pp.

EU (2011). Directive 2011/92/EU of the European Parliament on the assessment of the effects of certain public and private projects on the environment.

EU (2014a). Directive 2014/52/EU amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment

EU (2014b). Directive 2014/955/EU amending decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council.

EU (2017a). Environmental Impact Assessment of Projects Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU).

EU (2017b). Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).

Fáilte Ireland (2016). Tourism facts 2015 – preliminary. http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/3_General_SurveysReports/Tourism-Facts-2015-Preliminary.pdf?ext=.pdf

Fairbanks RG (1989). A 17,000 year glacio-eustatic sea level record: influence of glacial melting rates on the Younger Dryas event and deep ocean circulation. *Nature* **342**: 637-642.

Fairweather (2016). Application for incidental harassment authorization for 2016 anchor retrieval program Chukchi and Beaufort Seas Alaska. Prepared for Fairweather LLC by Fairweather Science LLC, April 2016.

Fariña AC, Azevedo M. Landa J, Duarte R, Sampedro P (2008). *Lophius* in the world; a synthesis on the common features and life strategies. *ICES Journal of Marine Science* **65**: 1272-1280.

Fernand L, Nolan GD, Raine R, Chambers CE, Dye SR, White M & Brown J (2006). The Irish coastal current: a seasonal jet like circulation. *Continental Shelf Research* **26**: 1775-1793.

Fitch S & Gaffney V (2011). West Coast Palaeolandscapes Survey. University of Birmingham and Dyfed Archaeological Trust, 53pp.

Fitch S, Gaffney V, Gearey, B & Ramsey E (2011). Between the Lines – enhancing methodologies for the exploration of extensive inundated landscapes. *In: Cowley, D (Ed.) Remote Sensing for Archaeological Heritage Management, EAC Occasional Paper No.5. EAC: Brussels*. pp. 173-204.

Flemming NC (2002). The scope of Strategic Environmental Assessment of North Sea areas SEA3 and SEA2 in regard to prehistoric archaeological remains. Technical Report to the DTI, 51pp.

Flemming NC (Ed.) (2004). The prehistory of the North Sea floor in the Context of the Continental Shelf archaeology from the Mediterranean to Nova Zemlya. Submarine Archaeology of the North Sea: Research priorities and collaboration with industry. Council for British Archaeology Research Report 141, York. pp. 11-20.

Flemming NC (Ed.) Harff J, Moura D, Burgess A & Bailey GN (2017). Submerged Landscapes of the European Continental Shelf: Quaternary Paleoenvironments. Wiley-Blackwell, 552pp.

Flemming NC, Bailey GN & Sakellariou D (2012). Migration: Value of submerged early human sites. *Nature* **486**: doi:10.1038/486034a (correspondence).

Forster P, Ramaswamy V, Artaxo P, Berntsen T, Betts R, Fahey DW, Haywood J, Lean J, Lowe DC, Myhre G, Nganga J, Prinn R, Raga G, Schulz M & Van Dorland R (2007). Changes in Atmospheric Constituents and in Radiative Forcing. In: *Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M & Miller HL (Eds.). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Fossette S, Hobson VJ, Girard C, Calmettes B, Gaspar P, Georges J & Hays H (2010). Spatio-temporal foraging patterns of a giant zooplanktivore, the leatherback turtle.

Journal of Marine Systems **81**: 225-234.

Fossitt (2000). A Guide to Habitats in Ireland.

Fugro (2015). Metocean Criteria for the Kinsale Head Field. Report Number: C70236/8564/R4, 49pp. + appendices.

Fugro ERT (2012). Well 48/24-10 Barryroe post-drilling ROV survey. March 2012 Report for Providence plc. Report Number: J36244-1.

Fugro (2017). Pre-decommissioning Environmental Survey Results, Kinsale Area.

Gaffney V, Fitch S & Smith D (2009). Europe's lost world: The rediscovery of Doggerland. Council for British Archaeology Research Report 160, 202pp.

Gaffney V, Thomson K & Fitch S (2007). Mapping Doggerland: The Mesolithic Landscapes of the Southern North Sea. Institute of Archaeology and Antiquity, University of Birmingham. Archaeopress, Oxford, 131pp.

Gardline (2015). Middleton Site Survey, Irish Celtic Sea Block 49/11. Environmental Baseline Survey. Document Reference 10501. Report to PSE Seven Heads Limited.

Garthe S & Hüppop O (1999). Effect of ship speed on seabird counts in areas supporting commercial fisheries. *Journal of Field Ornithology* **70**: 28-32.

Garthe S & Hüppop O (2004). Scaling possible adverse effects of marine windfarms on seabirds: developing and applying a vulnerability index. *Journal of Applied Ecology* **41**: 724-734.

Genesis (2011). Kinsale Facilities Decommissioning: Inventory of Facilities to be Decommissioned. Document Number J71912-A-A-TN-002-D2. Report to Kinsale Energy.

