



Environmental and Social Impact Assessment for Venus Development (Offshore Block 2913B), Namibia

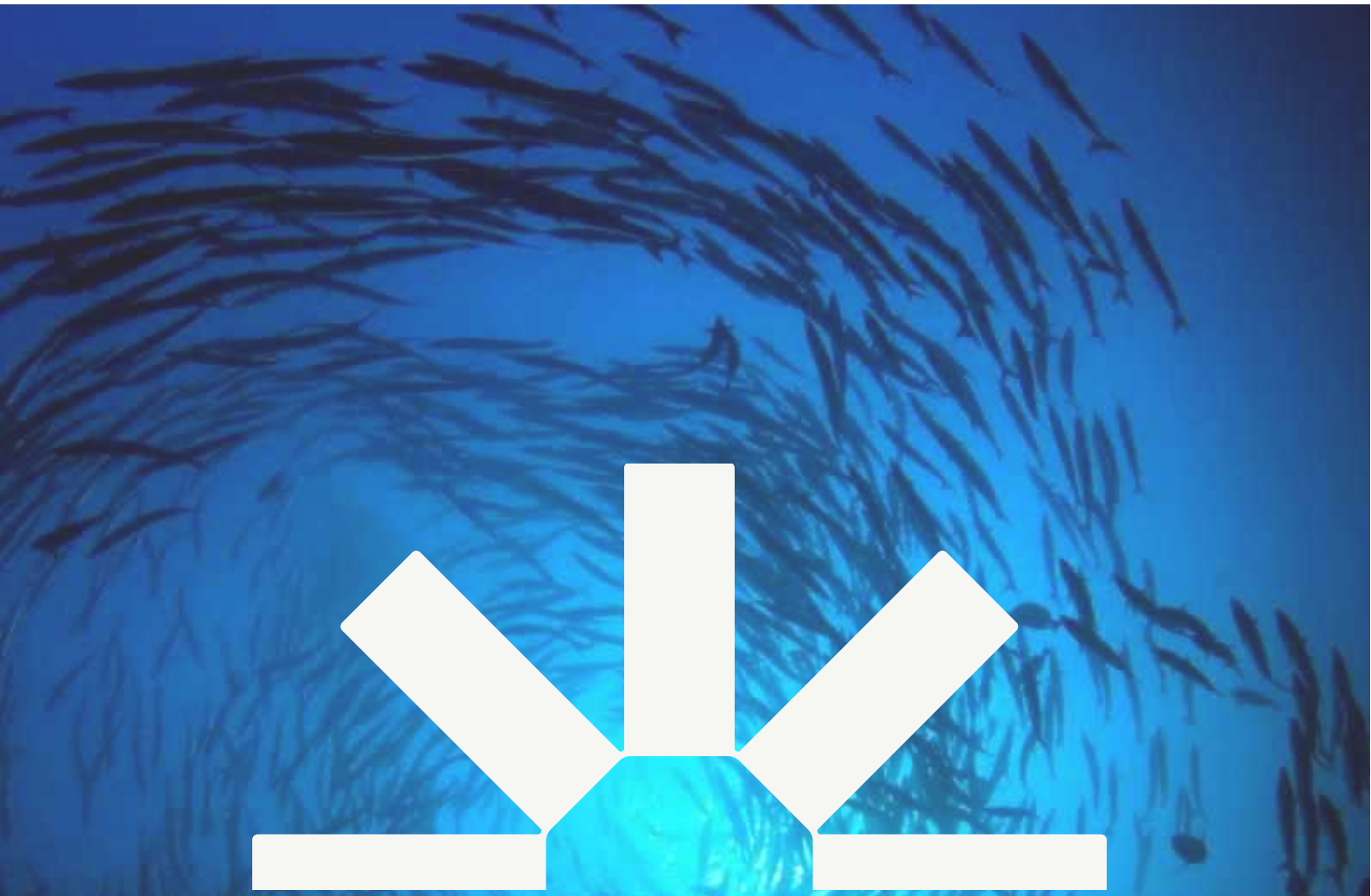
Final Scoping Report

FOR: TotalEnergies EP Namibia B.V.

SLR Project No.: 713.000024.00001

Revision: 0

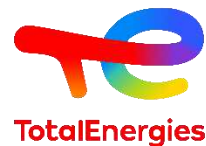
30 May 2025



Environmental and Social Impact Assessment for Venus Development (Offshore Block 2913B), Namibia

Final Scoping Report

TotalEnergies EP Namibia B.V. and the Joint Venture Partners



Prepared by:

SLR Environmental Consulting (Namibia) (Proprietary) Limited

8 General Murtala Muhammed Ave, Eros,
Windhoek

SLR Project No.: 713.000024.00001

Authority Reference No: APP - 005431

30 May 2025



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This summary contains [underlined hyperlinks](#) that provide readers of the electronic version with the option to access additional information on certain aspects, if interested.

1.0 Introduction

[TotalEnergies EP Namibia B.V.](#) (TEEPNA), together with its Joint Venture (JV) Partners (currently [Impact Oil and Gas](#), [NAMCOR](#) and [Qatar Energy](#)), discovered hydrocarbons in Block 2913B offshore Namibia in 2022 and appraised the discovery, called Venus. Based on the exploration and appraisal results, as well as ongoing development studies, TEEPNA and its JV partners are studying the feasibility to develop the offshore Venus Field to produce crude light oil for commercialisation. This field is situated offshore, about 300 km from Oranjemund, 320 km from Lüderitz and 700 km from Walvis Bay in deep water (around 3 000 m) (see Figure 1).

The Joint Venture proposes to:

- Drill up to 40 subsea wells from the seabed.
- Produce hydrocarbons from subsea wells and separate the fluids on a Floating Production, Storage and Offloading (FPSO) vessel moored at the Venus Field.
- Re-inject the gas back through dedicated subsea wells.
- Transfer the oil from the FPSO to tankers for transport to the buyer.

No onshore facilities are associated with this project.

Before the JV can proceed with the proposed development, it is required to obtain an Environmental Clearance Certificate (ECC) from the Ministry of Environment, Forestry and Tourism ([MEFT](#)). As part of this process, an Environmental and Social Impact Assessment (ESIA) must be undertaken.



Figure 1: Locality of Block 2913B and Venus Field off the southern coast of Namibia

Purpose of this Document

This document provides a non-technical summary of the Final Scoping Report (FSR) and informs about:

- The ESIA process.
- The proposed activities.
- The current biophysical and socio-economic status of the project region.
- Possible project impacts identified.
- Proposed specialist input to assess such impacts.

Who are the Consultants?

SLR Environmental Consulting Namibia (Pty) Ltd ([SLR](#)) is an independent environmental consulting company and has been appointed by the JV to conduct the ESIA process.



SLR is supported by another Namibian firm, [Urban Dynamics Africa](#) (Pty) Ltd to manage the stakeholder engagement process.



Your Role

If you are interested in this project or feel that you are affected by it, and therefore consider yourself an Interested and/or Affected Party (I&AP), you can:

- Register on the project database.
- Get information about the proposed project.
- Join meetings and give your input in the Impact Assessment Phase.
- Review and comment on reports in the Impact Assessment Phase..

How to Register

Please register on the database by scanning the QR code linking to [an online form](#) or by using the contact details below.



Contact Details

Tel: 0811 245 188 or 0813 548 251

Email: ESIAVenusOffshoreDev@udanam.com

Website: <https://www.slrconsulting.com/afr/public-documents/ESIA-Venus-Offshore-dev/>

2.0 ESIA and Public Consultation Process

An ESIA helps plan and make decisions about a project. It identifies and assesses the potential positive and negative biophysical, cultural, and socio-economic impacts of proposed activities. It also identifies management measures to reduce impacts (where required) or enhance benefits. The ESIA process is defined in the [Namibian Environmental Impact Assessment EIA Regulations](#) and consists of two main phases (see Figure 2): the Scoping Phase and the Impact Assessment Phase. **This ESIA process is currently at the end of the Scoping Phase (shown in dark green).**

