Exploration Drilling within Block ER236, off the East Coast of South Africa

Final Scoping Report – V1

March 2018

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Exploration Drilling within Block ER236, off the East Coast of South Africa

Eni

Final Scoping Report

March 2018

Compiled by: Claire Alborough and Lindsey Bungartz

For and on behalf of Environmental Resources Management

Approved by: Ingeborg McNicoll

Signed:

Position: Senior Partner

Date: 8 March 2018

List of Abbreviations, Acronyms and Units

ADI	Area of Direct Influence
AEL	Atmospheric Emissions Licence
AII	Area of Indirect Influence
ALARP	As Low As Reasonably Practicable
AOI	Area of Influence
BAR	Basic Assessment Report
CH4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CRR	Comments and Response Report
CSP	Concentrated Solar Power
DAFF	Department of Agriculture, Forestry and Fisheries
DC	Direct Current
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DOE	Department of Energy
DP	Dynamic Positioning
DPS	Dynamic Positioning System
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
E	East
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Ecological Importance and Sensitivity
EMBF	Enhanced Mineral Oil Based Fluid
EMP	Environmental Management Plan
EMPr	Environmental Management Plan report
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
Eps	Equator Principles
ERM	Environmental Resources Management
EEZ	Exclusive Economic Zone
FSR	Final Scoping Report
GDARD	Gauteng Department of Agriculture and Rural Development
GEMSS	Generalized Environmental Modelling System for Surfacewaters
GHG	Greenhouse Gas
GJ	Giga Joules
GNR	Government Notice Regulation
ha	Hectares
HSE	Health, Safety, Environment
I&APs	Interested & Affected Parties
IAEA	International Atomic Energy Agency
ICRC	International Commission on Radiological Protection
IDZ	Industrial Development Zone
IEM	Integrated Environmental Management

IEP	Integrated Energy Plan
IFC	International Finance Corporation
m	Meters
mamsl	Meters Above Mean Sea Level
MAP	Mean Annual precipitation
MARPOL	International Convention for the Prevention of Pollution from Ships
MES	Minimum Emissions Standards
MGO	Marine Gas Oil
MPRDA	Mineral and Petroleum Resources Development Act
MPRDAA	Mineral and Petroleum Resources Development Amendment Act
NADF	Non-Aqueous Drilling Fluids
NDP	National Development Plan
NEMA	National Environmental Management Act
NEMAA	National Environmental Management Amendment Act
NEMAQA	National Environmental Management: Air Quality Act
NEMBA	National Environmental Management: Biodiversity Act
NEMWA	National Environmental Management: Waste Act
NEMICMA	National Environmental Management: Integrated Coastal Management Act
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
PASA	Petroleum Agency South Africa
PM	Particulate Matter
POB	People on Board
PoS	Plan of Study
PPE	Personal Protective Equipment
PPP	Public Participation Process
PS	Performance Standard
PSVs	Platform Supply Vessels
ROV	Remote Operated Vehicle
S&EIR	Scoping and Environmental Impact Report
SAHRA	South African Heritage Resources Agency
SBF	Synthetic Based Fluids
SDFP	Spatial Development Framework Plan
SO_2	Sulphur Dioxide
SOx	Sulphur Oxides
SRE	Solids Removal Efficiency
ToR	Terms of Reference
UNCLOS	United Nations Convention on Law of the Sea
VOCs	Volatile Organic Compounds
VOS	Voluntary Observing Ships
WBDF	Water-Based Drilling Fluids
WML	Waste Management Licence
%BFROC	Percent Base Fluid Retained On Cuttings

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

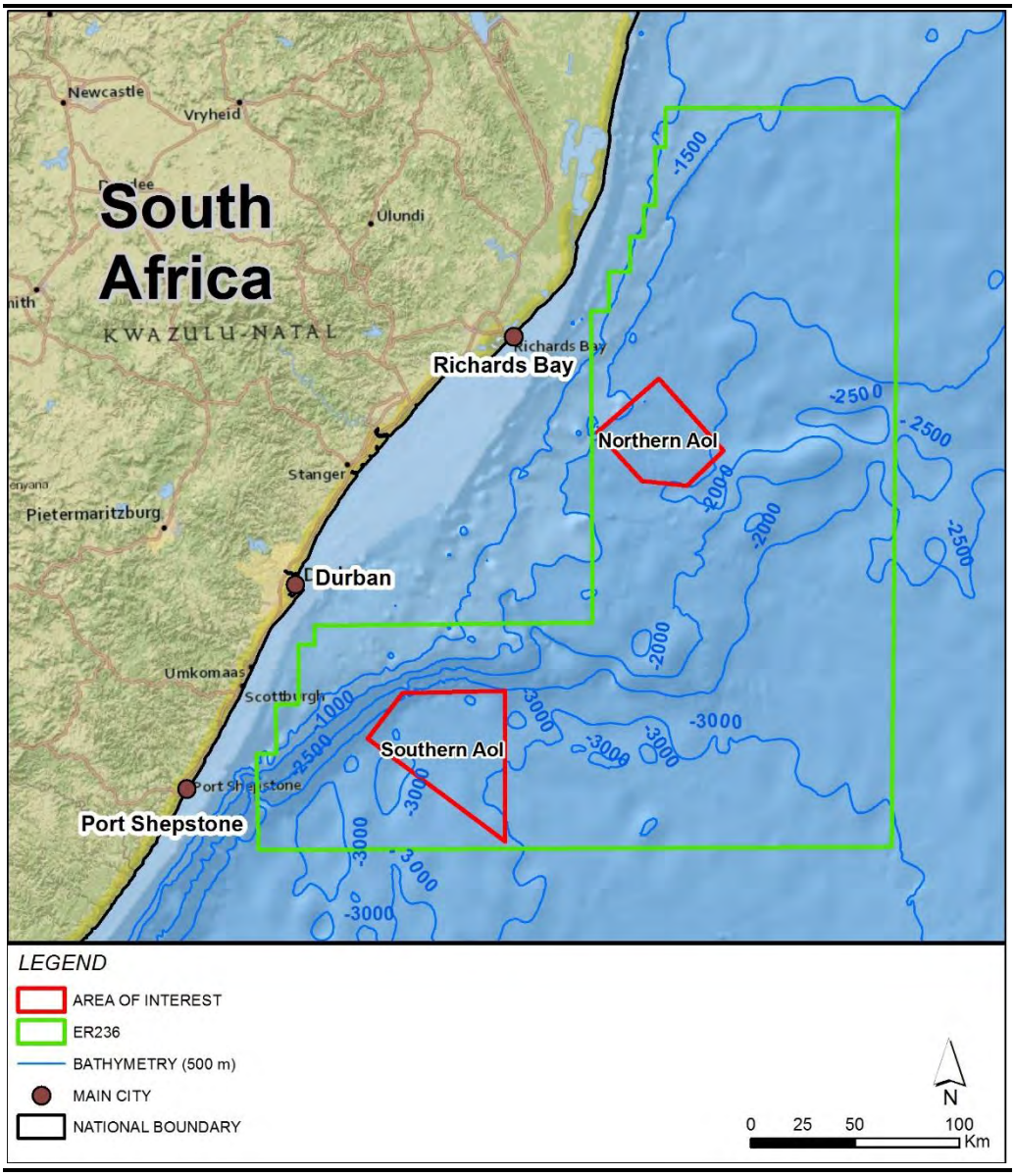
Eni South Africa BV (Eni), and Sasol Africa Limited (Sasol) hold an Exploration Right off the East Coast of South Africa. Eni and Sasol are considering the possibility of conducting an exploration drilling programme in Block ER236 (12/3/236) to assess the commercial viability of the hydrocarbon reservoir for future development.

Eni is considering drilling up to six deep water wells within Block ER236, four wells within a northern 1,717.50 km^2 [1] area of interest, in water depths ranging between 1,500 m and 2,100 m and two wells within a southern 2,905 km^2 area of interest (*Figure 1.1*), in water depth ranging between 2,600 m and 3,000 m. The specific number of wells and their locations would be based on a number of factors, including further analysis of seismic data, the geological target (the hydrocarbon bearing geology into which the well is to be drilled), and the presence of any seafloor obstacles. In addition, the success (if valuable hydrocarbon is discovered) of the first well in each area will determine whether or not subsequent wells are drilled.

The drilling of the first exploration well is planned in 2019. The expected drilling depth would be approximately 3,800 m and 4,100 m from the sea surface to target depth in the northern area, while at around 5,450 m in the southern one. The drilling of one well is expected to take in the order of two months to complete. Depending on the success of the first well within the northern area of interest, up to three additional wells comprising an additional exploration well at a second location and the possibility of one appraisal close to each exploration well location, may be drilled to establish the quantity and potential flow rate of any hydrocarbon present. The time sequence of these possible additional wells will be dependent on the results of the first exploration well, and will not occur immediately after the drilling of the initial well. Within the southern area of interest one potential exploration well will be drilled and a possible appraisal well depending on the results of the first well. Well testing may be conducted on the appraisal wells if they present potential commercial quantities of hydrocarbon.

[1] Underlined text indicates the changes made from the Draft Scoping Report

Figure 1.1 ***Locality Map***



1.2 *PURPOSE OF THIS PROJECT*

ERM has been appointed by Eni to undertake the full Environmental Impact Assessment (EIA) Process as per the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations, 2014 (as amended in 2017). The project requires Environmental Authorisation (EA) from the National Department of Mineral Resources (DMR), through the Petroleum Agency South Africa (PASA). The authorisation would be under NEMA. Since this is an offshore oil and gas project, the DMR is the competent authority, which means that it has powers to either authorise the development or refuse it.

Applications must be submitted to PASA, who is responsible for evaluating applications, entering into negotiations with applicants and making recommendations to the Minister of Mineral Resources on their acceptability.

A typical EIA is usually undertaken in three phases namely Scoping Phase, Specialist Study Phase and Impact Assessment. This Scoping Report documents the findings of the Scoping Phase.

The Scoping Report identifies the potentially significant environmental and social issues relating to the establishment/construction, operation and decommissioning of the proposed project that should be addressed in the EIA. This was done through a desktop review of available project and baseline information, and initial public engagement.

Copies of the draft Scoping Report will be available for public comment for 30 days. Comments will be addressed in a Comments and Responses Report and included in the final Scoping Report submitted to PASA for review.

The Scoping Report includes a description of the proposed project infrastructure and activities, alternatives considered, and the EIA methodology. A description of the stakeholder engagement process and the key issues raised by stakeholders through the consultation activities are also presented. These issues have informed the development of the Plan of Study for EIA, which defines the detailed studies to be undertaken as part of the Specialist Studies Phase.

1.3 PROJECT PROPONENT

The contact details for the applicant are presented below:

Box 1.1 Contact Details of Project Applicant / Proponent

Eni South Africa BV
1st Floor, Icon Building c/o Cube WS
Cnr Lower Long St. & Hans Strijdom Rd.
Foreshore, 8001, Cape Town, South Africa
Wrk: +27 21 412 1582
Contact: Alessandro Gelmetti, Managing Director

1.4 THE EIA TEAM

ERM is a global environmental consulting organisation employing over 5,000 specialists in over 150 offices in more than 40 countries. In South Africa, ERM Southern Africa employs over 150 environmental consultants out of offices in Johannesburg, Durban and Cape Town.

The requirement for environmental consultants to act independently and objectively is a well-established principle in South African law and elsewhere. The EIA regulations (GN R.982, as amended), specifically state that an EAP (environmental assessment practitioner) (must have) no business, financial, personal or other interest in the activity, application or appeal in respect of which that EAP is appointed in terms of these Regulations other than fair remuneration for work performed in connection with that activity; or that there are no circumstances that may compromise the objectivity of that EAP in performing such work.

ERM is a privately owned company registered in South Africa. ERM has no financial ties to, nor is ERM a subsidiary, legally or financially, of Eni. Remuneration for the services by the Proponent in relation to this EIA is not linked to an approval by the decision-making authority. Furthermore, ERM has no secondary or downstream interest in the development.

The role of the environmental consultants is to provide credible, objective and accessible information to government and other stakeholders, so that an informed decision can be made about whether the project should proceed or not.

The ERM team selected for this project possess the relevant expertise and experience to undertake this EIA. As such, ERM has signed the legally required declaration of independence to function as an objective Environmental Assessment Practitioner (EAP). The CVs and details of the Independent Environmental Practitioner are presented in *Annex A*.

The contact details of the EAP for the application are presented in ***Box 1.1***

Box 1.2 ***Contact Details of the EAP***

Environmental Resources Management Southern Africa (Pty) Ltd.
Postnet Suite 90
Private Bag X12
Tokai
7966

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2nd Floor | Great Westerford | 240 Main Road | Rondebosch | 7700
Cape Town | South Africa
T +27 21 681 5400 | F +27 21 686 0736
E Claire.alborough@erm.com

The core EIA team members involved in this EIA are listed in *Table 1.1*.

Table 1.1 The EIA Team

Name	Role	Qualifications, Experience
Ingeborg McNicoll	Project Director	BSc (Hons) Marine Biology. 35 years' experience
Claire Alborough	Project Manager	BSc (Hons), MPhil, 10 years' experience
Lindsey Bungartz	Stakeholder Engagement Specialist	BSocSc (Hons), 10 years' experience

1.5 UNDERTAKING BY EAP

Section 16 (1) (b) (iv), Appendix 1 Section 3 (1) (r), Appendix 2 Sections 2 (1)(i) and (j) and Appendix 3 Section 3 (s) of the Environmental Impact Assessment (EIA) Regulations, 2014 (promulgated in terms of NEMA), require an undertaking under oath or affirmation by the Environmental Assessment Practitioner (EAP) in relation to:

- The correctness of the information provided in the report;
- The inclusion of comments and inputs from stakeholders and interested and affected parties;
- Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties; and
- The level of agreement between the EAP and interested and affected parties on the Plan of Study for undertaking the environmental impact assessment.

As such ERM and the practitioners managing the project confirm the following:

- To the best of our knowledge that the information provided in this Scoping Report is the most recent detail provided by the proponent and specialists thus far in the process.
- Comments and associated response are included in *Annex B* and summarised in a comments and responses report (CRR).
- Information provided to and communication with stakeholders is included in *Annex B*.

1.6 SCOPING REPORT REQUIREMENTS AS PER EIA REGULATIONS 2014 (AS AMENDED)

Table 1.2 illustrates the legislated content of the Scoping Report.

Table 1.2 Content of Scoping Report

Legislated Content- Appendix 2 Section 2	Section in this Report
(a) details of-	
(i) the EAP who prepared the report	*Chapter 1*
(ii) the expertise of the EAP, including a curriculum vitae	*Chapter 1 and Annex A*
(b) the location of the activity (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	*Section 4.1*
(c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	*Chapter 4*
(d) a description of the scope of the proposed activity, including-	
(i) all listed and specified activities triggered;	*Section 2.3.2*
(ii) a description of the activities to be undertaken, including associated structures and infrastructure	*Chapter 4 and Section 2.3.2*
(e) a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process	*Chapter 2 and 3*
(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	*Chapter 2*
(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including	
(i) details of all the alternatives considered;	*Section 4.8*
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	*Section 6.6 and Annex B*
(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	*CRR in Annex C*
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	*Chapter 5*
(v) the impacts and risks which have informed the identification of each alternative, including the nature, significance, consequence, extent, duration and probability of such identified impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated.	*Chapter 4*

Legislated Content- Appendix 2 Section 2	Section in this Report
(vi) the methodology used in identifying and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives	*Chapter 4, 7 and 8*
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	*Chapter 4 and 7*
(viii) the possible mitigation measures that could be applied and level of residual risk	*Chapter 4 and 7*
(ix) the outcome of the site selection matrix	*Chapter 4*
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such	*Chapter 4*
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity	*Chapter 4*
(h) a plan of study for undertaking the environmental impact assessment process to be undertaken, including-	
(i) a description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity	*Chapter 8*
(ii) a description of the aspects to be assessed as part of the environmental impact assessment process;	*Chapter 8*
(iii) aspects to be assessed by specialists;	*Chapter 8*
(iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists	*Chapter 8*
(v) a description of the proposed method of assessing duration and significance	*Chapter 8*
(vi) an indication of the stages at which the competent authority will be consulted;	*Chapter 8*
(vii) particulars of the public participation process that will be conducted during the environmental impact assessment process;	*Chapter 8*
(viii) a description of the tasks that will be undertaken as part of the environmental impact assessment process;	*Chapter 8*
(ix) identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored.	*Chapter 8*
(i) an undertaking under oath or affirmation by the EAP in relation to ─	
(i) the correctness of the information provided in the report;	*Chapter 1*
(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties; and	*Chapter 1*
(iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	*Chapter 1*
(j) an undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;	*To be included in Final Scoping Report*
(k) where applicable, any specific information required by the competent authority;	*To be included in Final Scoping Report*
(l) any other matter required in terms of section 24(4) (a) and (b) of the Act.	

1.7 REPORT STRUCTURE

The remainder of this Report is structured as follows:

- Chapter 2: Project Motivation
- Chapter 3: Administrative Framework
- Chapter 4: Project Description
- Chapter 5: Environmental and Social Baseline
- Chapter 6: EIA Process
- Chapter 7: Identification of Impacts
- Chapter 8: Plan of Study for EIA
- Chapter 9: Conclusion

The Report is supported by the following annexes:

- Annex A: Details of Environmental Assessment Practitioner
- Annex B: Stakeholder Engagement
    - B1 – I&AP Database
    - B2 – Initial Notification Material
    - B2.1 – Notification
    - B2.2 – Adverts
    - B2.3 – Background Information Document
    - B3– Site Notices
    - B4 - Comments Received
- Annex C: Comments and Responses Report

2 ADMINISTRATIVE FRAMEWORK

2.1 INTRODUCTION

This section provides an overview of legislation, conventions and information documents that have informed the scope and content of this report and the approach to the EIA process.

2.2 OVERVIEW OF 'ONE ENVIRONMENTAL SYSTEM'

In 2007 / 2008, the Department of Environmental Affairs (DEA) and the Department of Mineral Resources (DMR) agreed that environmental regulation would be removed from the scope of the MPRDA and would be regulated under NEMA, which would give rise to a "One Environmental System" for the country relating to mining and related activities. The implementation of this was given effect by the National Environmental Management Amendment Act, 2008 (No. 62 of 2008) (NEMAA) and the Mineral and Petroleum Resources Development Amendment Act, 2008 (No. 49 of 2008) (MPRDAA).

Subsequent to the 8 December 2014, all applications for Environmental Authorisations (EA's), including those for mining and petroleum related activities previously regulated in terms of the MPRDA, must now be undertaken in terms of NEMA and the associated EIA Regulations.

2.3 KEY RELEVANT LEGISLATION

2.3.1 *Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)*

The primary legislation governing the South African upstream mining and petroleum sector is the MPRDA. Although the MPRDA governs South Africa's petroleum industry as well as its mining industry, petroleum activities are primarily accommodated within a separate chapter of the statute, namely, Chapter 6. Chapter 6 makes provision for two permits (reconnaissance permits and technical co-operation permits) and two rights (exploration rights and production rights).

In terms of the MPRDA, an Exploration Right must be approved prior to the commencement of exploration activities. Eni and Sasol hold an existing Exploration Right for ER236, which is currently in its first two year renewal period, as of 11 07 2017.

The Act should be read together with the Mineral and Petroleum Resources Development Regulations, 2004 (GNR.527 of 23 April 2004); (MPRDA Regulations) and it should be noted that the MPRDA is currently pending amendment by the MPRDA Amendment Bill 15D, 2013. The current form of the amendments would however not change the Environmental Authorisation process or requirements in terms of NEMA.

2.3.2 National Environmental Management Act (Act No. 107 of 1998)

The National Environmental Management Act (No.107 of 1998) (NEMA) is the South African framework legislation with respect to environmental protection and management. Section 2 of NEMA provides a range of environmental principles that are to be applied by organs of state when making decisions that significantly affect the environment. Two of the key principles include:

- Environmental management must place people and their needs at the forefront, and serve their physical, psychological, developmental, cultural and social interests equitably.

- Development must be socially, environmentally and economically sustainable.

NEMA also provides for the participation of Interested and Affected Parties (I&APs) and stipulates that decisions must take into account the interests, needs and values of all I&APs.

Section 28 of NEMA imposes a duty of care on every person who causes, has caused, or may cause significant pollution or degradation of the environment to take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring.

The Environmental Authorisation process in South Africa is governed by NEMA as amended and the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended) promulgated under NEMA. The relevance of this legislation is summarised below.

NEMA Environmental Authorisation

Chapter 5 of NEMA, as amended, outlines the general objectives and implementation of Integrated Environmental Management. This provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals that are likely to have a detrimental effect on the environment. Whilst Section 23 sets out the basic objectives and principles of the IEM procedure, Section 24 sets out how these objectives and principles are to be accomplished.

Regulations governing the environmental authorisation process have been promulgated in terms of NEMA and include the following:

- Environmental Impact Assessment Regulations (GNR R982/2014);
- Environmental Impact Assessment Regulations Listing Notice 1 (GNR 983/2014);
- Environmental Impact Assessment Regulations Listing Notice 2 (GNR 984/2014); and
- Environmental Impact Assessment Regulations Listing Notice 3 (GNR 985/2014).

*It should be noted that the above regulations were amended in April 2017 by Government Notices 324, 325, 326 and 327.

Activities that trigger GNR 983 and GNR 985 require a Basic Assessment Report (BAR) process to be undertaken, whereas activities identified in terms of GNR 984 will require a full Scoping and Environmental Impact Report (S&EIR) process. GNR 982 sets out the general procedure to follow when conducting either a BAR or S&EIR process.

With reference to the EIA Regulations 2014 (as amended), the identification of the competent authority states as follows:
'The competent authority in respect of the activities listed in this part of the schedule is the competent authority in the province in which the activity is to be undertaken, unless-

a) it is an application for an activity contemplated in section 24C(2) of the Act, in which case the competent authority is the Minister or an organ of state with delegated powers in terms of section 42(1) of the Act;
b) the listed or specified activity is or is directly related to-

    i. **prospecting or exploration of a mineral or petroleum resource;** or
    ii. extraction and primary processing of a mineral or petroleum resource;'

It is therefore understood that the competent authority for this project will be the Department of Mineral Resources (DMR). As such, Eni will be required to obtain a positive Environmental Authorisation from the DMR prior to commencement of the proposed activities. The Petroleum Agency of South Africa (PASA) accept and process offshore petroleum EA applications on behalf of the DMR, however the DMR is required to sign off on the final decision.

Numerous trigger activities have been identified for this project in terms of all the listing notices (refer to *Table 2.1*).

In instances where all the listing notices are triggered (as in this project), GNR 984 requirements will take precedent and the project will be subject to a full S&EIR process prior to commencement of any of the associated activities.

Table 2.1 Listed Activities in Terms of the NEMA EIA Regulations, 2014 (as amended, 2017)

Listed Activity	Activity Description	Project Trigger
GNR 983 Activity 14	The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	The proposed drilling operation would make use of infrastructure, which would handle and potentially store oil, gas and/or fuel (diesel). Information on the anticipated storage capacity for these substances is currently not confirmed and this activity is included to provide for a situation where storage capacity exceeds 80 m^3 but falls below 500 m^3.
GNR 983 Activity 22	The decommissioning of any activity requiring – (i) a closure certificate in terms of section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or (ii) a prospecting right, mining right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.	In terms of Section 43(3) of the MPRDA, a closure certificate must be applied for upon, inter alia: • the lapsing of an Exploration Right; or • the relinquishment of any portion of the licence area. Based on the results of the well drilling programme, a decision would be made as to whether to permanently or temporarily abandon the wells. The possible abandonment of wells may result in a decision by Eni to relinquish the licence area or a portion thereof.
GNR 984 Activity 7	The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods— (i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day; (ii) in liquid form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 50 cubic metres per day;	The proposed project would make use of drilling infrastructure (eg pipes, casings etc.) which would potentially transport oil and/or gas to the drilling unit should a discovery be made. Due to the anticipated depth of the proposed wells, this infrastructure would exceed 1 000 m in length. The designed throughput capacity of this infrastructure could potentially exceed the thresholds specified in the listed activity.

Listed Activity	Activity Description	Project Trigger
GNR 984 Activity 14	The development and related operation of- (ii) An anchored platform; or (iii) any other structure or infrastructure on, below or along the sea bed	The proposed drilling operations would result in the placement of drilling equipment (ie a wellhead) on the sea bed. In the case that a well is unsuccessful, the wellhead equipment would be removed. However, should the well be commercially viable, the wellhead would potentially remain in place until such time as the well is brought into production.
GNR 984 Activity 18	Any activity including the operation of that activity which requires an exploration right as contemplated in section 79 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including — (a) associated infrastructure, structures and earthworks;	Eni currently hold an Exploration Right for ER236. An Environmental Management Programme (EMPr) was undertaken for the initial Exploration Right application in terms of the MPRDA requirements at the time. The Work Programme approved for the Exploration Right and the EMPr did not cover the drilling of exploration wells. PASA has confirmed that an EIA in terms of NEMA is required to be undertaken for this activity.

Financial Provision Regulations, 2015

Section 24P of NEMA requires that an applicant for EA relating to prospecting, mining, exploration, production or related activities on a prospecting, mining, exploration or production area must make the prescribed financial provision for the rehabilitation, management and closure of environmental impacts, before the Minister responsible for mineral resources issues the EA.

In terms of the National Environmental Management Act: Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, Operations (GN R1147, which came into effect on 20 November 2015) an applicant or holder of a right must determine and make financial provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts of exploration, operations, as contemplated in the Act and to the satisfaction of the Minister of Mineral Resources.

At the end of the operation (ie drilling and well completion) the well will be plugged and abandoned. This will involve setting cement plugs inside the wellbore and testing them for integrity. The BOP will be then retrieved at surface and the drillship and support vessels will depart the area. A decommissioning (abandonment) plan or financial provisions for decommissioning will be required and will be submitted to the Minister as

part of the Environmental Authorisation application process. This will be undertaken by an appropriate specialist.

2.3.3 National Environmental Management: Waste Act (No. 59 of 2008)

Section 19 of National Environmental Management: Waste Act (No. 59 of 2008) (NEMWA) provides for the listing of waste management activities that have, or are likely to have a detrimental effect on the environment.
In accordance with this, GN 921 of 29 November 2013 lists waste management activities for which a waste management licence (WML) is required in terms of Section 20 of the Act. Furthermore, it classifies each of the waste management activities into different categories, with more onerous provisions assigned for activities that are regarding as being more detrimental to the environment. In this regard, 'Category A' activities require a NEMA BAR process to be conducted prior to commencement. 'Category B' activities require a full S&EIR process to be conducted, while 'Category C' activities are wholly exempt from the WML permitting process, as long as they show compliance with a set of prescribed standards.

It is ERM's understand that a WML is not required for the currently proposed activities.

2.3.4 National Environmental Management: Air Quality Act (No. 39 of 2004)

National Environmental Management: Air Quality Act (No. 39 of 2004) (NEMAQA) deals with the control and management of emissions related to activities contained in the Listed Activities and Associated Minimum Emission Standards GN 893 of 22 November 2013 (MES). NEMAQA prescribes the need for an Atmospheric Emission Licence (AEL) if more than 10 kg of operational waste is incinerated per day. The AEL process involves the undertaking of a Basic Assessment in accordance with NEMA.

Should Eni decide to incinerate non-toxic combustible wastes on the drilling unit and support vessels, they would be required to apply to DEA: Air Quality Management Services for an AEL. It is however currently Eni's intention to bring all wastes to shore for appropriate disposal.

2.3.5 National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008)

The National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008) (NEMICMA) sets out a system of integrated coastal and estuarine management in South Africa to promote the conservation of the coastal environment and to ensure that the development and the use of natural resources within the coastal zone are socially and economically justifiable and ecologically sustainable. Section 69 of the NEMICMA prohibits the discharge of effluent that originates from a source on land into coastal waters except in terms of a CWDP issued by the DEA.

NEMICMA has also provided for the repeal of the former Sea-shore Act 21 of 1935 and the Dumping at Sea Control Act 73 of 1980.

Dumping Regulations

Dumping at Sea Regulations were published on 21 July 2017 in terms of sections 83(1) (g), (h), (k) and (r) of NEMICMA, these govern dumping permit applications as allowed for by section 71(1) of NEMICMA. However, it should be noted that, as per NEMICA, dumping does not include:

- Disposing of or storing in the sea any tailings or other material from the bed or subsoil of coastal waters generated by the lawful exploration, exploitation and associated off-shore processing of mineral resources from the bed, subsoil or substrata of the sea; and

- Operational waste from a vessel, aircraft, platform or other man-made structure at sea.

As such it is understood that a dumping permit would not be required for this project.

2.4 OTHER APPLICABLE LEGISLATION

This section provides a list of other national and international legislation and conventions potentially applicable to the proposed project. Additional authorisations or permits may be required in terms of such legislation, but fall outside the scope of this EIA process.

2.4.1 National Legislation

National legislation potentially relevant for the project (in addition to those presented in preceding sections) is listed below.

- Constitution of the Republic of South Africa (No. 108 of 1996);
- National Environmental Management: Integrated Coastal Management Act (No. 24 of 2008);
- National Water Act (No. 36 of 1998);
- National Heritage Resources Act (No. 25 of 1999);
- National Environmental Management: Biodiversity Act (No. 10 of 2004);
- National Environmental Management: Protected Areas Act (No. 57 of 2003);
- Sea-Shore Act (No. 21 of 1935);
- Marine Living Resources Act (No. 18 of 1998);
- Occupational Health and Safety Act (No. 73 of 1989);
- Gas Act (No. 48 of 2001);
- Noise Control Regulations under the Environmental Conservation Act (No. 73 of 1989);
- Major Hazard Installation Regulations (GNR. 692 of 30 July 2001);

- Hazardous Substances Act (56 of 1973) and Regulations (No. 85 of 1983);
- Explosives Act (No. 15 of 2003);
- Electricity Regulation Act (No. 4 of 2006);
- Nature and Environmental Conservation Ordinance (No. 19 of 1974);
- Marine Pollution (Prevention of Pollution from Ships) Act (No. 2 of 1986);
- National Ports Act (No. 12 of 2005); and
- Marine Traffic Act (No. 2 of 1981).
- Carriage of Goods by Sea Act, 1986 (No. 1 of 1986);
- Dumping at Sea Control Act, 1980 (No. 73 of 1980);
- Marine Pollution (Control and Civil Liability) Act, 1981 (No. 6 of 1981);
- Marine Pollution (Intervention) Act, 1987 (No. 65 of 1987);
- Maritime Safety Authority Act, 1998 (No. 5 of 1998);
- Maritime Safety Authority Levies Act, 1998 (No. 6 of 1998);
- Maritime Zones Act, 1994 (No. 15 of 1994);
- Merchant Shipping Act, 1951 (No. 57 of 1951);
- Mine Health and Safety Act, 1996 (No. 29 of 1996);
- National Nuclear Energy Regulator Act, 1999 (No. 47 of 1999);
- Nuclear Energy Act, 1999 (No. 46 of 1999);
- Sea Birds and Seals Protection Act, 1973 (No. 46 of 1973);
- Ship Registration Act, 1998 (No. 58 of 1998);
- South African Maritime Safety Authority Act, 1998 (No. 5 of 1998);
- South African Maritime Safety Authority Levies Act, 1998 (No. 6 of 1998);
- Wreck and Salvage Act, 1995 (No. 94 of 1995).

Applicable provisions from these laws and regulations will be incorporated into the design and implementation of the Project.

2.4.2 International Requirements

International Marine Pollution Conventions

- International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL);

- Amendment of the International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL) (Bulletin 567 – 2/08);

- International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention);

- United Nations Convention on Law of the Sea, 1982 (UNCLOS);

- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (the London Convention) and the 1996 Protocol (the Protocol);
- International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties (1969) and Protocol on the Intervention on the High Seas in Cases of Marine Pollution by substances other than oil (1973);

- Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1989); and

- Convention on Biological Diversity (1992).

Other International Legislation

- International Commission on Radiological Protection (ICRC); and

- International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material, 1984.

3 PROJECT MOTIVATION

3.1 NEED AND DESIRABILITY

3.1.1 Project Background: Oil Exploration in South Africa

In 1967, the government of the Republic of South Africa granted to Soekor (Pty) Ltd (under exploration Lease OP26) the right to explore for oil and gas in the whole of the offshore region of the South African Coast (with the exception of the area under the now defunct OP8, a five nautical mile coastal strip between Cape Town and the Wilderness). In 1994, the offshore region to approximately the 2,000 m isobath (1) was divided into licence blocks numbered 1 to 18 for the purposes of licensing acreage for oil and gas exploration to international companies.

In 1996, the Soekor Petroleum Licensing Unit, now the Petroleum Agency of South Africa (PASA), was created with the prime function of attracting international exploration companies to prospect for offshore oil and gas. The OP26 Lease was transferred to PASA in October 2000.

Although exploration offshore of South Africa began in the 1940's, with the majority of exploration drilling occurring between 1981 and 1991, commercial oil and gas discoveries have been limited. Offshore exploration off South Africa's coast was previously restricted primarily by the depth of the potential resources and secondly by the ocean currents. Recent improvements in exploration technology, coupled with the need for South Africa to diversify its energy mix has seen increased interest in exploration activity off South Africa's coast (SAOGA). (2)

It has been estimated that South Africa has possible resources of approximately 9 billion barrels of oil and approximately 60 trillion cubic feet of gas offshore, however uncertainty remains high (Operation Phakisa, 2014) and further exploration activities are necessary to prove the viability of these resources.

The main objective of further exploration is to investigate the subsea geological structures to determine the presence of naturally occurring hydrocarbons (ie oil and gas), ultimately ensuring the development of the natural oil and gas resources of the Republic of South Africa.

(1) Defined as a line on a map connecting points of equal underwater depth.
(2) https://www.saoga.org.za/oil-gas-hubs/upstream-oil-gas-south-africa

3.1.2 Policy Framework

The South African White Paper on the Energy Policy (1998) is the overarching policy document which has guided and continues to guide future policy and planning in the energy sector. As outlined in the Ministerial foreword to the White Paper, fossil fuels play a central role in the socio-economic development of the country, while at the same time providing the necessary infrastructural economic base for the country to become an attractive host for foreign investments in the energy sector. The white paper states that 'Government will ensure the optimal and environmentally sustainable exploration and development of the country's natural oil and gas resources to the benefit of all' and undertakes to 'ensure private sector investment and expertise in the exploitation and development of the country's oil and gas resources'. The successful exploitation of these natural resources would contribute to the growth of the economy and relieve pressure on the balance of payments.

The development of a National Integrated Energy Plan (IEP) was envisaged in the White Paper on the Energy Policy of the Republic of South Africa of 1998 and, in terms of the National Energy Act, 2008 (Act No. 34 of 2008), the Minister of Energy is mandated to develop and, on an annual basis, review and publish the IEP in the Government Gazette. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. (DoE, 2016). Key objectives of the IEP (2016) include the following:

- Security of supply;
- Minimising the cost of energy; and
- Diversification of supply sources and primary sources of energy.

The discovery of a commercially viable reserve of oil and/or gas offshore South Africa would assist in meeting the above objectives.

In addition, in mid-2014 the South African government launched Operation Phakisa, an approach that aims to enable South Africa to implement its policies and programmes better, faster and more effectively. One of Operation Phakisa's aims is to unlock the economic potential of South Africa's oceans. In this regard four priority sectors have been selected as new growth areas in the ocean economy, including:

- Marine transport and manufacturing activities, such as coastal shipping, trans-shipment, boat building, repair and refurbishment;
- Offshore oil and gas exploration;
- Aquaculture; and
- Marine protection services and ocean governance.

In summary, based on the overarching policies and the explicit intentions of Operation Phakisa, the South African government's position is supportive of oil and gas exploration.

3.1.3 Conclusion

South Africa's current crude oil demand is over 600 000 barrels / day. South Africa currently imports approximately 70 percent of its liquid fuel, which comprises crude oil and finished products. The other approximately 30 percent is sourced from the local production of synfuels from coal and gas. Crude oil prices combined with the Rand/Dollar exchange rate therefore have a major impact on fuel prices in South Africa. (1)

In light of the above, exploration success would result in long-term benefits for South Africa consisting of access to new energy sources, improved security of supply, in-country investments in a development project (including job creation), increased government revenues, contribution to economic growth and reduced dependence on the importation of hydrocarbons.

(1) http://www.energy.gov.za/files/petroleum_frame.html

4 PROJECT DESCRIPTION

4.1 BACKGROUND OF THE PROPOSED PROJECT

Eni South Africa BV (Eni), and Sasol Africa Limited (Sasol) hold an Exploration Right (ER236), offshore of the KwaZulu-Natal coast, between St Lucia and Port Shepstone. Eni and Sasol are considering the possibility of conducting an exploration drilling programme in Block ER 236 (12/3/236) to assess the commercial viability of the hydrocarbon reservoir for future development.

Depending on the success (if valuable hydrocarbon is discovered) of the first exploration well in each area of interest, up to three additional wells in the northern area of interest, comprising an additional exploration well at a second location and the possibility of one appraisal well close to each exploration well location and one additional appraisal well in the southern area of interest, may be drilled to establish the quantity and potential flow rate of any hydrocarbon present.