Geological Survey of Ireland (2017). Inch, Co. Cor.http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 (accessed July 2017)

Geraci JR & St. Aubin DJ (1990). Sea Mammals and Oil: Confronting the Risks. Academic Press, San Diego.

Gerritsen HD & Lordan C (2014). Atlas of Commercial Fisheries around Ireland, Marine Institute, Ireland. ISBN 978-1-902895-56-7. 59 pp.

Gill AB & Bartlett M (2010). Literature review on the potential effects of electromagnetic fields and subsea noise from marine renewable energy developments on Atlantic salmon, sea trout and European eel. Report No. 401, commissioned by Scottish Natural Heritage, 27pp.

Goff GP & Stenson GB (1988). Brown adipose tissue in leatherback sea turtles: a thermogenic organ in an endothermic reptile? *Copeia* **1988**:1071-1075.

Google Maps (2017). Inch, Co.Cork. *https://www.google.ie/maps/place/Inch,+Greenpark,+Co.+Cork/@51.795828,8.1797505,15z/data=!4m5!3m4!1s0x48437e14e6ff132d:0x611622eb6174a87!8m2!3d51.803374!4d-8.1795427%20* (accessed June 2017)

Gordon JDM (2006). Fish and fisheries in the SEA 7 area. Report to the Department of Trade and Industry by Scottish Association for Marine Science (SAMS), Dunstaffnage Marine Laboratory, Oban, 122pp.

Hammond GP & Jones CI (2008). Embodied energy and carbon in construction materials. *Proceedings of the ICE Energy* **161**: 87-98.

Hammond GP & Jones CI (2011). Inventory of Carbon & Energy (ICE) Version 2.0.

Hammond PS, Gordon JCD, Grellier K, Hall AJ, Northridge SP, Thompson D & Harwood J (2003). Background information on marine mammals relevant to Strategic Environmental Assessments 2 and 3. Report to the Department of Trade and Industry, 81pp.

Hansen L & Jacobsen J (2003). Origin and migration of wild and escaped farmed Atlantic salmon, *Salmo salar* L., in oceanic areas north of the Faroe Islands. *ICES Journal of Marine Science* **60**: 110-119.

Harland Ej & Richards SD (2006). SEA 7 technical report: Underwater ambient noise. Report no. QINETIQ/06/00577.

Hartley Anderson (2003). Ecological Review of ROV video and other seabed survey information for the seven heads gas field development. Report to Ramco Seven Heads Limited, 13pp.

Hartley J & Dicks B (1977). Survey of the benthic macrofaunal communities of the Celtic Sea. FSC Report No. FSC/OPRU/10/77. Oil Pollution Research Unit (Field Studies Council), Pembroke. 16pp. + appendix.

Hartley JP (1979). On the offshore mollusca of the Celtic Sea. *Journal of Conchology* **30**: 81-92.

Hay SJ, Hislop JRG & Shanks AM (1990). North Sea Scyphomedusae; summer distribution, estimated biomass and significance, particularly for O-group gadoid fish. *Netherlands Journal of Sea Research* **25**: 113-130.

Hays GC, Houghton JDR & Myers AE (2004). Pan-Atlantic leatherback turtle movements. *Nature* **429**: 522.

Heessen HJL, Daan H & Ellis JR (2015). *Fish Atlas of the Celtic Sea, North Sea and Baltic Sea*. Wageningen Academic Publishers, the Netherlands, 572pp.

Heritage Council (2011). Best Practice Guidance for Habitat Survey and Mapping.

Hildebrand JA (2009). Anthropogenic and natural sources of ambient noise in the ocean. Marine *Ecological Progress Series* **395**: 5-20.

Hope Jones P (1980). The effect on birds of a North Sea gas flare. *British Birds* **73**: 547-555.

Horsburgh K & Lowe J (2013). Impacts of climate change on sea level. MCCIP Science Review 2013, pp. 27-33.

Houghton JT, Ding Y, Griggs DJ, Noguer M, Van der Linden PJ Dai X, Maskell K & Johnson CA (Eds.) (2001). Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. University Press, Cambridge, United Kingdom and New York, NY, USA, 881pp.

HSE (2009). Guidelines for Pipeline Operators on Pipeline Anchor Hazards. Health & Safety Executive, 14pp.

Hüppop O, Hüppop K, Dierschke J & Hill R (2016). Bird collisions at an offshore platform in the North Sea. *Bird Study* **63**: 73-82.

ICES (2009). Review of the Biologically Sensitive Area / Irish Box.

http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2009/Special%20Requests/EC%20Irish%20box.pdf (accessed March 2017)

IEMA (2011). Special Report: The State of Environmental Impact Assessment Practice in the UK. Institute of Environmental Management & Assessment, 98pp.

Iglésias SP, Toulhoat L & Sellos DY (2010). Taxonomic confusion and market mislabelling of threatened skates: important consequences for their conservation status. *Aquatic Conserv: Mar. Freshw. Ecosyst.* **20**: 319-333.

Infomar website: http://www.infomar.ie/data/ (accessed April 2017).