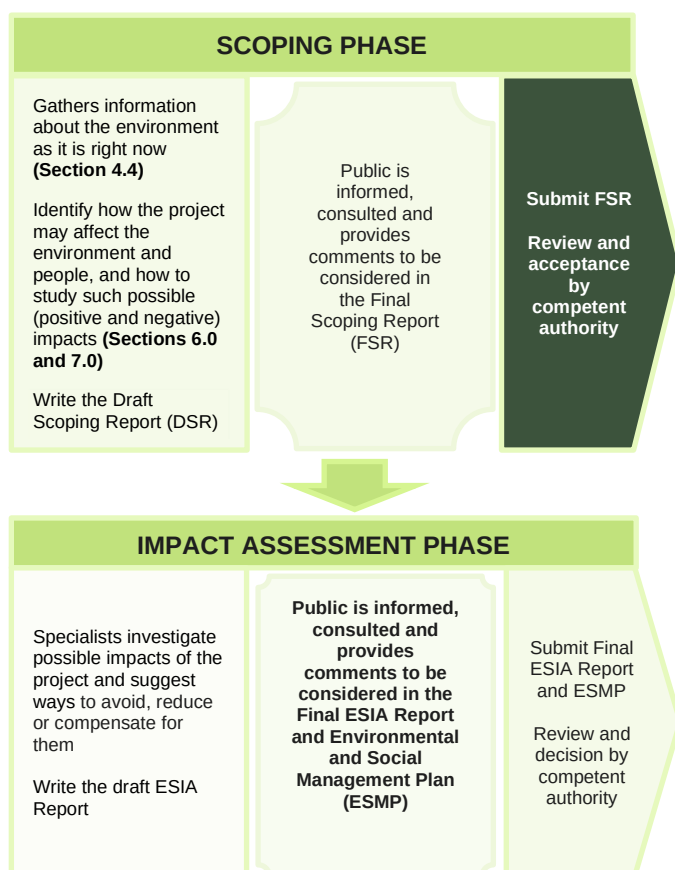


Figure 2: ESIA process phases and steps

Public consultation is a very important part of the ESIA process. The purpose is to:

- Notify I&APs of the proposed activities.
- Provide information on the proposed activities.
- Provide the opportunity to ask questions and state concerns regarding the proposed activities.

In mid-March 2025, the public was made aware of this ESIA and the availability of the DSR for comment through site notices, newspaper advertisements, radio announcements, social media posts and notification letters. The DSR was released for public comment from 2 April-13 May. During this time, 16 Public Meetings, 13 Focus Group Discussions and 6 Dedicated Meetings were undertaken in Keetmanshoop, Bethanie, Lüderitz, Oranjemund, Windhoek, Swakopmund, Henties Bay and Walvis

Bay. Comments raised during the consultation period and the engagements were responded to and considered in the Final Scoping Report.

3.0 Need and Desirability

Namibia's plans and policies aim to reduce greenhouse gas emissions while making sure there is enough energy and growing the economy fairly. They also support finding and using local oil resources to help the economy develop.

Globally, different energy mix forecasts are available showing that the oil demand remains high ([International Energy Outlook, US EIA](#)).

Even though there will still be demand for oil, and the country aims at developing economy, the desirability of a specific project also depends on its environmental and social impacts. These impacts will be assessed during the Impact Assessment Phase of this ESIA.

Compatibility with climate change-related policies and targets depends on the global ability to counterbalance project emissions with reductions from other sources, which is complex to be analysed at a project level.

4.0 Description of Proposed Activities

The JV is currently studying the feasibility to develop the offshore Venus Field to produce crude light oil for commercialisation. Those studies as well as the outcome of this ESIA may lead to a Final Investment Decision (FID) by the JV.

Once ECC is granted and the FID has been taken, the construction, drilling and installation will take approximately 5 years to complete, and then the production will start and last for approximately 20 years+.



Key activities are briefly described below.

4.1 Drilling

Up to 40 subsea wells will be drilled by up to three drilling units (see example in Figure 3). About half of the wells will be used for oil production, while the other half will be used for gas re-injection.



A well is created by drilling a hole into the seabed using a drill bit attached to a rotating drill string, which crushes the rock into small particles, called "cuttings". Depending on the stage of drilling, these cuttings are either (1) discharged onto the seafloor next to the hole or (2) brought up to the drilling unit through a riser where they are cleaned and released into the water from the drilling unit (see Figure 4).

Once the desired depth has been reached, steel pipes are inserted and cemented into the hole to ensure it is stable and that the different geological formations are isolated.





Figure 3: Drilling Unit

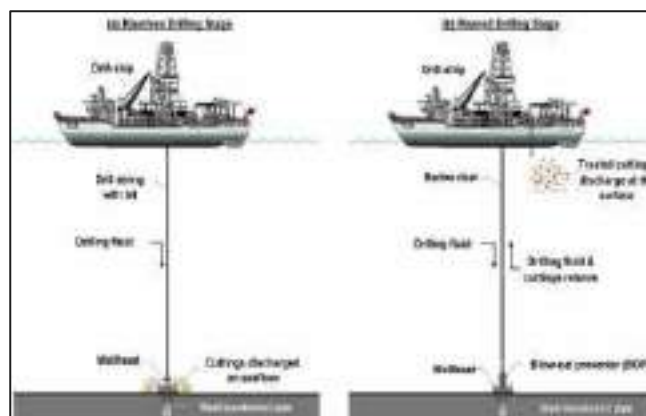


Figure 4: Drilling Stages

During the risered drilling stage, a Blow Out Preventer (BOP) is installed on the wellhead in order to seal the well and prevent any uncontrolled release of fluids (a 'blow-out'). Before completion, some subsea wells may be tested to refine the knowledge of the reservoir characteristics.

4.2 Installation

Subsea equipment (comprising of Xmas trees, jumpers, flowlines, umbilicals, risers) are required to connect the subsea wells to the Floating Production Storage Offloading (FPSO) vessel.

The footprint of Venus subsea development will extend ~20 km in a NW-SE direction and ~15 km in a E-W direction.

In addition, anchors and mooring lines will also be installed prior to FPSO arrival on Venus field.

A mooring buoy will also be installed at the selected nearshore transshipment area.

4.3 Production

During production, a Floating Production Storage and Offloading (FPSO) vessel (Figure 5) will be anchored at the Venus Field. Reservoir fluids (composed of gas, oil and water) from the subsea wells are transported via the flowlines to the FPSO, where they are separated:

- Oil will be stored within the FPSO hull until offloading to a Dynamic Positioning Shuttle Tanker (DPST) approximately once a week during peak operations.
- Gas will be reinjected back into dedicated subsea wells via flowlines and a portion of it used for power generation for the FPSO.
- Water will be treated and released into the sea.

Key FPSO characteristics:

- Production capacity: 160 000 barrels of oil per day
- Storage capacity: around 2 million barrels of oil
- Gas separation capacity: 550 000 MMscfd
- Closed flare system coupled with a venting recovery unit
- Produced water treatment capacity: 15 000 barrels per day



Figure 5: Example of FPSO vessel

The offshore production principles are shown in Figure 6 (please note that it is a concept representation). The main steps during production – from extracting the fluid to transporting the oil – are conceptually shown in Figure 7.

Nearshore transshipment:

After offloading the oil from the FPSO, the DPST will sail to a nearshore area and transfer the oil to a conventional tanker for onward transport to the buyer. The JV are undertaking ongoing studies to finalise the precise location for the nearshore transshipment area. It will likely be located in coastal waters near Walvis Bay ~5-10 km from the coast (~depth of 30-40m), locations closer to Lüderitz have also been assessed.