The specific number of wells and their locations would be based on a number of factors, including further analysis of seismic data, the geological target (the hydrocarbon bearing geology into which the well is to be drilled), and the presence of any seafloor obstacles. The time sequence of these possible additional wells will be dependent on the results of the first exploration wells. Well testing may be conducted on the appraisal wells if they present potential commercial quantities of hydrocarbon.

4.2 PROJECT LOCATION

Eni proposes to drill exploration wells inside Block ER236, within two areas of interest:

- A northern 1,717.50 km^2 area of interest, which is located, at its closest point, approximately 62 km from shore, in water depths ranging between 1,500 m and 2,100 m (*Figure 4.1*).
- A southern approximately 2,905 km^2 area of interest, which is located, at its closet point, approximately 65 km from shore, in water depths ranging between 2,600 m and 3,000 m (*Figure 4.1*).

The expected drilling depth would be between approximately 3,800 m and 4,100 m from sea level in the northern area, while around 5,450 m for the southern area.

The co-ordinates of the Block ER236 and the drilling areas of interest are provided in *Table 4.1* and *Table 4.2* respectively.

Table 4.1 Coordinates of the Block ER236 (WGS84 UTM Zone 36S)

Point	Latitude	Longitude
A	27°48'30"S	32°52'0"E
B	27°48'30"S	34°0'0"E
C	31°0'0"S	34°0'0"E
D	31°0'0"S	30°49'0"E
E	30°35'0"S	30°49'0"E
F	30°35'0"S	30°55'0"E
G	30°22'24,6"S	30°55'0"E
H	30°22'24,72"S	31°2'0"E
I	30°7'0"S	31°2'0"E
L	30°2'0"S	32°30'0"E
M	28°41'18"S	32°30'0"E
N	28°41'18"S	32°35'20"E
O	28°31'4"S	32°35'20"E
P	28°31'4"S	32°41'30"E
Q	28°21'59"S	32°41'30"E
R	28°21'59"S	32°45'40"E
S	28°13'51"S	32°45'40"E
T	28°13'51"S	32°49'0"E
U	27°58'47"S	32°49'0"E
V	27°58'47"S	32°52'0"E

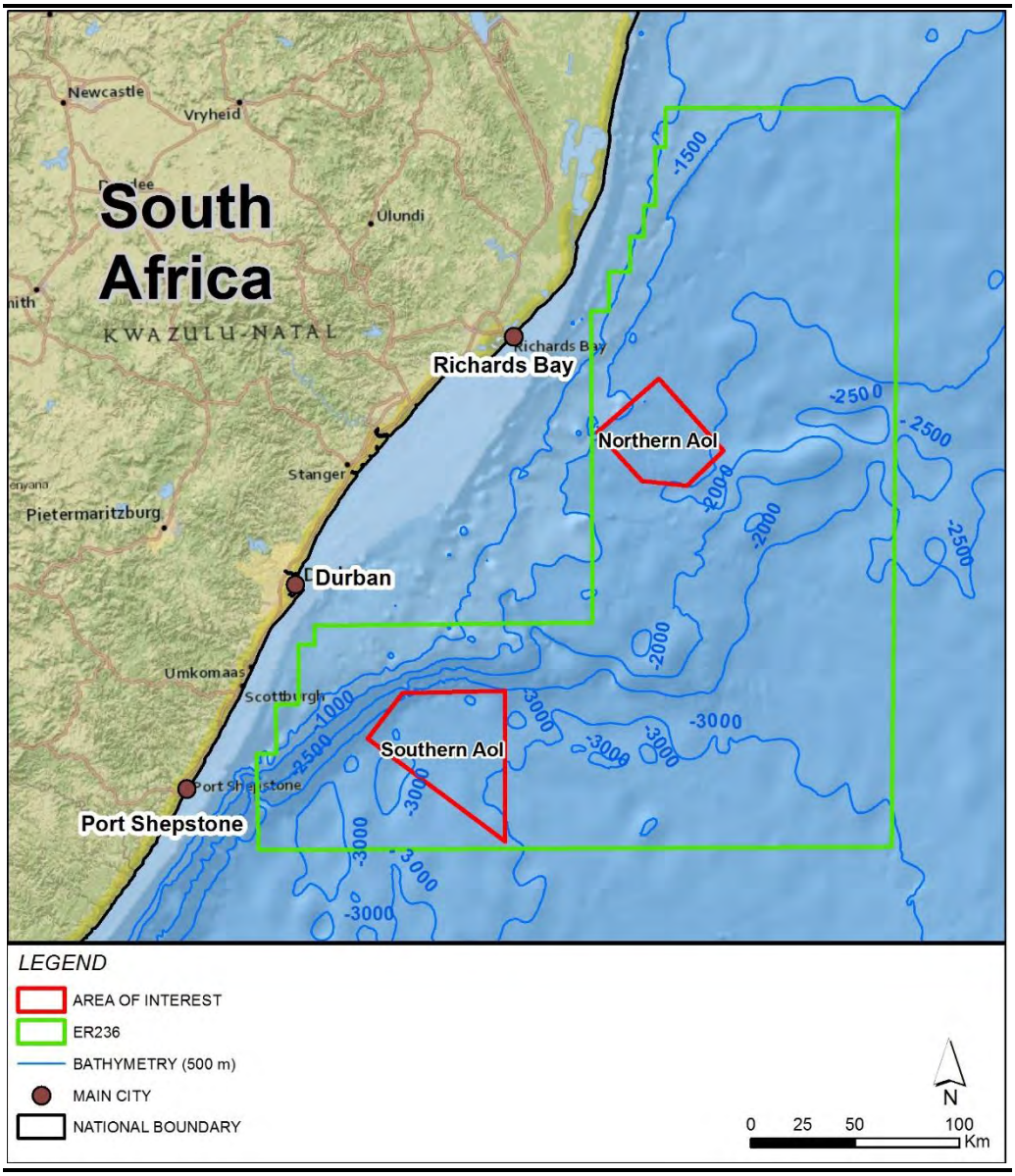
Table 4.2 Coordinates of the Northern Drilling Area of Interest (WGS84 UTM Zone 36S)

Point	Latitude	Longitude
A	29° 12' 33,341"S	32° 31' 46.013"E
B	28° 58' 47.34"S	32° 49' 32.73"E
C	29°17'28.529"S	33°8'58.59"E
D	29°26'34.962"S	32°58'11.965"E
E	29°25'22.117"S	32°44'46.372"E

Table 4.3 Coordinates of the Southern Drilling Area of Interest (WGS84 UTM Zone 36S)

Point	Latitude	Longitude
A	30°19' 39.588"E	32° 3' 48.518"E
B	30°58' 35.904"E	32° 3' 25.921"E
C	30°31' 35.022"E	31° 22' 26.396"E
D	30°19' 49.794"E	31° 33' 7.656"E

Figure 4.1 *Location of the Project Area*



4.3 PROJECT SCHEDULE

The earliest that drilling is expected to take place is in 2019. The drilling of one well is estimated to take approximately 71 days to complete.

The drillship will be mobilised from either West or East Africa and will enter South African waters either at the Namibian or Mozambican border, as such at the worst case mobilisation will take in the order of 5 days.

4.4 MAIN PROJECT COMPONENTS

This section describes the main project components, these include the following:

- Deep Water Drillship;
- Exclusion Zone;
- Shore base;
- Supply and stand-by vessels;
- Personnel;
- Crew transfer; and
- Infrastructure and services.

4.4.1 Deep Water Drillship

Various types of drilling vessels are used worldwide in offshore drilling operations, with the type of unit typically dependent on water depths in which it needs to operate. Alternative drilling vessels types are discussed further in *Section 4.8.2*. Due to water depth in the area of interest, it is anticipated that exploratory drilling will be conducted using a deep water drillship. The deep water drill ship (*Figure 4.2)* will be kept in position using a dynamic positioning system (DPS) which allows for minimal subsea disturbance due to its ability to operate without moorings. A significant benefit to using a drill ship is the ease of mobility as it is a self-propelled vessel with the flexibility to move from location to location without the need of transport vessels. An example of deep water drillship specifications is presented in *Table 4.4* below.

Figure 4.2 Example of a Typical Drillship

Source: Shutterstock, 2017

Table 4.4 Example Drillship Specifications

Parameter	Example Drillship
Principal Dimensions / Operating Parameters	
Length	228 m
Breadth	42 m
Depth	19 m
Operational draft	12 m
Transit draft	13 m
Maximum water depth	3,658 m
Maximum drilling depth	10,660 m
Moonpool	25.6 m x 10.26 m
Available Accommodation	200 People on Board (POB)
Storage Capacities	
Active mud	2,000 bbl
Reserve mud	10,000 bbl
Brine water	3,000 bbl
Base oil	3,000 bbl
Bulk mud/cement	34,500 bbl
Drill water	18,000 bbl
Fuel oil	50 000 bbl
Machinery / Equipment / Fittings	
Main generator sets	6 x diesel generators, 9, 900 HP each

Source: Eni, 2015 and Saipem, 2017[1]

4.4.2 Exclusion Zone

During the drilling operations, there will be a temporary 500 m safety zone around the drillship, which will be enforced by a standby vessel. The safety zone would be described in a Notice to Mariners as a navigational warning.

The purpose of the safety zone is to prevent a vessel collision with the drillship during operations. Under the Marine Traffic Act, 1981 (No. 2 of 1981), an "exploration platform" or "exploration vessel" used in prospecting for or mining of any substance falls under the definition of an "offshore installation" and as such it is protected by a 500 m safety zone.

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part B, Section II, Rule 18), a drillship that is engaged in underwater operations is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Vessels engaged in fishing are required to, so far as possible, keep out of the way of the well drilling operation.

[1] http://www.saipem.com/SAIPEM_en_IT/scheda/Vessels/Saipem+12000.page

4.4.3 Shore Base

An onshore logistics base would be located in either Richards Bay or Durban, on an existing brownfield site (previously developed land) within the Port or the Industrial Development Zone (IDZ). A final decision has not yet been taken as a logistics survey is still to be undertaken in the identified areas.

This base would include a yard area and a warehouse, to provide storage for drilling materials, including hardware material (tubular, wellhead), bulks (barite, bentonite, cement), other minor equipment. In the case where water and diesel supply by pipeline is not available, it could be necessary to provide a limited storage (tanks) to avoid interruptions in supply. The need for an area for setting a mud plant is still to be clarified. Supply vessels providing fuel, food supplies, water etc. to the drillship would also use the shore base. In addition, the shore base would have a mooring area with minimum draft of 6,5 m and length of about 100 m, a temporary office for up to 5 persons, and would include temporary waste management transfer facilities and bunkering service for vessels.

Preliminarily, the following maximum space requirements have been identified:

- Open area/pipe yard: up to 5,000 sqm;
- Warehouse: up to 500 sqm; and
- Shelter: up to 100 sqm.

These values are the maximum potential values as the possibility of using the maximum storage capacity of the drillship is being investigated in order to reduce onshore space requirements.

The location of the heliport for crew change and MEDEVAC services, as well as the commercial airport to be utilised will be determined once the logistic base location is confirmed.

It is anticipated that the service infrastructure required to provide the necessary onshore support is currently in place at both the Port of Durban and Richards Bay and no additional onshore infrastructure would be necessary for this project. Likewise, no new facilities or construction would be needed for helicopter support.

4.4.4 Supply and Standby Vessels

For the duration of the drilling operation, the drillship will be supported by platform supply vessels (PSVs), which are general purpose vessels designed to carry a variety of equipment and cargo. These vessels will supply the drillship three to four times a week with drilling muds, cement and equipment such as casing, drill pipe and tubing. They will also remove waste that must be appropriately disposed of on land. The number of firm PSVs has not yet been defined (it is anticipated that there will be two or three).

A standby vessel (or a PSV in dual mode – supply and standby) would also be available to support the drilling operations during an emergency, including oil containment/recovery and rescue and to supply any specialised equipment necessary in case of an emergency.
The standby vessel would also be used to patrol the area to ensure that other vessels adhere to the 500 m exclusion zone around the drillship.

4.4.5 Personnel

The shore base will be located in Richards Bay or Durban and all shore based personnel will reside locally. The majority of on-shore staff employed will be local if an existing locally based logistics company will be evaluated as suitable for operational logistics support and follow up. If not suitable, expatriate staff expert in drilling operations will integrate with and train inexperienced local staff. Eni representatives will also be located in the Cape Town Office.

The drillship will accommodate around 200 personnel. The majority of staff employed will be expatriates due to the short-term nature of the work and the necessary expertise and required technical skills. In accordance with Eni's guidelines the vessel will be manned as a minimum in compliance with the requirements of the Flag State and the IMO Reg A 890 (21) – Principle of Safe Manning, dated 25 Nov. 1999. In addition, the crew must also be adequate in terms of number and qualifications to safely operate the vessel and to carry out all operations.

The number of personnel on the supply vessels will vary based on vessel size and the types of activities they support. The preferred option is to utilise local vessel and staff if suitable for drilling operations service. All workers will be provided with health and safety training and Personal Protective Equipment (PPE) suitable for the types of activities.

4.4.6 *Crew Transfers*

Transportation of personnel to and from the drillship would most likely be provided by helicopter operations from Richards Bay or Durban. The drillship would accommodate around 200 personnel. Crews would generally work in 12 hour shifts in 2 to 4 week cycles. Crew changes would be staggered, and in combination with ad hoc personnel requirements. Thus helicopter operations to and from the drillship would occur on an almost daily basis. The helicopter crew would generally work in 10 hour shifts in 2 to 4 week cycles and in accordance with Eni's Aviation Manual.

4.4.7 *Infrastructure Support and Services*

Freshwater

The project will require seawater and some limited industrial water for making the water based drilling muds for the upper hole sections of the well and for rig cleaning. This industrial water will be transported from shore.

The drinking (potable) water for the POB the drillship will be either bottled water or provided by reverse osmosis system.
The estimated amount of water to be utilised by the project will be quantified during the EIA process and presented in the EIR. The amount of water used by the project will be managed by implementing Eni's sustainable water management guideline.

Fuel

Estimates for the fuel (marine gas oil) use per day by the drillship and supply vessels during transit, standby and drilling operations are provided in *Table 4.5* below. The estimated total fuel consumption during the mobilisation and drilling phase (approximately 5 days drillship mobilisation and 71 days drilling) by all the project vessels is provided in *Table 4.6.*

Table 4.5 Estimated Daily Fuel Use by the Drillship and Supply Vessels

Vessel	Mobilisation	Drilling phase
Drillship (tonnes/day)	90	30
Supply Vessels for Supply Service (tonnes/day/vessel)	10	10
Supply Vessel for Standby Service	4	4

Table 4.6 Total Estimated Fuel Consumption by the Drillship and Supply Vessels

Fuel Demand Estimate	Total fuel consumption (tonnes)
Drillship	2,580
Supply Vessel for Supply service	710
Supply Vessel for Standby service	284
Total	**3,574**

Food Supplies and Local Services

A catering company will provide food and beverages to the offshore vessels. Food selection, quantities, and sourcing will be undertaken with support from the shore base (coordinate local purchases, etc.), it has not as yet been confirmed; however it is likely that the bulk of food will be purchased in either Richards Bay or Durban.

4.5 PROJECT ACTIVITIES

Project activities associated with drilling include the following phases:

- Mobilisation of the supply vessels to Richards Bay or Durban, operation of the shore-based facilities for handling support services needed by the drillship;
- Drilling of a well;
- Well execution (side track, logging, completion) options;
- Optional well testing;
- Well abandonment; and
- Demobilisation of the drillship, vessel and local logistics base.

All activities will be conducted in conformity with recognised industry international best practice.

4.5.1 *Mobilisation Phase*

Vessel Mobilisation and Site Preparation

During mobilisation, the drillship will arrive directly on location from previous country of intervention (probably from West Africa or North/East Africa). Support vessels could sail directly in convoy with the drillship to site or from the Richards Bay or Durban mooring area. The drillship will be equipped with navigation equipment for accurate station keeping above the well location (dynamic positioning – using thrusters).

Once in position, the drillship will carry out its pre-drilling activities comprising seabed survey; remote operated vehicle (ROV) dive; positioning; beacon placement and dynamic positioning (DP) trials. These activities will be followed up with safety checks, drills, communication tests and drilling of the pilot hole. This will take approximately 9 days to complete.

4.5.2 *Drilling Phase*

Well Drilling

After the mobilisation, the first process is the drilling phase. The strategy for the first exploration planned well is not yet defined and, therefore, could be in the northern drilling area of interest consisting of drilling a main hole approximately 62 km south east of Richards Bay, in water depths ranging between 1,500 m and 2,100 m or in the southern drilling area where the exploration well is approximately 145 km east north-east of Port Shepstone, in a water depth of around 3,000 m. The drilling activity proposed is a vertical well to a total depth of approximately 3,800 m and 4,100 m below the seafloor (*Figure 4.4)* for the wells located in the northern area, while 5,450 m for the well located in the southern area, in order to evaluate and confirm the commercial viability of the reservoir. The expected hydrocarbon for this well is oil.

A standard well design and program for subsea well has been described below, however this will be updated after the completion of seismic interpretation and stratigraphy evaluation by the geologists and petroleum engineers. The well path will be defined accordingly.

During the drilling phase, different drilling bits sizes are used to drill a series of telescoping holes, from the seabed to the total depth of the planned well. The first hole, the outer, is the biggest and called the top hole, while the next inner holes are progressively smaller and smaller as the well depth increases. This continues until the final hole, which is the smallest, reaches the reservoir level.

The drill bit is connected to surface by a string of hollow tubulars referred to as the drill string. On the rig floor, drill pipes are one by one attached to the top of the string as the drill bit advances into the borehole. The action of drilling (creating a hole in the rocks stratigraphy) is obtained by applying weight and rotation to the bit.

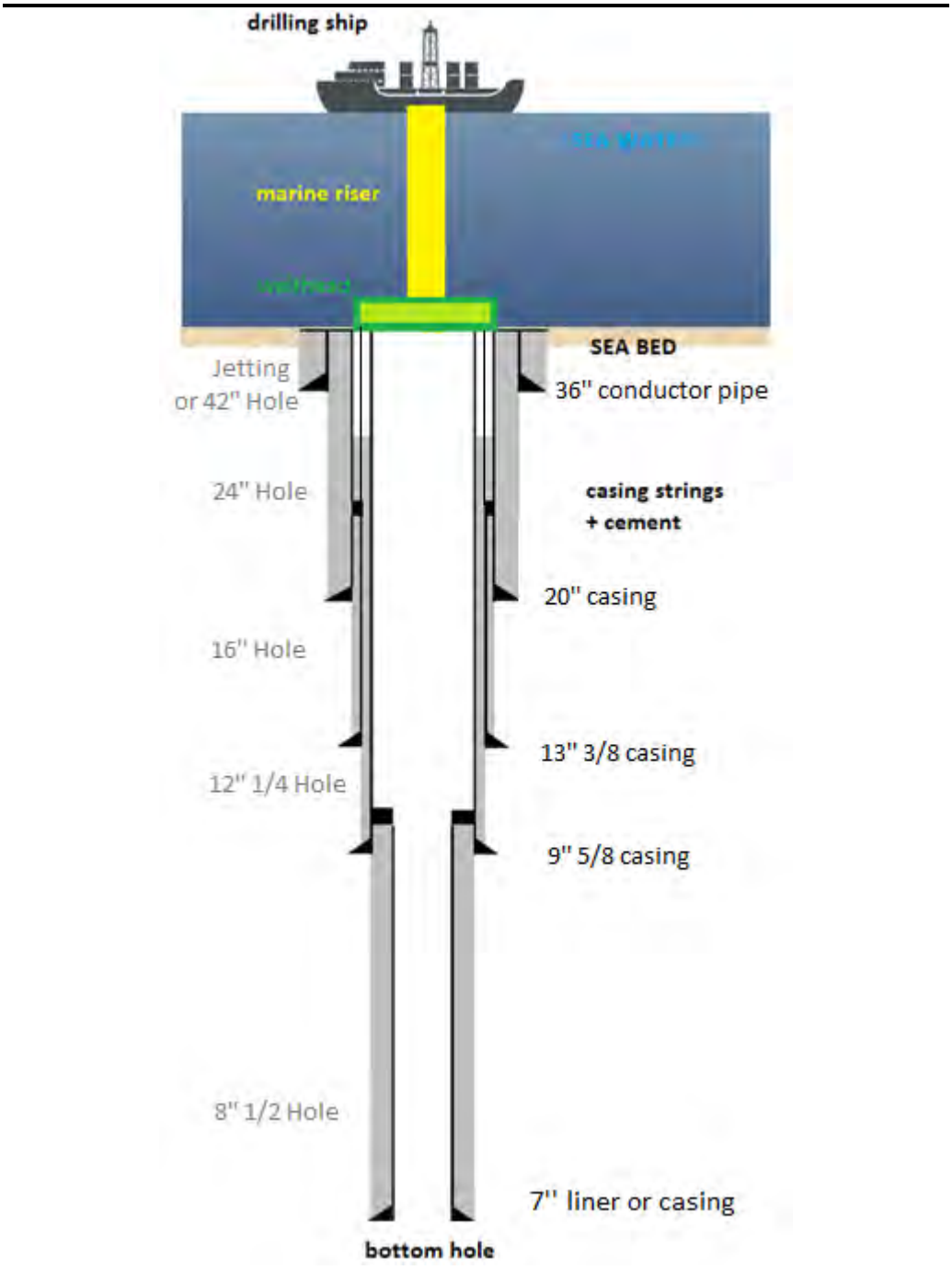
The topdrive, installed in the drillship's derrick, advances the drill string into the well, and provides the rotation and weight on bit required to drill. To give additional torque, sometimes a downhole motor is installed at the bottom of the string, whose rotor is connected to the bit. A sophisticated telemetry system is connected to the string and it transmits to surface the drilling parameters (direction, pressure, rotation, weight etc.) to guarantee a full control and safety during the drilling phase.

Once each hole section has been drilled, casing (steel tubulars) is run into the well and cemented in place to secure/seal the hole interval just drilled and to allow for the drilling of the next (smaller) hole section. A wellhead is connected to the surface casing, to have a connection and anchoring point for the following casing head sections and the marine riser.

The cement operation consists in pumping cement down the drill string to the bottom. The cement flows, out the bottom of the casing shoe and back up into the annular space around the casing, the space between the cased hole and open hole.

When the cementing job is completed, a mechanical and sealing test is performed. Casing plus cement is a tested barrier that facilitates the drilling of the next section, allowing to reach the target final depth in the safest way.

Figure 4.3 Subsea Well Schematic at the End of Drilling Phase



Source: ENI, 2018

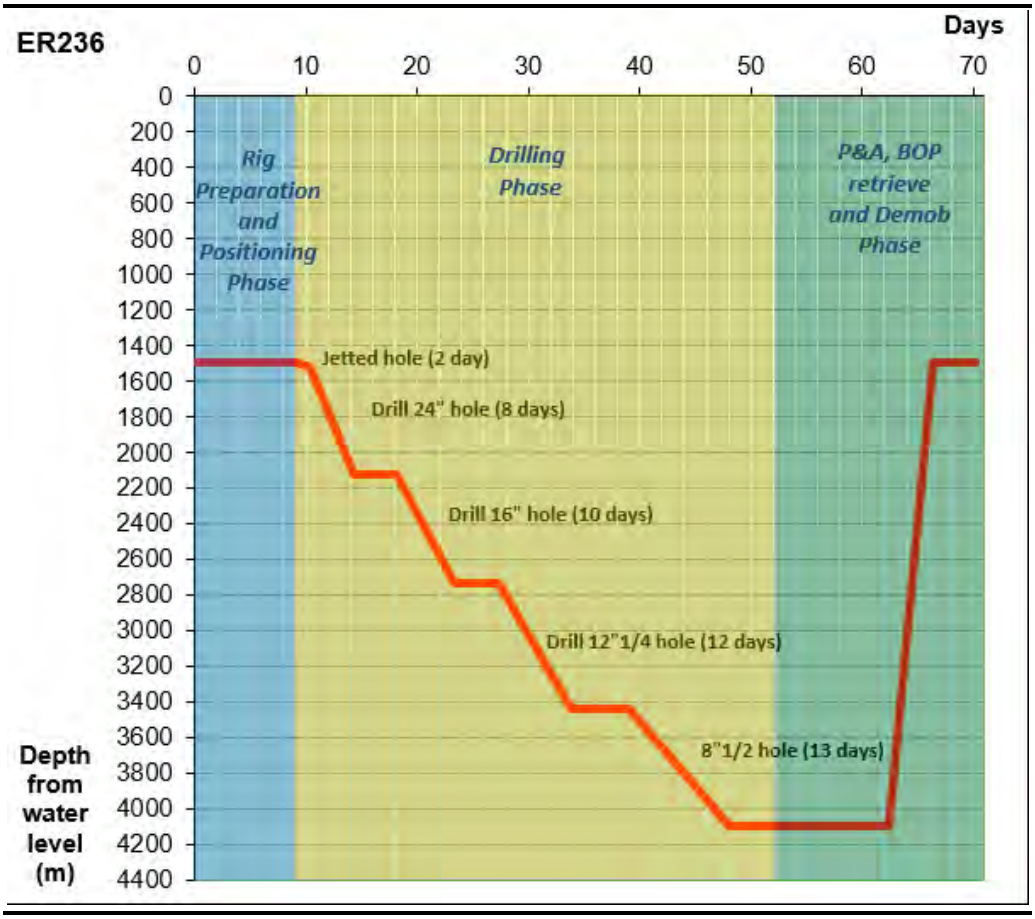
Table 4.7 ***Preliminary Well Design***

Section	Hole Size (inches)	Casing size (inches)	Drilling interval (m) [length –m-]	Effective drilling duration per phase (days)
1	Jetted (alternative 42″)	36″	Jetted	2
2	24″	20″	600 m	8
3	16″	13″ 3/8	600 m	10
4	12″1/4	9″ 5/8	700 m	12
5	8 ½	Open hole or 7″ liner	700 m	13
Total	-	-	2630 m	45 **

Source: Eni; 2018

**45 days is the estimated time for the effective drilling phase. 71 days is the estimated overall time for a single well campaign without welltesting but including mob/demob, drilling phase, casing runs, cement jobs, logs, BOP run and retrieve.

Figure 4.4 ***Preliminary Well Construction Phases vs Drilling Time Schedule***



Source: Eni; 2018

Mud System and Cuttings Discharge

Drilling is carried out using seawater and drilling mud. Muds can be water based mud (WBM), also called water base fluid (WBF), or non-aqueous drilling fluid (NADF).

Sea water is used during the first sections drilled riserless, the top hole drilling without riser installed. In conjunction with seawater, high viscous pills and sweeps could be used for the top-hole sections cleaning.

Water-Based Muds (WBM) consist of mixtures of clays, natural and synthetic organic polymers, mineral weighting agents, and other additives dissolved or suspended in freshwater, saltwater or brine (OGP, 2016). These muds are used subsequent to the installation of the riser.

Non-Aqueous Drilling Fluids (NADF): Deep water drilling concepts are technically challenging and require high performance drilling fluids with capabilities exceeding those available from WBM, in particular in terms of prevention of formation of hydrates and preservation of wellbore stability. As a result, non-aqueous drilling fluids (NADF), for which the continuous phase is primarily a non-water soluble base fluid, have also been used extensively by the petroleum industry. Low toxicity mineral oil based fluids, highly refined mineral oils and synthetic fluids (esters, paraffin's and olefins) are generally used as base fluids.

An IOGP Group 3 non aqueous base fluid (NABF) with low to negligible aromatic content will be used for this project. (1)

A combination of seawater, WBMs and NADFs will be used for drilling activities in the drilling area of interest. The mud program will be defined based on final well design and expected rheology.

The main functions of drilling fluids (also referred to as drilling muds) include the following:

- Removal of drilled rock cuttings from the the bottom of the well and from the well bore and transportation of these cuttings to the surface;
- Control of formation pressures and prevention of formation fluids entering the well bore (ie 'primary well control');
- Transmission of hydraulic horsepower to the drill bit;
- Provision of hydrostatic pressure as well as chemical stability to the rock to maintain the integrity of the hole and prevent hole collapse;
- Corrosion control of the metal components of the drilling tools;
- Lubrication and cooling of the drill bit.

The physical and chemical properties of the drilling fluid are constantly monitored and adjusted to suit varying down-hole conditions. These

(1) Based on classification by the International Oil and Gas Producers (IOGP).

conditions are, in part, due to the variation in formation pressure within the well bore at different depths. In particular, fluid density (or mud weight) is adjusted via weighting materials such as barite.

For deep water well construction, after drilling the first casing interval, a drilling riser, ie a hollow tube known as the 'marine riser' is run between the drillship and the wellhead at seabed, so that drilling fluid can be pumped through the drill pipe, out through the drill bit and circulated back up to surface through the marine riser. The marine riser allows cuttings to be brought back up to the rig to be collected and properly disposed.

Prior to the installation of the riser, meaning during the drilling of top hole intervals drilled riserless, sea water, high viscous pills and sweeps, cuttings and excess cement are returned directly to the seabed (quantities of discharges are included in *Section 4.5.2*).

Once the riser is installed the drilling fluid is circulated into the well bore through the centre of the drill pipe and the mixture of mud and cuttings is then returned to the rig via the annulus to a solids control system (*Figure 4.5*), which is designed so that drilling mud can be processed to remove drill cuttings (small rock fragments, sand and silt) and subsequently re-circulated back down-hole. The WBM and/or NADF drill cuttings are routed through a cuttings dryer (centrifuge type equipment) to remove residual liquids for reuse and the cuttings are discharged overboard in accordance with Eni's Waste Management Guidelines, local regulation and International recommendations. Solids removal efficiency for each hole section will be monitored to ensure solids control and fluids recovery equipment is operating as designed.

The WBM and/or NADF drill cuttings will be discharged overboard only following treatment in accordance with International recommendations and Eni's Waste Management Guidelines. Base fluid retained on cuttings will not exceed limits detailed in *Section 4.6.2*.

Please see *Section 4.8.2* for a discussion of the alternative methods for cuttings discharge.

The amount of drilling waste discharge estimated for one well is quantified in *Table 4.8* below.

Table 4.8 Typical Well Design and Estimated Discharges

Section	Hole Size (inches)	Casing size (inches)	Proposed Mud Type	Volume of cuttings (m^3)	Volume of mud to be disposed of (m^3)°
1	42″	36″	Sea water and sweeps	100	200 (seabed)
2	24″	20″	Sea water and sweeps	300	700 (seabed)
3	16″	13′′ 3/8	NADF	120	recovered
4	12″1/4	9′′ 5/8	NADF	70	recovered
5	8 ½	Open hole or 7′′	NADF	30	recovered
Total	-	-	-	620	900

Source: Eni; 2018

4.5.3 Well Execution Options

Well Logging

Continuous testing is carried out on the drill cuttings transferred to the surface. These tests are used to determine and obtain information on the presence of hydrocarbons, formation types being drilled and formation pressures. Further information is obtained on the physical properties of the rock formations by means of open and cased hole logging using sensors introduced down- hole on a wireline cable, or by means of sensors located in the drill collar (measurement while drilling). A logging plan will be developed and implemented in accordance with standard industry best practices.
In the case of exploration wells, once a full log of the reservoir section has been undertaken, the well will be permanently plugged and abandoned.

Well Completion

Well completion and well testing operations will not be conducted during exploration wells (first wells) drilling but, if hydrocarbon is discovered, may be performed after drilling of the appraisal wells.

The completion phase of an oil or gas well takes place after the reservoir formation has been drilled and the production casing cemented. Preliminary completion operations are usually required to clean and condition a wellbore from mud, in order to prepare the well for the following operations.

At the beginning of the completion operations, the wellbore is displaced with a completion brine, necessary to balance the downhole pressure and, at the same time, to complete the removal of mud and solids from the well in order to minimise any potential damage to the formation.

A specific tubular string, the completion string, is then run in hole. This string can be secondary named well testing or completion strings, if used during well testing or in the case of preparation for further production respectively.

This string allows subsea safety, guaranteeing full control of hydrocarbon flow during the testing or production phase.

Subsequently the weighted completion fluid that maintains sufficient pressure and prevents formation fluids from migrating into the hole, is displaced out of the well-bore in order to start the next phase, if required, the well testing phase.

Well Testing

As stated previously, well testing may be conducted on the appraisal wells if they present potential commercial quantities of hydrocarbon.

A well test is a temporary completion of a well to acquire dynamic rate through time, pressure, and fluid property data.
The well test often indicates how the well will perform when it is subjected to various flow conditions. An analysis is usually performed on the data to determine reservoir parameters and characteristics including pressure, volume, and temperature.

Current testing practices are carried out using modern testing equipment and high resolution pressure data acquisition system, getting the reservoir evaluation objectives depends on the behavior of the formation fluid properties, well completion, and flow assurance situations are only known when testing is carried out.

The well test objectives are to:

1. Determine key technical factors of the reservoir (eg size, permeability and fluid characteristics) and values for use in future drilling.
2. Obtain representative data including reservoir pressure, production rates and sample(s).

While testing, hydrocarbons are sent to a flare boom with a burner to ensure as complete destruction of fluids (including hydrocarbons) as possible. Flaring may be initiated using LNG or similar fuel to ignite the mixture. To ensure that burning can be done downwind of the drillship, more than one flare boom can be used, or the ships positioning may be adjusted. Water misters may be used to mitigate heat exposure on the rig.

The flow periods and rates will be limited to the minimum necessary to obtain the required reservoir information during the well test. It is anticipated that a maximum well test time for this project will be approximately 20 days.

Downhole sampling, if required, normally consists of recovering reservoir fluids via wireline or through specific tools added directly to the temporary test string. Wireline testing involves running instruments into the borehole on a cable to measure formation pressures and obtain fluid samples. Formation fluids are brought to the surface where the composition can then be analysed.

The following key well testing preventative measures will be implemented during the well testing program:

- Monitor flare performance to maximise efficiency of flaring operation;
- Ensure sufficient compressed air provided to oil burner for efficient flaring;
- Flare equipment appropriately inspected, certified and function tested prior to operations;
- Flare equipment appropriately maintained and monitored throughout well testing operations;
- The equipment is designed and built to appropriate codes and standards and certified;
- The appropriate emergency stop mechanisms are in place to halt testing in case of emergency.

Well Control and Blowout Prevention

Health, safety and environmental protection are prioritised throughout the drilling process. In particular, there is a specific focus and attention during preparation and operations to avoid any potential accidental events, with related hydrocarbon release or uncontrolled flow from downhole to seabed or at surface (rig floor).

In fact well control during well operations is a routine function, with each well designed and executed to minimise risk of developing a well control incident.

Down-hole conditions, such as shallow gas and high-pressure zones can cause control problems as a sudden variations in well pressure. A well kick can occur if there is an influx of formation fluids with sufficient pressure to displace the well fluids.

The primary well control against a well kick is provided by the maintenance of a sufficient hydrostatic head of weighted drilling mud/completion brine in the well bore to balance the pressures exerted by fluids in the formation being drilled.

Secondary well control is provided by the installation of mechanical device, such as the float collar in the drilling string and the blowout preventer (BOP) at seabed, installed on top of the wellhead after the running and setting of the surface casing. The BOP effectively closes and seals the annulus if there is a sudden influx of formation fluids into the well bore, by the use of a series of hydraulically/electrically actuated rams. In addition, this device allows the formation fluids to be safely vented or pumped at the surface with the well closed, thereby enabling other methods to be applied to restore a sufficient hydrostatic head of mud on the well bore, for example pumping a higher density volume of mud, the so called 'kill mud'. The capacity and pressure rating of equipment, safety device and the BOP rating exceed the predicted reservoir pressures.

The well control philosophy and procedure, constantly updated by the Eni drilling department, includes the identification and assessment of all well blowout risks.

4.5.4 Well Abandonment

Once drilling is completed, the well will be plugged and abandoned. This will involve setting cement plugs inside the wellbore and testing them for integrity. The BOP will be then retrieved at surface.

4.5.5 Demobilisation

On completion of drilling, the drillship and support vessels will leave the well location. A final ROV survey will be performed at seabed.

4.5.6 HSE Risk Management during Operations

As a component of Eni's HSE (health, security, environment and safety) risk management, a comprehensive HSE Policy is in place that includes mobilisation and demobilisation; drilling and completion operations and procedures.

Eni is committed to protecting the health, safety and security of its employees and those of its contractors, to ensure that all activities are conducted in a manner that protects the environment and people who are potentially impacted by its operations.

4.6 PLANNED EMISSIONS AND DISCHARGES, WASTE MANAGEMENT

This section presents the main sources of emissions to air, discharges to sea and waste that would result from the planned drilling activities and associated operations.

The principle of Eni for waste management is to follow the following golden rules; in the order of priority: reduce, reuse, recycle, recover, treat, dispose.

All vessels would have equipment, systems and protocols in place for prevention of pollution by oil, sewage and garbage in accordance with MARPOL 73/78.

A project specific Waste Management Plan (covering all wastes generated offshore and onshore) would be developed in accordance with MARPOL requirements, South African regulations and Eni's waste management guidelines.

Waste disposal sites and waste management facilities would be identified, verified and approved prior to commencement of drilling.