International Maritime Organisation (1978). International Convention for the Prevention of Marine Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, 1973 and 1978

IoP 2000, Guidelines for the Calculation of Estimates of Energy use and Gaseous Emissions in the Decommissioning of offshore structures, The Institute of Petroleum, February 2000 ISBN 0 8593 255 3.

IPCC (1996). Climate Change 1995. The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, 531pp. + appendices.

IPCC (2001). Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). *In: JT Houghton, Y Ding, DJ Griggs, M Noguer, PJ van der Linden and D Xiaosu (Eds.).* Cambridge University Press, UK pp 944.

IPCC (2007). Climate Change 2007: The physical science basis. *In: S Solomon, D Qin, M Manning, Z Chen, M Marquis, KB Averyt, M Tignor & HL Miller Eds. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996pp.

IPCC (2013). Summary for Policymakers. *In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V & Midgley PM (Eds.) Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Irish Government (2012). Harnessing our Ocean Wealth: An Integrated Marine Plan for Ireland. July 2012, 74pp.

Irish Wildlife Trust (2018). Protecting Our Ocean's Wealth - a proposal for legal protection of threatened marine species. Irish Wildlife Trust, 42pp.

IWDG (2018). Irish Whale and Dolphin Group Casual Cetacean Sightings, National Biodiversity Data Centre, Ireland, accessed 17 May 2018. https://maps.biodiversityireland.ie/Dataset/216.

Jee Ltd. (2015). Mattress Solutions: Prepared by Jee Ltd. on behalf of Zero Waste Scotland and Decom North Sea, 83pp.

Jennings S & Kaiser MJ (1998). The effects of fishing on marine ecosystems. *Advances in Marine Biology* **34**: 210-352.

Jereb P, Allcock AL, Lefkaditou E, Piatkowski U, Hastie LC & Pierce GJ (2015). Cephalopod biology and fisheries in Europe: II. Species accounts. ICES Cooperative Research Report No. 325, 360pp.

JNCC website. Lamprey Information Sheets.

http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=S1095 (accessed March 2017).

John O'Donovan & Associates (1976). Land Terminal at Inch Co Cork Ireland, Office & Pumphouse details, Drawing No. 1055-106 Rev A.

Johns D & Wootton M (2003). Plankton Report for Strategic Environment Assessment Area 4. Report to the Department of Trade and Industry. The Sir Alister Hardy Foundation for Ocean Science (SAHFOS), 26pp.

Jones EL, McConnell BJ, Smout S, Hammond PS, Duck CD, Morris CD, Thompson D, Russell DJF, Vincent C, Cronin M, Sharples RJ & Matthiopoulos J (2015). Patterns of space use in sympatric marine colonial predators reveal scales of spatial partitioning. *Marine Ecology Progress Series* **534**: 235-249.

King & Berrow (2009). Marine turtles in Irish waters. Special Supplement to the Irish Naturalists' Journal, 30pp.

Kirtman B, Power SB, Adedoyin JA, Boer GJ, Bojariu R, Camilloni I, Doblas-Reyes FJ, Fiore AM, Kimoto M, Meehl GA, Prather M, Sarr A, Schär C, Sutton R, van Oldenborgh GJ, Vecchi G & Wang HJ (2013). Near-term Climate Change: Projections and Predictability. *In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V & Midgley PM (Eds.) Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 953-1028.

Kopke K, O'Mahony C, Cummins V & Gault J (2008). Assessment of coastal recreational activity and capacity for increased boating in Cork Harbour. Coastal and Marine Resources Centre, University College Cork, 52pp.

Lambeck K & Purcell AP (2001). Sea-Level Change in the Irish Sea since the Last Glacial Maximum: Constraints from isostatic modelling. *Journal of Quaternary Science* **16**: 497-506.

Laurenson CH, Dobby H, McLay HAS & Leslie B (2008). Biological features of the *Lophius piscatorius* catch in Scottish waters. *ICES Journal of Marine Science* **65**: 1281-1290.

Law RJ, Kirby MF, Moore J, Barry J, Sapp M & Balaam J (2011). PREMIAM – Pollution Response in Emergencies Marine Impact Assessment and Monitoring: Post-incident monitoring guidelines. Science Series Technical Report No. 146, Cefas, Lowestoft, 164pp.

Long AJ & Roberts DH (1997). Sea-level change. *In: M Fulford, T Champion & A Long Eds. England's Coastal Heritage: A survey for English Heritage and the RCHME*. English Heritage Archaeological Report 15. English Heritage, London, pp. 25-49.

Long D, Graham C & Stevenson A (2004). *In: NC Flemming Ed. Submarine Prehistoric Archaeology of the North Sea: Research priorities and collaboration with industry*. Council for British Archaeology Research Report 141, York, pp. 99-101.

Lordan L, Doyle J, Fitzgerald R, O'Connor S, Blaszkowski M, Stokes D, Ni Chonchuir G, Gallagher J, Butler R, Sheridan M & Simpson S (2015). FU19 *Nephrops* grounds 2015UWTV survey report and catch options for 2016. Marine Institute UWTV Survey Report, 18pp.