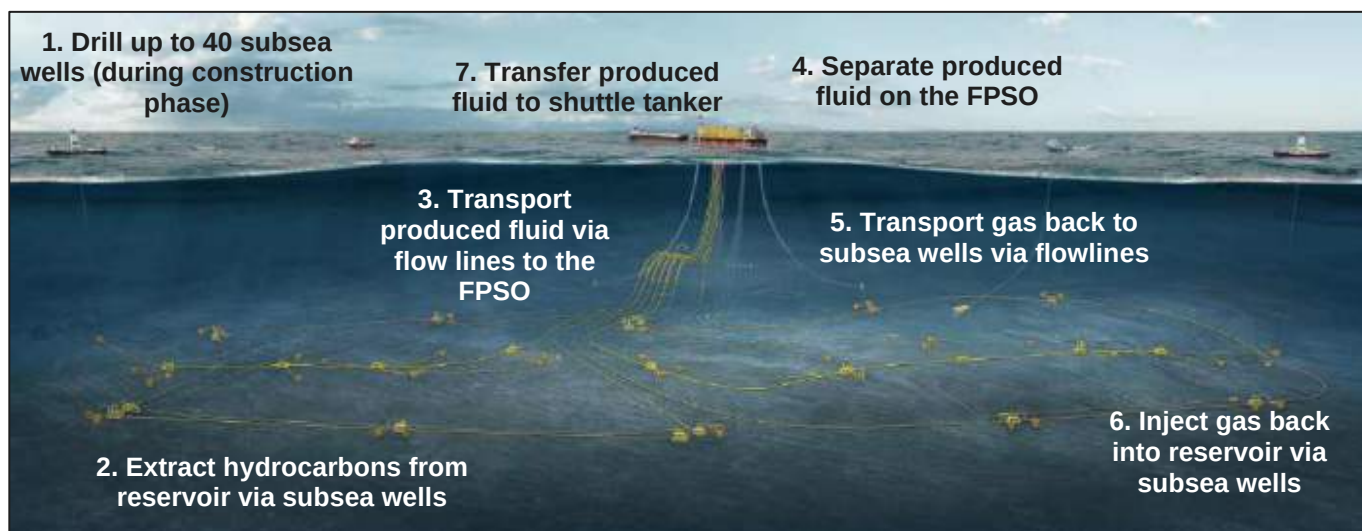


Figure 6: Offshore production concept

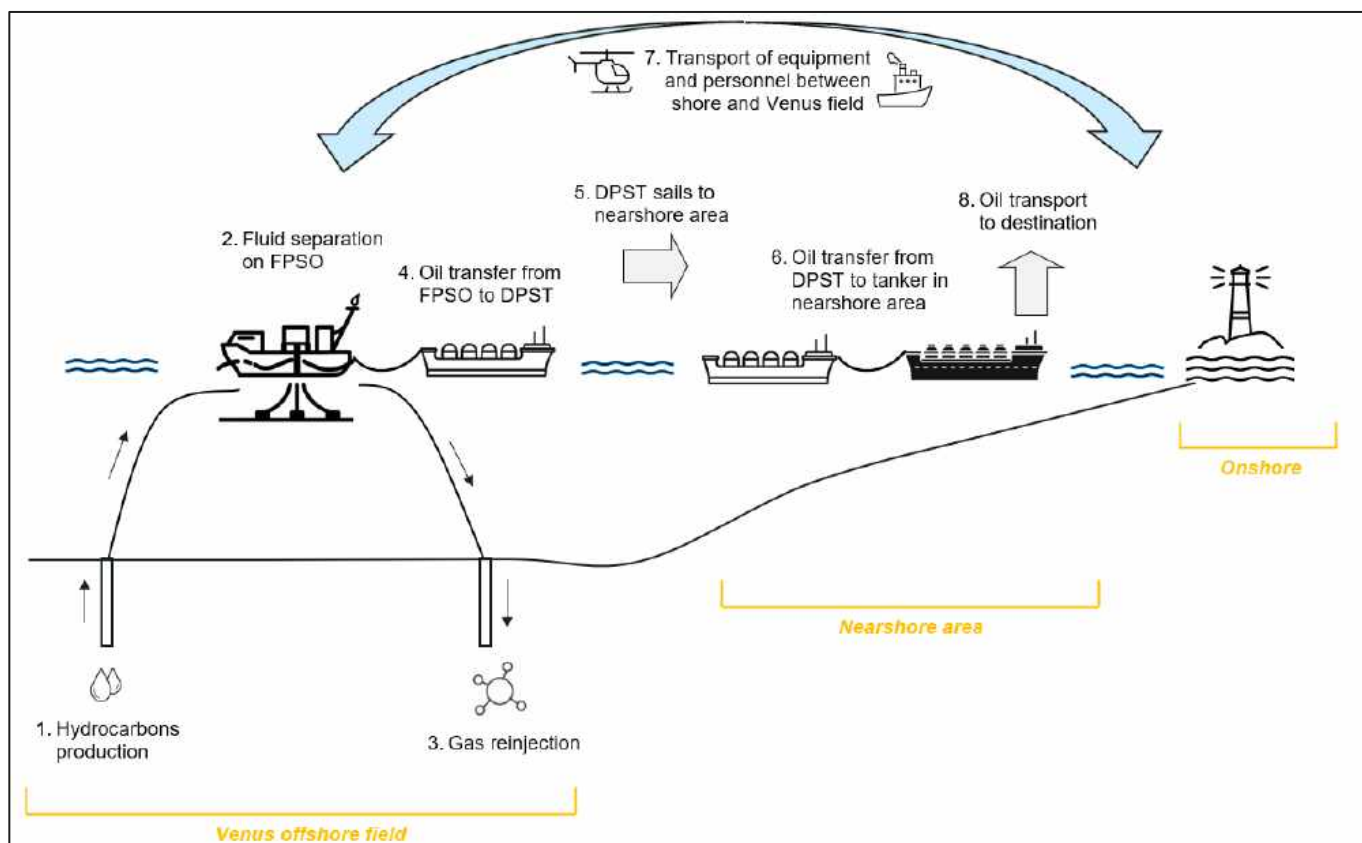


Figure 7: Main steps during production

4.4 Decommissioning

The Venus Project facilities are being engineered to have a design life of minimum 20 years and will be decommissioned at the end of field life. Any extension to this requirement will necessitate a full assessment.

Before the Venus production operations end, the JV will prepare a detailed decommissioning plan in compliance with relevant contracts, licenses, laws, and regulations applicable at that moment. Such plan includes removing subsea production structures like Xmas trees or Flow Lines End Termination (FLET) minimizing disturbance, and restoring the site as close as possible to its natural state based on a Net Environmental Benefit Analysis (NEBA). The decommissioning plan will also include measures to reduce socio-economic disruptions related to the closure.

Wells will be sealed with cement plugs, which are tested to ensure they close the well properly. Wellheads are removed or left on seafloor if it is safe to do so, in line with international best practices. The FPSO will be towed to a specialised port for taking apart and recycling.

4.5 Support and Logistics

Onshore logistics will be provided from Lüderitz (which is closest) and Walvis Bay (where main construction facilities are located) to support offshore operations during the drilling, installation, production and decommissioning phases.

Support and supply vessels (see example in Figure 8) will travel between those ports and the Venus field carrying supplies and equipment during construction, drilling, installation, production and decommissioning.



Figure 8: Example of supply vessel

Personnel working offshore will be transported by helicopter from existing airport facilities, mainly Lüderitz.

All vessels must comply with international standards for operations and the management and discharge of waste and other effluents. When offshore treatment is not possible, waste will be disposed or recycled at licenced onshore waste sites.

5.0 Key Environmental and Socio-Economic components

This section provides a brief description of the attributes of the receiving environment within Block 2913B and the Venus development Project's Area of Influence (central to southern Namibian coastal and offshore areas).

5.1 Physical Environment



Block 2913B is located offshore in the deep sea in water depths ranging from 2 600 m to 3 300 m. Water depth is ~3 000 m and relatively constant across the Venus development footprint, with a variance of ~100 m across the field.

Photos from environmental surveys show that the seabed in the project area is homogeneous mostly 'sandy mud' (see Figure 9).

Tripp [Seamount](#) is located approximately 100 km east of the Venus field.



Figure 9: Seafloor with sandy mud habitat at Venus area in Block 2913B.

5.2 Biological Environment

5.2.1 Offshore Venus Field

Block 2913B is located in the large [Benguela Current Large Marine Ecosystem \(BCLME\)](#), with cold surface water, high biological productivity and changing physical, chemical and biological conditions. This system supports a wide variety of marine species including fish, whales, dolphins, seals and seabirds.

Benthic (seabed) plants and animals differ depending on the type of ocean floor and depth. In deeper water, such as in the Venus Field, the seafloor is largely mud with few plants and animals. Worms, starfish, sea pens, urchins, anemones and sea cucumbers are expected to live in/on the seabed.

Demersal fish (those that live and feed on or near the seabed) off the Namibian Coast include hake, kingklip, sharks, rays and skates, though many live in water shallower than 1 000 m (outside of the project area).



Pelagic animals (those that live and feed in the open water column) include:

- Plankton – This is expected to be *low* in the project area.
- Fish eggs and larvae – The project area does *not overlap* with the areas where eggs and larvae of commercially important fish (e.g. hake, sardine, anchovy) are located.
- Fish – Large migratory species (tunas, billfish, pelagic sharks) may travel *through* the project area. Smaller species (snoek, sardine / pilchard, anchovy, chub and horse mackerel and round herring) mainly occur in shallower waters and are *not* expected in the project area.
- Turtles – Some turtles may *occasionally* be found in the project area, most likely Leatherback turtles.
- Seabirds – The project area does *not overlap* with Penguin or Cape Gannet feeding and breeding areas.
- Marine mammals – Long-finned pilot whale, sperm whale and humpback whale are most likely in the project area *at certain times*. Many whales migrate from the southern African west coast to Antarctica or Subantarctic.