4.6.1 Emissions to Air

The principal sources of emissions to air from the proposed drilling campaign would be from exhaust emissions from power generation on the vessels. If well testing is conducted on the appraisal well, then emissions would be generated from hydrocarbon flaring for the limited duration of the well test. Estimated emissions to air from flaring during well testing quantified during the EIA process and presented in the EIA report.

Dynamically positioned vessels have relatively high fuel consumption and consequently high levels of corresponding air emissions. Diesel oil or marine gas oil (MGO), if available, would be used as fuel for all vessels resulting primarily in emissions of carbon dioxide (CO_2), sulphur oxides (SOx), nitrogen oxides (NOx) and carbon monoxide (CO). Relative to these pollutants, smaller quantities of non-methane volatile organic compounds (VOCs), methane (CH4) and particulate matter (PM10/PM2.5) will also be released. These emissions are released during the normal operation of a marine vessel and have the potential to result in a short-term localised increase in pollutant concentrations. They also contribute to regional and global atmospheric pollution.

Helicopter emissions levels would depend on actual fuel consumption and hence would vary with flying time, payload, weather, speed etc. Estimated emissions to air from vessels and helicopter fuel use will be quantified during the EIA process and presented in the EIA report.

4.6.2 Discharges to Sea

Drill Cuttings and Mud Disposal

During the drilling of the well, drill cuttings are produced as the rock is broken down in small rock particles by the drill bit advancing through the subsurface. The amount of drill cuttings that will be discharged during the drilling of the planned well are described in *Table 4.9*.

As discussed in *Section 4.5.2*, for deep water drilling, sea water with high viscous pills and sweeps are used for drilling the top-hole sections of the well drilled riserless (that is without the marine riser installed) while WBM and/or NADF are used for the subsequent sections (with riser installed on top of wellhead and BOP).

During the riserless drilling stage (top hole section drilling) fluid and cuttings are discharged directly on the seabed in immediate proximity of the well. Following installation of the riser (at the end of top hole section) excess seawater stored in tanks will be discharged.

During WBM and/or NADF drilling, drilling muds are circulated in a closed loop system which recycles the drilling muds and removes the drill cuttings. The returns from downhole (muds and cuttings) are routed to the shakers which will physically separate the drill cuttings from the drilling muds (*Figure 4.5* and *Figure 4.6*).

Prior to overboard discharge, the final processing of the drill cuttings will be the cuttings dryer to reduce the base fluid retained on the cuttings and discharged to sea under the following circumstances and limitations:

- Drill cuttings drilled with NADF:
  - Facilities located beyond 4.8 km from shore;
  - Organic Phase Drilling Fluid concentration: maximum residual non aqueous phase drilling fluid (NAF) 5% (C16-C18 internal olefins) or 9.4% (C12-C14 ester or C8 esters) on wet cuttings;
  - Hg: max 1 mg/kg dry weight in stock barite;
  - Cd: max 3 mg/kg dry weight in stock barite; and
  - Ship-to-shore otherwise.

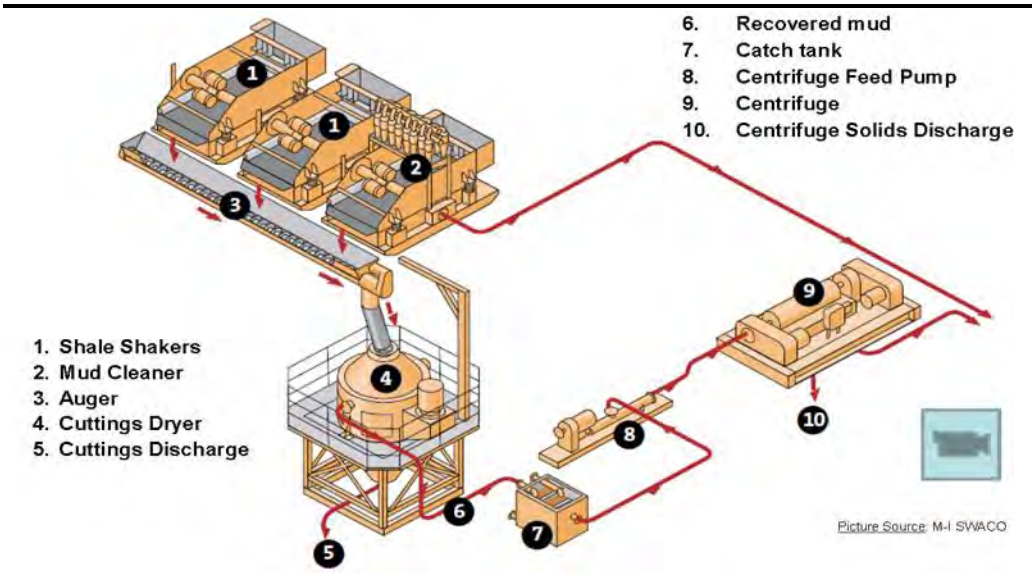
- Drill cuttings drilled with WBM:
  - Facilities located beyond 4.8 km from shore;
  - Hg: max 1 mg/kg dry weight in stock barite;
  - Cd: max 3 mg/kg dry weight in stock barite;

- Maximum chloride contraction must be less the four time the ambient concentration of fresh or brackish receiving water; and
- Ship-to-shore otherwise.

For this project Eni will adopt a vertical cuttings dry system that will limit the maximum residual non aqueous phase drilling fluid (NADF) below 5 percent on wet cuttings.

At the end of operation, the residual NADF in the loop and in tanks will be delivered to shore for recycling or waste in dedicated waste management facilities. WBM will be discharged overboard if in compliance with specific standards (1), otherwise this will be disposed of offshore.

Figure 4.5 Typical Solids Control/Fluid Recovery System



Source: MI-Swaco, 2016

(1) 96 hr LC-50 of suspended Particulate Phase (SPP) – 3 % vol. toxicity test first for drilling fluids or alternatively testing based on standard toxicity assessment species.

Figure 4.6 Example Shale Shakers

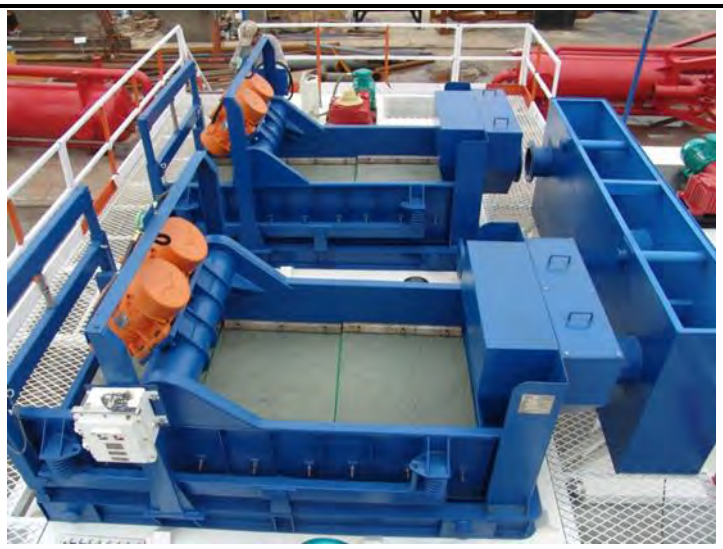


Table 4.9 Cuttings Discharge Quantities per Well

Waste Type	Est. Discharge (m^3)	Comments
High viscous pills and sweeps discharged at the sea floor while drilling the riserless hole intervals	900	Drill 42″ and 24″ hole intervals with sea water and 100 bbls viscous gel sweeps every 30 m. 2 sweeps at TD
Surplus whole WBM left at the end of well operations	100	Discharge to sea
WBM slops generated during operations such as tank cleaning or operating	150	Tank cleaning prior to displacement to NADF
WBM sludges generated during operations such as tank cleaning or cementing	100	Tank cleaning

Cement

During the initial cementing operation (top hole section), the required cement volume will be pumped into the annular space between the casing and the borehole wall. An excess of cement, necessary to guarantee sufficient presence of cement through the overall annulus, will emerge out of the top of the well. Doing this, the conductor pipe and surface casing are cemented all the way to the seafloor.

After the riser has been installed, for the next phases cement jobs, the excess of cement could be returned via the riser to the drilling vessel and treated using the solids control system. Unused cement slurry that has already been mixed is discharged overboard to avoid plugging the lines and tanks.

Bilge Water

All deck drainage from work spaces (bilge water) will be collected and piped into a sump tank on board the project vessels to ensure MARPOL 1973/78 Annex I compliance. The fluid will be monitored and any oily water would be processed through a suitable separation and treatment system prior to discharge overboard at a maximum of 15 ppm oil in water.

Sewage

Sewage discharge from the project vessels would meet the requirements of MARPOL 73/78 Annex IV. MARPOL 73/78 Annex IV requires that sewage discharged from vessels be disinfected, comminuted and that the effluent must not produce visible floating solids in, nor cause discoloration of the surrounding water. The treatment system must provide primary settling, chlorination and dechlorination. The treated effluent is then discharged into the sea.

Galley Wastes

The disposal into the sea of galley waste is permitted, in terms of MARPOL 73/78 Annex V, when the vessel is located more than 3 nautical miles (approximately 5.5 km) from land and the food waste has been ground or comminuted to particle sizes smaller than 25 mm.

Detergents

Detergents used for washing exposed marine deck spaces would be managed as bilge water. The toxicity of detergents varies greatly depending on their composition. Water-based or biodegradable detergents are preferred for use due to their low toxicity.
In certain cases of specific area cleaning, eg marine deck with no contamination of pollutants, using no toxic detergent, direct overboard discharge may be considered.

4.6.3 Land Disposal

A number of other types of wastes generated during the drilling activities would not be discharged at sea but would be transported to shore for disposal. These wastes would be recycled or re-used if possible or disposed at an appropriate licensed municipal landfill facility or at an alternative approved site.

Typical waste types generated by a drillship that are disposed of onshore include:

- Garbage (eg paper, plastic, wood and glass) including wastes from accommodation and workshops etc;
- Scrap metal and other material;

- Drums and containers containing residues (eg lubricating oil) that may have environmental effects;

- Used oil, including lubricating and gear oil; solvents; hydro-carbon based detergents, possible drilling fluids and machine oil;

- Chemicals and hazardous wastes (eg radioactive materials, neon tubes and batteries);

- Medical waste from treatment of personal onboard the vessel;

- Filters and filter media from machinery;

- Drilling fluid, including WBM, NADF, brine from drilling and completion activities.

At the end of operations, the overboard discharge of hazardous chemicals, cement bulks or any other chemical is not permitted by Eni. The preferred solution for unused chemicals is to return them to the supplier for reuse in other projects. Should this not be possible these could be stored in a dedicated warehouse for future use by Eni or managed as per the above mentioned golden rules.

4.6.4 Noise Emissions

The main sources of noise from the proposed drilling programme include noise produced by the drillship and supply vessels. The noise characteristics and level of various vessels used in the drilling programme will vary between 130 and 182 dB re 1µPa at 1 m (Simmonds *et al*, 2003; Richardson *et al*, 1995). The particular activity being conducted by the vessels changes the noise characteristics, for example, if it is at idle, holding position using bow thrusters, or accelerating.

4.7 UNPLANNED EMISSIONS AND DISCHARGES

This section presents the main sources of emissions that would result from the unplanned/ accidental events during the drilling activities and associated operations.

4.7.1 Hydrocarbons and Chemical Spills

Two of the main types of accidental events that could occur while drilling wells that could result in a discharge of hydrocarbons or chemicals to the marine environment are loss of well containment and single-event/batch spills.

Loss of well containment is a continuous release which could last for a measurable period of time, while a single-event spill is an instantaneous or limited duration occurrence. Eni is committed to minimising the release of hydrocarbons and hazardous chemical discharge into the marine environment and avoiding unplanned spills.

In case of accidental events, Eni minimises any adverse effects to the environment and plans to accomplish this goal by:

i) incorporating oil and chemical spill prevention into the drilling plans;
ii) Ensuring that the necessary contingency planning has taken place to respond effectively in the event of an incident.

Eni will develop and implement an Oil and Chemical Spill Response Plan in the event of an accidental release of oil offshore.

In addition, precautions are taken to ensure that all chemicals and petroleum products stored and transferred onshore and offshore are done so in a manner to minimise the potential for a spill and environmental damage in the event of an accidental release.

4.8 PROJECT ALTERNATIVES

One of the objectives of an EIA is to investigate alternatives to the project. In relation to a proposed activity **"alternatives"** means different ways of meeting the general purposes and requirements of the proposed activity.

Appendix 2 Section 2 (h)(i) of the EIA Regulations, 2014 (as amended), requires that all S&EIR processes must identify and describe alternatives to the proposed activity that are feasible and reasonable. Different types or categories of alternatives can be identified, eg location alternatives, type of activity, design or layout alternatives, technology alternatives and operational alternatives. The 'No Go' or 'No Project' alternative must also be considered.

Not all categories of alternatives are applicable to all projects. The consideration of alternatives is inherent in the detailed design and the identification of mitigation measures, and therefore, although not specifically assessed, alternatives have been and will continue to be taken into account in the design and EIA processes.

Despite many advances in seismic data acquisition and analysis, currently no alternatives exist to definitively establish the presence of hydrocarbon reserves other than through exploration and appraisal drilling.
No activity alternatives have therefore been assessed. It should however be noted that some pre-drilling activities may be undertaking, including an ROV survey.

A summary is provided below of the alternatives considered for this EIA.

4.8.1 Site Locality Alternative

Drilling Location

Eni is the operator and holds an Exploration Right for ER236. Both 2D and 3D seismic surveys have been undertaken over ER236 and possible areas of interest identified. Based on the interpretation of the seismic information, Eni have identified two areas of interest covering a limited area of ER236, in which they are considering undertaking exploration drilling activities in order to determine the presence and viability of the reserve. The northern area of interest (1,840 km^2) is located approximately offshore of Richards Bay, and the southern area (2905 km^2) approximately offshore of Port Shepstone. Although the well locations are still to be finalised based on a number of factors, including further analysis of the seismic data, the geological target and seafloor obstacles, this EIA considers that the wells could be drilled within the area of interest.

Onshore Logistics Base

An onshore logistics base will either be located in the Port of Richards Bay or the Port of Durban, the decision between these locations will be dependent on discussions with Transnet and the availability of sufficient space to accommodate the logistics base.

The EIA will assess the impacts from a logistics base in either Richards Bay or Durban.

4.8.2 Technology Alternative

Drilling Vessel Alternatives

There is a range of drilling vessels available to conduct the drilling of an offshore well. For deep water areas these are restricted to two options, drillships or semi-submersible rigs. *Figure 4.7* shows the options available and the associated operation depths.

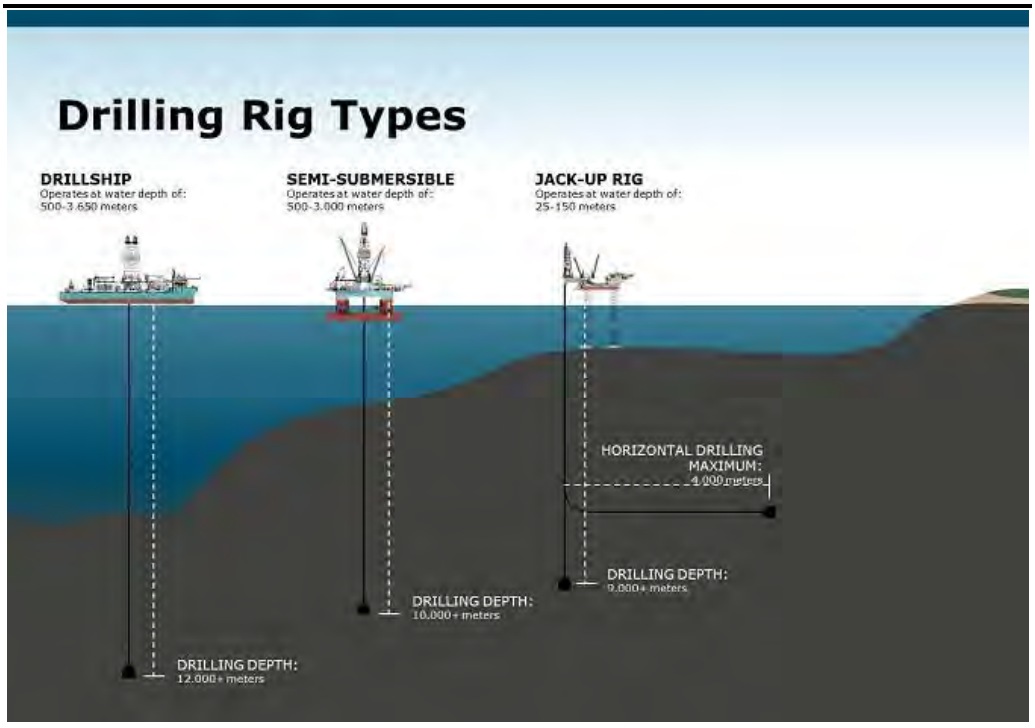
As discussed in *Section 4.4.1*, a drillship is commonly kept in position using a DPS which allows for minimal subsea disturbance due to its ability to operate without moorings. A significant benefit to using a drillship is the ease of mobility as it is a self-propelled vessel with the flexibility to move from well to well or location to location without the need of transport vessels. This option does however require greater energy use (and therefore emissions) and the DPS produces greater underwater sound during operation.

A semi-submersible drill rig has to be towed to a site and is either moored to the seabed using a series of anchors which may extend up to 1 km from the rig or may use dynamic positioning to stay in position. These rigs have a partially submerged structure below the water line. Water is used as a ballast control to maintain flotation and stability.

This option will cause greater disturbance to the seabed due to the presence of the moorings, but requires less energy use and produces less underwater sound.

Both drilling units are self-contained units with derrick and drilling equipment, an internal access to the water surface called moonpool, a helicopter pad, fire and rescue equipment and crew quarters. The operations and discharges are similar. Each drilling unit would also require between one to three supply vessels, it is likely that a semi-submersible drill rig would require more support vessels (or more trips by the support vessel to the base) than a drillship, as a drillship has more onboard storage capacity. A drillship is also significantly more mobile than a semisubmersible.

Figure 4.7 Drilling Vessel Alternatives



Source: http://www.maerskdrilling.com/en/about-us/the-drilling-industry

Eni's preferred drilling vessel is a drillship due to distance from shore, water depth constraints and its availability, flexibility and ease of mobility.

Drilling Fluids

Various factors govern the best combination of drilling chemicals used to produce the required drilling mud needed to lubricate the drill bit, maintain well pressure control, and carry cuttings to the surface.

According to the IOGP classifications, the three types of NADF that could be used for offshore drilling can be defined as follows:

- Group I NADF (high aromatic content) - These base fluids were used during initial days of oil and gas exploration and include diesel and conventional mineral oil based fluids. They are refined from crude oil and are a non-specific collection of hydrocarbon compounds including paraffins, olefins and aromatic and polycyclic aromatic hydrocarbons (PAHs). Group 1 NADFs are defined by having PAH levels greater than 0.35%.

- Group II NADF (medium aromatic content) - These fluids are sometimes referred to as Low Toxicity Mineral Oil Based Fluids (LTMBF) and were developed to address the rising concern over the potential toxicity of diesel-based fluids. They are also developed from refining crude oil but the distillation process is controlled such that the total aromatic hydrocarbon concentration is less than Group I NADFs (0.5 – 5%) and the PAH content is less than 0.35% but greater than 0.001%.

- Group III NADF (low to negligible aromatic content) - These fluids are characterised by PAH contents less than 0.001% and total aromatic contents less than 0.5%. They include synthetic based fluids (SBF) which are produced by chemical reactions of relatively pure compounds and can include synthetic hydrocarbons (olefins, paraffins and esters). Using special refining and/or separation processes, base fluids of Group III can also be derived from highly processed mineral oils (paraffins, enhanced mineral oil based fluid (EMBF)). PAH content is less than 0.001%.

A combination of WBDFs and NADFs will be used to drill the proposed exploration well. It is anticipated that an IOGP Group III non aqueous base fluid (NABF) with low to negligible aromatic content will be used for this project. Refer to *Section 4.5.2* for further information.

Drill Cuttings Disposal Method

The solids control system applies different methods to remove solids (drill cuttings - particles of stone, clay, shale and sand) from the drilling fluid and to recover drilling fluid so that it can be reused. During riserless drilling, using sea water and high viscous sweeps and pills, cuttings are disposed of directly at the seabed. Once the riser has been installed on top of the wellhead and cuttings can be returned to the rig, there is no standard practice for the treatment and disposal of drill cuttings that is applied worldwide.

As per OGP (2003) there are three alternatives for the discharge of drill cuttings, namely:

- Offshore treatment and discharge to sea - where cuttings are discharged overboard from the drilling vessel or platform after undergoing treatment by solids control equipment and fluid contaminant reduction system;

- Re-injection - where drill cuttings are ground to fine particle sizes and disposed of, along with entrained drilling fluids, by injection into permeable subterranean formations; and

- Onshore disposal and treatment - where cuttings and the associated drilling fluids are collected and transported for treatment (eg thermal desorption, land farming) if necessary and final disposal by techniques such as land filling, land spreading, injection, or re-use.'

Re-injection is not an option in this location and is generally not possible during exploration drilling and as such the two potentially disposal options discussed below are discharge to sea and onshore disposal. See *Table 4.10* which documents the advantages and disadvantages of each option.

Offshore Treatment and Discharge to Sea

This option involves discharging the drilling cuttings, after specific treatment, to the marine environment.

Drill cuttings would be treated to remove drilling fluid for reuse and reduce oil content to less than 5 percent of wet cuttings weight (as low as possible) using a suitable combination of shakers, a centrifuge and/or a cuttings dryer. Other possible additional systems could include a washing system and a thermo-mechanical treatment unit.

The cuttings containing residual fluid are then mixed with sea water and discharged to the sea through a pipe known as a chute (or caisson). The end of the chute is typically located approximately 15 m below the water surface. Unlike the other disposal options, no temporary storage for cuttings is required.

In South Africa, offshore discharge is the accepted method of disposal, if cuttings have been treated and contamination concentrations are below the maximum allowable thresholds.
The expected dispersion (fall and spatial extent of the deposition) of discharged cuttings will be predicted in the "drilling discharge modelling - drill cuttings dispersion model" study during the next phase of the EIA.

Offshore pre-treatment and Onshore Disposal

As per OGP (2003), this option would involve the processing of cuttings onboard the drilling vessel, followed by storage and transportation to shore for disposal.

Consequently, there are some aspects of onshore disposal that must be considered when evaluating the viability of this option, advantages and disadvantages of:

- Marine transport (skip and ship, which is common to all potential onshore disposal options);

- Onshore disposal facility option;

- Additional movements of skips on board of vessel with increased risk for workers during lifting operations; and

- Limited availability on deck space on board for equipment and reduced chemicals and fluids storage capacity; more difficult to allocate materials to guarantee stability of boat.

The potential onshore disposal options include:

- Landfill disposal: Depending on the level of treatment and residual oil content in percentage of dry cuttings, the cuttings would more than likely need to be disposed of at a hazardous landfill site.

- Land-farming: This involves spreading fully treated cuttings followed by mechanical tilling with the addition of nutrients, water and or oxygen as necessary to stimulate biodegradation by naturally occurring oil-degrading bacteria, material is applied several times at the same location. Depending upon the location of the land-farm, a liner, over liner, and/or sprinkler system may be required.

- Re-use (eg road construction). Treated cuttings may be used for construction or other alternative uses. If necessary or optimal, cuttings could be further treated prior to re-use, eg with thermal-mechanical treatment or bio-remediation.

Table 4.10 Advantages (+) and Disadvantages (-) of Offshore Discharge and Onshore Disposal of Drill Cuttings (adapted from OGP, 2003)

Economics	Operational	Environmental
Offshore Discharge		
+ Very low cost per unit volume treatment + No potential liabilities at onshore facilities – Potential future offshore liability – Cost for modelling and analysis (eg, compliance testing, dispersion model) - field analysis of cuttings prior of discharge and potential impacts (eg, compliance testing,, field monitoring programmes)	+ Simple process with limited equipment needed + No transportation to onshore involved (less movement of skips and supply vessel, less costs) + Limited number of skips on board, easier logistics and deck management+ Low power and fuel requirements + Low personnel requirements + Low safety, environment and health risks (e.g. filling and transport of skips, stability of rig, possible incident and contamination on deck) + Limited or no shore-based infrastructure required - Necessity of cuttings bulk to increase cutting storage capacity prior of treatment process - Drilling speed affected by treatment and discharge processes' speed + Very limited or No weather restrictions - Pre-treatment equipment required - Risk of plugging lines when using drier and washing system – Management requirements of fluid constituents - Continuous analysis of residual cuttings prior to discharge	+ No incremental air emissions + Low energy usage + No environmental issues at onshore sites - Potential for short-term localised impacts on seafloor (benthic community) and water column biology due to chemicals and sediments in the water column and settling on the seafloor

Onshore Disposal		
Marine transport: + Waste can be removed from drilling location eliminating future liability at the rig site – Transportation cost can be high for additional navigation of supply vessel and it could vary with distance of shorebase from the drilling location – Transportation may require chartering of additional supply vessels – Additional costs associated with offshore transport equipment (vacuums, augers) cuttings skips or bulk containers) and personnel – Operational shut-down due to inability to handle generated cuttings would make operations more costly	Marine transport: – Safety hazards associated with loading and unloading of waste containers on workboats and at the shorebase – Increased handling of waste is necessary at the drilling location and at shorebase – Additional personnel required – Risk of exposure of personnel to aromatic hydrocarbons – Efficient collection and transportation of waste are necessary at the drilling location – May be difficult to handle logistics of cuttings generated with drilling of high rate of penetration large diameter holes – Weather or logistical issues may preclude loading and transport of cuttings, resulting in a shut down of drilling or need to discharge - Rig stability may be effected in case of bad weather, necessity to additional move equipment and skips on board to guarantee balance	Marine transport: + No impacts on benthic community + Avoids seabed and water column possible impacts to environment and biotic sensitivities – Fuel consumption and consequent air emissions associated with transfer of wastes to a shore base – Increased risk of spills in transfer (transport to shore and offloading) – Disposal onshore creates new problems (eg, potential groundwater contamination) – Potential interference with shipping and fishing from increased vessel traffic and increased traffic at the port
Onshore operations: + On land transportation costs – Potential future liabilities	Onshore operations: – Onshore transport to site – Safety risk to personnel and local inhabitants in transport and handling – Disposal facilities require long-term monitoring and management - Additional footprint in logistic base for temporary storage of skips	Onshore operations: + Reduces impacts to seafloor and biota – Potential for onshore spills – Air emissions associated with transport and equipment operation -

Land-farming: + Inexpensive relative to other onshore options – Requires long-term land lease - Possible necessity of compensative/restoration activities for land use authorisation	Land-farming: - Limited use due to lack of availability of and access to suitable land – Requires suitable climatic conditions – Cannot be used for wastes with high salt content without prior treatment - Necessity to develop specific treatment facilities	Land-farming: + If managed correctly minimal potential for groundwater impact + Biodegradation of hydrocarbons – Air emissions from equipment use and off-gassing from degradation process – Runoff in areas of high rain may cause surface water contamination – May involve substantial monitoring requirements - Limited availability/experience for cuttings management in South Africa
Landfill: -Additional pressure on existing landfills - Possible necessity of compensative/restoration activities for land use authorisation	Landfill: -Requires appropriate management and monitoring may have requirements on maximum oil content of wastes - Necessity to develop specific treatment facilities – Land requirements – May be limited by local regulations	Landfill: – Potential groundwater and surface water impacts – Air emissions associated with earthmoving equipment – May be restrictions on oil content of wastes - Limited availability/experience for cuttings management in South Africa

Although the onshore disposal option has the benefit that it does not leave an accumulation of cuttings on the seafloor, it has several disadvantages (eg additional pressure on existing landfill sites and potential impacts on vegetation and groundwater) and involves a substantial amount of additional equipment, transportation, and facilities.

The additional transportation requirements to transfer the cuttings to shore increases environmental and safety risks associated with shipping and handling of materials.

Considering the aspects previously discussed, the dynamic nature of the marine environment in the area of interest and in order to limit the footprint for onshore landfarming and waste facilities in the area, considering the lack of dedicated facilities for onshore cuttings treatment, according to South African legislation, international best practise and Eni technical guidelines, Eni's preferred option is to off-shore treat and discharge cuttings in accordance with the previously defined limitations.

4.8.3 Design or Layout Alternatives

Number of Wells

Eni proposes to drill:

- Up to four wells within the northern area of interest: up to two exploration wells and up to two appraisal wells;
- Up to two wells within the southern area of interest: one exploration well and one appraisal well.

The number of wells to be drilled will be determined by the success of the first wells.

The EIA will assess the drilling of six wells within the areas of interest.

Scheduling

The initial drilling activities are currently proposed in 2019, the time of year has not as yet been confirmed.

4.8.4 No-Go Option

The No-Go alternative will be considered in the EIA in accordance with the requirements of the EIA Regulations, 2014 (as amended). The No Go alternative entails no change to the status quo, in other words the proposed exploration drilling activities will not be conducted in ER236.

The option not to proceed with exploration or appraisal drilling would leave the areas of the potential drilling sites in their current environmental state, with the oil/gas potential remaining unknown.

While exploration or appraisal drilling does not automatically lead to the development of oil/gas production, it is an essential stage in the process, which might lead to the drilling of production wells and thereafter significant employment opportunities in this sector, if commercial reserves can be exploited. The 'do nothing' or 'no-go' option forgoes these possible advantages.

5 ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE

5.1 OVERVIEW

The objective of the environmental and social baseline is to establish the characteristics of the existing biophysical and socio-economic conditions in the Project Area. The baseline serves as the reference point against which changes can be predicted and monitored.

This Chapter presents the baseline conditions in the Project Area. The baseline was determined through a review of existing information which includes: previous projects which have occurred in the surrounding blocks, municipal documents and social websites as referenced at the end of this document. Further to this, a Marine Ecology Assessment as well as a Fisheries Study were conducted to determine the baseline conditions of the Project Area.

5.2 PROJECT AREA

The Project Area comprises the various biophysical and socio-economic conditions receptors may be affected both directly and indirectly by the project activities described below. The Project Area can be separated into Areas of Direct Influence (ADI) and Areas of Indirect Influence (AII) depending on the source and causes of the impacts and these will vary in extent depending on the type of receptor affected.

The Project Area is offshore of the KwaZulu-Natal (KZN) coast, between St Lucia and Port Shepstone and includes the entire Block ER236. The ADI includes the northern and southern areas of interest (*Section 4.2*), located at their closest points approximately 62 km and 65 km from shore respectively, and the supply vessel and helicopter routes to and from either Richards Bay or Durban. The AII includes the entire block and the parts of the shoreline where an accidental oil spill may beach. The extent of an oil spill will be determined during the oil dispersion modelling study which will be conducted during the EIA phase of the project.

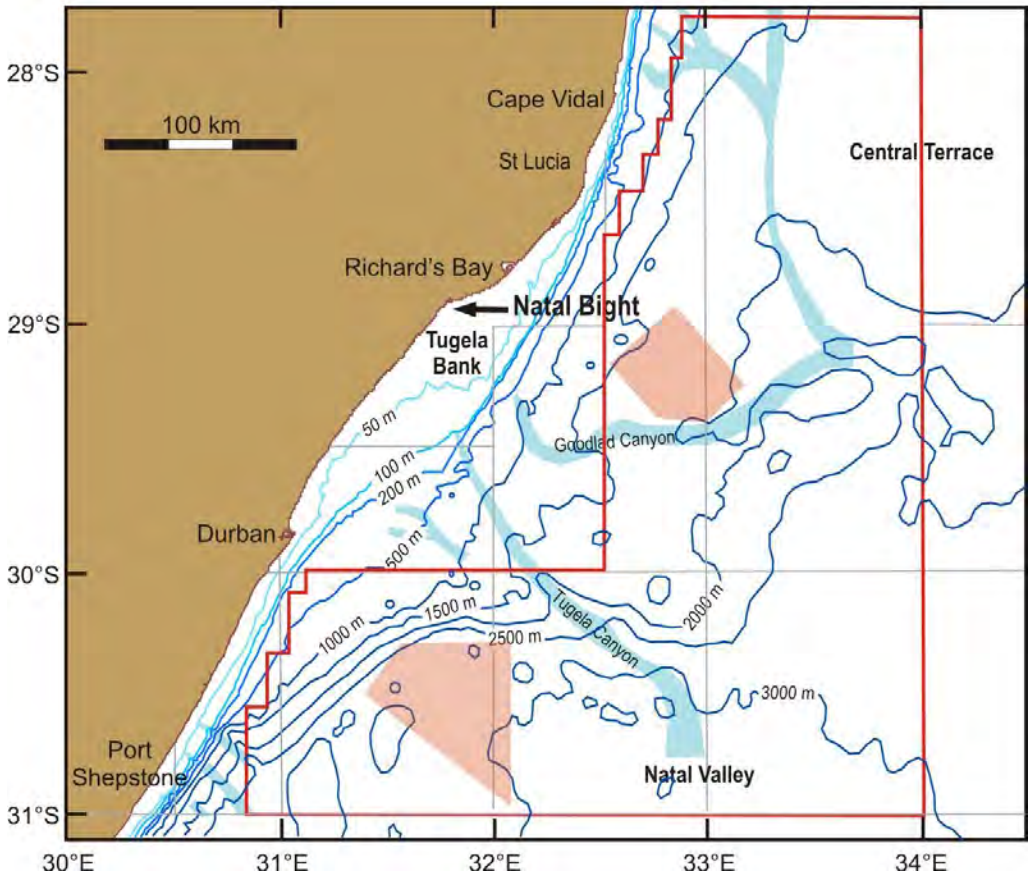
5.3 ENVIRONMENTAL BASELINE

5.3.1 Marine Environment

Bathymetry and Sediments

The orientation of the coastline along the East Coast is relatively uniform, and north-northeast trending. A significant topographical feature is the Natal Bight, a coastal indentation between Cape Vidal and Durban (*Figure 5.1*).

Figure 5.1 Bathymetry of the South African East Coast



Note: Shown on the figure are Block ER236 (red polygon), the areas of interest (orange shading) and features and places mentioned in the text. The positions of submarine canyons and feeder valleys (blue shading) as identified in Lombard *et al.* (2004) are also indicated.

Source: Pisces, 2017

The majority of the East Coast region has a narrow continental shelf and a steep continental slope. The Tugela Bank, located along the KZN coast between 28° 30′ S and 30° 20′ S, is a prominent feature on the continental shelf. Here the continental shelf widens to 50 km offshore, the maximum width reached along the East Coast (Lutjeharms *et al*., 1989) and the continental slope is more gentle (Martin & Flemming, 1988). To the south, the continental margin descends into the Natal Valley, while to the north-eastwards it develops into the Central Terrace (*Figure 5.1*).

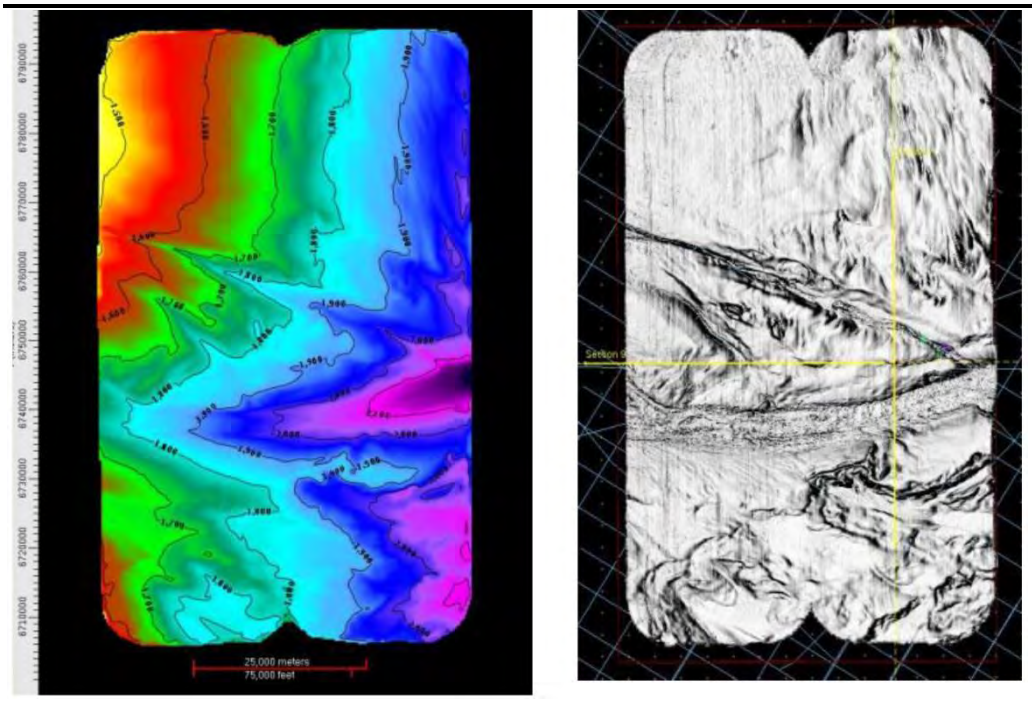
The Tugela Bank is interrupted by two canyons: the large and prominent Tugela Canyon and the smaller Goodlad Canyon (also referred to as 29°25′ S). The northern area of interest for well drilling lies east of the Natal Bight in >1,500 m water depth. The southern area of interest lies off Port Shepstone in > 2,600 m water depth, to the south of the Tugela Canyon.