Lowe JA, Howard TP, Pardaens A, Tinker J, Holt J, Wakelin S, Milne G, Leake J, Wolf J, Horsburgh K, Reeder T, Jenkins G, Ridley J, Dye S & Bradley S (2009). UK Climate Projections science report: Marine and coastal projections. Met Office Hadley Centre, Exeter, UK, 95pp.

Lucke K, Siebert U, Lepper PA & Blanchet M (2009). Temporary shift in masked hearing thresholds in a harbour porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli. *Journal of the Acoustic Society of America* **125**:4060–4070.

Maes J, Liquete C, Teller A, Erhard M, Luisa PM, Barredo J, Grizzetti B, Cardoso A, Somma F, Petersen J-E, Meiner A, Royo GE, Zal N, Kristensen P, Bastrup-Birk A, Biala K, Piroddi C, Egoh B, Degeorges P & Lavalle C (2016). An indicator framework for assessing ecosystem services in support of the EU Biodiversity Strategy to 2020. *Ecosystem Services* **1**: 31-39.

Maitland PS & Hatton-Ellis TW (2003). *Ecology of the Allis and Twaite Shad: Conserving Natura 2000 Rivers Ecology Series No. 3*. English Nature, Peterborough, 28pp.

Marine Institute & the Department of Housing, Planning and Local Government (2013). Ireland's Marine Strategy Framework Directive Article 19 Report: Initial assessment, GES and targets and indicators. Marine Institute and Department of Environment, Community and Local Government, Ireland, 129pp. + appendices.

Marine Institute & the Department of Housing, Planning and Local Government (2015). Marine Strategy Framework Directive Article 11 Monitoring Programmes Report. 658pp. + appendices.

Marine Institute (2006). Water-based tourism and leisure product audit, 113pp.

Marine Institute (2009). Irish ocean climate and ecosystem status report 2009, 116pp.

Marine Institute (2010). Kinsale Head Gas Storage Project. Final Report Volume 2 of 2; Results; Geophysical, Geotechnical and Environmental Services; Project Reference CE10018; July - September 2010.

Marine Institute (2011). Environmental Baseline Survey Report, Barryroe Drill Site. Eire Block 48/24. Report to Senergy.

Marine Institute (2012). Atlas of Irish groundfish trawl surveys: supporting fish stock assessment and new ecosystem advice. Marine Institute, ISBN 978-1-902895-53-6, 61pp.

Marine Institute (2013). Marine mammals and megafauna in Irish waters – behaviour, distribution and habitat use. Marine Research Sub-Programme, NDP 2007-13 Series, 200pp.

Marine Institute (2016). The Stock Book: Annual review of fish stocks in 2016 with management advice for 2017. Report to the Minister for Agriculture, Food and the Marine, 504pp.

Marine Institute (2017). The Stock Book. Annual Review of Fish Stocks in 2017 with Management Advice for 2018. Marine Institute, 492pp.

McCleave JD & Arnold GP (1999). Movements of yellow- and silver-phase European eels (*Anguilla anguilla* L.) tracked in the western North Sea. *ICES Journal of Marine Science* **56**: 510-536.

McKenna MF, Ross D, Wiggins SM & Hildebrand JA (2012). Underwater radiated noise from modern commercial ships. *Acoustical Society of America* 131: 92-103.

McMahon CR & Hays G (2006). Thermal niche, large-scale movements and implications of climate change for a critically endangered marine vertebrate. *Global Change Biology* 12: 1330-1338.

Merchant ND, Brookes KL, Faulkner RC, Bicknell AW, Godley BJ & Witt MJ (2016). Underwater noise levels in UK waters. *Scientific Reports* **6**: 36942, 10pp.

Met Eireann website (https://www.met.ie/forecasts/marine-inland-lakes/buoys)

Molvaer OI, Gjestland T (1981). Hearing damage risk to divers operating noisy tools under water. *Scandinavian Journal of Work, Environment & Health* **7**: 263-270.

Momber G, Tomalin DJ, Scaife RG & Satchell J (2011). Mesolithic Occupation at Bouldnor Cliff and the Submerged Prehistoric Landscapes of the Solent. Council for British Archaeology, 197pp.

Montevecchi WA. (2006). Influences of artificial light on marine birds. In: Rich, C., Longcore, T. (Eds.), Ecological Consequences of Artificial Night Lighting. Island Press, Washington, DC, USA, pp.94-113.

Montgomery J, Beaumont J, Jay M, Keefe K, Gledhill AR, Cook GT, Dockrill SJ & Melton ND (2013). Strategic and sporadic marine consumption at the onset of the Neolithic: increasing temporal resolution in the isotope evidence. *Antiquity* **78**: 1060-1072.

Moriarty C (1999). Strategy for the development of the eel fishery in Ireland. *Fisheries Bulletin* **19**: 46pp.