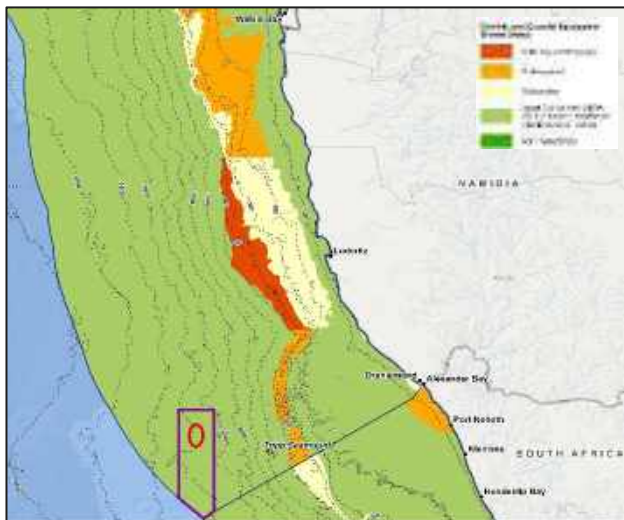


Figure 10: Benthic ecosystem threat status

The seabed habitat at depths beyond 500 m, including the area where the Venus Field is located, is considered 'Least Threatened' (see Figure 10).

The Venus Field is adjacent to the [Orange Seamount and Canyon Complex Ecologically and Biologically Significant Area \(EBSA\)](#) (Figure 11). This EBSA includes different habitats (seamount and canyons – outside of the project area) and is important for threatened species and habitats and biological diversity. Management recommendations for this EBSA do not prohibit petroleum extraction. The Block does not overlap with any Marine Protected Areas (Figure 12).

5.2.2 Nearshore Transshipment Area

In the likely transshipment location close to Walvis Bay, nearshore activities may fall within the foraging and migratory corridors of seabirds, seals, and whales (e.g. Humpback and Southern right whale). Additionally, there could be overlap with coastal EBSAs (Figure 11 and Figure 12), as well as be in the vicinity of Ramsar sites or Important Bird Areas (IBAs) located on the coast.

For other less likely locations, in addition to above, the nearshore transshipment area may overlap with the Namibian Islands Marine Protected Area (NIMPA), which stretches ~30 km from the coast and includes 16 offshore islands, islets and rocks.

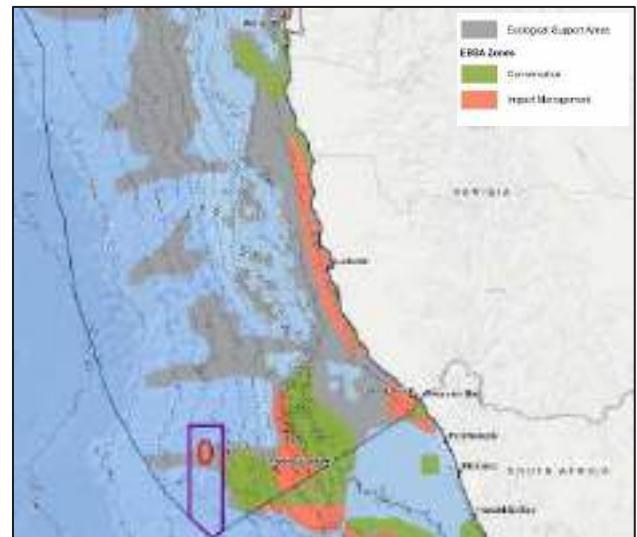


Figure 11: EBSAs and Ecological Support Areas (ESAs)



Figure 12: Marine Protected Areas and Coastal National Parks

5.3 Fishing Activity

5.3.1 Offshore Venus Field



Several commercial fisheries operate off the Namibian Coast. The large pelagic longlines sector is the only Namibian commercial fishing sector that overlaps with the Venus Field.

5.3.2 Nearshore Transshipment Area

Several commercial fishing sectors operate off the Namibian coast, primarily from the ports of Walvis Bay and Lüderitz. Nearshore transshipment areas may overlap with the traditional linefish sector, which typically operates in shallower waters up to 22 km offshore.

Overlap with other commercial fishing activities is unlikely, as most operate in deeper waters, ranging from 200 m to 850 m deep, and thus offshore of likely transshipment areas.

Mariculture operations are concentrated around Lüderitz, Walvis Bay, Swakopmund, and, more recently, Oranjemund. Operations may also overlap with small-scale fisheries.

5.4 Socio-Economic Environment



The Namibian coastline from Walvis Bay in the north to Oranjemund in the south is broadly considered the project's potential area of influence.

Lüderitz, located in the //Karas Region, is a port town primarily supporting the fishing, mining and offshore oil and gas sectors. Industrial development is limited, with most parts of the town are residential neighbourhoods.

Walvis Bay, in the Erongo Region, is Namibia's third largest town and the country's largest commercial port. This port handles container imports and exports, transshipments, bulk commodities, and offshore oil and gas support activities. Industrial development extends into the desert, and the fishing industry plays an important role in the local economy.

The Venus Field lies within the shipping route around southern Africa (see Figure 13). Five submarine cables pass through Namibian waters. The Venus field lies between the West Africa Cable System and Equiano submarine cables (Figure 14).

The coastal region south of Lüderitz is a restricted diamond mining area, which limits public access. Marine diamond mining is currently limited to the southern half of the Namibian offshore to depths of 150 m (Figure 14).

5.5 Heritage

Numerous shipwrecks are located along the Namibian coastline. The Environmental Baseline Survey (EBS) in Block 2913B did not identify any wrecks. The possibility of identifying new shipwrecks is low.

Intangible Cultural Heritage includes ritual and spiritual practices influenced by the histories of the San, Ovahimba, Herero, and Ovambo peoples, with rare connection with the ocean or sea displayed.

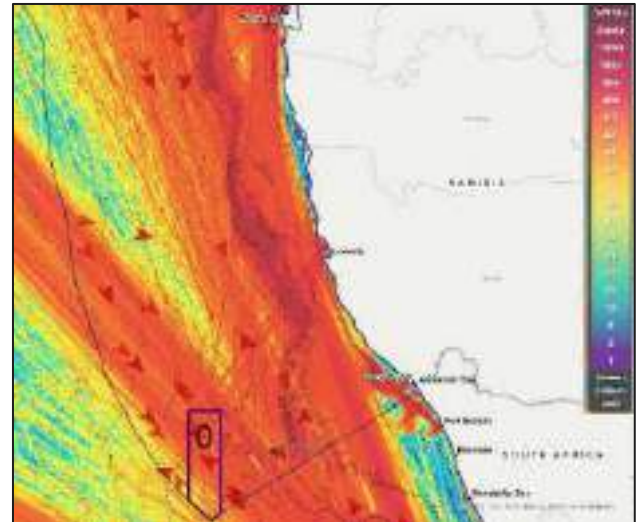


Figure 13: Shipping density

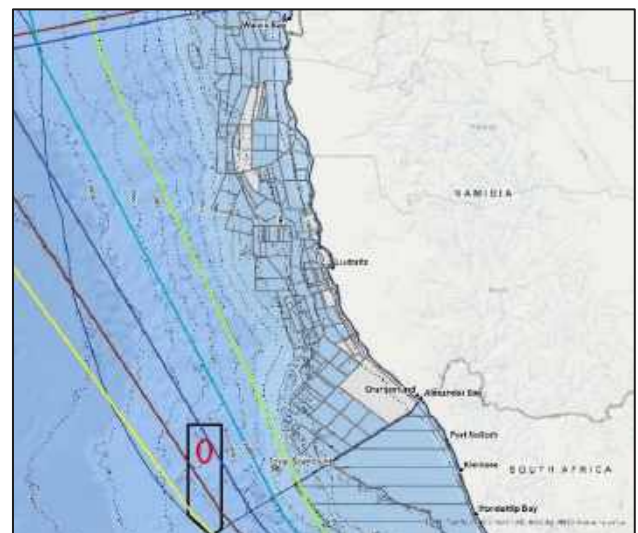


Figure 14: Mining areas and submarine cables

6.0 Key Environmental and Socio-Economic Potential Impacts

During the Scoping Phase, SLR identified several potential impacts of the project on the natural environment and people (see Table 1) – these will be further assessed in the ESIA.

Table 1: Key potential project impacts

Project Activity	Potential Impacts
Presence of subsea infrastructure	• Changes to seabed habitat through additional hard substrate • Impacts on religious and ritual connections to the coast / sea
Emissions to the atmosphere	• Emission of greenhouse gases • Reduction in local air quality, which could have effects on health if it reaches coastal receptors
Discharges to sea	• Physical disturbance of the seabed and smothering of plants and animals living on it • Increased sea water turbidity and water contamination • Impacts on fishing success • Impacts on religious and ritual connections to the coast / sea
Underwater noise	• Behavioural disturbance, and physical and/or physiological injury of marine fauna • Impacts of fishing success • Impacts on religious and ritual connections to the coast / sea
Implementation of safety zones	• Exclusion of fishing activities within safety zone around drill unit, FPSO, DPST and project vessels affecting catches
Operational requirements (logistics, procurement, services, etc.)	• Income generation from provision of local services at onshore base • Employment of some staff for offshore and onshore services • Competition for and availability of services

The ESIA also considers unplanned events (Table 2). These are not expected to happen. Nevertheless, it is important that potential impacts, if they happen, are understood, so that measures can be taken to prevent and minimise effects. Such unplanned events mainly include marine diesel spill, oil spill during transfer, well blow-out, gas injection line rupture.