A further canyon is located to the south of the Bank where the continental shelf narrows and the continental margin descends into the Natal Valley.

The Goodlad Canyon emerges from the Tugela Bank at 2,320 m (Goodlad, 1986). There are limited data on the Goodland Canyon features; however, it is reported to start as a small 20 m deep valley (Martin & Flemming, 1988) deepening to 250 m while becoming a 50 km wide, shallow valley at a depth of 1,400 m. The gradient of the canyon walls are less steep than those of the Tugela Canyon and limited tributaries occur (Young, 2009). No information specific to the canyon off Durban could be sourced (Pisces, 2017).

These canyons therefore differ significantly in morphology from those in northern KZN, where coelacanths have been reported. Firstly, the canyon heads lack the amphitheatre-shaped head morphology. Secondly, they are located at far greater depth than the Sodwana canyons and lack connectivity to the shelf, and finally, they show no significant tributary branches (Wiles *et al*., 2013). Although terraces are present and may provide shelter in the form of caves and overhangs, they occur at depths (>1,500 m) well beyond those at which coelacanths have been recorded to date. Evidence of deep water canyons at depths (>1,500 m) were found during a seismic survey conducted in the northern area of interest. The canyon was found to be in the centre of the area of interest (*Figure 5.2*). Due to the depth of the canyon coelacanths are unlikely to be present. No drilling will occur within canyons.

Figure 5.2 Evidence of Deep Water Canyon – Block ER236



Source: Eni, 2017

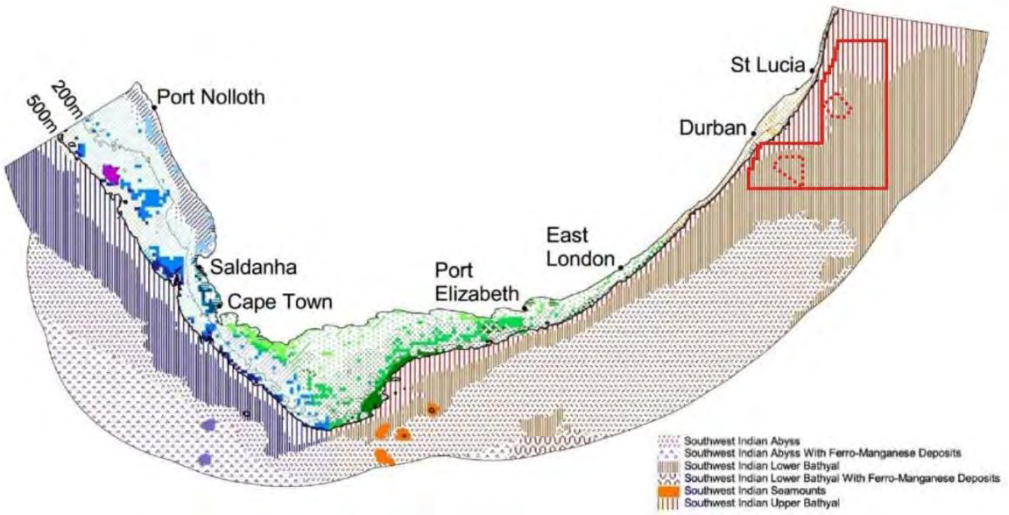
The Tugela Bank is the major sedimentary deposition centre of the KZN continental shelf, being characterised by fluvial deposits of Tugela River and Mgeni River origin. Sediment dispersal in the Bight is controlled by the complex interaction of shelf morphology, the Agulhas Current, wave regime, wind-driven circulation, sediment supply and the presence of the semi-permanent gyre. The seabed is thus sedimentary in nature but varies in the degree to which it is consolidated (CBD, 2013).

North of Durban, the shelf region is dominated by terrigenous sand (0.063 to 2 mm), with patches of gravel (>2 mm) occurring throughout the area. Areas on the mid-shelf contain sediments comprising up to 60 percent terrigenous mud. Two large mud depo-centres are found off the Tugela River mouth, while a smaller one is located off St Lucia. These mud depo-centres are a rare environment along the east coast of South Africa, comprising only about 10 percent of the shelf area (Demetriades & Forbes, 1993). The muds and their associated elevated organic contents provide habitat dominated by benthic and deposit feeders that favour muddy sediments and turbid waters. Despite being primarily a soft-sediment habitat, low profile beachrock outcrops (Fennessy, 1994a, 1994b; Lamberth *et al*., 2009) occur just offshore of the 50 m contour off Durban and around the 200 m contour off Richard's Bay.

South of Durban, sand dominates both the inshore and offshore surficial sediments, although a substantial gravel component is present on the middle and outer shelf to as far as Port St Johns, occurring as coarse lag deposits in areas of erosion or non-deposition. Traces of mud are present on most areas of the shelf, although significant mud depo-centres are absent. The Agulhas Current and/or waves affect the sediment bedform patterns on the KZN continental shelf. North and south of the Tugela Bank, the Agulhas Current generates active dune fields at the shelf edge (Flemming & Hay, 1988). In contrast, sediments on the shelf area of the Tugela Bank to a depth of 100 m are affected mostly by wave action (CSIR, 1998). South of the Ilovo River the inner shelf comprises sand sheets, while sand ribbons and streamers occur on the mid-shelf comprises, with gravel pavements dominating the outer shelf.

The outer shelf is dominated by gravels of shell-fragment and algal-nodule origin (Heydorn *et al*., 1978). Outer shelf sediments are influenced solely by the strong Agulhas Current, forming large-scale subaqueous dunes with a southwesterly transport direction. Subaqueous dunes in the inner and mid shelf are prone to current reversals (Uken & Mkize, 2012). The northern area of interest for well drilling comprises Southwest Indian Upper and Lower Bathyal benthic habitats, whereas Southern Indian Lower Bathyal benthic habitat dominates in the southern area of interest (*Figure 5.3*), both of which have been assigned an ecosystem threat status of 'least threatened' in the SANBI 2011 National Biodiversity Assessment (Sink *et al*., 2011) reflecting the great extent of these habitats within the South African Exclusive Economic Zone (EEZ) (*Figure 5.4*).

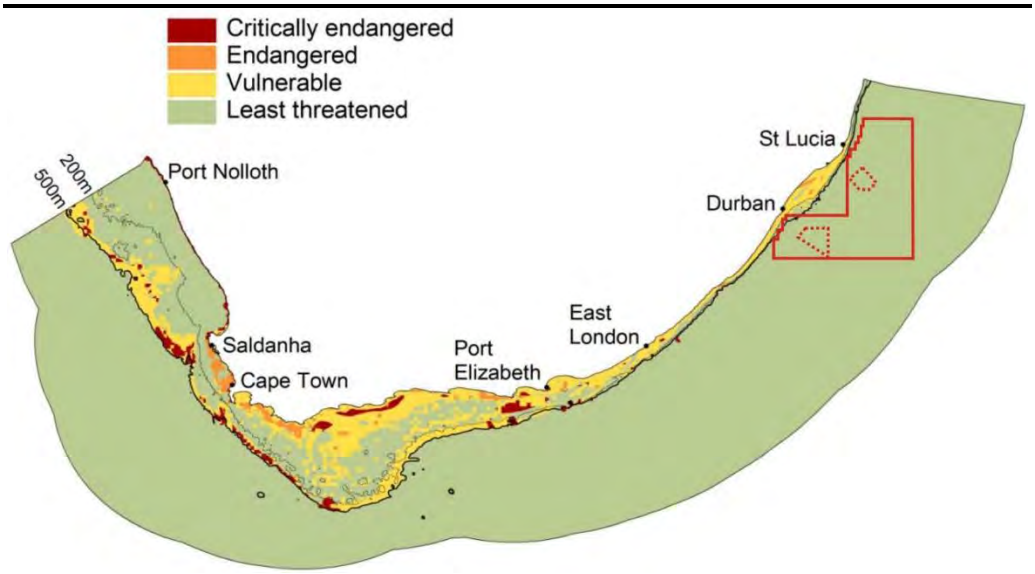
Figure 5.3 Coastal and Benthic Habitat Types off the South African East Coast



Note: Shown on the Figure are Block ER 236 (red polygon) and the areas of interest for well drilling (red dotted line)

Source: Adapted from Sink *et al*. 2012 in Pisces, 2017

Figure 5.4 The Ecological Threat Status of Coastal and Offshore Benthic Habitat Types off the South African East Coast



Note: Shown on the Figure are Block ER 236 (red polygon) and the areas of interest for well drilling (red dotted line)

Source: Adapted from Sink *et al*. 2012 in Pisces, 2017

Water Masses and Circulation

The oceanography of this coast is almost totally dominated by the warm Agulhas Current that flows southwards along the shelf edge (Schumann, 1998) (*Figure 5.5*). The main source of the Agulhas Current is from recirculation in a South-West Indian Ocean subgyre.

Further contributions to the Agulhas Current come from the Mozambique Current and the East Madagascar Current in the form of eddies that act as important perturbations to the flow (Lutjeharms, 2006). It flows southwards at a rapid rate following the shelf edge along the East Coast, before retroflecting between 16° and 20° E (Shannon, 1985). It is a well-defined and intense jet some 100 km wide and 2,300 m deep (Schumann, 1998; Bryden *et al*., 2005). Current speeds of 2.5 m/s or more have been recorded (Pearce *et al*., 1978).

Where it meets the northern part of the Tugela Bank near Cape St Lucia, the inertia of the Agulhas Current carries it into deep water. This generates instability in the current (Gill & Schumann, 1979) resulting in meanders and eddies (Pearce *et al*., 1978). Three eddy types have been identified in the Agulhas Current (Gründlingh, 1992):

Table 5.1 Eddy Types Identified in the Agulhas Current

Type	Description
Type I	These are meanders that comprise smaller shear/frontal features to a depth of at least 50 m, which dissipate over a period of days
Type II	These are meanders comprising the large clockwise loops generated within the Natal Bight. These loops are explained below: • The extremely transient Natal Pulse occurs when meanders move in a southward flow offshore, enabling sluggish and occasional northward flow to develop close inshore (Schumann, 1988); • The larger Natal Gyre is a clockwise circulation cell that extends from Durban to Richard's Bay, resulting in northward flow inshore (Pearce, 1977a, 1977b).
Type III	These are meanders, which are the larger meanders that originate north of St Lucia.

Source: Pisces, 2017

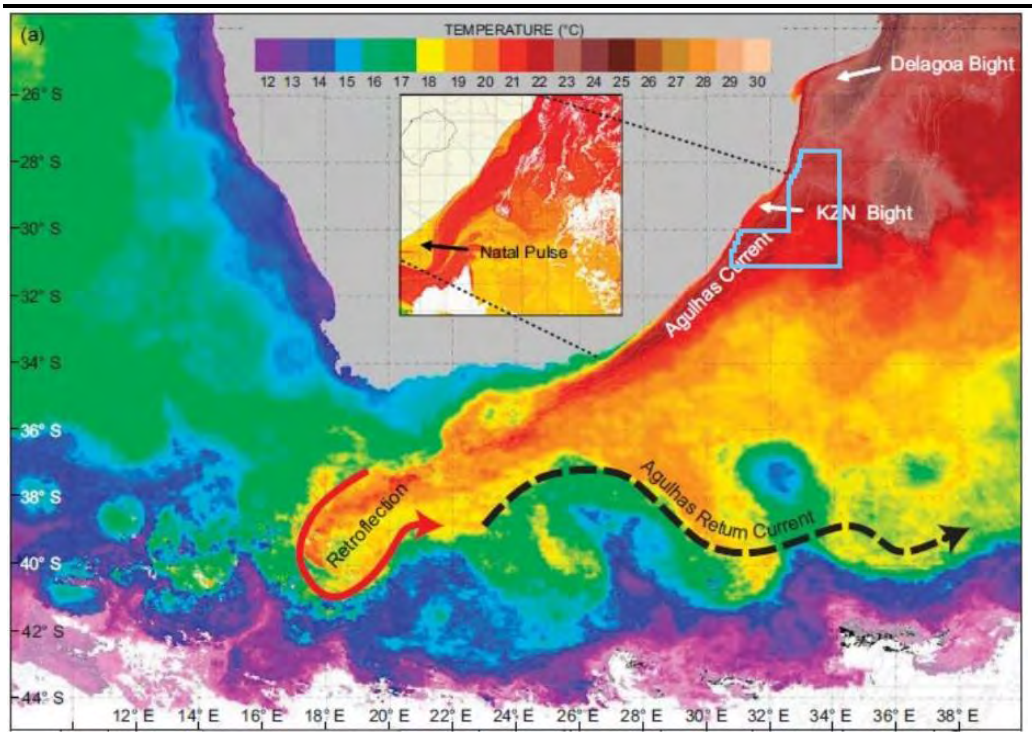
South of Durban, the continental shelf again narrows and the Agulhas Current re-attaches itself as a relatively stable trajectory to the coast, until off Port Edward it is so close inshore that the inshore edge (signified by a temperature front) is rarely discernible (Pearce, 1977a). At Port St Johns, however, there exists a semi-permanent eddy, which results in a northward-flowing coastal current and the movement of cooler water up the continental slope onto the centre of the very narrow shelf (Roberts *et al*., 2010). Further south, when the Agulhas Current reaches the wider Agulhas Bank, where the continental slopes are weaker, it starts to exhibit meanders, shear edge eddies and plumes of warm surface waters at the shelf edge, before retroflecting eastwards as the Agulhas Return Current to follow the Subtropical Convergence (Lutjeharms, 2006) (*Figure 5.5*).

In common with other western boundary currents, a northward (equatorward) undercurrent, termed the Agulhas Undercurrent, is found on the continental slope of the East Coast at depths of between 800 m and 3,000 m (Beal & Bryden, 1997).

As the Agulhas Current originates in the equatorial region of the western Indian Ocean its waters are typically blue and clear, with low nutrient levels and a low frequency of chlorophyll fronts. On the Tugela Bank, however, nutrient concentrations are characterised by short-term temporal variations, but are higher than in areas where the continental shelf is narrower (Carter & d'Aubrey, 1988).

This is attributed in part, to the topographically induced upwelling that occurs in the area as a result of the bathymetric arrangement of the Natal Bight (Gill & Schumann 1979; Schumann 1986; Lutjeharms *et al.*, 1989). The cold nutrient-rich upwelled waters are a source of bottom water for the entire Natal Bight (Lutjeharms *et al.*, 2000a, b). However, from all other perspectives, the Bight may be considered a semi-enclosed system (Lutjeharms & Roberts, 1988) as the strong Agulhas Current at the shelf edge forms a barrier to exchanges of water and biota with the open ocean. The location of the area of interest is offshore and to the east of the Tugela Banks, however, suggests that nutrient concentrations will be comparatively low.

Figure 5.5 The Predominance of the Agulhas Current in Block ER 236



Note: Shown on the Figure is Block ER236 (pale blue outline)

Source: Adapted from Roberts *et al.* 2010 in Pisces, 2017

The surface waters are a mix of Tropical Surface Water (originating in the South Equatorial Current) and Subtropical Surface Water (originating from the mid-latitude Indian Ocean). Surface waters are warmer than 20°C and have a lower salinity than the Equatorial Indian Ocean, South Indian Ocean and Central water masses found below. Surface water characteristics, however, vary due to insolation and mixing (Schumann, 1998).

Seasonal variation in temperatures is limited to the upper 50 m of the water column (Gründlingh, 1987), increasing offshore towards the core waters of the Agulhas Current where temperatures may exceed 25° C in summer and 21° C in winter (Schumann, 1998). Further offshore of the core waters, and thus across most of the Block ER 236, temperatures decrease.

Winds and Swells

The main wind axis off the KZN coast is parallel to the coastline, with north-north-easterly and south-south-westerly winds predominating for most of the year (Schumann & Martin, 1991) and with average wind speeds around 2.5 m/s (Schumann, 1998) (*Figure 5.6 and Figure 5.7*)

In the sea areas off Durban, the majority of swells are from the South and South-southwest, with the largest attaining in excess of 7 m. During summer and autumn, some swells also arrive from the east (*Figure 5.8*). The less regular weather patterns affecting the East Coast (eg low pressure cells present NE of Durban, cut-off low pressure cells and tropical cyclones) strongly influence the wave climate, resulting in swells in excess of 10 m (Hunter 1988; Schumann 1998). The giant waves (>20 m high) that are at times encountered within the Agulhas Current (Heydorn & Tinley, 1980), arise from the meeting of the south-westerly swells and the southerly flowing Agulhas Current, and may be a navigation hazard at times.

Nutrients

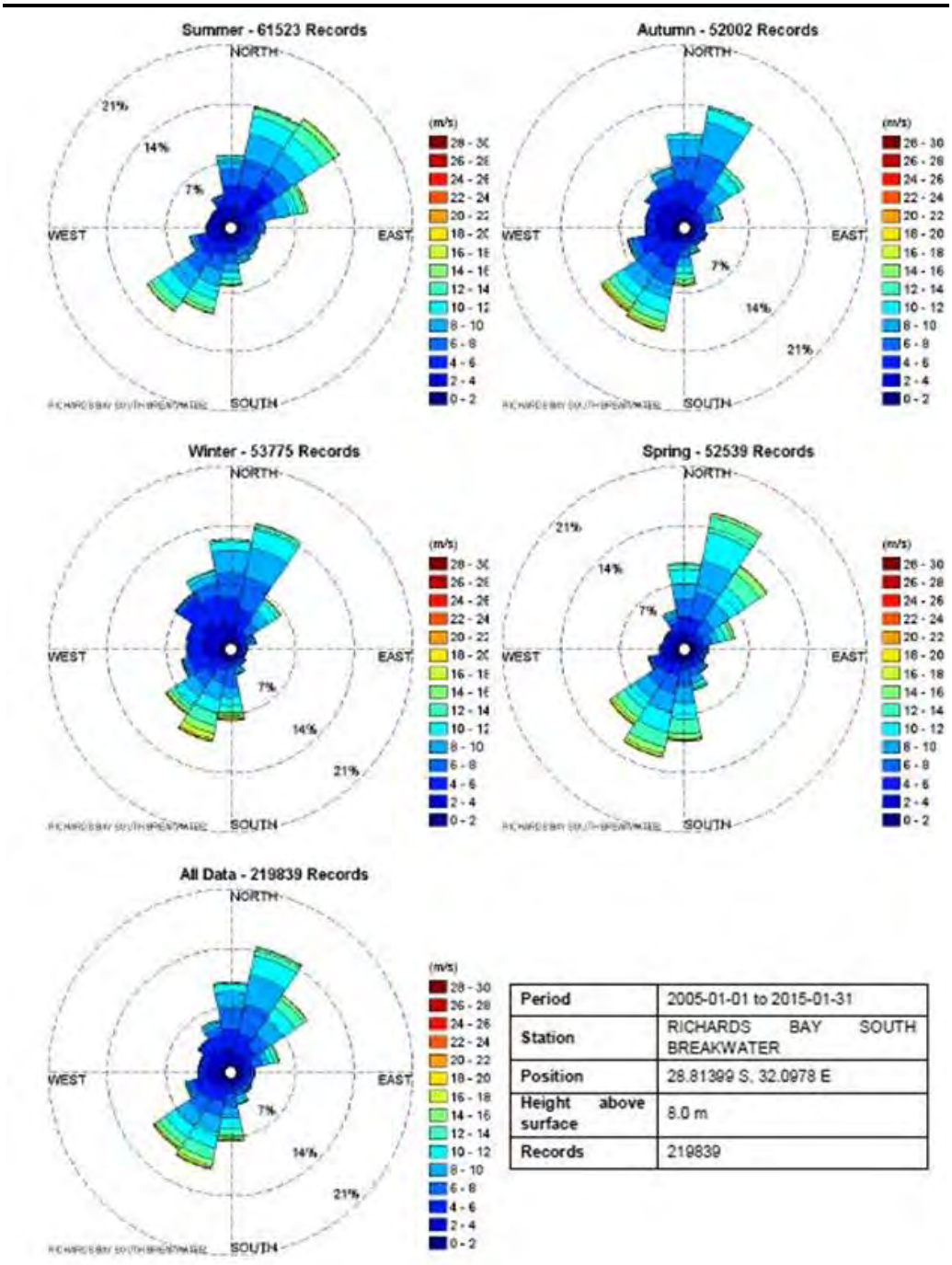
Nutrient inputs on the Tugela Banks are thought to originate from a combination of an upwelling cell off Richards Bay, the Tugela River and a cyclonic lee eddy off Durban. The marine nutrients are derived from a topographically-induced upwelling cell just south of Richards Bay (Gill & Schumann, 1979; Schumann, 1988; Lutjeharms *et al*., 1989). The cold nutrient-rich upwelled waters are a source of bottom water for the entire Natal Bight (Lutjeharms *et al*., 2000a, b), but the quantity and regularity of this nutrient supply remains unknown. The cyclonic eddy incorporates enrichment, retention and concentration mechanisms and together with the upwelling and elevated phytoplankton production in the north of the Bight (Lutjeharms *et al*., 2000b), creates the necessary conditions for enhanced survivorship of early larvae and juveniles of pelagic spawners (Beckley & van Ballegooyen, 1992; Hutchings *et al.,* 2003).

River discharge also has profound effect on physical, chemical and biological processes in coastal waters, and in KZN the effect of catchment-derived nutrient supply onto the Tugela Banks is thought to be pronounced given that nutrient supply from upwelling events is limited (Lamberth *et al*., 2009). The importance of localised fluvial processes (under normal flow, reduced flow and flood events) in driving marine food webs has recently received much research attention (DWAF, 2004; Lamberth *et al*., 2009; Turpie & Lamberth, 2010).

Nutrient inputs into the coastal environment through river runoff are predicted to stimulate phytoplankton and zooplankton production and ultimately the larval, juvenile and adult fish that depend on them as a food source. Proposed impoundments on the Tugela River may thus have cascade effects on ecosystem functioning of the Tugela Banks, with far-reaching consequences for the sustainability of local fisheries (commercial and subsistence).

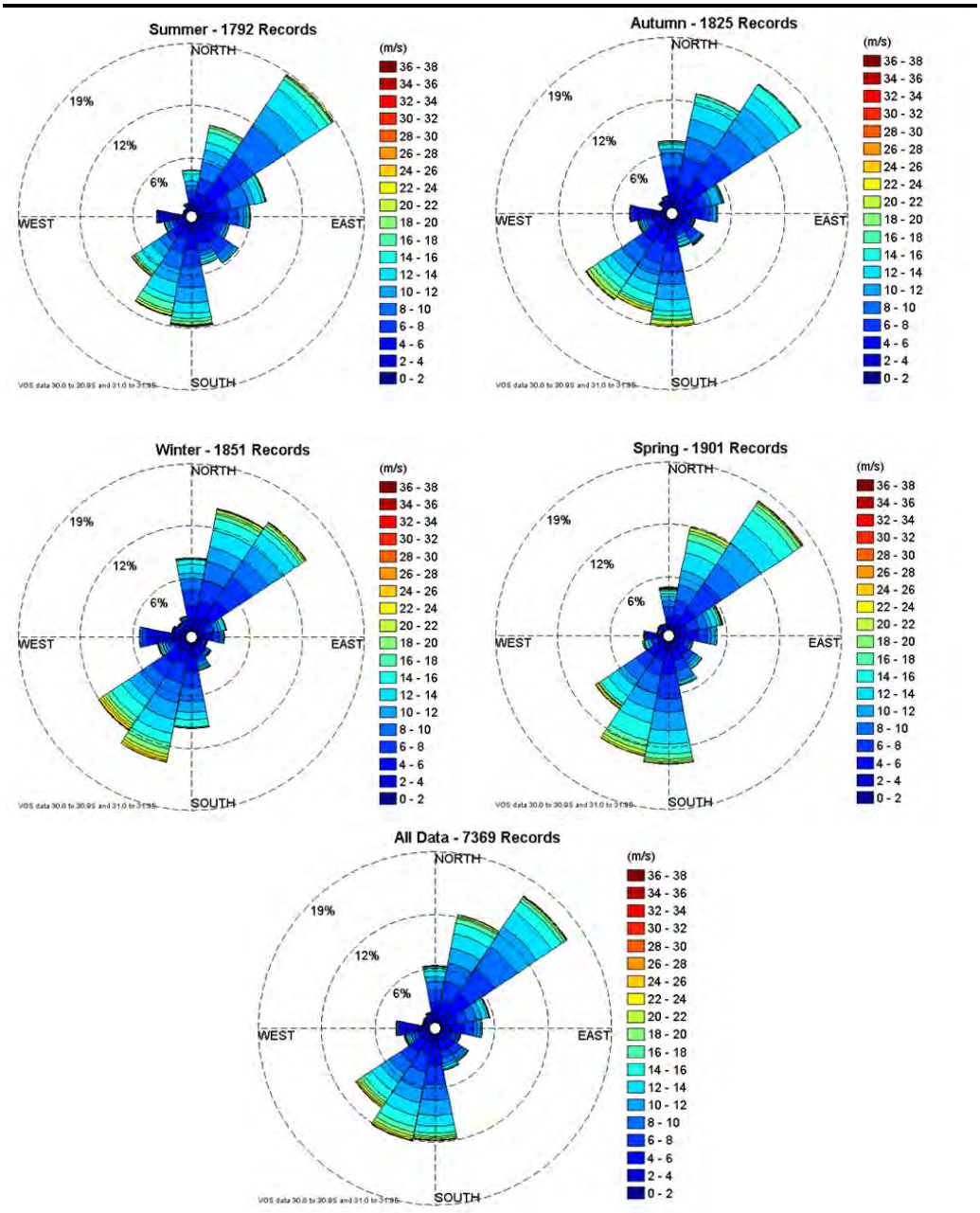
The turbid, nutrient-rich conditions are also important for the life-history phases (breeding, nursery and feeding) of many demersal and pelagic species. The area harbours the only commercial shallow-water prawn trawl fishery in the country and is thus of considerable socio-economic importance to KZN.

Figure 5.6 ***VOS Wind Speed vs Wind Direction for Richards Bay Breakwater (28.8°S and 32.1° E)***



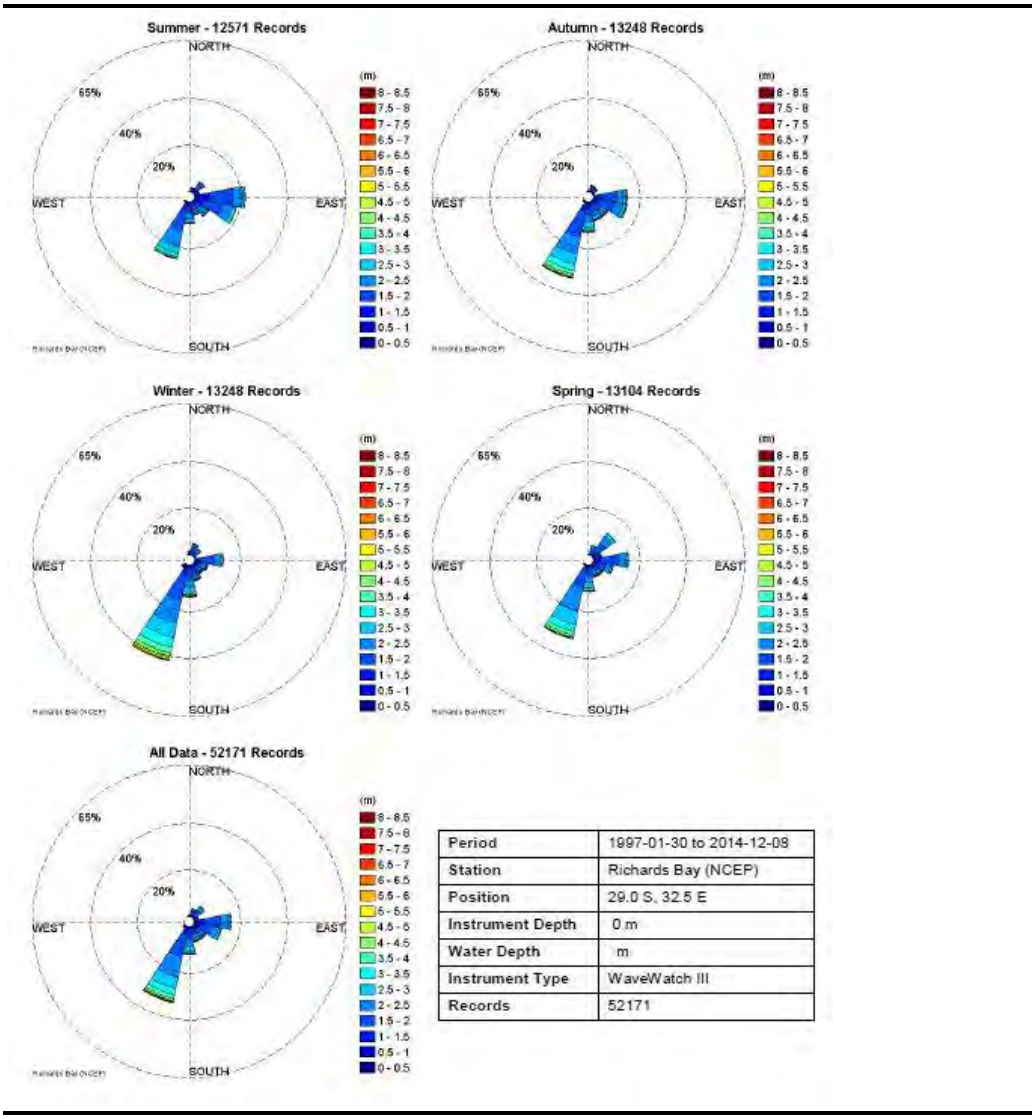
Source: 1960-02-15 to 2012-04-13; 4,515 records in Pisces, 2017

Figure 5.7 ***VOS Wind Speed vs Wind Direction for Port Shepstone (30.0° to 30.9° S and 31.0° to 31.9° E)***



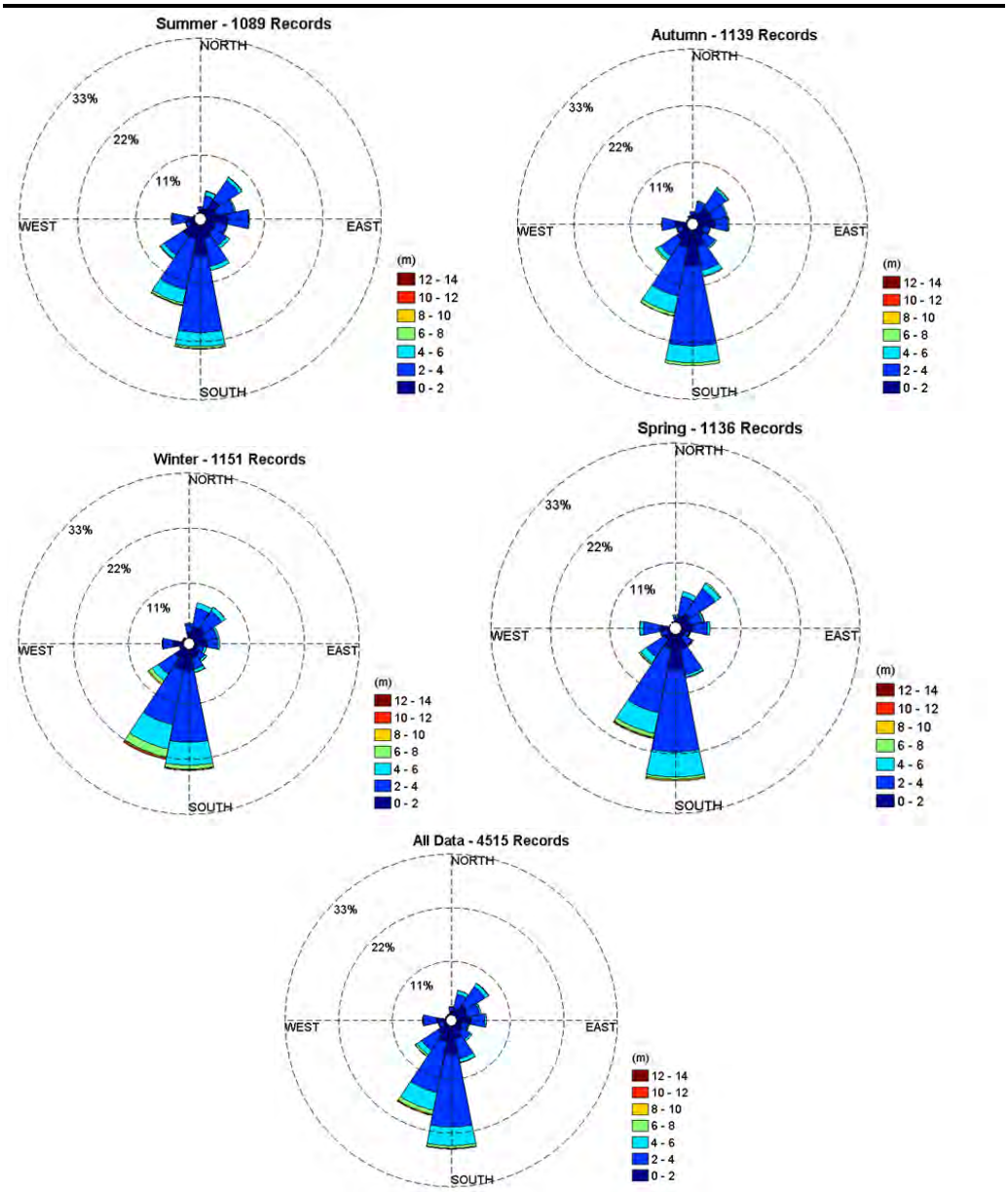
Source: CSIR 1960-02-15 to 2012-04-13; 7,369 records in Pisces, 2017

Figure 5.8 ***VOS Wave Height (Hmo) vs Wave Direction for a deepwater location offshore of Richards Bay (29.0°S and 32.5° E)***



Period	1997-01-30 to 2014-12-08
Station	Richards Bay (NCEP)
Position	29.0 S, 32.5 E
Instrument Depth	0 m
Water Depth	m
Instrument Type	WaveWatch III
Records	52171

Figure 5.9 ***VOS Wave Height (Hmo) vs Wave Direction for Port Shepstone (30.0° to 30.9° S and 31.0° to 31.9° E)***



Source: CSIR 1960-02-15 to 2012-04-13; 4,515 records in Pisces, 2017

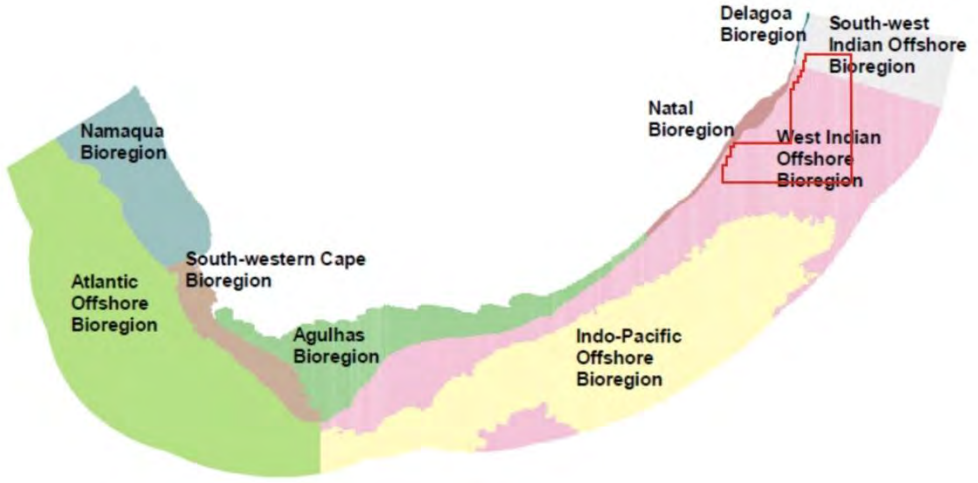
5.3.2 Biological Environment

Biogeographically Block ER 236 and the area of interest falls into the West Indian Offshore bioregion (*Figure 5.10*) (Lombard *et al.*, 2004). The offshore areas comprise primarily deep water benthic habitats and the water body. Due to limited opportunities for sampling, information on the pelagic and demersal communities of the shelf edge, continental slope and upper and lower bathyal are very poorly known.

Consequently, much of the information on the baseline environment provided below relates to the inshore (shallow waters prior to where the shelf of the Thukela Bank starts dropping off, on average less than 50 m water depth) and continental shelf (water depths less than 200 m[1]) regions, which fall within the Natal Bioregion (*Figure 5.10*).

The benthic communities within these habitats are generally ubiquitous throughout the southern African East Coast region, being particular only to substratum type and/or depth zone. They consist of many hundreds of species, often displaying considerable temporal and spatial variability. The biological communities 'typical' of each of these habitats are described briefly below, focusing both on dominant, commercially important and conspicuous species, as well as potentially threatened or sensitive species, which may be affected by the proposed project.