Myhre G, Shindell D, Bréon F-M, Collins W, Fuglestvedt J, Huang J, Koch D, Lamarque J-F, Lee D, Mendoza B, Nakajima T, Robock A, Stephens G, TTakemura T & Zhang H (2013). Anthropogenic and Natural Radiative Forcing*. In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V & Midgley PM (Eds.) Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 659-740.

National Monuments Service (2017). Records of Monuments and Places. www.archaeology.ie

National Roads Authority (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes.

Nedwell JR & Edwards B (2004). A review of measurements of underwater man-made noise carried out by Subacoustech Ltd, 1993-2003 Subacoustech Report ref: 534R0109, 131pp.

Nelms SE, Piniak WED, Weir CR & Godley BJ (2016). Seismic surveys and marine turtles: an underestimated global threat? Biological Conservation 193: 49-65.

Neptune LNG (2016). Application for incidental harassment authorization for the non-lethal taking of marine mammals – Neptune LNG Deepwater Port. Prepared for Neptune LNG LLC by CSA Ocean Sciences, Inc. June 2016.

NMFS (2016). Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: underwater acoustic thresholds for onset of permanent and temporary threshold shifts. National Marine Fisheries Service, U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p. http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

Nolan C, O'Donnell C, Lynch D, Lyons K, Keogh N, McAvoy S, Cronin C & Hunt W (2014). Celtic Sea Herring Acoustic Survey cruise report 2014. FSS Survey Series 2014/04,51pp.

NPWS (2013). The Status of Protected EU Habitats and Species in Ireland. Overview Volume 1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland. Editor: Deirdre Lynn, 149pp.

NPWS (2014). Guidance to minimise the risk to marine mammals from man-made sound sources in Irish waters. Guidance Document by the National Parks and Wildlife Service of the Department of Arts, Heritage and Gaeltacht, Dublin. January 2014. Available at https://www.npws.ie/sites/default/files/general/Underwater%20sound%20guidance_Jan%202014.pdf

NPWS website. Protected sites information sheets. https://www.npws.ie/protected-sites https://www.npws.ie/protected-sites/spa/004002 (accessed June 2017).

Ó Cadhla O, Strong D, O' Keeffe C, Coleman M, Cronin M, Duck C, Murray T, Dower P, Nairn R, Murphy P, Smiddy P, Saich C, Lyons D & Hiby L (2008). An assessment of the breeding population of grey seals in the Republic of Ireland, 2005. Irish Wildlife Manuals No. 34. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland. 60pp.

O'Boyle S & Silke J (2010). A review of the phytoplankton ecology in estuarine and coastal water around Ireland. *Journal of Plankton Research* **32**: 99-118.

O'Brien JM, Berrow SD, Ryan C, McGrath D, O'Connor I, Pesante G, Burrows G, Massett N, Lötzer V & Whooley P (2009). A note on long-distance matches of bottlenose dolphins (Tursiops truncatus) around the Irish coast using photo-identification. *Journal of Cetacean Research and Management* **11**: 71-76.

O'Donnell C, Saunders R, Lynch D, Lyons K & Wall D (2008). Celtic Sea Herring Acoustic Survey cruise report 2008. FSS Survey Series 2008/03,57pp.

O'Donnell C, Lynch D, Lyons K, Ni Riogain P & Volkenandt M (2011). Celtic Sea Herring Acoustic Survey cruise report 2011. FSS Survey Series 2011/03,48pp.

O'Donnell C, Nolan C, Sullivan M, Lyons K, McKeogh E, McAvoy S, Ingham S & O'Sullivan E (2012). Celtic Sea Herring Acoustic Survey cruise report 2012. FSS Survey Series 2012/05,43pp.

O'Donnell C, Nolan C, Mullins E, Lyons K, Volkenandt M, Keogh N, McAvoy S & Williams D (2013). Celtic Sea Herring Acoustic Survey cruise report 2013. FSS Survey Series 2013/04,51pp.

O'Donnell C, Lynch D, Lyons K, Keogh N & O'Donovan M (2015). Celtic Sea Herring Acoustic Survey cruise report 2015. FSS Survey Series 2015/04,53pp.

O'Donnell C, Sullivan M, Lyons K, Keogh N & Quinn M (2016). Celtic Sea Herring Acoustic Survey (CSHAS) cruise report 2016. FSS Survey Series 2016/04, 44pp.

O'Dwyer M (2016). Air Quality in Ireland 2015 - Key Indicators of Ambient Air Quality. Environmental Protection Agency, 75pp.

OECD (1992). Decision of Council C(92)39/FINAL on the Control of Transboundary Movements of Wastes Destined for Recovery Operations

OECD (2001). Decision of Council C(2001)107/FINAL concerning the Control of Transboundary Movements of wastes Destined for Recovery Operations, C(2001)107/ADD1, C(2004)20, C(2005)141 and C(2008)156, respectively

Oesterwind D, ter Hofstede M, Harley B, Brendelberger H & Piatkowski U (2010). Biology and meso-scale distribution patterns of North Sea cephalopods. *Fisheries Research* **106**: 141-150.