Table 2: Potential impacts of unplanned events

Potential impacts from unplanned events
• Seawater pollution from a marine diesel or oil spill could impact animals (and plankton) in the water column and on the sea surface • Fishing vessels may not be able to enter polluted sea areas for some time, and fish species may avoid such areas • Reduction of catch could decrease fishing income • Tourism and other coastal activities may have to reduce their activities and corresponding incomes in case of nearshore pollution • Pollution could affect people's cultural heritage value of and links to the sea • Uncontrolled release of gas or evaporated oil could increase pollutants and GHG in the air



7.0 Specialist Studies

Specialists will study and assess the key potential impacts and identify measures to avoid or reduce negative impacts to acceptable levels and enhance any benefits (positive impacts).

Modelling studies will predict how far disturbance may spread in the sea:

- Underwater noise modelling
- Drilling discharges modelling
- Liquid effluent discharges modelling
- Oil spill modelling

Results from the modelling studies may be used by some of the specialists to assess impacts that may occur. Proposed specialist impact assessments include:

- Marine ecology impact assessment
- Fisheries impact assessment
- Socio-economic impact assessment
- Cultural heritage impact assessment
- Air quality impact assessment
- GHG and Climate change risk assessment
- Waste management study
- Closure and decommissioning study

A human rights screening is underway to determine whether a full assessment is required.

Specialists will also recommend mitigation to minimise potential impacts and / or optimisation measures to enhance potential benefits. These measures will be included in the ESMP.



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Appendices

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Acronyms and Abbreviations

Acronym/ Abbreviation	Definition
BID	Background Information Document
BOP	Blow-Out Preventer
Btu	British thermal units
CITES	Convention on International Trade of Wild Fauna and Flora Endangered Species
CLC	Convention on Civil Liability for Oil Pollution Damage
CMS	Convention on Migratory Species
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
CRR	Comments and Responses Report
CT	Conventional Tanker
DEA	Directorate of Environmental Affairs
DPST	Dynamic Positioned Shuttle Tanker
DSR	Draft Scoping Report
FSR	<u>Final Scoping Report</u>
EBSA	Ecologically or Biologically Significant Area
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPL	Exclusive Prospecting Licence
ESA	Ecological Support Area
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FAQ	Frequently Asked Questions
FPSO	Floating Production Storage and Offloading
FSR	Final Scoping Report
GHG	Greenhouse Gases
GN	Government Notice
HPP	Harambee Prosperity Plan
I&APs	Interested and Affected Parties
ICCAT	International Convention for the Conservation of Atlantic Tunas
IEA	International Energy Agency
IMO	International Maritime Organisation
JV	Joint Venture composed of TotalEnergies EP Namibia B.V., Impact Oil & Gas Namibia (Pty) Ltd ("Impact Oil & Gas"), NAMCOR, QatarEnergy International E&P LLC ("QatarEnergy"), all holding the PEL 0056 for Block 2913B
JV Operator	TotalEnergies EP Namibia B.V.
LUCORC	Lüderitz upwelling cell – Orange River Cone
LWD	Logging While Drilling
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
MGO	Marine Gas Oil
MIME	Ministry of Industries, Mines and Energy
MOC	Management of Change
MoU	Memorandum of Understanding
MPA	Marine Protected Area
MSDS	Material Safety Data Sheet
MSP	Marine Spatial Planning
MTI	Ministry of Trade and Industry
MWT	Ministry of Works and Transport
NADF	Non-Aqueous Drilling Fluid



Acronym/ Abbreviation	Definition
NAMPORT	Namibia Ports Authority
NBSAP	National Biodiversity Strategy and Action Plan
NCCC	National Climate Change Committee
NCCSAP	National Climate Change Strategy and Action Plan
NDC	Nationally Determined Contribution
NDP5	Fifth National Development Plan
NIMPA	Namibian Islands' Marine Protected Area
NIRP	National Integrated Resource Plan
NMVOC	Non-Methane Volatile Organic Compounds
OECD	Organisation for Economic Co-operation and Development
OSCP	Oil Spill Contingency Plan
OSRL	Oil Spill Response Limited
PAH	Polycyclic Aromatic Hydrocarbon
PEL	Petroleum Exploration Licence
PIT	Petroleum Income Tax
PM	Particulate Matter
ROV	Remote Operating Vehicle
SAN	South African Navy
SEP	Stakeholder Engagement Plan
SIA	Socio-Economic Impact Assessment
SLR	SLR Environmental Consulting (Namibia) (Pty) Ltd
SME	Small and Medium Enterprise
SOLAS	International Convention for the Safety of Life at Sea, 1974
TB	Tuberculosis
TCEQ AEGL-1	Texas Commission on Environmental Quality Acute Exposure Guideline Level-1
TEEPNA	TotalEnergies EP Namibia B.V.
UNCBD	United Nations Convention on Biological Diversity
UNCLOS	United Nations Law of the Sea Convention
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VOC	Volatile Organic Compounds
VSP	Vertical Seismic Profiling
WBM	Water-Based Mud
WHO AQG	World Health Organisation Air Quality Guidelines



General Terminology

Terms	Definition
Activity	An “activity” is defined as a distinct process or risk undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation.
Area of Influence	The IFC Performance Standard 1 defines the area of influence as: • The area likely to be affected by: (i) the project and the client’s activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the project; (ii) impacts from unplanned but predictable developments caused by the project that may occur later or at a different location; or (iii) indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities’ livelihoods are dependent. • Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable. • Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted In practical terms, the area of influence indicates where and to what extent the Operator should focus its efforts on analysing, mitigating and compensating for the direct and indirect impacts of the proposed project.
Area of Interest	The Area on Interest is the area within the licence block that the operator has identified, based on available data, for the proposed activities.
Aspect	An environmental or social ‘aspect’ is an element of an organisation’s activities, products and services which can interact with the natural and social environment. The interaction of an aspect with the natural and social environment may result in an impact.
Baseline	A description of the physical, biological and socio-economic environment based on data and information from the pre-project conditions that provides a reference against which any future changes associated with a project can be assessed, and which provides information for subsequent monitoring of biodiversity performance. The baseline should identify and describe the attributes of the physical, biological, socio-economic and cultural receiving environment both in the immediate and wider area around a project site.



Terms	Definition
Cumulative Impact	Impacts that in combination with other impacts from the same project or other existing or planned (but reasonably foreseeable) projects affect the same environmental or social resources and/or receptors as the Project. They may be of two types: • Additive - impacts that may result from the combined or incremental effects of future planned activities (i.e. those developments currently in planning and not included as part of the existing baseline conditions); or • In-combination - impacts where individual project-related impacts are likely to affect the same environmental or socioeconomic feature (e.g., a combined effect of noise and drill cutting on a receptor acting together in space and time could result in increased effects greater than the individual effects in isolation).
Effect	Effect is a change in a variable or parameter caused or influenced by a project activity, but where no judgement or evaluation is made about the consequence of this change on a receptor. Effects are typically related to abiotic or physico-chemical changes (e.g., change in water quality, air quality or noise) (see 'Impact' below)
Embedded or Project Controls	The physical or procedural measures that are built into the design or operation of a project and required by law or standard for good international industry practice and which serves to mitigate potential consequences on the environment (e.g., application of MARPOL standards; installation of air quality scrubbers on smoke stacks). These measures are typically incorporated into the project description and should not be considered additional mitigation measures in the evaluation of post-mitigation impact significance.
Footprint	The area directly affected by a project usually through physical disturbance such as land clearance and placement of infrastructure and which falls within the direct area of influence of the project.
Joint Venture partner(s)	A Joint Venture partner(s) is a party/company that collaborates with others to share resources, expertise, and costs to achieve a project's goals.
Impact	Impact is a change resulting from an aspect acting on a natural or environmental and socio-economic receptor (e.g., impact of air quality change on nearby settlement or impact of water quality change on instream biota etc.). Impacts are evaluated in an ESIA process using an agreed impact assessment methodology taking into account aspects such as receptor sensitivity, intensity, extent and duration. Impacts can be direct, indirect, induced, or cumulative.
Mitigation Hierarchy	A process of sequentially prioritising the application of measures to avoid, mitigate, restore and offset impacts to minimise impacts to as low as reasonably possible (ALARP).