Figure 5.10 ***The South African Inshore and Offshore Bioregions in Relation to Block ER236***



Note: Shown on the Figure is Block ER236 (red polygon)

Source: Adapted from Lombard *et al*. 2004 in Pisces, 2017

Phytoplankton and Ichthyoplankton

The nutrient-poor characteristics of the Agulhas Current water are reflected in comparatively low primary productivity in KZN inshore areas, with chlorophyll a concentrations ranging between 0.03 and 3.88 µg/l (Carter & Schleyer, 1988; see also Coetzee *et al*., 2010).

Further offshore and in Block ER236, the pelagic environment is characterised by very low productivity, with the low variability in water-column temperature resulting in very low frequency of chlorophyll fronts.

[1] The shelf break occurs at approximately the 200 m isobath with a relatively steep slope towards the sea.

Phytoplankton, zooplankton and ichthyoplankton abundances in Block ER236 are thus expected to be extremely low.

In contrast, on the Tugela Bank, short-term increases in productivity are associated with localised upwelling (Oliff, 1973). Continental shelf waters support greater and more variable concentrations of zooplankton biomass (*Figure 5.10*) than offshore waters (Beckley & Van Ballegooyen, 1992), with species composition varying seasonally (Carter & Schleyer, 1988). Copepods represent the dominant species group in shelf waters (Carter & Schleyer, 1988), although chaetognaths are also abundant (Schleyer, 1985).

Ichthyoplankton

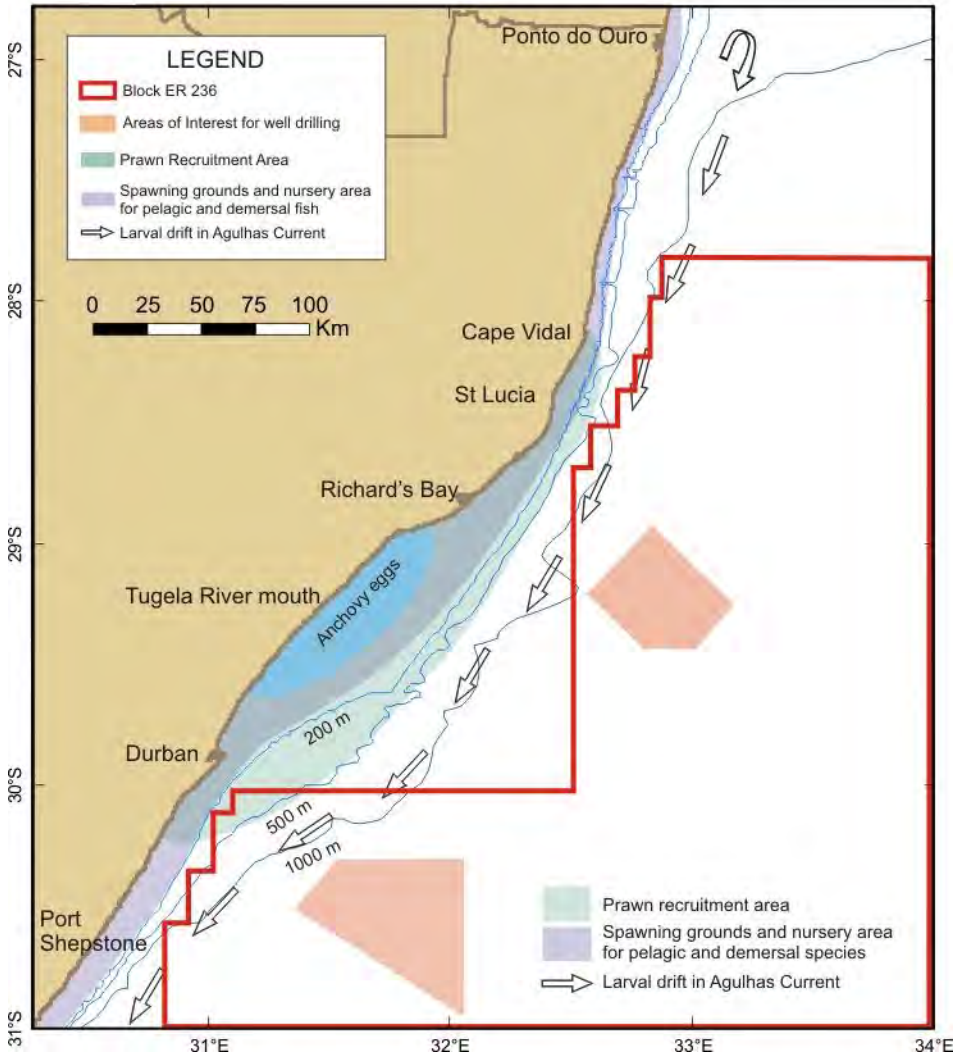
Pilchard (*Sardinops sagax*) eggs occur primarily in waters less than 200 m, outside Block ER236, along the Eastern Cape and the southern KZN coast with the onset of the "sardine run" between May and July (Anders, 1975; Connell, 1996). The sardine and other clupeid eggs persist in inshore waters throughout winter – spring, before disappearing in early summer as the shoals break up and move northwards and further offshore (Connell, 2010). Recent evidence suggests that the inshore areas of the KZN coast may also function as a nursery area for these small pelagic species during the winter months (Connell, 2010; Coetzee *et al*., 2010) as freshwater flows from the large rivers serve as cues for spawning and the recruitment of juveniles (Lamberth *et al*., 2009). Anchovy (*Engraulis japonicus*) eggs were reported in the water column during December as far north as St Lucia (Anders, 1975).

Numerous other fish species (eg squaretail kob and various sciaenids (snapper, sin croaker, beareded croaker)) use the Tugela Banks as a nursery area due to suitable food sources and protection from predators in the turbid water (Fennesy, 1994a). For example, juvenile squaretail kob and snapper kob are seasonally abundant as a bycatch in the shallow-water prawn fishery from January to March, before moving from their feeding areas on the trawling grounds to low reef areas where their diet changes to include more teleosts (Fennessey, 1994a). The Tugela Banks are also known to serve as a nursery area for the endangered scalloped hammerhead shark, slinger and black mussel cracker (CBD, 2013), and five species of dasyatid rays (Fennessy, 1994b). The Banks serve as a spawning area for (amongst others) bull shark, sand tiger shark, black mussel cracker and king mackerel and migration route for sardine ('sardine run') (Haupt, 2011; Harris *et al*., 2011; Sink *et al*., 2011; Ezemvelo KZN Wildlife, 2012; CBD, 2013). Numerous linefish species (eg dusky kob *Argyrosomus japonica*, elf *Pomatomus saltatrix* and garrick *Lichia amia*) undertake spawning migrations along the inshore areas of the coast into KZN waters during the winter months (Van der Elst, 1976, 1981; Griffiths, 1988; Garret, 1988).

Many of the species listed have been identified as either 'threatened' by IUCN (2017) or listed as priority species for conservation due to over-exploitation (Sink & Lawrence, 2008).

Following spawning during spring and summer (November to April), the eggs and larvae are subsequently dispersed southwards by the Agulhas Current (Connell, 2010) (*Figure 5.11*), with juveniles occurring on the inshore Agulhas Bank (Van der Elst, 1976, 1981& Garret, 1988). Ichthyoplankton likewise is confined primarily to waters less than 200 m, with larval concentrations varying between 0.005 and 4.576 larvae/m^3. Concentrations, however, decrease rapidly with distance offshore (Beckley & Van Ballegooyen, 1992). The area of interest is in water depths of more than 500 m and therefore ichthyoplankton abundance is likely to be low. As can been seen in *Figure 5.11* the area of interest is offshore of major fish spawning and migration routes.

Figure 5.11 ***Major Fish Spawning, Nursery and Recruitment Areas along the KZN Coast in Relation to Block ER236***



Note: Shown on the Figure on Block ER 236 (red polygon) and the areas of interest (orange square)

Source: Pisces, 2017

Fish

Pilchards (*Sardinops sagax*) are a small pelagic shoaling species typically found in shelf water between 14 °C and 20 °C. Spawning occurs on the Agulhas Bank during spring and summer (November to April). During the winter months of June to August, the penetration of northerly-flowing cooler water along the Eastern Cape coast and up to southern KZN effectively expands the suitable habitat available for this species, resulting in a 'leakage' of large shoals northwards along the coast in what has traditionally been known as the 'sardine run'. The cool band of inshore water is critical to the 'run' as the sardines will either remain in the south or only move northwards further offshore if the inshore waters are above 20 °C.

The shoals can attain lengths of 20 to 30 km and are typically pursued by Great White Sharks, Copper Sharks, Common Dolphins (*Figure 5.13*, right), Cape Gannets and various other large pelagic predators (www.sardinerun.co.za, O'Donoghue *et al*., 2010a, 2010b, 2010c). The sardine run occurs along the continental shelf (overlapping with the spawning area indicated in *Figure 5.11)* inshore of Block ER236 and the area of interest.

A high diversity of pelagic Teleosts (bony fish) and Chondrichthyans (cartilaginous fish) is associated with the numerous inshore reefs and shelf waters inshore of Block ER236. Many of the fishes are endemic to the Southern African coastline and form an important component of the commercial and recreational line fisheries of KZN.

The fish most likely to be encountered on the shelf, beyond the shelf break and in the offshore waters of Block ER236 are the large migratory pelagic species, including various tunas (*Figure 5.12*, left), billfish (*Figure 5.12*, right) and sharks (the great white shark (*Carcharodon carcharias)* and the whale shark (*Rhincodon typus*)), many of which are considered threatened by the International Union for the Conservation of Nature (IUCN), primarily due to overfishing. Tuna and swordfish are targeted by high seas fishing fleets and illegal overfishing has severely damaged the stocks of many of these species. Similarly, pelagic sharks, are either caught as bycatch in the pelagic tuna longline fisheries, or are specifically targeted for their fins, where the fins are removed and the remainder of the body discarded.

Figure 5.12 Large Migratory Pelagic Fish that Occur in Offshore Waters

Note: Longfin Tuna (Left) and Blue Marlin (Right)

Source: www.samathatours.com; www.osfimages.com

Reef Communities

The subtidal shallow reefs of the East Coast range from rich, coral-encrusted sandstone reefs in the north to the more temperate rocky reefs further south. To the north of Block ER236, the Maputaland Coral Reef system, which extends from Kosi Bay to Leven Point (27°55'40"S, 32°35'40"E), constitute the southernmost coral-dominated reefs of Africa (UNEP-WCMC, 2011). South of the iSimangaliso Wetland Park (St Lucia) reef habitat is provided by rock outcrops, although both hard and soft corals still occur. Both reef types are characterised by diverse invertebrate and ichthyofaunal biota of Indo-Pacific origin (*Figure 5.13*, left). The coral reef habitat also provides shelter and a food source for the highly diverse Indo-Pacific reef fish community.

Both the coral-dominated reefs off Sodwana Bay (to the north of Block ER236) and the sandstone reefs off Durban and the KZN South Coast (inshore of Block ER236) are popular amongst divers for their wealth of invertebrate and fish diversity.

Figure 5.13 The Reefs of KZN and the Annual Sardine Run

Note: Reefs (left) and sardine run (right)

Source: www.sa-venues.com; www.sea-air-land.com

Marine Mammals

The marine mammal fauna of the East Coast comprise between 28 and 38 species of cetaceans (whales and dolphins) known (historic sightings or strandings) or likely (habitat projections based on known species parameters) to occur there (Findlay, 1989; Findlay *et al*., 1992; Ross, 1984; Peddemors, 1999; Best, 2007) (*Table 5.2*). Seals occur only occasionally in the form of vagrant Cape fur seals (*Arctocephalus pusillus pusillus*) (CSIR, 1998). The offshore areas have been particularly poorly studied in which case almost all available information from deeper waters (>200 m) is based on historic whaling records, and information on smaller cetaceans is particularly poor. There are 36 species of cetaceans that are likely to be found within Block ER236. Of the 36 species, according to the South African Red List Assessment, the Antarctic Blue whale (*Balaenoptera musculus intermedia*) is 'critically endangered', the Indo-Pacific humpback dolphin (*Sousa chinensis*), fin whale (Balaenoptera physalus) and sei whale (*Balaenoptera borealis*) are considered 'endangered' and the Ifafi-Kosi Bay sub-population of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), Sperm whale (*Physeter macrocephalus*) and the inshore population of Bryde's whale (*Balaenoptera brydei*) are considered 'vulnerable' (Child *et al*., 2016). Altogether nine species are listed as 'data deficient' underlining how little is known about cetaceans, their distributions and population trends (Pisces, 2017).

The distribution of whales and dolphins on the East Coast can largely be split into those associated with the continental shelf and those that occur in deep, oceanic waters. Species from both environments may, however, be found to be associated with the shelf (200 to 1,000 m), making this the most species-rich area for cetaceans. Cetacean density on the continental shelf is usually higher than in pelagic waters as species associated with the pelagic environment tend to be wide-ranging across thousands of kilometres. The most common species within the Block ER236 (in terms of likely encounter rate not total population sizes) are likely to be the common bottlenose dolphin (*Tursiops truncatus Figure 5.14,* left), Indo-pacific bottlenose dolphin (*Tursiops aduncus*), short-finned pilot whale (*Globicephala macrorhynchus*), Indo-Pacific humpback dolphin (*Sousa chinensis, Figure 5.14*, right) and humpback whale (*Figure 5.15*, left).

Cetaceans comprised two basic taxonomic groups: the mysticetes (filter-feeding baleen whales) and the odontocetes (toothed predatory whales and dolphins). Due to large differences in their size, sociality, communication abilities, ranging behaviour and acoustic behaviour, these two groups are considered separately.

Figure 5.14 The Bottlenose Dolphin and the Indo-Pacific Humpback Dolphin

Source: www.fish-wallpapers.com; www.shutterstock.com

Baleen whales that are found in the offshore waters of the East Coast include the blue, fin, sei, minke, dwarf minke, inshore Bryde's, Pygmy Right, Humpback and Southern Right whale. Most of these species occur in deeper pelagic waters, with only occasional visits into the shallower shelf waters. These species show some degree of migration either to, or through, Block ER 236 when en route between higher-latitude feeding grounds (Antarctic or Subantarctic) and lower-latitude breeding grounds.

As whales follow geographic or oceanographic features, the northward and southward migrations may take place at different distances from the coast, thereby influencing the seasonality of occurrence at different locations. Due to the complexities of the migration patterns, the species of key stakeholder concern (humpbacks and southern right wales) are discussed in further detail below.

Humpback whales (*Megaptera novaeangliae*)

Humpback whales (*Figure 5.15*, left) are known to migrate between their Antarctic feeding grounds and their winter breeding grounds in tropical waters. The main winter concentration areas for humpback whales on the African east coast include Mozambique, Madagascar, Kenya and Tanzania on the east coast. During this migration they use subtropical coastal areas as important migratory corridors and exhibit a widespread seasonality in occurrence along the South African east coast (Best, 2007).

Humpback whales and their migration patterns have been studied for a number of years, showing a strong bimodal seasonality in the presence of humpback whales on South Africa's eastern coast, with peaks in abundance in June/ July and September corresponding with their northward and southward migration respectively (Findlay et al. 2011). However, in 2013, a study by Banks made observations of migrations extending further north than previously recorded, with most reaching southern African waters around April, continuing through to September/October when the southern migration begins and continues through to December and as late as February (Banks, 2013).

Cow-calf pairs are typically the last to leave southern African waters on the return southward migration, although considerable variation in the departure time from breeding areas has been recorded (Barendse *et al.,* 2010).

As indicated in Banks (2013), the highest concentrations of humpback whales in or near Block ER236 can be expected in June to July and October to December. Humpback whales are least likely to be present in or near Block ER236 from Febuary to March.

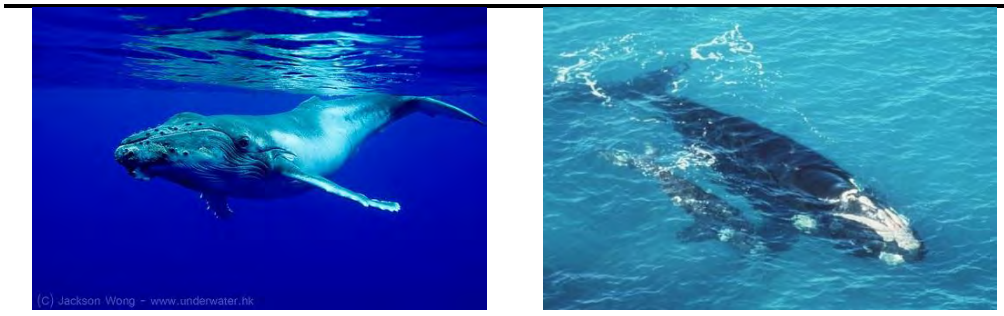
Southern right whales (*Eubalaena australis*)

The Southern African population of southern right whales (*Figure 5.15,* right) historically extended from Southern Mozambique (Maputo Bay) (Banks *et al.,* 2011) to Southern Angola (Baie dos Tigres) and is considered a single population within this range (Roux *et al.,* 2015). Winter concentrations have been recorded along the Southern and Eastern Coasts of South Africa as far north as Maputo Bay, with the most significant concentration currently on the South Coast between Cape Town and Port Elizabeth. They typically occur in coastal waters off the South Coast between June and November, although animals may be sighted as early as April and as late as January. They migrate to the southern African sub-region to breed and calve, inhabiting shallow coastal waters in sheltered bays (90 percent were found less than 2 km from shore; Best, 1990; Elwen & Best, 2004).

While in local waters, southern right whales are found in groups of 1 to 10 individuals, with cow-calf pairs predominating in inshore nursery areas. From July to October, animals aggregate and become involved in surface-active groups, which can persist for several hours.

Southern right whales will pass through Block ER236 in July and August and again on their southward migration in October/November.

Figure 5.15 The Humpback Whale and the Southern Right Whale



Source: www.divephotoguide.com; www.aad.gov.au

Odontocetes

The Odontocetes are a varied group of animals including the dolphins, porpoises, beaked whales and sperm whales.

Species occurring within the broader project area display a diversity of features, for example their ranging patterns vary from extremely coastal and highly site specific to oceanic and wide ranging. Those in the region can range in size from 1.9 m long (Spinner dolphin) to 17 m (bull sperm whale).

Turtles

Five species of sea turtles occur along the East coast of South Africa; the green turtle (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*) and loggerhead (*Caretta caretta*).

Loggerheads and leatherbacks nest along the sandy beaches of the northeast coast of KZN, South Africa, as well as southern Mozambique during summer months. These loggerhead and leatherback nesting populations are the southern-most in the world (Nel *et al*., 2013). Even though these populations are smaller (in nesting numbers) than most other populations, they are genetically unique (Dutton *et al*., 1999; Shamblin *et al*., Submitted) and thus globally important populations in terms of conservation of these species.

Satellite tracking of female loggerhead and leatherback turtles during inter-nesting periods revealed that loggerheads remained close to the shore (within the boundaries of the iSimangaliso Wetland Park) between nesting events (*Figure 5.16*), whereas leatherbacks travelled greater distances (more than 300 km) and beyond the borders of the MPA. Consequently, a southward extension of the MPA has been proposed in order to include a greater portion of the core range of inter-nesting leatherbacks and provide better protection.

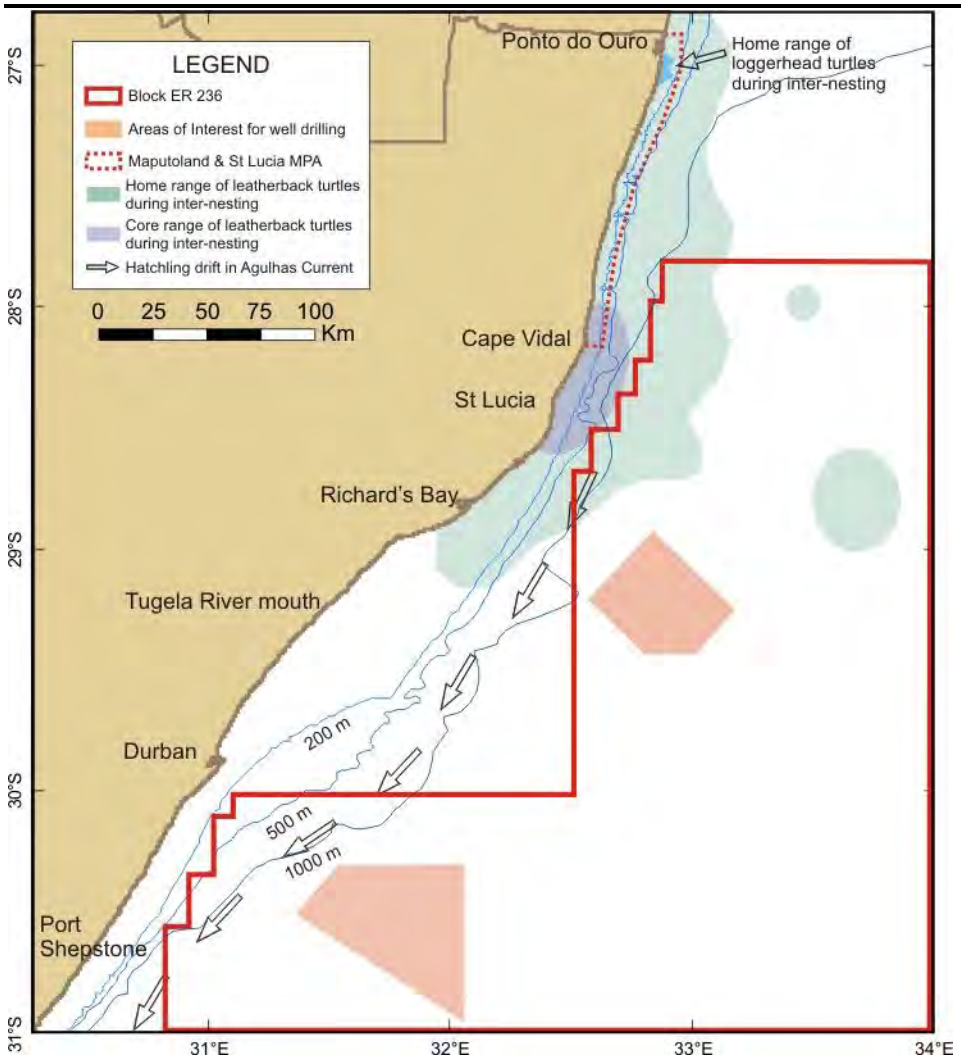
The inshore regions of the northern portion of Block ER236, coincide with the inter-nesting migrations for leatherbacks, but the area of interest lies offshore of the inter-nesting range. Both species are thus likely to be encountered in Block ER236 during their foraging migrations.

Loggerhead and leatherback females come ashore to nest from mid-October to mid-January each year. They crawl up the beach and deposit an average of approximately 100 (loggerheads) or approximately 80 (leatherback) eggs in a nest excavated with their hind flippers. The eggs incubate for two months and hatchlings emerge from their nests from mid-January to mid-March. The mean hatching success for loggerheads (73 percent) and leatherbacks (76 percent) on the South African nesting beaches (de Wet, 2013) is higher than reported at other nesting sites globally. Nevertheless, eggs and emerging hatchlings are nutritious prey items for numerous shoreline predators, resulting in the mean emergence success and hatchling success being slightly lower than the hatching success. However, emergence and hatchling success for both species is similarly higher in South Africa than reported at other nesting beaches as mortality is largely limited to natural sources due to strong conservation presence on the nesting beach, which has reduced incidents of egg poaching and female harvesting to a minimum (Nel, 2010).

The production of both loggerhead and leatherback hatchlings is thus remarkably high in South Africa, making the nesting beaches in northern KZN some of the most productive (relative to nesting numbers) in the world.

In the IUCN Red listing, the hawksbill turtle is described as 'Critically Endangered', the green turtle is 'Endangered' and Leatherback, Loggerhead and Olive Ridley are 'Vulnerable' on a global scale. Leatherback turtles are thus in the highest categories in terms of need for conservation in CITES (Convention on International Trade in Endangered Species), and CMS (Convention on Migratory Species). As a signatory of CMS, South Africa has endorsed and signed two sister agreements specific to the conservation and management of sea turtles (these are the Africa-Atlantic and Indian Ocean South East Asia Memoranda of Understanding). South Africa, as a nation, is therefore committed to the protection of all species of sea turtles occupying its national waters, whether they are non-resident nesters (loggerhead and leatherback turtles) or resident foragers (hawksbill and green turtles; Oceans and Coast, unpublished data). In addition to sea turtle habitat and physical protection in the St. Lucia and Maputaland Marine Reserves, turtles in South Africa are protected under the Marine Living Resources Act (1998).

Figure 5.16 ***The Home and Core Ranges of Loggerheads and Leatherbacks during Inter-Nesting***



Note: Shown on the Figure are the Marine Protected Area specifically important for Loggerheads and Leatherbacks aggregation and nesting (spotted red line) and the areas of interest (orange polygons) within Block ER236 (red line).

Source: Oceans and Coast, unpublished data

Seabirds

The East Coast provides few suitable breeding sites for coastal and seabirds with only three species (Grey-headed gull, Caspian tern and Swift tern) (*Figure 5.17*) recorded to breed regularly along the coast (CSIR, 1998). In the offshore environment of Block ER236, the birds most likely to be encountered are the pelagic migrant species such as albatross, petrels and shearwaters. Encounter rates are likely to be higher during winter months and during the inshore sardine 'run', when many of the pelagic species come inshore to follow the shoals northwards up the coast (O'Donoghue *et al*., 2010a, 2010b, 2010c). Coastal species may be encountered in the inshore areas Block ER236, particularly in the vicinity of larger estuaries (Richards Bay, St Lucia).

Figure 5.17 Typical Plunge-Diving Seabirds on the East Coast are the Swift Tern (Left) and the Cape Gannet (Right)

Sources: www.johanngrobbelaar.co.za; www.oceanwideimages.com

Table 5.2 Marine Mammals Likely to be Encountered in Block ER236

Common Name	Species	Shelf	Offshore	Seasonality	Likely encounter freq.	IUCN Conservation Status	Global IUCN Status
Delphinids							
Common bottlenose dolphin	*Tursiops truncatus*	Yes	Yes	Year round	Monthly	Least Concern	Least Concern
Indo-Pacific bottlenose dolphin	*Tursiops aduncus-Ifafa-Kosi Bay subpopulation*	Yes		Year round	Weekly	Vulnerable	
	Tursiops aduncus-Ifafa-False Bay subpopulation	Yes		Year round	Weekly	Near threatened	
	Tursiops aduncus-Seasonal subpopulation	Yes		Year round	Monthly	Data Deficient	Data Deficient
Common (short-beaked) dolphin	*Delphinus delphis*	Yes	Yes	Year round	Monthly	Least Concern	Least Concern
Common (long-beaked) dolphin	*Delphinus capensis*	Yes		Year round	Monthly	Least Concern	Data Deficient
Fraser's dolphin	*Lagenodelphis hosei*		Yes	Year round	Occasional	Least Concern	Least Concern
Pan tropical Spotted dolphin	*Stenella attenuata*	Yes	Yes	Year round	Occasional	Least Concern	Least Concern
Striped dolphin	*Stenella coeruleoalba*		Yes	Year round	Occasional	Least Concern	Least Concern
Spinner dolphin	*Stenella longirostris*	Yes		Year round	Occasional	Data Deficient	Data Deficient
Indo-Pacific humpback dolphin	*Sousa chinensis*	Yes		Year round	Monthly	Endangered	Near threatened
Long-finned pilot whale	*Globicephala melas*		Yes	Year round	<Weekly	Least Concern	Data Deficient
Short-finned pilot whale	*Globicephala macrorhynchus*		Yes	Year round	<Weekly	Least Concern	Data Deficient
Killer whale	*Orcinus orca*	Occasional	Yes	Year round	Occasional	Least Concern	Data Deficient
False killer whale	*Pseudorca crassidens*	Occasional	Yes	Year round	Monthly	Least Concern	Data Deficient
Risso's dolphin	*Grampus griseus*	Yes (edge)	Yes	Year round	Occasional	Least Concern	Least Concern
Pygmy killer whale	*Feresa attenuata*		Yes	Year round	Occasional	Least Concern	Data Deficient
Sperm whales							
Pygmy sperm whale	*Kogia breviceps*		Yes	Year round	Occasional	Data Deficient	Data Deficient
Dwarf sperm whale	*Kogia sima*		Yes	Year round	Occasional	Data Deficient	Data Deficient
Sperm whale	*Physeter macrocephalus*		Yes	Year round	Occasional	Vulnerable	Vulnerable
Beaked whales							
Cuvier's	*Ziphius cavirostris*		Yes	Year round	Occasional	Least Concern	Least Concern
Arnoux's	*Berardius arnouxii*		Yes	Year round	Occasional	Data Deficient	Not assessed
Southern bottlenose	*Hyperoodon planifrons*		Yes	Year round	Occasional	Least Concern	Least Concern
Hector's	*Mesoplodon hectori*		Yes	Year round	Occasional	Data Deficient	Data Deficient

Common Name	Species	Shelf	Offshore	Seasonality	Likely encounter freq.	IUCN Conservation Status	Global IUCN Status
Strap-toothed whale	*Mesoplodon layardii*		Yes	Year round	Occasional	Data Deficient	Data Deficient
Longman's	*Mesoplodon pacificus*		Yes	Year round	Occasional	Data Deficient	Data Deficient
True's	*Mesoplodon mirus*		Yes	Year round	Occasional	Data Deficient	Data Deficient
Gray's	*Mesoplodon grayi*		Yes	Year round	Occasional	Data Deficient	Data Deficient
Blainville's	*Mesoplodon densirostris*		Yes	Year round	Occasional	Data Deficient	Data Deficient
Baleen whales							
Antarctic minke	*Balaenoptera bonaerensis*	Yes	Yes	>Winter	Monthly	Least Concern	Data Deficient
Dwarf minke	*Balaenoptera acutorostrata*	Yes		Year round	Occasional	Least Concern	Least Concern
Fin whale	*Balaenoptera physalus*		Yes	MJJ & ON	Occasional	Endangered	Endangered
Antarctic Blue whale	*Balaenoptera musculus intermedia*		Yes	MJJ	Occasional	Critically Endangered	Endangered
Sei whale	*Balaenoptera borealis*		Yes	MJ & ASO	Occasional	Endangered	Endangered
Bryde's (inshore)	*Balaenoptera brydei (subspp)*		Yes	Year round	Occasional	Vulnerable	Data Deficient
Pygmy right	*Caperea marginata*	Yes		Year round	Occasional	Least Concern	Data Deficient
Humpback	*Megaptera novaeangliae*	Yes	Yes	AMJJASOND	Daily	Least Concern	Least Concern
Southern right	*Eubalaena australis*	Yes		JJASON	Daily	Least Concern	Least Concern

5.3.3 Marine Protected Areas

Maputaland and St Lucia Marine Reserves

The Maputaland and St Lucia Marine Reserves form a continuous protected area stretching 150 km from the Mozambique border southwards to Cape Vidal, and 3 nautical miles (approximately 5.5 km) out to sea. They are components of the iSimangaliso Wetland Park. No fishing is allowed in the Sanctuary Zone between beacon N5 at Red Cliffs and beacon N6 at Leven Point, extending three nautical miles (approximately 5.5 km) due east from the high-water mark. In the Restricted Zones which lie to the north of beacon N5 at Red Cliffs and to the south of beacon N6 at Leven Point, respectively, shore anglers may catch fish, and skiboat anglers and spearfishers may catch pelagic bony fish.

The area off St Lucia was selected as an MPA because it is an important area for leatherback turtles which nest on adjacent beaches and forage offshore with tracking data reflecting turtle habitat use well beyond the three nautical mile approximately 5.5 km) boundary of the existing St Lucia and Maputaland MPAs. Threatened seabirds drive the remaining areas although linefish of conservation concern also contribute to importance of the area.

The MPA protects a large number of turtle nesting sites; the migration of whales, dolphins and whale-sharks offshore; coelacanths in the submarine canyons; and a considerable number of waterfowl associated with the iSimangaliso Wetland Park, including large breeding colonies of pelicans, storks, herons and terns.

Aliwal Shoal

The Aliwal Shoal MPA is located inshore of the southern area of interest and extends along the KZN south coast for 18.3 km between the Mzimayi and Umkomaas River mouths, and from the high-water mark to seven kilometres offshore.

The Aliwal Shoal is a sub-tidal reef located 5 km offshore near Umkomaas which supports corals (including 15 species of hard corals and four species of soft corals), fish and shark communities, which have created a popular attraction to divers and fisherman. Many endangered and endemic reef fish are found on the shoal, which has resulted in formation of specific no take areas (eg Crown Area and Produce restricted areas). Further south lies the small Trafalgar Marine Reserve, which stretches for only 6 km along the KZN south coast adjacent to the Mpenjati Nature Reserve, and extends 500 m offshore.

The Aliwal Shoal MPA was selected as an MPA to conserve the biodiversity of the area. The Aliwal Shoal was historically a site of conflict between user groups, but agreements have now been reached in regard to the partitioning of uses between fishing, diving and spear-fishing, which have been formalised in a management plan. The MPA has various functions including the conservation of fauna, management of conflict between user groups, and the development of a world-class diving site.

5.3.4 Focus Areas for Offshore Biodiversity Protection

The Offshore MPA Project (SANBI, 2011) aimed to support the implementation of the National Protected Area Expansion Strategy (Government of South Africa, 2010), which highlighted the need to establish specific offshore MPAs and to provide suitable protection of inshore systems within South Africa. Priority areas for different types of objectives were explored during this project and it is recognised that protection may be apportioned between different types of spatial management including different zones of MPAs but also other types of spatial management.

As part of the Offshore MPA Project, ten focus areas have been identified for offshore protection along the South African coast. At this stage, these focus areas only represent preliminary delineations for the spatial management of South Africa's offshore, based on best available information. As such, practical proposed boundaries for each focus area will need to be properly determined (in subsequent stages of development of the programme) through finer-scale interrogation of available spatial data and further stakeholder consultation.

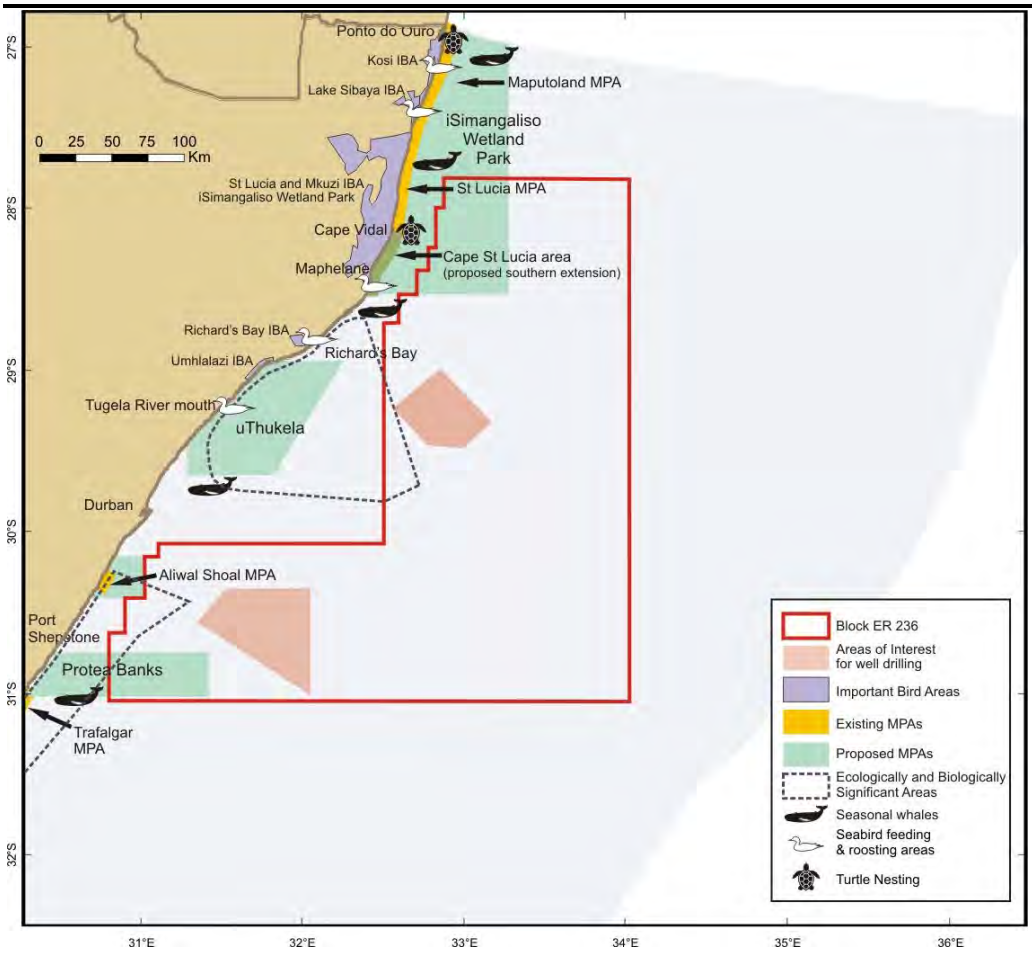
Each of these focus areas has been set out with specific objectives, key stakeholders and potential spatial management measures. It is however also important to take note of such developments, as while it may not affect the current proposed activity, it may have implications any future activity. In this regard, specific types of spatial management measures that could be implemented in such areas could include, amongst others, zoned Marine Protected Areas or Fisheries Management Areas promulgated through South Africa's Marine Living Resources Act.