OGUK (2013). Long-term degradation of Offshore Structures and Pipelines Decommissioned and left *in situ.* Commissioned by Oil & Gas UK, 41pp.

OHSS (2012). Asbestos Management Survey Report, Bravo Platform, Report 8007 Rev 01.

OHSS (2016). Asbestos Management Survey Report, Alpha Platform, Report 7302 Rev D03.

Oil and Gas UK (2009). Accident statistics for offshore units on the UKCS 1990-2007 Issue 1 April 2009, 127pp.

Oil and Gas UK (2015). Guidelines for the Abandonment of Wells, Issue 5

OSPAR (1992). Convention for the Protection of the Marine Environment of the North-East Atlantic.

OSPAR (1998). Decision 98/3 on the Disposal of Disused Offshore Installations.

OSPAR (2000). Quality Status Report 2000. OSPAR Commission, London, 108pp.

OSPAR (2009). Overview of the impacts of anthropogenic underwater sound in the marine environment. OSPAR Commission Biodiversity Series 2009. Publication Number 441/2009, 134pp.

OSPAR (2014). Levels and trends in marine contaminants and their biological effects – CEMP Assessment Report 20 1 3. OSPAR Commission Monitoring and Assessment Series, 21pp.

OSPAR Commission (2017). Third Integrated Report on the Eutrophication Status of the OSPAR Maritime Area. OSPAR Commission Report Number 694/2017, 164pp.

Owl Ridge Natural Resource Consultants (2016). Application for incidental harassment authorization for the taking of marine mammals in conjunction with proposed Alaska Phase of the Quintillion Subsea Project 2016. Prepared for Quintillion Subsea Operations LLC by Owl Ridge Natural Resource Consultants, January 2016.

Pangerc T, Robinson S, Theobald P & Galley L (2016). Underwater sound measurement data during diamond wire cutting: first description of radiated noise. *Proceedings of Meetings on Acoustics* **27**: 040012. doi: 10.1121/2.0000322.

Pantin HM (1991). The sea-bed sediments around the United Kingdom: their bathymetric and physical environment, grain size, mineral composition and associated bedforms. British Geological Survey Research Report SB/90/1.

Pearson WH, Skalski JR & Malme CI (1992). Effects of sounds from a geophysical survey device on behaviour of captive rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Science* **49**: 1357-1365.

Penrose & Gander (2016). British Isles & Republic of Ireland Marine Turtle Strandings & Sightings Annual Report 2015, 27pp.

Pikesley SK, Godley BJ, Ranger S, Richardson PB & Witt MJ (2014). Cnidaria in UK coastal waters: description of spatio-temporal patterns and inter-annual variability. *Journal of the Marine Biological Association of the United Kingdom* **94**: 1401-1408.

Pingree RD & Le Cann B (1989). Celtic and Armorican slope and shelf residual currents. *Progress in Oceanography* **23**: 303-338.

Popper AN, Hawkins AD, Fay RR, Mann DA, Bartol S, Carlson TJ, Coombs S, Ellison WT, Gentry RL, Halvorsen MB, Løkkeborg S, Rogers PH, Southall BL, Zeddies DG & Tavolga WN (2014). Sound exposure guidelines for fishes and sea turtles: A technical report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

Pybus C (1996). The planktonic diatoms of Galway Bay, seasonal variations during 1974/5. *Biol. Environ. Proc. R. Irish Acad.* **96B**: 169-176.

Rakka M & Minto C (2015). An investigation into the effects of environmental and observational variables on haul-out counts of harbour seals (*Phoca vitulina vitulina*) in Ireland. A report by the Marine and Freshwater Research Centre, Galway-Mayo Institute of Technology, 201pp.

Ramboll (2017a). Seven Heads Gas Field Decommissioning - Report to inform the Comparative Assessment of Decommissioning Options using Net Environmental Benefit Analysis

Ramboll (2017b). Kinsale Head Rest of Field Decommissioning - Report to inform the Comparative Assessment of Decommissioning Options using Net Environmental Benefit Analysis

Rocha F, Guerra A & Gonzalez AF (2001). A review of reproductive strategies in cephalopods. *Biological Reviews* **76**: 291-304.

Ronconi RA, Allard KA & Taylor PD (2015). Bird interactions with offshore oil and gas platforms: Review of impacts and monitoring techniques. *Journal of Environmental Management* **147**: 34-45.

RPS (2015), Midleton Prospect Exploration Activities - Environmental Impact Assessment Screening

Report and Environmental Risk Assessment, Document No. MGE0502RP0002. Report to PSE Seven Heads Ltd.

Rutenko AN & Ushchipovskii VG (2015). Estimates of acoustic noise generated by auxiliary vessels working with oil-drilling platforms. *Acoustical Physics* **61**: 556-563.

Ryan C, Rogan E & Cross T (2010). The use of Cork Harbour by bottlenose dolphins (*Tursiops truncatus*, Montagu, 1821). *Irish Naturalists Journal* **31**: 1-9.