Terms	Definition
Offset	Measures taken to compensate for any significant residual, adverse impacts that cannot be avoided, minimised and/or rehabilitated or restored, in order to achieve no net loss or preferably a net gain of biodiversity.
Operator	An Operator, in the oil and gas industry, is the entity responsible for managing and controlling the operations within an offshore licence block, including drilling, production, and maintenance activities.
Planned Impact	An impact that is expected as a result of a Project's planned activity (e.g., generation of drill cuttings during drilling), i.e. impacts related to normal operations. Planned impacts would include a standard or normal occurrence that may arise during routine project activities (including small uncontrolled discharges during normal operations), as opposed to an unplanned event (such as well blow out, tanker collision, dam break etc.).
Pre-Mitigation	The assessment of impact significance <u>before</u> mitigation has been applied but which includes the implementation of embedded control measures.
Project	The Project includes all the infrastructure components and activities which form part of the development, including all related and ancillary facilities or infrastructure (e.g., power and water supply, roads, waste services etc.) without which the Project cannot proceed. It also includes any other developments or activities which follow as a necessary consequence of the project. The IFC Performance Standard 1 defines the term "project" as a set of business activities, including those where specific physical elements, aspects, and facilities likely to generate risks and impacts, have yet to be identified. Where applicable, this could include aspects from the early developmental stages through the entire life cycle (design, construction, commissioning, operation, decommissioning, closure or, where applicable, post-closure) of a physical asset.
Residual impact	The assessment of impact significance <u>after</u> additional technically feasible and agreed mitigation has been applied in accordance with the mitigation hierarchy (including the implementation of embedded control measures).
Receptor	Receptors are environmental components, people and cultural heritage assets that may be affected (adversely or beneficially) by the proposed project. They can be categorised into three types: • Physical marine environment (i.e. non-living (abiotic) environmental components, e.g., water and air quality, marine sediments, geology, noise, etc.). • Biological environment (i.e. terrestrial, coastal and marine habitats, flora and fauna, protected areas, etc.). • Socio-economic (i.e. local economy, people, settlements, livelihoods (e.g., resource users), and cultural heritage, etc.).



Terms	Definition
Scoping	Scoping is the process of defining the range of issues and alternatives to be considered and the approach to be followed in an ESIA process. It is typically designed to focus the ESIA on significant issues including those perceived as important by stakeholders.
Sensitivity	A term used to denote the importance or value or vulnerability of a receptor to an impact. Sensitivity ratings are defined specific to different receptor types.
Screening	Screening is a process to determine whether a proposed activity requires an environmental assessment, as well as the type and level of assessment required and is typically undertaken prior to commissioning an ESIA process. The term may also be used as a high-level assessment of potential impacts that may arise, for example, through the use of an activity- impact interaction matrix.
Unplanned Impact	Impacts that result from an unplanned or non-routine event and which are not reasonably foreseeable or expected during the Project. The probability or likelihood of occurrence is described when assessing unplanned impacts but is not used to influence the significance rating. Unplanned events include a fuel/oil spill during drilling operations but does not include routine spills during normal operations.



1.0 Introduction

This chapter provides the background and location of the proposed activity and describes the purpose of and structure of this report.

1.1 Background and Location

TotalEnergies EP Namibia B.V.(TEEPNA), and its Joint Venture (JV) partners (at present Impact Oil & Gas, NAMCOR and QatarEnergy)¹ are the joint holders of an Exploration Licence over Block 2913B, located off the southern coast of Namibia (see Figure 1-1). Block 2913B covers an area of 8 215 km² in extent and is located offshore southern Namibia, approximately 300 km from Oranjemund, 320 km from Lüderitz and 700 km from Walvis Bay, in water depths ranging from 2 600 to 3 300 m.

As part of the process of applying for offshore exploration drilling activities in the Block 2913B, an Environmental and Social Impact Assessment (ESIA) process was undertaken, which culminated in the Ministry of Environment, Forestry and Tourism (MEFT) issuing an Environmental Clearance Certificate (ECC) for the proposed activities on 19 September 2019 (MEFT Ref No. ECC-00134). The ECC was issued for a period of three years, expiring on 19 September 2022 and then renewed with the same reference for an additional three year, expiring on 19 September 2025².

In addition to above exploration and appraisal drilling activities, seismic surveys were conducted under ECC Ref No. 1475 – Seismic Survey Programme in Licence Block 2912 and 2913B, Orange Basin, Namibia. This ECC was initially issued on 29 June 2021, with 3 years validity and was renewed with the reference number 2401779 from 27 August 2024 to 27 August 2027.

Close-out reports were delivered to MEFT for each activity performed as part of the above-mentioned ECCs.

To date, the JV has undertaken the following key exploration and appraisal activities in Block 2913B related to Venus field:

- Drilled Venus-1X exploration well between November 2021 and March 2022, resulting in a significant discovery of light oil with associated gas;
- Drilled Venus-1A appraisal well between March and June 2023;
- Re-entered Venus-1X well and undertook a Drill Stem Test (DST³) between June and September 2023 to investigate the ability to flow hydrocarbons from the Venus-1X well;
- Re-entered Venus-1A well and undertook a DST between September and December 2023;
- Drilled Venus-2A appraisal well and undertook a DST between December 2023 and April 2024;
- Performed geophysical and geotechnical survey in Venus field area from May 2024 to March 2025.

¹ Partners and their respective shares (participation interests) can change over the course of a project.

² TEEPNA is currently in the process of renewing its ECC for a further three years.

³ Drillstem tests are typically performed on exploration wells, and are often the key to determining whether a well has found a commercial hydrocarbon reservoir. The most typically consists of alternating flow and buildup periods to determine reservoir pressure, permeability thickness and flow potential.



Based on the exploration and appraisal results, as well as ongoing development studies, TEEPNA and its JV partners are studying the feasibility to develop the offshore Venus Field, located in the northern portion of Block 2913B in water depths of around 3 000 m (see Figure 1-1), and produce oil for commercialisation. The proposed Venus development has a footprint extending around 20 km in a NW-SE direction and 15 km in an E-W direction.

The proposed offshore development programme includes the following activities:

- Construction activities:
 - o Drilling up to 40 development wells, including Oil Producer (OP) wells and Gas Injection (GI) wells. Before completion, some subsea wells may be tested to refine the knowledge of the reservoir characteristics;
 - o Installation and commissioning of subsea infrastructure, which includes all equipment located on or below the seabed used to extract hydrocarbons from the reservoir and connect the wells to the Floating Production, Storage, and Offloading (FPSO) unit, e.g. well heads Xmas trees, flow lines tie-in and end-points, Subsea Umbilicals, Risers, and Flowlines (SURF);
 - o Mobilisation, mooring and commissioning of the FPSO unit; and
 - o Installation of a mooring buoy nearshore to support oil transshipment
- Production activities / operations:
 - o Offshore production operations, including the activities of the Dynamically Positioning Shuttle Tankers (DPST), which will be used to offload the oil from the FPSO unit;
 - o Nearshore transshipment operations, where the DPST will offload the oil to a conventional tanker, which will, then, transport the oil to its final destination; and,
 - o Onshore, marine and aviation support facilities and operations.

The proposed project triggers a number of listed activities in terms of the Environmental Impact Assessment (EIA) Regulations 2012, and as such requires an Environmental Clearance Certificate (ECC) before these activities can commence.

SLR Environmental Consulting (Namibia) (Pty) Ltd (SLR) was appointed as the independent Environmental Assessment Practitioner (EAP) to manage the ECC application and to undertake a Scoping and EIA process for the proposed development and production activities (hereafter collectively referred to as “Environmental and Social Impact Assessment” or “ESIA” process).

1.2 Objective and Purpose of this Report

This Final Scoping Report (FSR) has been prepared in compliance with Section 8 of the EIA Regulations 2012 (see Table 3-2) and forms part of the Scoping Phase of the ESIA process.

The objectives of the Scoping Phase and this FSR are to, amongst others:

- Identify policies and legislation relevant to the proposed activities;
- Present the need and desirability of the proposed activities;
- Describe the proposed activity, technology, and site(s) (including any alternatives);
- Describe the receiving (baseline) environment to provide an understanding of the environmental and social context and sensitivities within which the proposed activities would occur;
- Screen and identify potential impacts that will be further investigated in the Impact Assessment Phase; and



- Outline the public participation process and scope of specialist studies to be undertaken in the impact assessment phase, as well as the impact assessment methodology to be used to define impact significance (see Section 8.0).

It should be noted that all significant changes to the draft report are underlined and in a different font (Times New Roman) to the rest of the text.