The focus areas within the Project Area are shown in *Figure 5.18*. Although Block ER236 overlaps with the proposed Protea Banks and the extention of the iSimangaliso Wetland Park MPAs, there is no overlap of the areas of interest with the proposed protection areas.

Hope Spots are defined by Mission Blue of the Sylvia Earle Alliance as special conservation areas that are critical to the health of the ocean.

The first six Hope Spots were launched in South Africa in 2014 and include Aliwal Shoal in KZN, Algoa Bay, Plettenberg Bay, Knysna, the Cape Whale Coast (Hermanus area) and False Bay in the Western Cape. Of these, the Aliwal Shoal Hope Spot is located adjacent to (inshore) the southwestern corner of Block ER236 but well to the southwest (~250 km) of the area of northern interest for well drilling, and ~75 km inshore and west of the southern area of interest.

Figure 5.18 Focus Areas for Offshore Biodiversity Protection in Relation to Block ER236



Note: Shown on the Figure are Important Bird Areas (IBAs), proposed and existing Marine Protected Area (MPA) in relation to Block ER 236 (red polygon)

Source: Pisces, 2017

Tugela Banks

The Tugela Bank offshore focus area overlaps with the Block ER236 and the iSimangaliso offshore focus area is adjacent to the northern extent of the Block ER236. The closet boundary of the iSimangaliso offshore focus area is 10 km north of the Block ER236.The Tugela Banks is being considered as an offshore focus area for biodiversity protection because this area is highly productive and serves a nursery area for many species. This focus area was also identified by finescale planning conducted in KZN through the SeaPlan project led by Ezemvelo KZN Wildlife.

iSimangaliso Offshore: World Heritage Site

The iSimangaliso Wetland Park is recognised as a wetland of international importance under the Ramsar Convention and has been designated a World Heritage Site in terms of the World Heritage Convention Act (No. 49 of 1999). The iSimangaliso Wetland Park covers an area on 324 441 ha, including 230 km of coastline from Kosi Bay (bordering Mozambique) to south of Maphelane and three nautical miles (approximately 5.5 km) out to sea. The Park is governed by the National Environmental Management Protected Areas Act (No. 57 of 2003). In terms of Section 48(1) no person may conduct commercial prospecting or mining activities within a World Heritage Site. In addition, Section 50(5) states that no development is permitted in a World Heritage Site without prior written approval from the management authority, namely iSimangaliso Wetland Park Authority. The Project Area lies approximately 100km to the south of the World Heritage Site (*Figure 5.18*).

5.4 SOCIO-ECONOMIC BASELINE

The project is located off the coast of the KZN Province, and will have an onshore logistics base in either the Port of Richards Bay or the Port of Durban. Most of the activities associated with the project will take place offshore, with the exception of activities associated with the onshore logistics base. As such, this socio-economic baseline is focused on the local municipalities in which the logistics base may be located. This is because it is expected that although the project could result in macro-economic benefits at a national level, the primary socio-economic impacts of the project will be experienced at a local level.

5.4.1 *Administrative Structure*

The Provincial government is responsible for providing the strategic vision and framework for the Province. They are responsible for ensuring cooperation and collaboration between municipalities and that each municipality performs their respective functions. In turn, each of the District Municipalities is responsible for the preparation of a spatial development framework and for the overall provision of services and infrastructure within their District. The district municipalities are further divided into local municipalities. Local municipalities are responsible for developing an Integrated Development Plan, IDP, which is aligned with the strategic vision of the province, and sets out a road map for achieving local socio-economic development.

Provincial Context

The project is located off the coast of the KZN Province, the third smallest province in South Africa, covering an area of 94,361 km^2. KZN has the second largest population of the South African provinces, with a total of 11,065,240 people.

It borders Mpumalanga and the Free State on the west and the Eastern Cape to the south west. It also borders, Lesotho, Swaziland and Mozambique. Pietermaritzburg is the capital city, whilst Durban is the largest city, and considered the economic centre of the Province. Other major cities and towns in KZN include Richards Bay, Port Shepstone, Newcastle, Escourt, Ladysmith and Richmond. *Figure 5.19* shows the municipalities within the province.

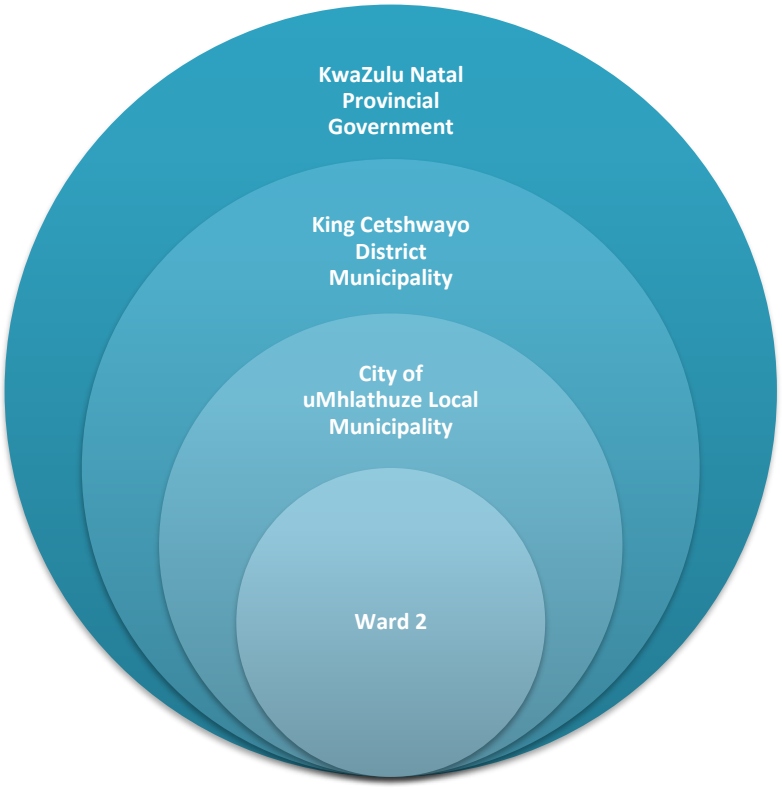
The tourism industry plays an important part the KZN economy with popular destinations including the coastal towns along the coast, as well as the mid-lands and Drakensberg Mountains.

Figure 5.19 KZN Municipalities

5.4.2 *King Cetshwayo District Municipality and the City of uMhlathuze Local Municipality*

The Port of Richards Bay is located in the City of uMhlathuze Local Municipality (uMhlathuze Local Municipality), which falls into the King Cetshwayo District Municipality (KCDM). The KCDM is one of the eleven (11) district municipalities within the KZN Province. It has a total of six (6) local municipalities namely: City of uMhlathuze, Umlalazi, Nkandla, Mbonambi, Ntambanana and Mthonjaneni Local Municipalities. The onshore logistics base will be located in Ward 2. *Figure 5.20* shows the administrative structure of the respective levels of government.

Figure 5.20 *Administrative Structure*



KCDM is located in the north eastern region of KZN, covering a total of 8,213 km². It has the third highest population in the KZN Province with an estimated total of 971,135 people. The District is home to the largest deep water port on the African continent ie the Port of Richards Bay.

The Port of Richards Bay handles over 75 million tons of cargo per annum, which is double the capacity of the Port of Durban to the south. In light of the above, the Port of Richards Bay has played a significant role in developing the manufacturing sector in the region, thus enabling it to be a large contributor to the economy and gross geographic product (uMhlathuze Municipality SDF, 2017/2018).

With this said, the KCDM has various challenges, including deep rural communities which are poverty stricken, a lack of basic services such as water and sanitation and unemployment (uMhlathuze Municipality SDF, 2017/2018).

Population Demographics

The uMhlathuze Local Municipality has a population of 410,465 people according to the 2016 community survey (StatsSA). This number has grown by 22.73 percent since the last census in 2011. Using the survey conducted in 2011, it was calculated that the uMhlathuze Municipality has a household size of approximately 3.95 people for an estimated total of 103,915 households (uMhlathuze Municipality SDF, 2017/2018). Comparative information around the population for the district and local municipality is provided in *Table 5.3.*

Table 5.3 Population Summary

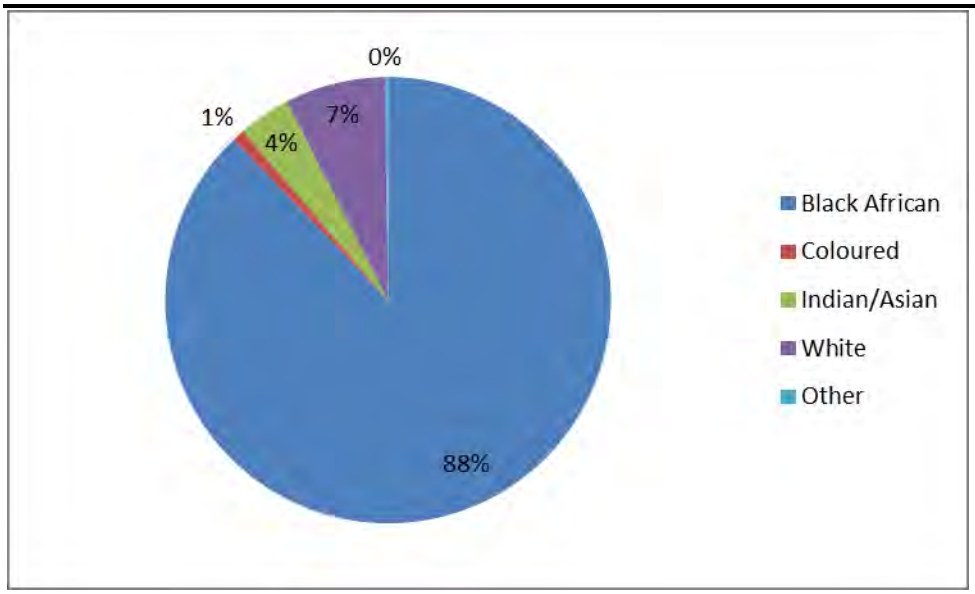
Year	Administrative Area Name	Size	Population	Growth Percentage
2011	King Cetshwayo District Municipality	8,213 km²	907,519	
2011	City of uMhlathuze Local Municipality	1,233 km²	334,459	
2016	King Cetshwayo District Municipality	8,213 km²	971,135	7.01
2016	City of uMhlathuze Local Municipality	1,233 km²	410,465	22.73

Source: uMhlathuze Municipality SDF, 2017/2018

According to the 2011 census, Black Africans are the majority population group making up 87.7 percent of the population. White people make up 7.3 percent, while the other population groups make up the rest as shown in *Figure 5.21.*

IsiZulu is the dominant language spoken in the uMhlathuze Local Municipality with 78.7 percent speaking the language (StatsSA, 2016).

Figure 5.21 Ethnic Composition in the City of uMhlathuze Local Municipality



Source: StatsSA 2016

Local Economy and Livelihoods

The uMhlathuze Local Municipality and KCDM economies are both primarily driven by Port of Richards Bay, which is one of the two largest and busiest ports on the African continent. This area contributes a total of 16.7 percent towards the KZN Gross Domestic Product (GDP).

The main activities being undertaken in the uMhlathuze Local Municipality include large scale industrial activities including coal terminals, aluminium smelters, as well as mining, paper mills, forestry, production of materials handling equipment and fertiliser and special chemicals production (uMhlathuze Municipal IDP, 2012/2017).

Unemployment

The unemployment rate in the uMhlathuze Local Municipality is estimated to be 40 percent (uMhlathuze Municipal IDP, 2012/2017). This comprises people who are unemployed but seeking employment, as well as those who are not seeking employment. According to the IDP, the unemployment issue is as a result of the lack of skills, which is largely attributed to apartheid regime where a system was created that excluded the majority of the population from receiving quality education, but directed them to semi-skilled or unskilled labour instead (uMhlathuze Municipal IDP, 2012/2017).

Education

An uThungulu (KCDM) Quality of Life Survey conducted in 2009 illustrated that a larger percentage of the population was noted to have reached secondary education (30.52 percent).

Only 22.41 percent reached grade 12 and a smaller 8.45 percent make it to tertiary level education (uMhlathuze Municipal IDP, 2012/2017). A pattern is seen in the District where the level of education decreases whilst the demand for skills increases.

Social Infrastructure and Services

Water and Sanitation

The City of uMhlathuze receives funding from the Municipal Infrastructure Grant (MIG). This funding is used for water (70 percent) and sanitation (30 percent) services. This funding, however, was found to be ineffective in improving sanitation services in the area. A total of 86.37 percent of the households in the uMhlathuze Local Municipality has access to basic RDP (1) level water services, whereas 57.91 percent have access to basic level sanitation services.

Waste

An estimated 53.5 percent of households have their waste removed by the local authority or a private company at least once a week. There is a large number of households that rely on their own refuse dumps, (38.4 percent) and a small percentage relies on communal dump alternatives (2.6 percent) (StatsSA, 2016).

Energy

The uMhlathuze Local Municipality has no backlog of households waiting for services in terms of energy supply in the area. The regulator has enforced a grid code which provides guidelines and rules governing how Municipalities are to create and maintain electrical infrastructure assets. All energy distributors are to comply with the Distribution Grid Code as part of their licence (uMhlathuze Municipal IDP, 2012/2017).

Health

Within the uMhlathuze Local Municipality there are four hospitals and 23 health clinics. The IDP identified a need for additional health facilities in remote Traditional Authority areas.

The KCDM had an HIV prevalence of 38.5 percent in 2012 in the age groups 15 to 45 years, up from 33.4 percent the previous year (District Health Plan 2015/2016). This is significantly higher than the prevalence rate in KZN (25 percent) and South Africa (18 percent). The uMhlathuze Local Municipality IDP notes that there is a lack of clear and reliable data regarding HIV/ AIDS at a local municipal level, but that it is clear that it is a serious problem.

(1) Reconstruction and Development Programme (RDP)

It is further noted that the Tuberculosis (TB) cases in both the KCDM and the uMhlathuze Local Municipality are high, with TB being the leading cause of death in the KCDM (District Health Plan 2015/2016).

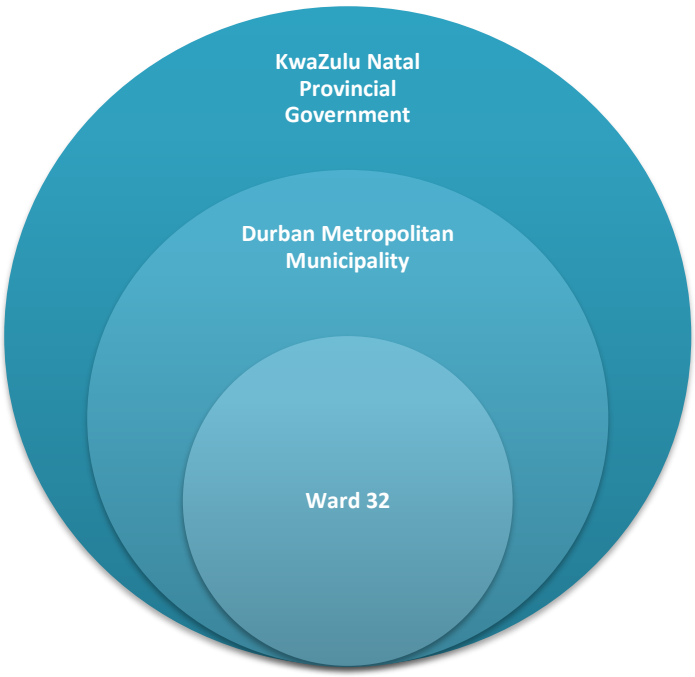
5.4.3 eThekwini Metropolitan Municipality

Administrative Structure

The onshore logistics base for the project may be situated in the Port of Durban, which is located in the eThekwini Metropolitan Municipality, Ward 32. *Figure 5.22* shows the administrative structure of the respective levels of government.

eThekwini Metropolitan Municipality (eThekwini Municipality) is a category A municipality which is located on the East Coast of South Africa, occupying an area of approximately 2,297 km^2 and comprises a population of 3,555,868 people (eThekwini Municipality IDP, 2016/2017). eThekwini Metropolitan is bordered by three district municipalities namely: iLembe to the north, uGu to the south and uMgungundlovu to the west (SDF, 2016/2017). It is characterised by its hilly topography and many gorges and ravines. It also houses one of Africa's most well managed and busiest ports, the Port of Durban. Durban is the largest city in KZN with just over one third of its total population, and it is the third largest city in the country (StatsSA, 2016).

Figure 5.22 Administrative Structure



Population Demographics

The population of eThekwini Municipality is approximately 3,555,868 people (eThekwini Municipality IDP, 2016/2017). The population is spread in such a way that the most concentrated region is the central and north planning regions. The outer west region however, which comprises the largest surface area (approximately 78,438 ha) only houses 11 percent of the total Municipality's population. The northern region houses 33 percent of the Municipality's population, and the central region houses 34 percent of the total population (eThekwini Municipality SDF, 2016/2017).

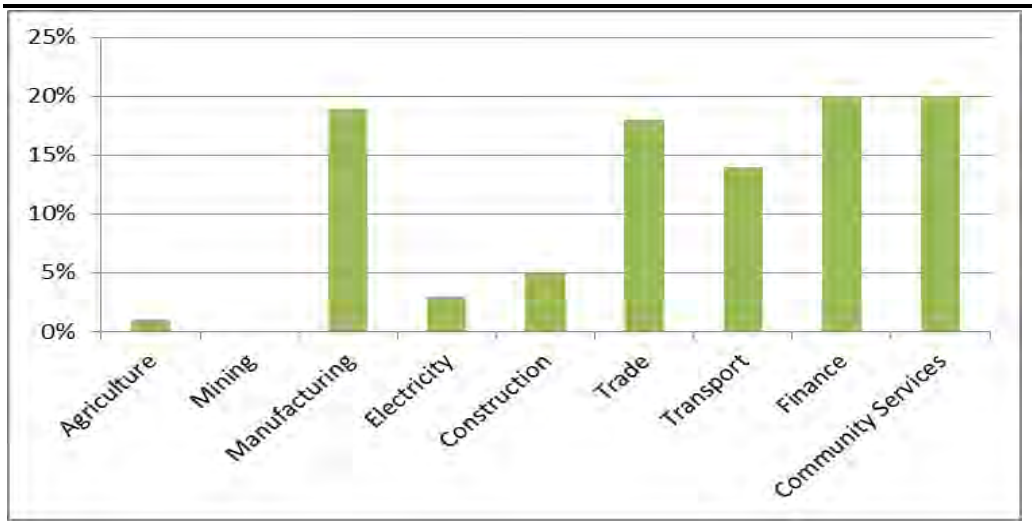
The gender profile in the eThekwini Municipality represents a larger percentage of females (51 percent) to males (49 percent). The majority of the population falls within the 0 – 29 age range, whereas the 60 – 70 age range constitutes a very small percentage of the population (eThekwini Municipality SDF, 2016/2017).

Local Economy and Livelihoods

According to the Quarterly Labour Force Survey by Statistics South Africa, the eThekwini municipal region was recorded to have the lowest unemployment rate in the second quarter of 2015 with only 16 percent of the region being unemployed (eThekwini Municipality IDP, 2016/2017). This region employs approximately 9 percent of the national population. Currently, eThekwini Metropolitan makes up 57.1 percent of the Provincial Gross Domestic Product (GDP), and 1 percent of the national GDP (eThekwini Municipality IDP, 2016/2017).

The sectors contributing the most to the eThekwini Municipality economy is the Finance and Community Services sectors (20 percent each), with Agriculture contributing the least with 1 percent (eThekwini Municipality IDP, 2016/2017). The figure below illustrates the sectoral composition of the GDP in the eThekwini Metropolitan Municipality.

Figure 5.23 Sectoral Composition of GDP in 2014: eThekwini Metropolitan Municipality

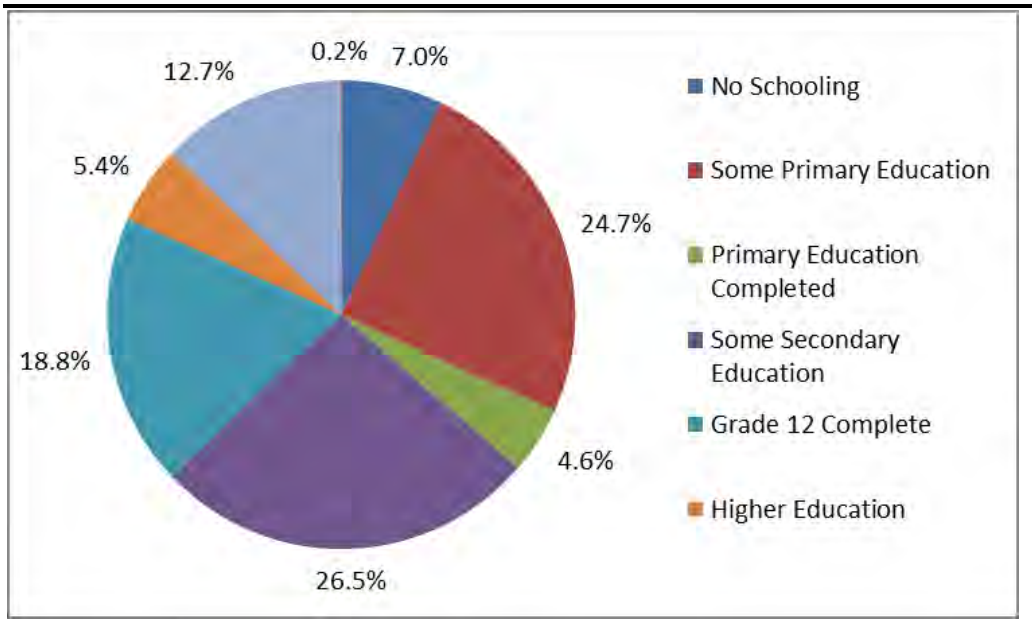


Source: eThekwini Municipality IDP, 2016/2017

Education

According to the eThekwini Spatial Development Framework (2016/2017), 29 percent of the eThekwini Metropolitan Municipality has some secondary education, while, only 8 percent has tertiary level education. *Figure 5.24* below illustrates the educational breakdown within the eThekwini Municipality.

Figure 5.24 Education Profile within eThekwini Metropolitan Municipality



Source: eThekwini Municipality SDF, 2016/2017

Social Infrastructure and Services

Water and Sanitation

Approximately 933,121 households were recorded to have access to water services in 2014/2015 at the Municipality. This marks 98.65 percent coverage across the region. The eThekwini Municipality currently maintains and manages 327 water storage facilities.

Energy

The portion of houses with no connection to electricity has decreased by 6.1 percent between the period of 2011/2012 and 2014/2015. The eThekwini Municipality aims to sustain this growth through the maintenance and handling of 152 major substations within the derestriction. In addition, the Municipality manages 31 waste water treatment plants, and 300 pump stations which have enabled it to reduce the sanitation backlog by 24 percent over a 5 year period.

Health

The prevalence of HIV/ AIDS in the eThekwini Municipality is high, as it is in the rest of South Africa (18 percent) and KZN (25 percent). Tuberculosis (TB) is recognised as the leading opportunistic infection amongst HIV positive persons with approximately two thirds of HIV infected persons co-infected with TB. In 2009 a total of 43,739 new and retreatment cases (both HIV positive and HIV negative) were registered in the eThekwini Municipality, making it one of the districts with the highest number of TB cases in South Africa. However the treatment rate in the eThekwini Municipality is high and treatment rates have improved from 70.8 percent in 2011 to 79,5 percent in 2013 (eThekwini Municipality IDP).

Key challenges relating to health service provision in the eThekwini Municipality are:

- High rate of HIV/AIDS and TB.
- High teenage pregnancy rate.
- Sexual abuse in children less than sixteen years.
- Abuse of chemical substances (drugs and alcohol). Lobby for change in the legislative framework.
- High incidence of injuries and trauma.
- Inequitable distribution of resources towards an urban bias.
- Only 66 percent of eThekwini residents have access to primary level care facility within a 5km access distance.
- Primary Health Care services are considered an unfunded mandate for the municipality however there are ongoing negotiations to improve funding.
- The number of Environmental Health Practitioners (EHPs) remains below the expected norms, however, the municipality has a multi-year funding plan to increase these numbers starting with the employment of 35 EHPs in the 12/13 financial year.
- Challenges with professional ethics and management capacity.

5.4.4 Fisheries

South Africa has a coastline that spans two ecosystems over a distance of 3,623 km, extending from the Orange River in the west on the border with Namibia, to Ponta do Ouro in the east on the Mozambique border.

The western coastal shelf has highly productive commercial fisheries similar to other upwelling ecosystems around the world, while the East Coast is considerably less productive but has high species diversity, including both endemic and Indo-Pacific species. South Africa's commercial fisheries are regulated and monitored by DAFF (previously managed under the Department of Environmental Affairs: Directorate: Marine and Coastal Management). All fisheries in South Africa, as well as the processing, sale in and trade of almost all marine resources, are regulated under the Marine Living Resources Act, 1998 (No. 18 of 1998) (MLRA).

Approximately 14 different commercial fisheries sectors currently operate within South African waters. In summary the sector comprises the following:

- Primary fisheries in terms of economic value and overall tonnage of landings are the demersal (bottom) trawl and long-line fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*) and the pelagic-directed purse-seine fishery targeting pilchard (*Sardinops ocellatus*), anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whitheadii*).

- Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African waters by the pelagic long-line and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*).

- The traditional line fishery targets a large assemblage of species close to shore including snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus japonicus*), yellowtail (*Seriola lalandi*) and other reef fish.

- Crustacean fisheries comprise a trap and hoop net fishery targeting West Coast rock lobster (*Jasus lalandii*), a line trap fishery targeting the South Coast rock lobster (*Palinurus gilchristi*) and a trawl fishery based solely on the East Coast targeting penaeid prawns, langoustines (*Metanephrops andamanicus* and *Nephropsis stewarti*), deep water rock lobster (*Palinurus delagoae*) and red crab (*Chaceon macphersoni*).

- Other fisheries include a mid-water trawl fishery targeting horse mackerel (*Trachurus trachurus capensis*) predominantly on the Agulhas Bank, South Coast and a hand-jig fishery targeting chokka squid (*Loligo vulgaris reynaudii*) exclusively on the South Coast.

In addition to commercial sectors, recreational fishing occurs along the coastline comprising shore angling and small, open boats generally less than 10 m in length. The commercial and recreational fisheries are reported to catch over 250 marine species, although fewer than 5 percent of these are actively targeted by commercial fisheries, which comprise 90 percent of the landed catch.

Most commercial fish landings must take place at designated fishing harbours. For the larger industrial vessels targeting hake, only the major ports of Saldanha Bay, Cape Town, Mossel Bay and Port Elizabeth are used. There are more than 230 (1) small-scale fishing communities on the South African coastline, ranging in size from small villages to towns. Small-scale fisheries commonly use boats but occur mainly close to the shore.

Description of Commercial Fishing Sectors and Fisheries Research Surveys

The fishing sectors which overlap with Block ER236 or may potentially be affected by the project activities are described in this section.

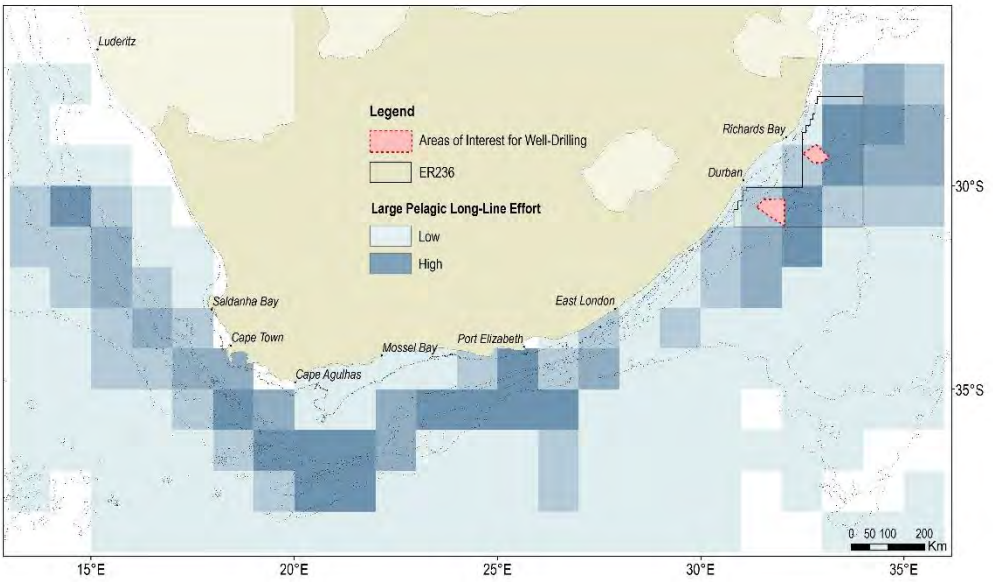
Large Pelagic Long Line

Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African Exclusive Economic Zone (EEZ) by the pelagic long-line and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). Tuna, tuna-like species and billfishes are migratory stocks and are therefore managed as a "shared resource" amongst various countries under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). In the 1970s to mid-1990s the fishery was exclusively operated by Asian fleets (up to 130 vessels) under bilateral agreements with South Africa. From the early 1990s these vessels were banned from South African waters and South Africa went through a period of low fishing activity as fishing rights issues were resolved. Thereafter a domestic fishery developed and 50 fishing rights were allocated to South Africans only.
These rights holders now include a small fleet of local long-liners, although the fishery is still undertaken primarily with Japanese vessels fishing in joint ventures with South African companies. There are currently 30 commercial large pelagic fishing rights issued and 21 vessels active in the fishery.

The fishery operates extensively within the South African EEZ, primarily along the continental shelf break and further offshore. As indicated in *Figure 5.25*, the Block ER236 coincides with the spatial distribution of pelagic long-line fishing effort.

(1) DAFF. 2016. Small-Scale Fisheries. A guide to the small-scale fisheries sector. http://small-scalefisheries.co.za/wp-content/downloads/SSF%20Booklet%20English.pdf

Figure 5.25 Spatial Distribution of National Pelagic Long-line Fishing Effort

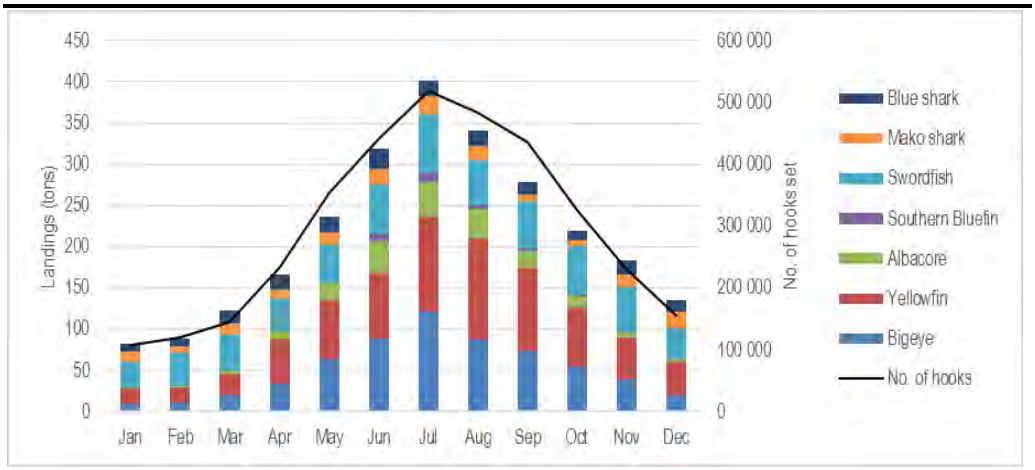


Note: The fishing effort is expended by the long-line sector targeting large pelagic species in relation to ER236 and the proposed areas of interest

Source: Capmarine, 2017

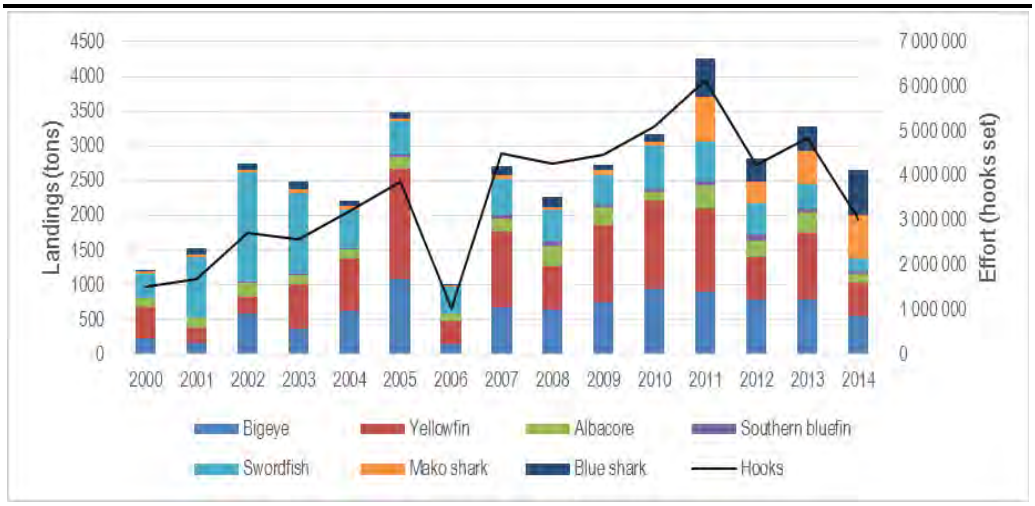
The fishery operates year-round with a relative increase in effort during winter and spring (see *Figure 5.26*). Catch per unit effort (CPUE) variations are driven both by the spatial and temporal distribution of the target species and by fishing gear specifications. Variability in environmental factors such as oceanic thermal structure and dissolved oxygen can lead to behavioural changes in the target species, which may in turn influence CPUE (Punsly and Nakano, 1992). During the period 2000 to 2014, the sector landed an average catch of 4,527 tons and set 3.55 million hooks per year. Catch and effort figures reported by the fishery for the years 2000 to 2014 are shown in *Figure 5.27*

Figure 5.26 Intra-Annual Variation of Catch and Effort Recorded by the Large Pelagic Long-Line Sector (Average Figures for the Period 2000 – 2014)



Source: Capmarine, 2017

Figure 5.27 ***Inter-Annual Variation of Catch Landed and Effort Expended by the Large Pelagic Longline Sector (2000 - 2014).***

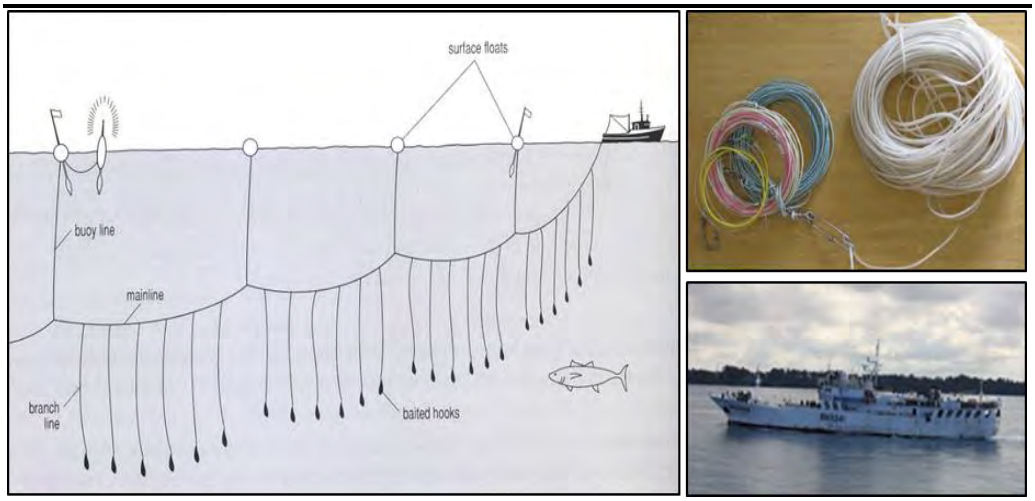


Source: Capmarine, 2017

Gear consists of monofilament mainlines of between 25 km and 100 km in length which are suspended from surface buoys and marked at each end (see *Figure 5.28*). As gear floats close to the water surface, it would present a potential obstruction to surface navigation. The main fishing line is suspended about 20 m below the water surface via dropper lines connecting it to surface buoys at regular intervals. Up to 3,500 baited hooks are attached to the mainline via 20 m long trace lines, targeting fish at a depth of 40 m below the surface. Various types of buoys are used in combinations to keep the mainline near the surface and locate it should the line be cut or break for any reason. Each end of the line is marked by a Dahn Buoy and radar reflector, which marks the line position for later retrieval.

Lines are usually set at night, and may be left drifting for a considerable length of time (up to 18 hours) before retrieval, which is done by means of a powered hauler at a speed of approximately one knot. During hauling, vessel manoeuvrability is severely restricted and, in the event of an emergency, the line may be dropped and hauled in at a later stage.

Figure 5.28 Typical Configuration of Long-Line Gear Targeting Pelagic Species (Left)



Note: This figure also includes a photograph of mainline with dropper line and trace line (upper right) and photograph of typical high seas long-line vessel (lower right).