Ryan C, Whooley P, Berrow S, Barnes C, Massett N, Strietman W, Broms F, Stevick PT, Fernald Jr TW & Schmidt C (2016). A longitudinal study of humpback whales in Irish waters. *Journal of the Marine Biological Association of the United Kingdom* **96:** 877-883.

Samuel Y, Morreale SJ, Clark CW, Greene CH, Richmond ME (2005). Underwater, low-frequency noise in a coastal sea turtle habitat. *Journal of the Acoustical Society of America* **117**: 1465-1472.

Saunders R, O'Donnell C, Campbell A, Lynch D, Lyons K & Wall D (2009). Celtic Sea Herring Acoustic Survey cruise report 2009. FSS Survey Series 2009/03, 63pp.

Saunders R, O'Donnell C, Campbell A, Lynch D, Egan A, Lyons K & Wall D (2010). Celtic Sea Herring Acoustic Survey cruise report 2010. FSS Survey Series 2010/03,52pp.

SCANS-II (2008). Small Cetaceans in the European Atlantic and North Sea. Final Report to the European Commission on Project LIFE04NAT/GB/000245. http://biology.st-andrews.ac.uk/scans2/

SFPA (2017). Code of practice for the microbiological monitoring of bivalve mollusc production areas. Sea Fisheries Protection Authority, version 6, 42pp.

SFPA website. Annual landing statistics 2015. http://www.sfpa.ie/Sea-FisheriesConservation/FisheriesStatisticsandQuotaUptake/AnnualLandingStatistics.aspx (accessed March 2017).

Shell (2017). Brent Field Pipelines Decommissioning Technical Document. Shell Report Number BDE-F-PIP-BA-5801-00001, 380pp.

Shine KP (2009). The global warming potential – the need for an interdisciplinary retrial. *Climatic Change* **96**: 467-472.

Sims DW, Southhall EJ, Tarling GA & Metcalfe J (2005). Habitat-specific normal and reverse diel vertical migration in the plankton-feeding basking shark. *Journal of Animal Ecology* **74**: 755-761.

Skalski JR, Pearson WH & Malme CI (1992). Effects of sounds from a geophysical survey device on catch-per-unit-effort in a hook-and-line fishery for rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Science* **49**: 1343-1356.

Solandt J-L & Chassin E (2014). Basking shark watch – overview of data from 2009-2013. Report by the Marine Conservation Society, 6pp.

Southall BL, Bowles AE, Ellison WT, Finneran JJ, Gentry RL, Greene CR, Kastak D, Ketten D, Miller J H, Nachtigal PE, Richardson WJ, Thomas JA & Tyack P (2007). Marine mammal noise exposure criteria: initial scientific recommendations. *Aquatic Mammals* **33**:411-522.

Sparling C, Smith K, Benjamins S, Wilson B, Gordon J, Stringell T, Morris C, Hastie G, Thompson D & Pomeroy P (2015). Guidance to inform marine mammal site characterisation requirements at wave and tidal stream energy sites in Wales. NRW Evidence Report No. 82. Report to Natural Resources Wales, 88pp.

Spence J, Fischer R, Bahtiarian M, Borodotsky L, Jones N & Dempsey R (2007). Review of existing and future potential treatments for reducing underwater sound from oil and gas industry activities. NCE Report 07-001 to the Joint Industry Programme on E&P Sound and Marine Life, 193pp.

Stone C, Webb A, Barton C, Ratcliffe N, Reed T, Tasker M, Camphuysen C & Pienkowski M (1995). An Atlas of Seabird Distribution in North-west European waters. Joint Nature Conservation Committee, Peterborough.

Stowasser G, Bustamente P, MacLeod CD, Wang J & Pierce GJ (2005). Spawning areas and selected metal concentrations in squid (*Loligo forbesii*) in UK waters with notes on metal concentrations in other squid species. Report to the Department of Trade and Industry. Department of Zoology, University of Aberdeen, 24pp.

Stowasser G, Pierce GJ, Wang J & Santos MB (2004). An overview of cephalopods relevant to SEA 5 area. Report to the Department of Trade and Industry. Department of Zoology, University of Aberdeen, 40pp.

Sutton G (2008). Irish Sea Marine Aggregate Initiative (IMAGIN) Project Synthesis Report Including: Geological Assessment, Environmental Assessment, Morphodynamic Modelling Web-based GIS System, Cost Benefit Analysis, Aggregate Resources and Markets-Wales. Marine Environment and Health Series, No. 36, 66pp.

Thaxter CB, Lascelles B, Sugar K, Cook ASCP, Roos S, Bolton M, Langston RHW & Burton NHK (2012). Seabird foraging ranges as a preliminary tool for identifying candidate Marine protected Areas. *Biological Conservation* **156**: 53-61.

The Port of Cork Company (2009). Leisure and recreation strategy, 28pp.

UKHO (1997). Irish Coast Pilot NP40: Offshore and coastal waters around Ireland and including routes to the Irish Sea from Atlantic Ocean landfalls.14th edition. The Hydrographer of the Navy, UK, 503pp.