The compilation of the FSR has been informed by comments and issues received following the distribution of the Draft Scoping Report (DSR) for a comment period (2 April to 13 May 2025) and those raised during public engagements held in Bethanie, Keetmanshoop, Lüderitz, Oranjemund, Windhoek, Swakopmund, Henties Bay and Walvis Bay as well as from the online public meeting held on 6 May 2025. Comments received by Urban Dynamics and SLR have been recorded and responded to in a Comments and Responses Report (see Appendix B.10 of the FSR). Note that confirmation of the receipts and administrative requests were not included in the Comments and Responses Report but were actioned by Urban Dynamics and/or SLR.

This report is submitted to the Ministry of Industries, Mines and Energy (MIME): Directorate of Petroleum Affairs for consideration and review. In terms of Section 32 of the Environmental Management Act, 2007 (No. 7 of 2007), MIME is required to make a recommendation on the acceptance or rejection of the report to the Ministry of Environment, Forestry and Tourism (MEFT): Directorate of Environmental Affairs (DEA), who makes the final decision regarding the acceptance of the FSR.



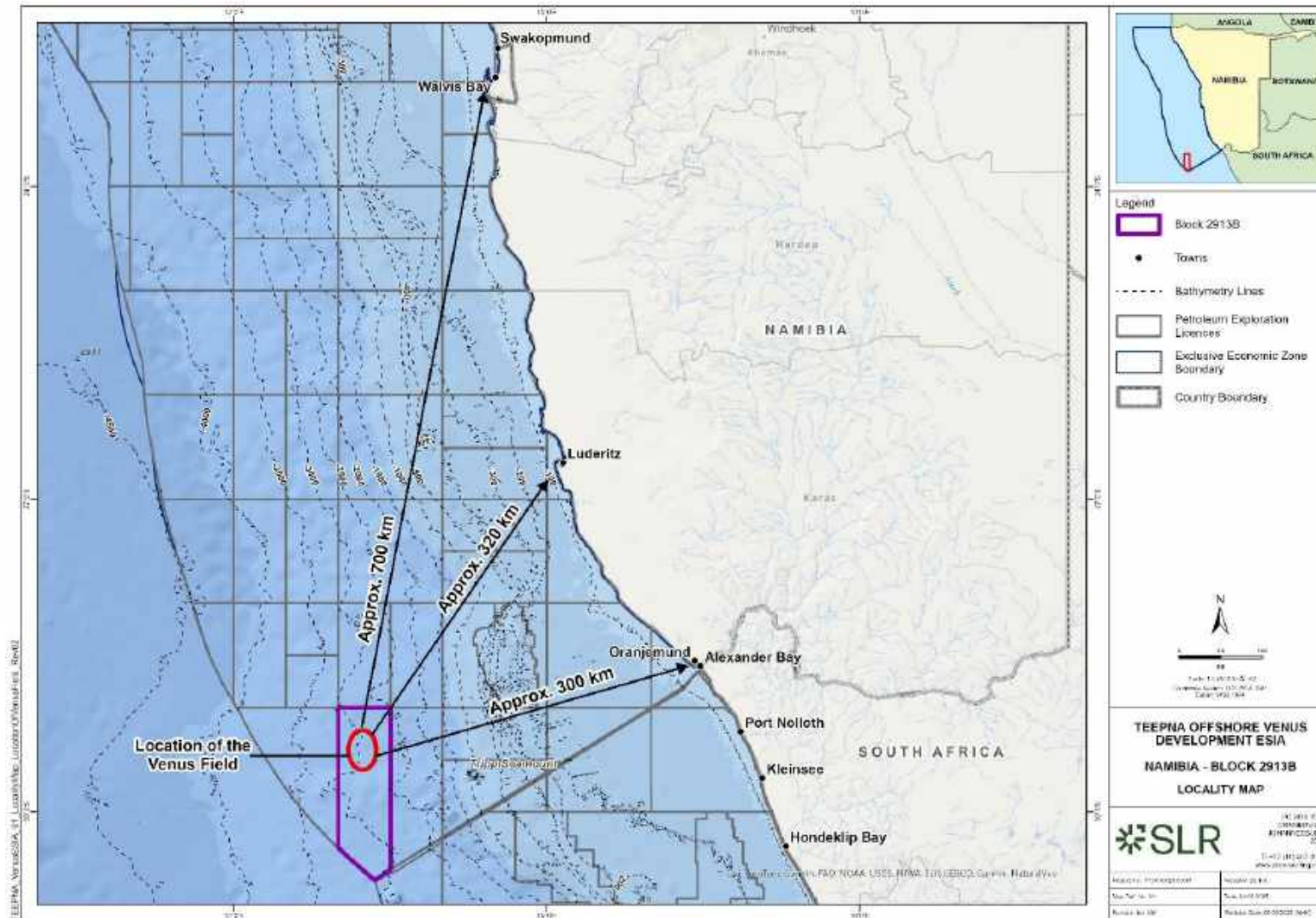


Figure 1-1: Locality Map of Block 2913B off the southern coast of Namibia.



1.3 Structure of this Report

An overview of the structure and content of this report is given in Table 1-1 below.

Table 1-1: Structure and content of the Final Scoping Report.

Section	Contents
Non-Technical Summary	Provides a synopsis of the FSR using non-technical language.
Chapter 1	Introduction Provides the background and location of the proposed activity, and describes the objectives, purpose and the structure of this report.
Chapter 2	Administrative and Legal Framework Outlines the Namibian administrative framework, key legislative requirements and other relevant local legislation and international conventions applicable to the proposed activities and ESIA process.
Chapter 3	ESIA Approach and Process Presents the ESIA project team, ESIA assumptions and limitations, and outlines the approach and process followed during the ESIA, including public participation aspects.
Chapter 4	Need and Desirability Analyses the need for, and desirability of the proposed activities based on its 'fit' with the policy and planning framework adopted by the Namibian administration.
Chapter 5	Description of the Proposed Activities Provides general information and a detailed description of the proposed activities and associated alternatives.
Chapter 6	Receiving Environment Describes the existing physical, biological, socio-economic and cultural environment that could potentially be affected by the proposed development and production activities.
Chapter 7	Screening of Environmental and Socio-Economic and Key Impacts Provides a high-level screening of the interaction between the proposed development and production activities and the biophysical and social environment; identifies key issues and impacts associated with the proposed activities; and describes alternatives and options for further consideration in the ESIA. This chapter also presents those impacts considered to be insignificant and which were screened out during the Scoping Phase
Chapter 8	Plan of Study for Impact Assessment Outlines the scope of further investigations (including the technical and specialist studies) to be undertaken during the Impact Assessment Phase and sets out the proposed approach to the assessment of impacts.
Chapter 9	References Provides a list of the references used in compiling this report.
Appendices	Appendix A: Curricula Vitae of the SLR ESIA Project Team Appendix B: Public Participation Process Documents Appendix B.1: Stakeholder Database Appendix B.2: Advertisements Appendix B.3: Radio Announcements



Section	Contents
	Appendix B.4: Site Notices Appendix B.5: I&AP Notification Letters Appendix B.6: Background Information Document and Non-Technical Summary of the DSR Appendix B.7: Public Meeting Presentation Appendix B.8: Meeting Minutes and Photographs Appendix B.9: I&AP Correspondence Appendix B.10: Comments and Responses Report Appendix B.11: SAIEA Independent Review Letter



2.0 Administrative and Legal Framework

This chapter outlines the Namibian administrative framework, key legislative requirements and other relevant local legislation and international policy and planning framework applicable to the proposed activities and ESIA process.

2.1 Namibian Institutional and Administrative Framework Applicable to this ESIA

2.1.1 Ministry of Environment, Forestry and Tourism

The MEFT is the custodian of Namibia's natural environment, and its mission is to "*promote biodiversity conservation in the Namibian environment through the sustainable utilisation of natural resources and tourism development for the maximum social and economic benefit of its citizens*". MEFT develops, administers and enforces environmental legislation and policy.

The Ministry comprises six directorates; one of which is the DEA. DEA gives effect to Article 95L of the Constitution by promoting environmental sustainability. The Environmental Commissioner serves as head of the DEA. The DEA administers ESIA processes undertaken in terms of the Environmental Management Act, 2007 and the EIA Regulations 2012 and will be responsible for issuing a decision on the ESIA and ECC application with input from MIME. If approved, the DEA will issue an ECC.

2.1.2 Ministry of Industries, Mines and Energy

The MIME is responsible for promoting and regulating the development and use of Namibia's natural resources. The Ministry comprises seven directorates; one of which is the Directorate of Petroleum Affairs.