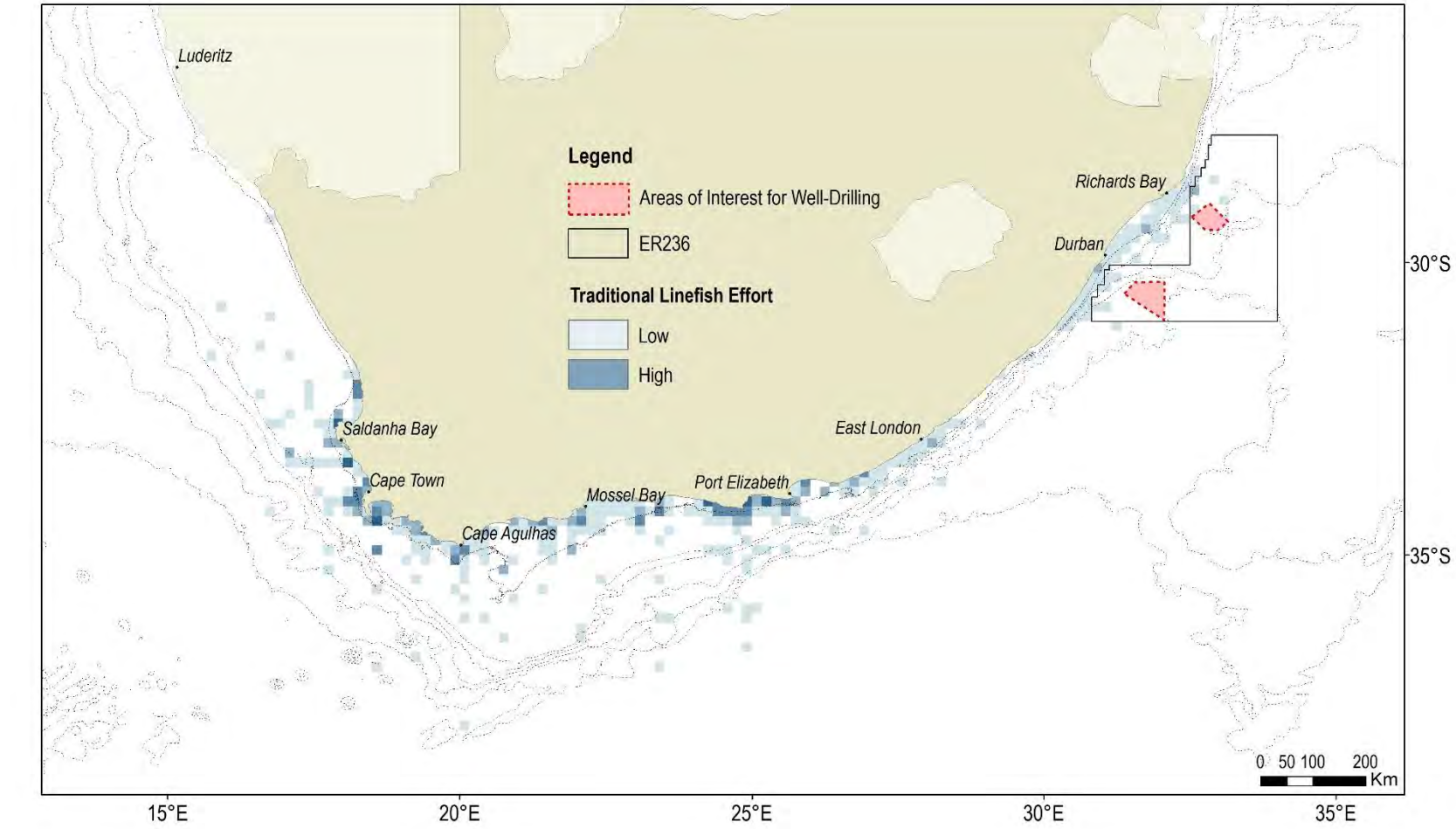
Source: Capmarine, 2017

Traditional Line Fish

The traditional line fishery is the country's third most important fishery in terms of total tons landed and economic value. It is a long-standing, nearshore fishery based on a large assemblage of different species. Within the Western Cape the predominant catch species is snoek (*Thyrsites atun*) while other species such as Cape bream (hottentot) (*Pachymetopon blochii*), geelbek (*Atractoscion aequidens*), kob (*Argyrosomus japonicus*) and yellowtail (*Seriola lalandi*) are also important. Towards the East Coast the number of catch species increases and includes resident reef fish (*Sparidae* and *Serranidae*), pelagic migrants (*Carangidae* and *Scombridae*) and demersal migrants (*Sciaenidae* and *Sparidae*). The fishery is widespread along the country's shoreline from Port Nolloth on the West Coast to Cape Vidal on the East Coast *(Figure 5.29)*. Effort is managed geographically with the spatial effort of the fishery divided into three zones. Most of the catch (up to 95 percent) is landed by the Cape commercial fishery, which operates on the continental shelf from the Namibian border on the West Coast to the Kei River in the Eastern Cape. Fishing vessels generally range up to a maximum offshore distance of about 70 km, although fishing at this outer limit and beyond is sporadic (C. Wilke, pers. comm[1]). The spatial distribution of line-fishing effort coincides with inshore areas of Block ER236.

[1] Mr C. Wilke (christopherW@daff.gov.za) is the chief technician at DAFF and is the principle contact for line-fish data collation.

Figure 5.29 Spatial Distribution of Fishing Effort Expended by Traditional Line-Fish Sector



Source: Capmarine, 2017

Crustacean Trawl Fishery

South Africa's crustacean trawl fishery operates exclusively within the province of KZN. The fishery consists of inshore and offshore sectors, which differ according to their targeted species, areas of operation and gear types. The fishery is managed using a Total Applied Effort (TAE) strategy, which limits the number of vessels permitted to fish on the inshore and offshore grounds. There are currently five vessels operating within the inshore grounds with another two vessels restricted to working in the offshore grounds only.

The KZN prawn trawler fleet comprises steel-hulled vessels ranging in length from 25 to 40 m and up to a Gross Registered Tonnage (GRT) of 280 tons. All are equipped with GPS, echosounders, radar and VHF/SSB radio. Most vessels are single otter trawlers, deploying nets from the stern or side at a speed of two to three knots. Trawl net sizes range from 25 m to 72 m footrope length, with a minimum mesh size of 60 mm. The duration of a typical trawl is four hours. Trip lengths range from three to four weeks and vessels may carry a crew of up to 20.

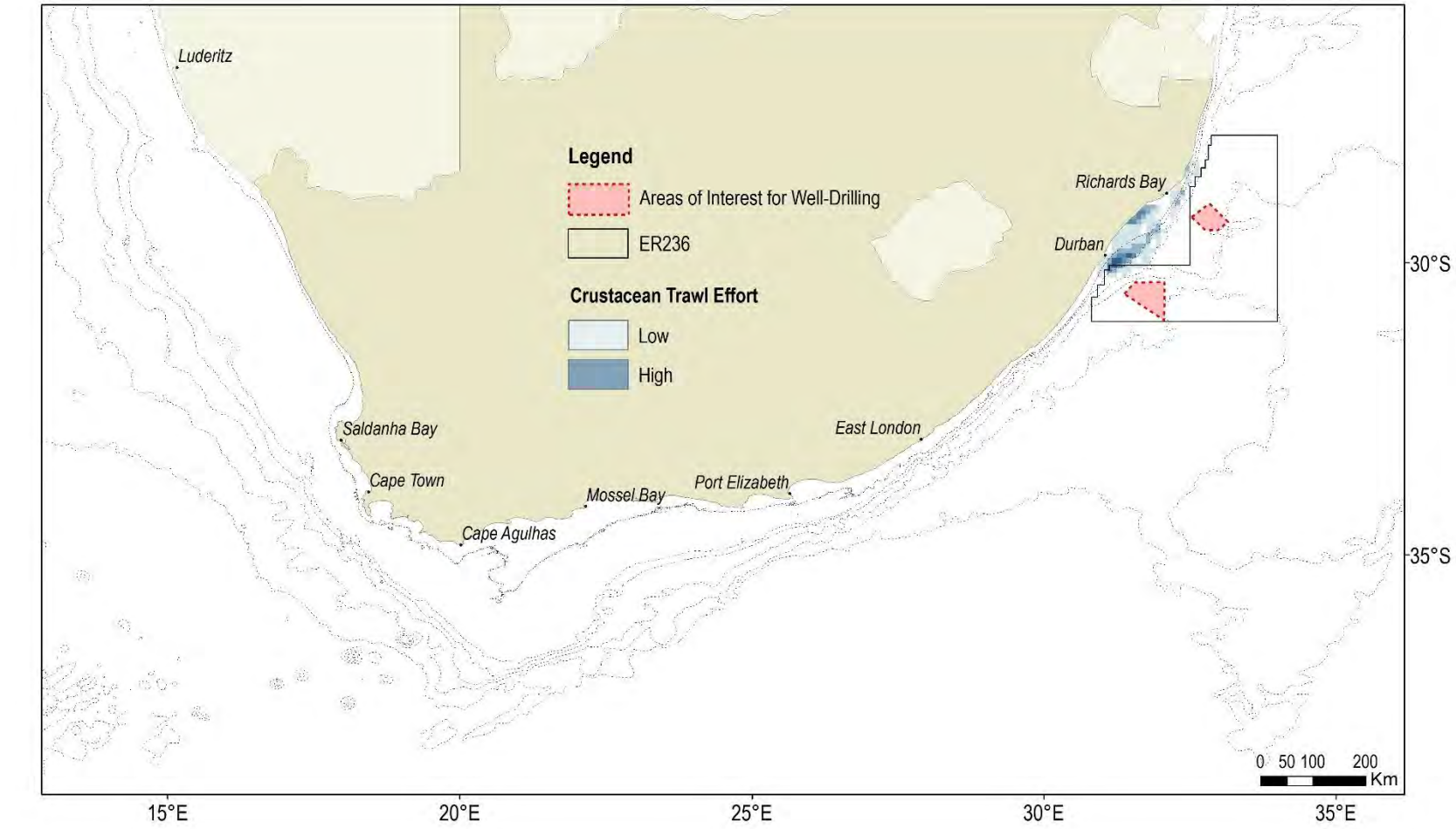
The inshore fishery is based on white prawns (*Fennereopenaeus indicus*), tiger prawns (*Penaeus monodon*) and brown prawns (*Metapenaeus monoceros*) which occur on the shallow water mud banks along the north-eastern coast of KZN. There are few areas within the habitat distribution of penaeid prawns that are suitable for trawling due to the steep drop off of the continental shelf on the East Coast. The inshore fishery operates on the Tugela Bank in water depths of up to 50 m and within 10 nautical miles (approximately 18.5 km) of the shore. There is a seasonal closure of the Tugela Bank grounds in order to minimise high bycatch levels, therefore trawlers operate only within these inshore grounds during the period March to August. During summer months activity shifts northwards towards St Lucia, where the fishery targets bamboo prawns (*Penaeus japonicus*) in addition to the previously-mentioned species. The prawn species on which the inshore fishery is based are fast-growing and are dependent on estuarine environments during the early phase of their life cycle. As juveniles they recruit onto the mud banks where they mature and reproduce. The catch composition within the fishery typically comprises 20 percent prawn species, while approximately 10 percent of the remainder of the catch is also retained for its commercial value and includes crab, octopus, squid, cuttlefish and line-fish. The remainder of the catch is discarded.

The deep water fishery operates between water depths of 100 m and 600 m from Amanzimtoti in the south to Cape Vidal in the north, covering approximately 1,700 km^2 along the edge of the continental shelf. The boundary between the delimitation of offshore and inshore fisheries is about seven nautical miles (12.9 km) from the shore. Offshore trawling takes place year-round. Targeted species include pink (*Haliporoides triarthus*) and red prawns, langoustines (*Metanephrops andamanicus* and *Nephropsis stewarti*), red crab (*Chaceon macphersoni*) and deep water rock lobster (*Palinurus delagoae*).

Catches are packed and frozen at sea and landed at the ports of Richards Bay or Durban.

Figure 5.30 indicates the location of fishing grounds in relation to the Block ER236. There is a potential overlap of the crustacean trawl fishery with the Block ER236.

Figure 5.30 Spatial Distribution of Effort Expended by the Crustacean Trawl Fishery



Source: Capmarine, 2017

5.4.5 *Marine Traffic*

A large number of vessels navigate along the East Coast on their way around the southern African subcontinent. The majority of this boat traffic, including commercial and fishing vessels, remains relatively close inshore on the East Coast. North- and south-bound cargo vessels usually remain over the mid-shelf (100 m isobath). In contrast, tankers and bulk carriers remain further offshore, unless needing to move inshore to avoid extremely rough conditions that develop in the Agulhas Current. Block ER236 may overlap with the routes taken by tankers and bulk carriers. The supply vessels may interact with the inshore vessel traffic due to the collection of supplies from the Port of Richards Bay or the Port of Durban. Important East Coast commercial harbours include Port Elizabeth, East London, Durban and Richards Bay.

5.4.6 *Recreational Uses*

Recreational use of the East Coast marine environment involves both consumptive and non-consumptive uses. The former involves coastal and boat-based users removing marine resources for their own consumption (eg recreational fishing), while the latter involves users making use of the marine environment without removing any marine resources from the area.

Consumptive Uses

Consumptive uses of marine resources along the East Coast includes recreational shore and boat-based anglers (Brouwer *et al*., 1997), spearfishers (Mann *et al*, 1997), divers collecting subtidal invertebrates, and exploiters of intertidal organisms. The recreational use of marine resources along the East Coast typically occurs within inshore waters in the vicinity of coastal towns and holiday resorts. As the northern area of interest is located a minimum of 62 km offshore and the southern area of interest a minimum of 65 km offshore, it is unlikely that the proposed exploration drilling activity will interfere with onshore recreational users. There is however a possibility that the offshore recreational boat-based fishing activities could be affected if they travel offshore and into the Block ER236.

Non-Consumptive Uses

Non-consumptive utilisation of the marine environment along the East Coast includes water sports such as surfing, boat sailing, power boating, diving, and nature watching and beach recreation.

As noted above, Block ER236 is located from 20 km offshore and thus sailing/ boating activities are unlikely to occur within Block ER236. However, there is a possibility of encountering sailing vessels passing into or out of South African waters.

5.4.7 *Mineral and Petroleum Prospecting and Exploration Rights and Activities*

Exploration activities are being undertaken in neighbouring oil and gas blocks including the following, which are currently under Exploration Right:

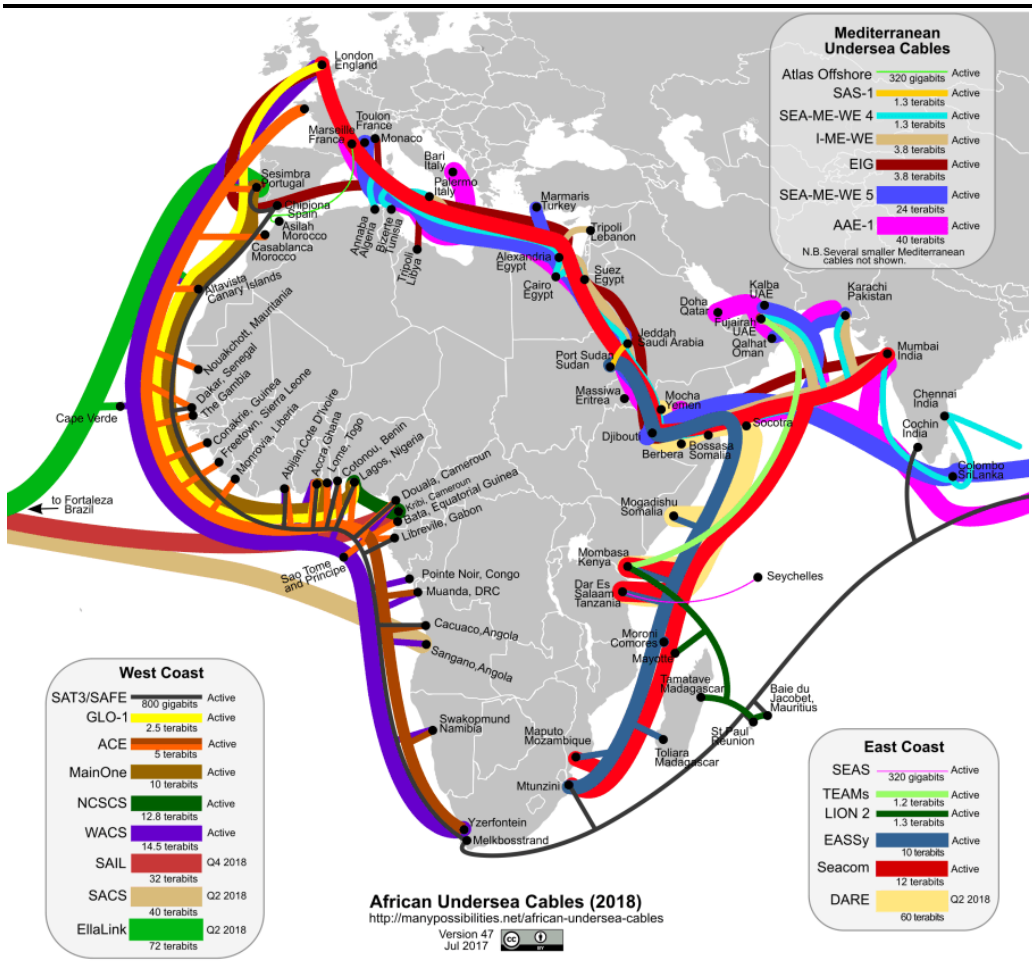
- Tugela South operated by EMEPSAL to the north-west.
- DeepWater Durban operated by EMEPSAL to the south.
- Silverwave deepwater block to the east.

No mineral prospecting activities are currently being undertaken within the Block ER236, which is situated in deep water. Although some mineral prospecting has taken place in South African waters, commercially viable ore has not been found.

5.4.8 *Submarine Cables*

There are a number of submarine telecommunications cable systems in South African waters (*Figure 5.31*). The SAFE, EASSy and Seacom cables land at Mtunzini, located approximately 40 km south of Richards Bay. Both the EASSy and Seacom cables may pass through Block ER236.

Figure 5.31 ***Submarine Cables***



Source: https://manypossibilities.net/african-undersea-cables/

5.5 SUMMARY OF KEY SENSITIVITIES

Table 5.4 Summary of Key Sensitivities

Feature	Description
Agulhas Current	• The Agulhas Current forms between 25° and 30° S, its main source coming from recirculation in a South-West Indian Ocean subgyre. • It flows southwards at a rapid rate following the shelf edge along the East Coast, before retroflecting between 16° and 20° E. It is a well-defined and intense jet some 100 km wide and 2,300 m deep. • Current speeds of 2.5 m/s or more have been recorded.
Seabed features and benthic habitat	• The AOI for well drilling lies east of the Natal Bight in >1,500 m water depth. • The Goodlad Canyon is located just to the south of the northern area of interest. • The Goodlad Canyon differs significantly in morphology from those in northern KZN, where coelacanths have been reported and therefore it is unlikely that coelacanths will be found here. • There is evidence from the seismic data collected in the northern area of interest of deep water canyons being present in the center of the area. No drilling will be undertaken in the canyons. • In the northern area of interest for well drilling Southwest Indian Upper and Lower Bathyal benthic habitats are found, whereas Southern Indian Lower Bathyal benthic habitat dominates in the southern area of interest, both of which have been assigned an ecosystem threat status of 'least threatened' in the SANBI 2011 National Biodiversity Assessment. • The benthic communities within these habitats are generally ubiquitous throughout the southern African East Coast region, being particular only to substratum type and/or depth zone.
Deep Water Corals	• The occurrence of deep water corals in Block ER 236 and the areas of interest are unknown.
Whales and Dolphins	• There are 36 species of cetaceans that are likely to be found within Block ER236. Of the 36 species, the Antarctic Blue whale is 'critically endangered', the Indo-Pacific humpback dolphin, fin whale and sei whale are considered 'endangered' and the Ifafi-Kosi Bay sub-population of the Indo-Pacific bottlenose dolphin, Sperm whale and Bryde's whale (inshore population) are considered 'vulnerable' in the IUCN South African Red Data book List Assessment. • The most common species within the areas of interest (in terms of likely encounter rate not total population sizes) are likely to be the common bottlenose dolphin, Indo-pacific bottlenose dolphin, short-finned pilot whale and humpback whale. • ER236 lies within the migratory route of Humpback (Least Concern) and Southern Right (Least Concern) whales. o Southern right whales will pass through Block ER236 in July and August and again on their southward migration in October/November. o Humpbacks have a bimodal distribution off the East coast, most reaching southern African waters around April, continuing through to September/October when the southern migration begins and continues through to December and as late as February. The calving season for Humpbacks extends from July to October, peaking in early August.

Feature	Description
Marine Turtles	• Five species of turtle are known to occur along the East Coast: leatherback, which is most frequently sighted, and the loggerhead, green, olive ridley and hawksbill turtles. In the IUCN Red listing, the hawksbill turtle is described as 'Critically Endangered', green turtle is 'Endangered' and leatherback, loggerhead and olive ridley are 'Vulnerable' on a global scale. • Both the leatherback and the loggerhead turtle nest on the beaches of the northern KZN coastline (St Lucia, iSimangaliso) between mid-October and mid-January. Hatchlings are born from mid-January through to mid-March when the Agulhas Current is warmest. Once hatchlings enter the sea, they move southward following the Agulhas Current and are thought to remain in the southern Indian Ocean gyre for the first five years of their lives. • The inshore regions of the northern portion of Block ER236, coincide with the inter-nesting migrations for leatherbacks, but the northern area of interest lies offshore of the inter-nesting range. • Leatherback and loggerheads are likely to be encountered in Block ER236 during their foraging migrations.
Marine Protected Areas	• Block ER236 does not overlap with the existing iSimangaliso Wetland Park. • Although Block ER236 overlaps with the proposed Protea Banks MPA and the extention of the iSimangaliso Wetland Park MPA, there is no overlap of the areas of interest with the proposed protection areas. • It should be noted that sections of the original ER236 which overlapped with the existing iSimangaliso and Aliwal Shoal MPA's were relinquished during the Exploration Right renewal process in 2016.
Fish spawning, nursery and recruitment areas	• The areas of interest are offshore of the major fish spawning and migration routes and ichthyoplankton abundance is likely to be low. • The sardine run along the Eastern Cape coast and up to southern KZN is inshore of the area of interest. • Pilchard eggs are inshore of the areas of interest.
Long Line Fishing	• The areas of interest overlaps with the long line fishing area which targets primarily tuna but also swordfish. • Block ER236 overlaps with the crustacean trawl fishery.
Marine Traffic	• The Project Area may overlap with the routes taken by tankers and bulk carriers. The supply vessels may interact with the inshore vessel traffic due to the collection of supplies from the Port of Durban. • Important East Coast commercial harbors include Port Elizabeth, East London, Durban and Richards Bay.
Recreational users	• The recreational use of marine resources along the East Coast typically occurs within inshore waters in the vicinity of coastal towns and holiday resorts.

6 EIA PROCESS

6.1 INTRODUCTION

An Environmental Impact Assessment (EIA) is a systematic process that identifies and evaluates the potential impacts (both positive and adverse) a proposed project may have on the physical, biological, chemical, and social environment. Mitigation/ enhancement measures are subsequently developed that will be incorporated in order to eliminate, minimise or reduce adverse impacts and enhance positive impacts.

As described in *Chapter 2*, the process in South Africa is regulated by the NEMA Environmental Assessment Regulations (GNR R982/2014, as amended 2017). The overall Scoping and Environmental Impact Reporting (EIR) process is illustrated in *Figure 6.1*.

The EIA process that is being undertaken for the project is aligned with the requirements of the 2014 EIA Regulations (as amended).

Figure 6.1 Environmental Impact Assessment Process

6.2 APPROACH TO EIA

An EIA process is initiated by the Scoping Phase, as shown in *Figure 6.1*. During the Scoping Phase, the Terms of Reference for the full EIA is formulated and requirements from the authorities clarified, and potential issues and concerns identified via consultation. A pre-application initial notification period was undertaken for this EIA process in order to announce the project, provide initial information on the project and gather initial concerns. This process has assisted in developing the Interested and Affected Party (I&AP) database.

After completion of the Scoping Phase, detailed specialist studies will be undertaken in order to address issues identified during the Scoping Phase. Specialists are expected not only to provide baseline information in their particular field of expertise for the Project Area, but also to identify which project actions will result in significant impacts. Specialists will recommend ways in which adverse impacts could be mitigated to reduce their severity, and positive impacts enhanced.

Draft reports are submitted for public review, during which time ERM present the key findings to all I&APs. All comments made by I&APs are captured in a Comments and Response Report (CRR), and in this report responses to all issues and concerns raised during the public review period are provided.

All recommendations cited in the EIA report must be detailed in an Environmental Management Programme report (EMPr), which defines the mitigation/ enhancement actions to be implemented. EMPrs are recognised as important tools for the sound environmental management of projects.

6.3 SCOPING PHASE

A principal objective of the Scoping Phase is to identify the key environmental, social and health issues and those project activities with the potential to contribute to, or cause, impacts to the environmental and social receptors.

At the Scoping Phase, the key issues are identified (often together with input from key stakeholders) and understood to a level which allows the definition of the Plan of Study for the EIA.

Issues that are not relevant are scoped out. This enables the resources for the EIA to be focused on collecting required information and identifying significant impacts while carrying out specialist studies and stakeholder engagement activities in an effective and efficient manner.

Specifically, the objectives of the Scoping Phase are to:

- Understand the legislative context and establish a description of baseline conditions;
- Identify project alternatives and preferred options for the proposed development;
- Identify stakeholders and plan or initiate communication with these stakeholders so as to gather issues of concern;
- Identify potential significant impacts; and
- Develop the Plan of Study for the EIA which sets out the proposed approach to the EIA, potential impacts to be evaluated and methodology to be used.

The following steps have been undertaken as part of the Scoping Phase, and are described below:

- Pre-application correspondence with the PASA;
- Desktop review of available information;
- Preparation of the draft Scoping Report;
- Submission of application form;
- Release of draft Scoping Report for public comment; and
- Finalisation of Scoping Report for submission to PASA.

6.3.1 Desktop Review

An initial review of available information was conducted. The desktop review included the following tasks:

- Initial review of relevant legislative and guidance documents;
- Identification and review of secondary data;
- Development of an outline description of the planned project activities; and
- Development of a plan for stakeholder engagement.

6.3.2 Public Participation

Details of the public participation process are provided in *Section 6.6*.

6.3.3 Scoping Report

In accordance with the regulatory requirements stipulated in GNR 984 of the EIA Regulations, 2014 (as amended), this draft Scoping Report (including Plan of Study), has been compiled as part of the EIA process.

The Scoping Report will be made available to stakeholders through the project website, selected libraries, and hard copies provided on request for a period of 30 days. After the 30 day public comment period, a CRR will be compiled and included in the final report along with any other updates or changes. The final Scoping Report (including Plan of Study) will be submitted to the Petroleum Agency South Africa (PASA) for their consideration.

Registered I&APs will be notified once the final Scoping Report has been submitted. The CRR will be included in the final Scoping Report and distributed to registered I&APs.

6.3.4 Submission of Application Form

The completed EIA application form will be submitted to the competent authority together with the draft Scoping Report. In terms of the 2014 EIA Regulations (as amended) the final Scoping Report is to be submitted to the competent authority within 43 days of submission of the application form.

6.4 SPECIALIST STUDY PHASE

A number of specialist studies have been identified to address key issues of concern. The findings of these studies will be incorporated into the Environmental Impact Assessment Report (EIR) that will close out the Integration and Assessment Phase. Further information related to the approach to the specialist studies and the impact assessment is contained in the Plan of Study for EIA in *Chapter 8*.

6.5 INTEGRATION AND ASSESSMENT PHASE

The final phase of the EIA is the Integration and Assessment Phase, which is described in detail in the Plan of Study for EIA (*Chapter 8*).

The assessment of impacts proceeds through an iterative process considering three key elements:

a) Prediction of the significance of impacts that are the consequence of the proposed development on the natural and social environment.

b) Development of mitigation measures to avoid, reduce or manage the adverse impacts and enhance positive impacts.

c) Assessment of residual significant impacts after the application of mitigation measures.

The draft EIR will be made available to I&APs for a 30 days public comment period. Registered and identified I&APs will be notified of the release of the draft EIR and where the report can be reviewed.

A public meeting will be held where the findings of the specialist studies and outcomes of the Integration and Assessment Phase will be presented and discussed.

Comments received on the draft EIR will be assimilated and the EIA project team will provide appropriate responses to all comments. A Comments and Responses Report will be included in the final EIR, which will be submitted to PASA for decision-making.

All registered I&APs will be notified when an Environmental Authorisation has been issued by the DMR. A 90 day (maximum time should an appeal be submitted) appeal period will follow the issuing of the Environmental Authorisation.

Table 6.1 Proposed Timeframe for the EIA

Activity	Timing
Final Scoping Report Submission	March 2018
Scoping Report Approval	April 2018
Disclosure of Draft EIA Report	May 2018
Submission of Final EIA Report	July 2018
Environmental Authorisation	November 2018

6.6 PUBLIC PARTICIPATION DURING SCOPING

6.6.1 Public Participation Objectives

Public consultation is an inclusive and culturally appropriate process which involves sharing information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration. It allows stakeholders to understand the risks, impacts and opportunities of the project in order to achieve positive outcomes.

The public participation process is designed to provide information to and receive feedback from I&APs throughout the EIA process, thus providing organisations and individuals with an opportunity to raise concerns, make comments and suggestions regarding the proposed project. By being part of the assessment process, stakeholders have the opportunity to influence the project layout and design, input into mitigation measures and technical solutions as well as the Plan of Study for the EIA.

The main objectives of public participation are:

- To ensure that adequate and timely information is provided to those potentially affected by the project;
- To provide these groups with sufficient opportunity to voice their opinions and concerns; and

- To ensure that comments are received in a timely manner so that they can be taken into account in project decisions.

6.6.2 *Legislative Context*

Public participation with regards to EIA's in South Africa is determined by the principles of the National Environmental Management Act (NEMA) (Act 107of 1998, as amended) and elaborated upon in 'GN 657: Guideline 4: Public Participation' (Department of Environmental Affairs, 2017), which states that: "*Public participation process" in relation to the assessment of the environmental impact of any application for an environmental authorisation, is defined in terms of National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) as a process by which potential interested and affected parties are given opportunity to comment on, or raise issues relevant to, the application.*"

Public participation is required for an Environmental Authorisation process in terms of the EIA Regulations GN R.982 (December 2014, as amended).

6.6.3 *Public Participation Activities*

Table 6.2 details the public participation tasks that have been undertaken to date. More details around the initial consultation and the pre-scoping engagement activities are provided after the table.

Table 6.2 Public Participation Tasks

Activity	Description and Purpose
Pre-Application	
Preparation of a preliminary stakeholder database	A preliminary database has been compiled of authorities (local and provincial), Non-Governmental Organisations, neighbouring landowners and other key stakeholders (refer to *Annex B*). This database of registered I&APs will be maintained and updated during the ongoing EIA process.
Preparation and Distribution of a Background Information Document (BID)	BIDs were distributed via email/post to all I&APs on the stakeholder database. See *Annex B*. The BID provides an introduction to the project and the EIA process.
Advertisement of the Project	The project was advertised in four newspapers; The Mercury and Isolezwe (in Zulu) with distribution around Durban, and The Zululand Observer and Ilanga Newspaper (in Zulu), with distribution around Richards Bay. The dates of distribution were as follows: • The Mercury – 18 September 2017 • The Zululand Observer – 18 September 2017 • Ilanga (advert in isiZulu) – 21 September 2017 • Isolezwe (advert in isiZulu) – 21 September 2017 See proof of advertisement in *Annex B*.

Activity	Description and Purpose
Erection of Site Notices	Site notices were placed at the following locations: eThekwini Municipality libraries: • Durban North; • Durban Central Lending; • Amanzimtoti; • Warner Beach; • Isipingo Beach; • Umkomaas; and • Tongaat Beach. uMhlathuze Local Municipality: • Richards Bay Municipality; and • Richards Bay Library. Entrance to the Port of Richards Bay.
Development of an Initial Comments and Response Report	All comments received during the initial consultation period were recorded into a Comments and Response Report. See included in *Annex C*.
Scoping Phase	
Release of draft Scoping Report for Public Comment	The draft Scoping Report was released for public comment. An advert was published in four newspapers; The Mercury and Isolezwe (in Zulu) with distribution around Durban, and The Zululand Observer and Ilanga Newspaper (in Zulu), with distribution around Richards Bay. The adverts were published on Monday 22 January 2018. Notifications were sent to all stakeholders on the database and the report was made available online and in the following libraries: • Durban Public Library • Richards Bay Public Library • Port Shepstone Public Library The comment period started on 22 January 2017 and ended on 1 March 2018. All comments received by 5 March 2018 have been included in the final Scoping Report. *It should be noted that an earlier version of the Draft Scoping Report was released for comment on 27 October 2017. Due to a change in project scope a notification was sent out on 7 November 2017 to notify stakeholders that the report would be re-released (this report) for a full 30 day comment period in early 2018.

Activity	Description and Purpose
Public Engagement Meeting	A total of three Public engagement meetings were held in the following locations: • Richards Bay (The Richards Hotel) – 6 February 2018 • Durban (Tropicana Hotel) - 7 February 2018; and • Port Shepstone (Port Shepstone Country Club) – 8 February 2018. These meetings were held to present the proposed project and solicit input from stakeholders into the scoping process. As a result of the concerns raised during the public meetings, the Non-Technical Summary of the Scoping Report was revised and translated into isiZulu. This was then placed on the project website on 2 February 2018. The public comment period was then extended for a week from 22 February 2018 to give the public an opportunity to comment on the isiZulu version. A follow up meeting was held with the SDCEA and the public on request on 28 February 2018 at the Austerville Community Hall. ERM prepared a letter of response addressing issues raised during the Durban public meeting which were not responded to in full during the meeting due to time constraints. As a result of the concerns raised during this meeting, the comment period was further extended until 5 March 2018 to enable the public to comment on the letter of response prepared. Presentation, attendance registers and meeting notes have been included in Annex B of the Final Scoping Report.
EIA Phase	
Release of draft EIR and EMP for Public Comment	The draft EIR and EMPr document will be made available for a 30-day comment period to stakeholders and the relevant authorities. A notification will be sent to all registered I&APs on the project database. This letter will invite I&APs to comment on the draft EIR. Newspaper adverts will be placed in local newspapers notifying stakeholders of the availability of the draft EIR report for review and inviting them to public meetings. All comments received, along with responses will be included in the final EIR.
Public Engagement Meetings	Public engagement meetings will be held during the comment period in order to present the findings of the EIA to stakeholders and receive their feedback. Presentation, attendance registers and meeting notes will be included in the final Scoping Report.
Notification of Environmental Authorisation	I&APs will be notified of the Environmental Authorisation and the statutory appeal period.

7 IDENTIFICATION OF POTENTIAL IMPACTS

7.1 INTRODUCTION

A key part of the Scoping Phase is a preliminary analysis of the ways in which the project may interact (positively and negatively) with environmental (including physical and biological receptors) and social resources or receptors. The impacts that are identified as potentially significant during the Scoping process provide focus for the studies undertaken during the EIA Phase. Each of the potentially significant impacts will be discussed and assessed in more detail in the EIR.

In order to complete the Scoping Phase, the EIA team has drawn upon:

- Knowledge of sources of potential impacts associated with oil and gas exploration projects;
- An identification of the main environmental and social resources and receptors from the review of existing published data sources; and
- The results of the initial consultation.

This Chapter provides a preliminary identification and evaluation of the environmental and social impacts of the project.

7.2 RESOURCES AND RECEPTORS

For this project the following main resources and receptors were determined to be relevant.

- *Physical Environment:* ambient air quality, global climate, noise levels, light, seabed features and geology, seabed sediment and characteristics, marine water quality.
- *Biological Environment:* benthic communities, deepwater corals, seabirds, fish and pelagic flora and fauna, marine mammals, marine turtles, protected areas/critical habitats, mangroves, marine flora.
- *Human Environment:* community health, community safety and security; local community, workforce, government stakeholders, infrastructure (eg submarine cables) marine traffic and transportation; fishing, navigation, cultural heritage, tourism/recreation, employment and income, utilities, local economy, visual, occupation health and safety.

7.3 OUTCOME OF THE SCOPING PROCESS AND IMPACT IDENTIFICATION MATRIX

The interactions of project activities with resources and receptors were identified during the Scoping Phase.

Activities that will occur during the project (mobilisation, operation and decommissioning) were identified (*Table 7.1*).