UKOOA (1998). Offshore Environmental Statement Guidelines. Issue 1, June 1998.

UN (1982). United Nations Convention on the Law of the Sea 1982.

UN (1989). Basal Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal.

Vega A, Hynes S & O'Toole E (2015). Ireland's ocean economy. Socio-Economic Marine Research Unit (SEMRU), National University of Ireland, Galway, 62pp.

Veirs S, Veirs V & Wood JD (2016). Ship noise extends to frequencies used for echolocation by endangered killer whales. *PeerJ* 4:e1657; DOI 10.7717/peerj.1657.

Wall D, Murray C, O'Brien J, Kavanagh L, Wilson C, Ryan C, Glanville B, Williams D, Enlander I, O'Connor I, McGrath D, Whooley P & Berrow S (2013). Atlas of the distribution and relative abundance of marine mammals in Irish offshore waters 2005 - 2011. Irish Whale and Dolphin Group, Merchants Quay, Kilrush, Co Clare.

Walsh S (2012). A summary of climate averages for Ireland 1981-2010. Met Éireann, Dublin, 16pp.

Wardle CS, Carter TJ, Urquhart GG, Johnstone ADF, Ziolkowski AM, Hampson G & Mackie D (2001). Effects of seismic air guns on marine fish. *Continental Shelf Research* **21**: 1005-1027.

Webb A, Elgie M, Irwin C, Pollock C & Barton C (2016). Sensitivity of offshore seabird concentrations to oil pollution around the United Kingdom. Report to Oil & Gas UK, 102pp.

Webb A, Harrison N, Leaper G, Steele R, Tasker M & Pienkowski W (1990). Seabird distribution west of Britain. Final report of Phase 3 of the Nature Conservancy Council Seabirds at Sea Project, November 1986 to March 1990. Nature Conservancy Council, Aberdeen.

Weinzettel J, Reenaas M, Solli C & Hertwich EG (2009). Life cycle assessment of a floating offshore wind turbine. *Renewable Energy* **34**: 742-747.

Westley K & Edwards R (2017). Irish Sea and Atlantic Margin. In: Flemming NC (Ed.) Harff J, Moura D, Burgess A & Bailey GN. Submerged Landscapes of the European Continental Shelf: Quaternary Paleoenvironments. Wiley-Blackwell, pp 241-280.

Westley K (2015). Submerged Mesolithic Landscape Investigation, Eleven Ballyboes, Republic of Ireland. *The International Journal of Nautical Archaeology* **44**: 243-257.

Whitehead PJP, Bauchot M-L, Hureau J-C, Nielsen J & Tortonese E (1986). *Fishes of the North-eastern Atlantic and the Mediterranean*. UNESCO, Paris.

WHO (2013). WHO (2013). Review of evidence on health aspects of air pollution – REVIHAAP project: final technical report, 302pp.

Whooley P, Berrow S & Barnes C (2011). Photo-identification of fin whales (*Balaenoptera physalus* L.) off the south coast of Ireland. *Marine Biodiversity Records* **4**: E8.

Wiedmann TO, Suh S, Feng, K, Lenzen M, Acquaye A, Scott K & Barrett JR (2011). Application of Hybrid Life Cycle Approaches to Emerging Energy Technologies. The Case of Wind Power in the UK. *Environmental Science & Technology* **45**: 5900-5907

Wiese FK, Montevecc, WA, Davore, GK, Huettman F, Diamond AW & Linke J (2001). Seabirds at risk around offshore oil platforms in the northwest Atlantic. *Marine Pollution Bulletin* **42**: 1285-1290.

Wildlife Service Ireland (1988). The Irish Red Data Book.

Woolf D & Wolf J (2013). Impacts of climate change on storms and waves. MCCIP Science Review 2013, pp. 20-26.

World Resources Institute (2011). Product Life Cycle Accounting and Reporting Standard. Greenhouse Gas Protocol, 144pp.

Xodus (2016a). Decommissioning Project Basis. Document A-301721-S00-REPT-001, 35pp.

Xodus (2016b). Subsea Facilities Decommissioning Study. Document A-301721-S00-TECH-006, 51pp.

Xodus (2016c). Subsea Decommissioning Strategy. Document A-301721-S00-TECH-005, 53pp + appendices.

Xodus (2016d). Appendix B: Method Statements. In: Engineering Services Kinsale Area Decommissioning Project – Cost Estimate. Document A-301721-S00-REPT-002, 8pp.

Yellishetty M, Haque N & Dubreuil A (2012). Issues and Challenges in Life Cycle Assessment in the Minerals and Metals Sector: A Chance to Improve Raw Materials Efficiency. In: Sinding-Larsen & Wellmer (Eds.) Non-Renewable Resource Issues. Springer Netherlands, pp 229-246.

Zykov M (2013). Underwater sound modelling of low energy geophysical equipment operations. JASCO Document 00600, Version 2.0. Technical report by JASCO Applied Sciences for CSA Ocean Sciences Inc., 59pp.