The evaluation of the significance of an interaction between an activity and an environmental or social resource or/receptor was made and significance was rated according to the following scale:

	No interaction
I	Interaction with the environment or receptor which is not expected to be significant
S	Interaction with the environment or receptor that could be significant
P	Positive interaction

Table 7.1 *Summary of Impact Sources and Receptors*

	ACTIVITIES	ENVIRONMENT & RECEPTORS																																
		Physical								Biological							Human																		
	Project Activity	**Ambient Air Quality**	**Global Climate**	**Noise Levels (Airborne and Underwater)**	**Light**	**Seabed features and geology**	**Seabed sediment and characteristics**	**Marine Water Quality**	**Benthic Communities**	**Sensitive Seabed Features (incl deepwater corals)**	**Seabirds**	**Fish & Pelagic Flora & Fauna**	**Marine Mammals**	**Marine Turtles**	**Protected Areas/ Critical/Sensitive Habitat**	**Marine Flora**	**Community Health**	**Community Safety & Security**	**Local Community**	**Workforce**	**Government Stakeholders**	**Infrastructure (eg submarine cable)**	**Marine Traffic & Transportation**	**Fishing**	**Navigation**	**Cultural Heritage**	**Tourism/ Recreation**	**Employment & Income**	**Utilities (eg water, onshore waste facilities)**	**Local Economy**	**Visual Impact & Aesthetic**	**Occupational Health and Safety and Security**
1	**Vessel activities**																																	
1.1	Presence supply and support vessels from onshore logistics base			i									i								i		i	i	i								
1.2	Power generation by vessels	i	s																															
1.3	Disposal of non hazardous wastes																												i					
1.4	Disposal of hazardous wastes																												i					
1.5	Discharge of oily water (eg deck drainage, bilge water, machinery space)							i																										
1.6	Discharge of sanitary effluents (black and grey water)							i																										
1.7	Disposal of galley waste							i				i	i	i																				
1.8	Ballast from support and supply vessels (potentially international)																																	
1.9	Provision of potable water																												i					
1.10	Bunkering	i	i																															
1.11	Local labour, equipment and services supply																			p							p		p					
2	**Drilling**																																	
2.1	Drillship positioning			s								i	s	i										s	i		i							
2.2	Physical presence drillship, wellhead and riser			s	i	i	i		i	s											i	i	i	s	i						i		
2.3	Power generation on drillship	i	s																															i
2.4	Cooling water system							i																										
2.5	Provision of potable water to Person on Board (POB) (discharge from reverse osmosis plant)							i																										
2.6	Provision of water for muds																												i					
2.7	Disposal of excess Water Based Drilling Fluid (WBDF) at surface							i				i																						
2.8	Discharge of top hole cuttings at seabed						i	i	s	s																								
2.9	Disposal of LTOBM ROC overboard						i	i	i	i		i																						
2.10	Disposal of excess cement						i	i	i	i																								
2.11	Well logging including Vertical Seismic Profiling (VSP). Logging while drilling and wireline logging			i									i																					
2.12	Discharge of oily water (eg deck drainage, bilge water, machinery space)							i																										
2.13	Discharge of sanitary effluents (black and grey water)							i																										
2.14	Disposal of galley waste							i				i	i	i																				
2.15	Disposal of non hazardous wastes																												i					
2.16	Disposal of hazardous wastes																												i					
2.17	Ballast from drillship (potentially international)							i																										
2.18	Helicopter support	i	i	i							i		i				i				i							i						
2.19	Local labour, equipment and services supply, incl. crew changes																s			p							p		p					
2.20	Well clean-up	i	i	i				i																										
2.21	Well testing appraisal well	i	s	i	i			i													i													i
2.22	Well abandonment						i	i																										
3	**Accidental/ Unplanned Events**																																	
3.1	Small (Tier 1) oil/ chemical spill, eg hose failure during bunkering							i				i	i	i	i																			i
3.2	Medium (Tier 2) oil spill, eg vessel collision diesel spill							s				s	s	s	s	s	s				s			s	i		i	i	i				i
3.3	Blowout (Tier 3 oil) at seabed	i	s				i	s	s	s		s	s	s	s	s	s				s			s	s		s	i	i				s
3.4	Dropped Objects								i																									i
3.5	Helicopter incidents	i	i				i											s					i	i	i		i						s
3.6	Piracy for mob/demob																																	s
3.7	Emergency disconnect riser						s	s	s	s																								

7.4 SUMMARY OF POTENTIAL IMPACTS AND RISKS

Potentially significant interactions are summarised in this section. The impacts associated with the project will probably be narrower in scope than what is identified below because mitigation measures will be built into the project design. However, the impact identification process is intended to be broad at this stage to consider a wide range of possibilities and inform project mitigation priorities.

A summary of the results of the scoping process are presented in (*Table 7.1*). During the Scoping Phase stakeholder engagement, these key impacts were discussed and new impacts or concerns were raised. The relevant issues raised during the stakeholder engagement process (*Annex C*) were used to update the summary of the potentially significant impacts from the Scoping Phase and is provided in *Table 7.2* were identified as being potentially significant. Non-significant issues are presented in *Table 7.3.*

Table 7.2 Potential Impacts from Planned Activities and Unplanned / Accidental Events

No.	Issue	Activities	Scoping Results
1		**Planned Activities**	
1.1	Seawater and sediment quality degradation /contamination and impacts on marine fauna	Wastewater discharges from the drillship, supply and support vessels	Operational discharges from the drillship and all the other project vessels could have an impact on the water quality of the area and therefore potentially impact fish, marine mammals and turtles present in the Project Area. Due to stakeholder concern, this impact will be assessed further in the EIR including a discussion around the mitigation of this impact by ensuring all vessel discharges are compliant with MARPOL 73/78 Annex I, Annex V and Annex IV.
		Disposal of cuttings to the seafloor and overboard during drilling	Cuttings discharged both at the seabed (prior to the installation of the riser) and overboard (after the installation of the riser) will generate a plume of sediment which would disturb the marine habitats, benthic communities and marine fauna present in the area. This impact will be assessed further in the EIR, which will include a discussion around the treatment and base fluid content of these muds and cuttings prior to disposal.
		Disposal of excess cement	Already mixed excess cement will be disposed of overboard. The cementing of the casing (steel pipe) into the well is required to ensure the safety of the well and avoid a blowout and oil spill. The presence of excess cement slurry that has already been mixed is unavoidable during operation and it will be disposed of overboard to avoid damages to lines, cement unit and tanks. The amount of excess slurry will be minimised as far as possible. Contaminant concentrations in seawater would be expected to return to background levels rapidly, with the assistance of currents and the mixing capacity of the water body (the assimilative capacity of water would be expected to minimise any impacts) and therefore have limited impacts on marine fauna. The impacts will however be assessed in the EIR.
		Drilling	The impact of drilling on the seabed will be very localised and short-term, limited physical impact to the seabed due to top hole (first section of drilling) cuttings discharge and excess cement. For the next phases, the dispersion of cuttings from the vessel will be modelled and results included in the EIA report and the impact to benthic fauna will be assessed.
1.2	Disturbance of marine organisms	• Drillship and vessels noise due to dynamic positioning and moving • Noise from drilling activities (including well logging) • Light pollution from drillship and vessels	Scoping determined that the underwater noise generated during the drilling works, including well logging and the presence of vessels and drillingship could lead to disturbances to marine habitats and fauna. The impact of such disturbances, including lights, vibrations and underwater noise, will be assessed further in the EIR.

No.	Issue	Activities	Scoping Results
1.3	Disturbance to fishing (commercial and subsistence)	• Drillship, supply, survey and support vessels transit to and from the Richards Bay/Durban Port • Presence of drillship at drilling location (including 500 m exclusion zone)	Both the Port of Richards Bay and the Port of Durban are large, commercial, high traffic ports and as such the additional vessel traffic for this project will be insignificant and will not be a major change from the current status quo in terms of impact to fishing activities. Long-line commercial and traditional line fishing activities occur within the area of interest and may therefore be impacted by the presence of the drillship at the drilling location and the enforcement of the 500 m exclusion zone. The extent to which fishing activities could be interrupted or placed at risk as a result of the drilling and vessel activities of this project will be assessed further in the EIR.
1.4	Climate change	Burning of fossil fuels	There are climate change implications from the burning of fossil fuels by the project vessels. The significance of this impact will be assessed further in the EIR.
2	**Unplanned/ Accidental Events**		
2.1	Marine pollution and impacts on marine fauna Community and workforce health and safety	Vessel collisions/electrical fires on-board etc.	The risk of a vessel collision due to the project vessel activities is low if appropriate mitigation measures are put in place and included in the EMPr for this project. Although the risk is low, the impact of a diesel spill due to a vessel collision between the project vessels and other vessels (eg fishing and commercial) on sensitive receptors (fish, marine mammals, turtles etc.), coastal and marine habitats, fishing and other users will be assessed further in the EIR. The impact of a vessel collision on the health and safety of the workforce and other users of the sea will also be assessed further in the EIR.
2.2	Marine pollution and impacts on marine fauna and fishing Community and workforce health and safety	Vessel collision between a drillship and a supply boat	The risk of a vessel collision between the drillship and supply vessels is low if appropriate mitigation measures are put in place and included in the EMPr for this project. Although the risk is low, the impact of a diesel spill due to a vessel collision between the drillship and supply vessel on sensitive receptors (fish, marine mammals, turtles etc.), coastal and marine habitats, fishing and other users will be assessed further in the EIR. The impact of this type of vessel collision on the health and safety of the workforce and other users of the sea will also be assessed further in the EIR.

No.	Issue	Activities	Scoping Results
	Fisheries	Blowout	The risk of a blowout for the project can be minimised by ensuring the blowout management protocol is included in the EMP and Oil Spill Response Plan for this project. The impact of a blowout of oil/gas will result in marine pollution and disturbance of sensitive receptors and marine and potentially coastal habitats. It will also impact fisheries, the health and safety of the workforce and result in decreased air quality in the region of the blowout. The significance of the impact of a blowout will therefore be assessed further in the EIR.
2.3	Community and workforce health and safety	Dropped objects	Dropped objects from the project vessels could lead to significant health and safety risks, the mitigation and prevention of these incidents needs to be included in the EMP for this project to minimise the risk. The significance of this impact will therefore be assessed further in the EIR.
		Helicopter incidents	The prevention of helicopter accidents during crew transfers will be included in the EMPr for this project in order to minimise the risk. The significance of this impact will therefore be assessed further in the EIR.
Additional Relevant Impacts Identified through Stakeholder Engagement during Scoping			
3	**Planned Activities**		
3.1	Maritime Heritage	Exploration drilling	The South African Heritage Resources Agency raised a concern that the exploration drilling activities could disturb cultural heritage material present on the seabed, particularly historical shipwrecks. Due to the known presence of shipwrecks in the Project Area the significance of this impact will therefore be assessed further in the EIR.

Table 7.3 Non-Significant Impacts

No.	Impact	Activities	Scoping Results
1	**Planned Activities**		
1.1	Community Health, Safety & Security	Interactions of foreign/ migrant workers with local residents	Although Scoping determined that the project will employ workers during all the phases of the project, due to the nature of the work, the majority of the employees onboard the drillship will be expatriate staff who may transit through Durban or Richards Bay for a short period of time. Shore base employees are likely to be mainly current employees of existing logistics companies based in these areas. Given the short-term nature of the project and the limited workers to be employed this impact was considered insignificant and will not be assessed further.

No.	Impact	Activities	Scoping Results
1.2	Local employment / income generation	Employment of labour and allocation of jobs Training / capacity building of local people	Eni has estimated that in the order of 10 jobs will be created for locals by this project. The project will use local labour as far as possible based on their existing skills and provide new employees with appropriate training. The temporary creation of local jobs and employment opportunities by this project and the associated possible positive impact on the economy is considered insignificant and will therefore not be assessed further in the EIR.
1.3	Local economy	Trade with local suppliers for food, fuel, water, hotel, waste treatment and other supplies	Scoping determined that the project will result in trade with local suppliers for food, fuel, water, hotel, waste treatment and other supplies. This may result in a positive impact, however given the short-term nature of the benefit and the large-scale suppliers who likely be utilised this impact was considered insignificant and will not be assessed further.
1.4	Degradation of air quality	Vessels and helicopter atmospheric emissions Power generation on the drillship during drilling Bunkering	A reduction in air quality from the vessel and helicopter activities, power generation and bunkering are not expected to be significant in a regional context, or to cause human health impacts due to the temporary nature of the project, the well mixed air shed of the offshore environment and the distance of the project site to shore. Therefore this impact was considered not significant and will not be assessed further.
1.5	Community Health, Safety & Security	Noise from helicopters	The noise generated by helicopters for crew transfers will be over the Port of Richards Bay or Durban, helicopters will not fly over residential areas and therefore this impact was considered not significant and will not be assessed further.
1.6	Increase in non-hazardous and hazardous wastes disposal	Disposal of non-hazardous and hazardous wastes generated by the project activities at onshore disposal sites	The project will result in an increase in both non- hazardous (eg: kichen waste and scrap metals) and hazardous (eg engine lubricants and filters) waste generated in the area. Wastes will be transported by vessels to the onshore supply base in Richards Bay or Durban for temporary storage prior to off-site disposal. Solid non-hazardous waste will be disposed of at a suitably licensed waste facility. Hazardous wastes will be treated/ disposed of at a licensed waste treatment/ disposal facility. Therefore this impact was considered not significant and will not be assessed further.
1.7	Fresh water supply	Provision of drinking water for the crew on all vessels Storage of water at onshore base	Water will be provided via a reverse osmosis plant onboard the project vessels, where required bottled water may be provided. Therefore this impact was considered not significant and will not be assessed further. Water stored at the onshore base for water supplies for the onshore staff will be sourced from the local municipality and will not have a significant impact.
1.8	Marine pollution and impacts on marine fauna	Discharge of well clean-up and well testing water	Following cessation of drilling activities, contaminant concentrations in seawater would be expected to return to background levels rapidly, with the assistance of currents and the mixing capacity of the water body (natural dispersion, dilution and assimilative capacity of water would be expected to minimise any impacts) and therefore have limited impacts on marine fauna. Control measures will be included in the EMPr. Impacts of well clean-up and testing water on water quality and marine fauna are therefore not expected to be significant and will not be assessed further.

No.	Impact	Activities	Scoping Results
		Well logging Logging while Drilling (LWD) and wireline logging (radioactive sources). Vertical Seismic Profiling (VSP) - either zero offset VSP or walk-away VSP	This will be a closed system and therefore there will be no interaction with the environment. Therefore this impact was considered not significant and will not be assessed further. Standard industry mitigation measures will be implemented for VSP activities. This, in addition to the very short duration of the activity means that the impact is considered not significant and will not be assessed further.
1.9	Disturbance of seabed geology	Drilling	The impact of drilling of the geology will be very localised to the drilling location and where the drill bit will penetrate the seabed geology. Therefore the impact was not considered significant and will not be assessed further.
1.10	Visual	Drillship	The drillship will be located more than 60 km offshore and therefore is very unlikely to be seen from the shore. Therefore this impact was considered not significant and will not be assessed further.
1.11	Community and workforce health and safety	Well abandonment	Wells drilled will be plugged and abandoned. Given that the water is deep and that the wellhead will be removed it is therefore not anticipated that the abandoned wells will have any impact on navigation or deep sea fishing. This impact is therefore considered not significant and will not be assessed further.
2	**Unplanned/ Accidental Events**		
2.1	Marine pollution and impacts on marine fauna	Small oil/chemical spills	Small chemical and oil spills on-board the vessel will be cleaned up immediately and adhere to the oil spill response plan and EMP. This means the impact of a small oil or chemical spill will not be significant and will not be assessed further.
2.2	Introduction of alien invasive species	Ballast from support and supply vessels (potentially international)	De- and re-ballasting of project vessels will only be undertaken in adherence to International Maritime Organisation (IMO) guidelines governing discharge of ballast waters at sea. The IMO states that vessels using ballast water exchange should, whenever possible, conduct such exchange at least 200 nm from the nearest land and in water of at least 200 m depth. Where this is not feasible, the exchange should be as far from the nearest land as possible, and in all cases a minimum of 50 nm from the nearest land and preferably in water at least 200 m in depth. Based on the implementation of these measures the impact is considered insignificant and will not be further assessed.
	Additional Relevant Impacts Identified through Stakeholder Engagement during Scoping		
3	**Planned Activities**		
3.2	Impact of drilling on MPAs	Exploration drilling	Stakeholders raised concerns over the impact of exploration drilling on the MPAs. The proposed drilling areas of interest do not overlap with current or proposed MPA's and therefore this impact has been assessed as significant.

8 PLAN OF STUDY FOR EIA

8.1 INTRODUCTION

The purpose of the Impact Assessment Phase of an EIA is:

- To address issues that have been raised during the Scoping Phase;
- Address and assess alternatives to the proposed activity in a comparative manner;
- Address and assess all identified significant impacts; and
- Establish mitigation measures.

A key outcome of screening and scoping activities undertaken to date (described in *Chapter 6*) is the Plan of Study (PoS) for the EIA.

This *Chapter* provides the proposed PoS for the EIA and is structured as follows.

- Overview of the Impact Assessment Phase;
- Specialist studies;
- Impact Assessment methodology;
- Proposed structure of the EIA Report (EIR); and
- Provisional schedule for the EIA process.

8.2 OVERVIEW OF IMPACT ASSESSMENT PHASE

Once public comments on the Scoping Report have been concluded, the Final Scoping Report will be submitted to PASA for consideration. This represents the end of the Scoping Phase of the EIA. The subsequent Impact Assessment Phase is described in more detail below.

8.2.1 Impact Assessment

Following the Scoping Phase of the project, the EIA team will:

- Update and finalise the technical project description as further project details become available;
- Conduct additional consultation and further refine the scope of the EIA as necessary;

- Collect additional baseline data through desktop research to complete a comprehensive description of the environmental and social conditions;

- Undertake an impact assessment of the project activities interactions with the key environmental and social resources and receptors;

- Develop mitigation and enhancement measures and outline an environmental management programme (EMPr) including an approach for monitoring;

- Report the findings in a comprehensive EIR.

8.2.2 Stakeholder Engagement Activities

During the Impact Assessment Phase the following stakeholder engagement activities will be undertaken:

- The draft EIR and EMPr document will be made available for a 30-day comment period to stakeholders and the relevant authorities. An isiZulu translation of the Executive Summary will be made available for review.

- A notification letter will be sent to all registered I&APs on the project database. This letter will invite I&APs to comment on the draft EIR.

- Additional site notices will be placed in libraries and municipal offices along the south coast (eg Ugu District Municipality).

- Newspaper adverts will be placed in local newspapers notifying stakeholders of the availability of the draft EIR report for review and inviting them to public meetings. This will include additional local newspapers (covering areas to the south of Durban where potential impacts may be felt) to those in which the original advertisments were placed.

- Public meetings will be held during the comment period in order to present the findings to stakeholders. EIA Phase meetings to be held in Richards Bay, Durban and Port Shepstone as before, with additional meetings depending on interest shown and stakeholder registration in other locations. As requested at the Scoping Phase meetings, an isiZulu translator will be present at meetings in KZN during the EIA phase public meetings.

- The final EIR will then be compiled and submitted to PASA for review and decision-making. All comments made during the comment period will be compiled in a comments and responses report in the final EIR.

- I&APs will be notified of the Environmental Authorisation and the statutory appeal period.

8.2.3 *Authority Interaction*

Authority consultation is integrated into the public consultation process, with additional one-on-one meetings held with the lead authorities where necessary. The competent authority (DMR, through PASA) as well as other lead authorities will be consulted at various stages during the EIA process.

8.3 *SPECIALIST STUDIES*

A number of issues have been identified during this Scoping Study which require specialist studies to understand the potential impact in more detail. The following specialist studies have been identified to address the key issues and data gaps:

- Marine ecology;
- Fisheries;
- Maritime heritage;
- Oil Spill modelling; and
- Drill cuttings modelling.

Details are provided in *Table 8.1* on the specialists identified to undertake the studies.

Table 8.1 Specialist Qualifications

Specialist Study	Specialist	Company	Qualifications	Experience
Marine Ecology	Dr Andrea Pulfrich	Pisces Environmental Services (Pty) Ltd (CapMarine)	PhD (Fisheries Biology), Christian-Albrechts University	Dr. Pulfrich has over 20 years' experience in marine biology with particular expertise in undertaking specialist environmental impact assessments, baseline and monitoring studies, and Environmental Management Programmes relating to marine diamond mining and dredging, hydrocarbon exploration and thermal/hypersaline effluents. She is a registered Environmental Assessment Practitioner and member of the South African Council for Natural Scientific Professions, South African Institute of Ecologists and Environmental Scientists, and International Association of Impact Assessment (South Africa).

Specialist Study	Specialist	Company	Qualifications	Experience
Fisheries	Dr David Japp	Capricorn Marine Environmental (Pty) Ltd (CapMarine)	MSc (Ichthyology and Fisheries Science), Rhodes University	Dr. Japp has worked in the field of Fisheries Science and resource assessment since 1987 and has considerable experience in undertaking specialist environmental impact assessments relating to fishing and fish stocks. His work has included environmental economic assessments and the evaluation of the environmental impacts on fishing.
	Ms Sarah Wilkinson	Capricorn Marine Environmental (Pty) Ltd (CapMarine)	BSc (Hons) Oceanography and Botany, University of Cape Town	Ms Wilkinson has worked on marine resource assessments, specializing in spatial and temporal analysis (GIS) as well as the economic impacts of fisheries exploitation in the southern African region for over 14 years
Maritime Heritage	Dr John Gribble	ACO Associates CC	BA (Hons), MA Archaeology, University of Cape Town	Dr Gribble has over 20 years of professional archaeological and heritage management experience. He has extensive experience in the production of offshore heritage impact assessments and his time at SAHRA has equipped him with an excellent understanding of their requirements in this regard.
Oil Spill and Drill cuttings modelling	Michael J. Fichera	Environmental Resources Management	B.S. in Civil Engineering and an M.E. in Environmental Engineering from Manhattan College	Mr Fichera has experience since 1993 in project management, oil and chemical spill modelling and toxicity assessments, mud and drill cuttings deposition modelling, water quality modelling, and natural resource damage assessments (NRDA). Michael's experience during spills includes emergency response site investigations, modelling the fate and transport of oil slicks and subsurface contamination, and providing both preliminary (rapid-response) and detailed natural resource damage estimates. He has also performed stochastic hypothetical predictions of spills for environmental impact statements and oil spill response plans. Michael has researched dissolved oil toxicity for biological effect modelling with COSIM, the oil spill assessment component of GEMSS®. Mike has conducted drill cuttings and spill modelling studies for eni for the Floating LNG project offshore Mozambique.

Specialist Study	Specialist	Company	Qualifications	Experience
Peer review of oil spill and cuttings modelling	Mr Stephen Luger	PRDW	MSc Engineering, University of Cape Town	Mr Luger has more than twenty-four years of experience in the application of numerical models in the fields of coastal hydrodynamics, waves, tsunamis, sediment transport, outfalls, water quality, dredging, oil spills and flooding. These modelling studies have been conducted for feasibility studies, environmental impacts studies, nuclear safety studies and detailed engineering design. The countries where the studies have been conducted include South Africa, Namibia, Gabon, Nigeria, Kenya, Mauritius, Seychelles, Guinea, Mozambique, Madagascar, Cameroon, Angola, Egypt, Bahrain, Qatar, United Arab Emirates, Jordan, Israel, Ireland, Chile, Peru, Brazil and Australia.

The table below identifies the provisional Terms of Reference for each proposed specialist study.

Table 8.2 Scope of Work for Specialist Studies

Topic	Terms of Reference
Marine Ecology	• The baseline study of marine ecology will be based on secondary data and will include a description of the marine environment and habitats as well as marine fauna, especially sensitive species. • A general description of the physical environment will also be prepared. • The study will focus on sensitive aspects of the marine environment. This will include marine reserves and other sensitive locations. • It will also include sensitive species such as marine mammals, sea turtles, and sea birds. • Assessment of potential impacts on fisheries using prescribed impact rating methodology. • A description of any assumptions made and any uncertainties or gaps in knowledge. • Recommendation of mitigation measures, where appropriate. • The baseline description and impact assessment will be included into the EIA Report.
Fisheries	• A description of the existing baseline fisheries characteristics within Block ER 236 and the areas of interest for well-drilling (distribution of fish stocks and commercial, subsistence and recreational fishing activities). • An introduction presenting a brief background to the study and an appreciation of the requirements stated in the specific terms of reference for the study. • Details of the approach to the study where activities performed and methods used are presented. • The specific identified sensitivity of fishing sectors related to the proposed activity. • Map/s superimposing the proposed areas of interest for well-drilling on the spatial distribution of effort expended by each fishing sector (data: 2005 – 2016). • Calculation of proportion of fishing ground that coincides with the proposed affected area. • Assessment of potential impacts on fisheries using prescribed impact rating methodology. • A description of any assumptions made and any uncertainties or gaps in knowledge. • Recommendation of mitigation measures, where appropriate.
Maritime Heritage	• A description of the existing marine heritage characteristics within Block ER 236 and the areas of interest for well-drilling (eg distribution of ship wrecks). • An introduction presenting a brief background to the study and an appreciation of the requirements stated in the specific terms of reference for the study. • Details of the approach to the study where activities performed and methods used are presented. • Assessment of potential impacts on marine heritage using prescribed impact rating methodology. • A description of any assumptions made and any uncertainties or gaps in knowledge. • Recommendation of mitigation measures, where appropriate.
Oil Spill Modelling	• Physical and chemical environmental impacts on surface waters from potential hydrocarbon spills will be assessed using a comprehensive modelling approach. In the comprehensive modelling approach, a single model, GEMSS® (Generalized Environmental Modelling System for Surfacewaters), is used to determine the fate and transport of unplanned hypothetical oil spills.

Topic	Terms of Reference

	• The following scenarios will be assessed:
	  • Scenario 1 - diesel spill associated with vessel collision happening either during drilling of wells;
	  • Scenario 2 - release of NADF due to the accidental disconnection of the riser occurring during the drilling phase
	  • Scenario 3 – blowout of crude oil at the wellhead on the seabed.
	• For each scenario, the "worst cases" will be determined using three different criteria: the conditions that result in the shortest time for oil to contact a shoreline, the case with the most amount of shoreline oiling, and the conditions in which the most amount oil spreads across the water surface.
	• Impacts will be assessed in terms of the probability of the presence of a visible hydrocarbon slick on the surface, probability of oil contacting shorelines, and dissolved aromatic concentrations in the water column. For the riser disconnect scenario, impacts will also include an evaluation of the suspended solids concentration and untreated NADF contamination on the sea floor using the GIFT module.
	• Results of the modelling will be provided as a stand-alone report, included as an annex to the main EIA report.

Drill Cuttings Dispersion Modelling	• Use of a global circulation model to represent the movement of currents, ocean temperatures, and salinity concentrations in three dimensions. Statistical analysis of the range of current speeds likely to be present where the discharges of cuttings and drilling fluids will take place. • Drill cuttings modelling will use the sediment fate and transport model, GIFT, a module of the Generalized Environmental Modelling System for Surfacewaters (GEMSS®). This three-dimensional particle-based model uses Lagrangian algorithms in conjunction with currents to estimate the fate and transport of release particulate material. • The intent of the study is to determine the water column suspended sediment concentrations and the bottom accumulation of the drill cuttings (the "footprint") to assess potential impacts to aquatic and benthic organisms. • Time-varying velocities mapped onto the model grid and computed by the hydrodynamic model will be used to disperse drill cuttings, modelled as particles. • Results of the modelling will be provided as a stand-alone report, included as an annex to the main EIA report.

8.4 IMPACT ASSESSMENT METHODOLOGY

An EIA methodology should minimise subjectivity as far as possible and accurately assess the project impacts. In order to achieve this ERM has followed the methodology defined below.

8.4.1 Impact Identification and Characterisation

An 'impact' is any change to a resource or receptor caused by the presence of a project component or by a project-related activity.
Impacts can be negative or positive.
Impacts are described in terms of their characteristics, including the impact type and the impact spatial and temporal features (namely extent, duration, scale and frequency). Terms used in this EIA are described in *Table 8.3.*

Table 8.3 Impact Characteristics

Characteristic	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the project (in terms of cause and effect).	**Direct** - Impacts that result from a direct interaction between the project and a resource/receptor (eg between occupation of the seabed and the habitats which are affected). **Indirect** - Impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment (eg viability of a species population resulting from loss of part of a habitat as a result of the project occupying the seabed). **Induced** - Impacts that result from other activities (which are not part of the project) that happen as a consequence of the project. **Cumulative** - Impacts that arise as a result of an impact and effect from the project interacting with those from another activity to create an additional impact and effect.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - impacts are predicted to be of short duration and intermittent/occasional. **Short term** - impacts that are predicted to last only for the duration of the drilling and well testing phase, ie 6 months or less. **Medium term** - impacts that are predicted to extend beyond the drilling phase but not longer than three years. **Long term** - impacts that will continue beyond three years but within 10 years. **Permanent** - impacts that cause a permanent change in the affected receptor or resource or ecological process, and which endures beyond 10 years.

Extent	The reach of the impact (i.e. physical distance an impact will extend to)	**On-site** - impacts that are limited to the site area only, ie within 500m of drilling well (exclusion zone). **Local** - impacts that are limited to the project site and within the block. **Regional** - impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystems, ie extend to areas outside the block. **National** - impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences. **Trans-boundary/International** - impacts that affect internationally important resources such as areas protected by international conventions or impact areas outside of South Africa.
Scale	Quantitative measure of the impact (eg the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.).	Quantitative measures as applicable for the feature or resources affects. No fixed designations as it is intended to be a numerical value.
Frequency	Measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description.

Unplanned events (eg incidents, spills) are considered in terms of likelihood (*Table 8.4*). The likelihood of an unplanned event occurring is determined qualitatively, or when data are available, semi-quantitatively. It is also important to distinguish that likelihood is a measure of the degree to which the unplanned event is expected to occur, not the degree to which an impact or effect is expected to occur as a result of the unplanned event.

Table 8.4 Definitions for Likelihood

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

8.4.2 Determining Impact Magnitude

Once impacts are characteristed they are assigned a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent;
- Duration;
- Scale; and
- Frequency.

Magnitude (from small to large) is a continuum. Evaluation along the continum requires professional judgement and experience. Each impact is evaluated on a case-by-case basis and the rationale for each determination is noted. Magnitude designations for negative effects are: negligible, small, medium and large.

The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue. In the case of a positive impact, no magnitude designation has been assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the project is expected to result in a positive impact.

Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes are regarded as having no impact, and characterised as having a negligible magnitude.

In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation is used. The likelihood factor is also considered, together with the other impact characteristics, when assigning a magnitude designation.

Determining Magnitude for Biophysical Impacts

For biophysical impacts, the semi-quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided below.

High Magnitude Impact affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) or a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations (physical and biological). A high magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

Moderate Magnitude Impact affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it (physical and biological). A moderate magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

Low Magnitude Impact affects a specific area, system, aspect (physical), group of localised individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localised area.

Determining Magnitude for Socio-economic Impacts

For socio-economic impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The quantitative elements are included into the assessment through the designation and consideration of scale and extent of the impact.

8.4.3 Determining Receptor Sensitivity

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, a water body) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered. Where the receptor is biological or cultural (ie the marine environment or a coral reef), its importance (local, regional, national or international) and sensitivity to the specific type of impact are considered. Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The universal sensitivity of receptor is low, medium and high.

For ecological impacts, sensitivity is assigned as low, medium or high based on the conservation importance of habitats and species.

For the sensitivity of individual species, *Table 8.5* presents the criteria for deciding on the value or sensitivity of individual species.

For socio-economic impacts, the degree of sensitivity of a receptor is defined as the level of resilience (or capacity to cope) with sudden social and economic changes. *Table 8.5* and *Table 8.6* present the criteria for deciding on the value or sensitivity of biological and socio-economic receptors.

Table 8.5 Biological and Species Value / Sensitivity Criteria

Value / Sensitivity	Low	Medium	High
Criteria	Not protected or listed as common / abundant; or not critical to other ecosystem functions (eg key prey species to other species).	Not protected or listed but may be a species common globally but rare in South Africa with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.	Specifically protected under South African legislation and/or international conventions e.g. CITES Listed as rare, threatened or endangered eg IUCN

Note: The above criteria should be applied with a degree of caution. Seasonal variations and species lifecycle stage should be taken into account when considering species sensitivity. For example, a population might be deemed as more sensitive during the breeding/spawning and nursery periods. This table uses listing of species (e.g. IUCN) or protection as an indication of the level of threat that this species experiences within the broader ecosystem (global, regional, local). This is used to provide a judgement of the importance of affecting this species in the context of project-level changes.

Table 8.6 Socio-economic Sensitivity Criteria

Sensitivity	Low	Medium	High
Criteria	Those affected are able to adapt with relative ease and maintain pre-impact status.	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.	Those affected will not be able to adapt to changes and continue to maintain-pre impact status.

8.4.4 Assessing Significance

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance rating will be determined, using the matrix provided in *Figure 8.1.*

Figure 8.1 Impact Significance

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. *Box 8.1* provides a context for what the various impact significance ratings signify.

Box 8.1 Context of Impact Significances

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the project.

8.4.5 Mitigation Potential and Residual Impacts

A key objective of an EIA is to identify and define socially, environmentally and technically acceptable and cost effective measures to manage and mitigate potential impacts. Mitigation measures are developed to avoid, reduce, remedy or compensate for potential negative impacts, and to enhance potential environmental and social benefits.

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in *Table 8.7.*
The priority is to first apply mitigation measures to the source of the impact (ie to avoid or reduce the magnitude of the impact from the associated project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (ie to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures. The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in *Table 8.7*.

Table 8.7 Mitigation Hierarchy

Avoid at Source; Reduce at Source:
avoiding or reducing at source through the design of the Project (eg avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
Abate/Minimize on Site:
add something to the design to abate the impact (eg pollution control equipment).
Abate/Minimize at Receptor:
if an impact cannot be abated on-site then control measures can be implemented off-site (eg traffic measures).
Repair or Remedy*:*
some impacts involve unavoidable damage to a resource (eg material storage areas) and these impacts require repair, restoration and reinstatement measures.
Compensate in Kind; Compensate through Other Means:
where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (eg financial compensation for degrading agricultural land and impacting crop yields).

As required by the South African EIA Regulations (as amended in 2017) the following additional items will be considered in the assessment of impacts and risks identified:

- The degree to which the impact and risk can be reversed (this will be rated on a scale of high, medium, or low);
- The degree to which the impact and risk may cause irreplaceable loss of resources (this will be rated on a scale of high, medium, or low).

This will inform the residual impact significance.

8.4.6 Residual Impact Assessment

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance.
This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

8.4.7 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact. How the impacts and effects are assessed is strongly influenced by the status of the other activities (eg already in existence, approved or proposed) and how much data is available to characterise the magnitude of their impacts.

The approach to assessing cumulative impacts is to screen potential interactions with other projects on the basis of:

- projects that are already in existence and are operating;
- projects that are approved but not as yet operating; and
- projects that are a realistic proposition but are not yet built.

8.5 PROPOSED STRUCTURE OF THE EIA REPORT

An outline of the proposed contents of the EIA Report is *Table 8.2* below.

Table 8.8 Proposed EIA Report Structure

Chapter Number	Contents Heading	Explanatory Note
Acronyms and Abbreviations		
Executive Summary		Summary of the entire EIA report.
1	Introduction	This *Chapter* will outline the development and structure of the EIA report including the background, terms of reference and declaration.
2	Administrative Framework	This *Chapter* will outline the policy, legal and institutional framework within which the EIA has been conducted.
3	Project Description	This *Chapter* will provide a concise description of the project and its geographical and temporal context. It will include a site description, an overview of the project design and details of project inputs and outputs.
4	Baseline Condition	This *Chapter* will summarise the available baseline data on the environmental and social resources and receptors within the Project Area. It will be based on secondary data sources and will consider changes in the baseline condition without the development in place.
5	Public Participation Process	This *Chapter* will present the results of consultation undertaken as part of the EIA, plus plans for future consultation. It will identify key project stakeholders and present their feedback on the project.
6	Impact Assessment Methodology	This *Chapter* will provide the methodology used to assess the impacts of the project on the bio-physical, terrestrial and socio-economic environment.
7	Impact Assessment	This *Chapter* will document the predicted positive and negative impacts of the project, outline general and specific mitigation measures to reduce, remove or avoid negative impacts to environmental and social receptors as well as measuring for monitoring these impacts. Any residual impacts (post mitigation) will be outlined. Cumulative impacts will be assessed as appropriate.
8	Environmental Management Programme (EMPr)	The EMPr will draw together the possible mitigation measures; group them logically into components with common themes; define the specific actions required and timetable for implementation; identify training needs, institutional roles and responsibilities for implementation.
9	Conclusion	This *Chapter* will provide conclusions based on the assessment as well as outline any further recommendations.
Bibliography & References		All references made in the report and documents drawn upon during the course of the assessment
Annexes		These will include all public consultation information as well as technical annexes with details of specialist reports.

8.6 PROVISIONAL SCHEDULE FOR THE EIA PROCESS

A provisional schedule for the EIA is provided in *Table 8.9* below.

Table 8.9 Provisional EIA Schedule

Activity	Timing
Final Scoping Report Submission	March 2018
Scoping Report Approval	April 2018
Disclosure of Draft EIA Report	May 2018
Submission of Final EIA Report	July 2018
Environmental Authorisation	November 2018

Anders, A.S., 1975. *Pilchard and anchovy spawning along the Cape east coast*. S. Afr. ship. news fish. ind. rev. 30 (9): 53-57.

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