The Directorate of Petroleum Affairs regulates the petroleum industry and administered by the Petroleum Commissioner. It issues licences for petroleum exploration and production. Exploration licenses under section 38 of the Petroleum (Exploration and Production) Act, 1991, and per the Environmental Management Act, 2007 and Regulations, 2013 (Listed Activity 3) an ECC must be awarded prior to the commencement of activities.

A Petroleum Production Licence is issued under section 46 of the Petroleum Act, 1991. An ECC is also required prior to the commencement of activities, as per the Environmental Management Act, 2007.

MEFT requires that ECC applications related to oil and gas developments must be submitted to MIME as the Competent Authority, with responsibility assigned to the Petroleum Commissioner. On conclusion of the ESIA process, MIME will make a recommendation on the ECC application to MEFT, who in turn makes the final decision on the application for ECC.

2.1.3 Ministry of Works and Transport

The Ministry of Works and Transport (MWT) is responsible for infrastructure development and setting transport policy and regulation. MWT comprises four departments, one of which is the Department of Transport.

The Directorate of Maritime Affairs falls under the Department of Transport. This Directorate is responsible for ensuring the safety of life and property at sea; the prevention and combat of pollution of the marine environment by ships; and promotion of Namibia's maritime interests. MWT: Directorate of Maritime Affairs is responsible for sending out Marine Circular(s) notifying other offshore users of any navigation warnings required during project implementation.



2.1.4 Namibian Ports Authority

The Namibian Ports Authority (Namport) is a public entity that reports to MWT. The National Ports Authority Act, 1994 (No. 2 of 1994) gives Namport the responsibility of protecting the environment within harbour areas. Namport manages both the Port of Walvis Bay and the Port of Lüderitz.

2.1.5 Ministry of Fisheries and Marine Resources

The Ministry of Fisheries and Marine Resources (MFMR) is responsible for the management and development of fisheries and aquaculture in Namibia. The Ministry is comprised of four directorates; two of which are the Directorate of Resource Management and Directorate of Operations.

The Directorate of Resource Management is responsible for scientific research and providing advice on the state of commercially important marine fish stocks and recommending catch quotas. It is also responsible for managing and regulating species fish size limits, dates of closed fishing seasons, declaring areas closed to fishing and determining fishing gear use.

The Directorate of Operations is responsible for monitoring, controlling and surveillance of fishing-related activities both at sea and onshore.

2.2 Namibian Laws and Policies Applicable to the Environmental Assessment of Oil and Gas Projects

2.2.1 Policy and Legal Framework for ESIA

2.2.1.1 Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1995

Namibia's Environmental Assessment Policy was published in 1995 and promotes sustainable development and economic growth while protecting the environment in the long-term. The government recognises that EIA (termed Environmental Assessment in the Policy) is a key tool to further the implementation of a sound Environmental Policy that strives to achieve Integrated Environmental Management. EIAs ensure the consequences of development projects are considered and incorporated into the planning process. Marine petroleum exploration and production are listed as an activity that requires an EIA.

Implications for this project: This ESIA process is undertaken in furtherance of this Policy.

2.2.1.2 Environmental Management Act, 2007

The Environmental Management Act, 2007 (No. 7 of 2007) was promulgated in December 2007 and came into effect on 6 February 2012. The main objectives of this Act are to ensure that:

- Significant effects of activities on the environment are considered carefully and timeously;
- There are opportunities for timeous participation by I&APs throughout the assessment process; and
- Findings are considered before any decision is made in respect of activities.

Section 3(2) of the Act provides a set of principles which give effect to the provisions of the Constitution for integrated environmental management. Decision-makers must take these principles into account when deciding on a proposed project or activity. This Act stipulates



that no party, whether private or governmental, can conduct a listed activity without an ECC obtained from the Environmental Commissioner.

Implications for this project: The proposed project requires an ECC. An ECC application was submitted to MIME and uploaded onto MEFT's online portal (see Section 3.4.1.1). This ESIA process is undertaken to inform MIME's and MEFT's consideration of the ECC application.

2.2.1.3 EIA Regulations 2012

The EIA Regulations 2012, promulgated on 6 February 2012 in terms of Section 56 of the Environmental Management Act, 2007 (Government Notice [GN] No. 30) provides for the control of certain listed activities. These listed activities are provided in GN No. 29 and are prohibited until an ECC has been obtained from MEFT. Such ECCs, which may be granted subject to conditions, will only be considered once there has been compliance with the EIA Regulations 2012. GN No. 30 sets out the procedures and documentation that need to be complied with in undertaking an EIA process.

Implications for this project: The proposed development project triggers listed activities (see Table 2-1), and this ESIA process is being undertaken to inform MIME's and MEFT's consideration of the ECC application.

Table 2-1: List of applicable activities that require an ECC in terms of the EIA Regulations 2012

Activity	Comment
2. Waste management, treatment, handling and disposal activities	
2.2 Any activity entailing a scheduled process referred to in the Atmospheric Pollution Prevention Ordinance, 1976.	There are currently no scheduled activities listed in terms of the Atmospheric Pollution Prevention Ordinance, 1976. This activity has, however, been included should the incineration of waste onboard the FPSO unit or other activities falling within this ordinance be listed in future.
2.3 The import, processing, use and recycling, temporary storage, transit or export of waste.	Waste would be generated during the development drilling, facilities installation, production and decommissioning phases, mainly associated with the drilling units, FPSO unit, DPST and support vessels. Various non-hazardous and hazardous wastes will be temporarily stored on vessels and transported to shore for onshore treatment, recycling and / or disposal by authorised contractors.
3. Mining and quarrying activities	
3.2 Other forms of mining or extraction of any natural resources whether regulated by law or not.	The objective of the proposed development relates to the extraction of a resource (hydrocarbons) from below the seabed in the licence area. The reservoir fluid will be extracted using producing wells. The reservoir fluids (oil, gas and water) will be separated and processed to required specifications on an FPSO unit. Once treated, the produced oil will be stored onboard the FPSO unit prior to transfer to DPSTs for transport to its final destination (by conventional oil tanker). Once treated, the produced gas will be re-injected to the reservoir and the produced water will be discharged overboard. More detail is provided in the project description (Section 5.0).
3.3 Resource extraction, manipulation, conservation and related activities.	
3.4 The extraction or processing of gas from natural and non-natural resources, ...	



Activity	Comment
8. Water resource development	
8.12 <i>The release of brine back into the ocean by desalination plants.</i>	Seawater is desalinated on the FPSO unit, drilling unit and some support vessels for fresh water and other purposes (e.g. hydrostatic test fluids). The waste stream from the desalination plant is brine (concentrated salt), which is produced in the reverse osmosis process. The brine stream will be discharged overboard.
9. Hazardous substance treatment, handling and storage	
9.1 <i>The manufacturing, storage, handling or processing of a hazardous substance defined in the Hazardous Substances Ordinance, 1974</i>	The objective of the proposed development relates to the extraction of a resource (hydrocarbons) from below the seafloor in the licence area. Hydrocarbons and Non-Aqueous Drilling Fluid (NADF) are not specifically defined in the Hazardous Substances Ordinance, 1974. This activity has, however, been included, as hydrocarbons and NADFs could be considered to have hazardous properties.
9.2 <i>Any process or activity which requires a permit, licence or other form of authorisation, ... in terms of a law governing the generation or release of emissions, pollution, effluent or waste.</i>	Effluent discharges (e.g. brine, produced water) from the FPSO unit, drilling unit and some support vessels may require an Effluent Discharge permit. The requirement for an Effluent Discharge permit will be confirmed in consultation with the Department of Water Affairs: Ministry of Agriculture, Water and Land Reform.
9.3 <i>The bulk transportation of dangerous goods using pipeline, funiculars or conveyors with a throughout capacity of 50 tons or 50 m³ or more per day.</i>	The proposed development activities would make use of infrastructure, which would convey oil or gas from the geological structure (reservoir) to the drilling unit at the surface during well testing and to the production platform (FPSO unit) during resource extraction and re-injection of gas back into the reservoir. The throughput capacity of hydrocarbons will be greater than 50 m ³ per day.
9.4 <i>The storage and handling of a dangerous goods, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 m³ at any one location.</i>	The FPSO unit has production capacity up to ~160 000 barrels (25 437 m ³) of oil per day at plateau and ~2 million barrels (317 975 m ³) of oil storage. Oil from the FPSO unit will be transferred to the DPST. The transfer of one ~1 Mbbl (~160 000 m ³) load will take up to ~24 hours (continuous transfer). Oil from the DPST will then be transferred to a conventional oil tanker. The transfer of one ~1 Mbbl load will take up to ~24 hours (continuous transfer). Detail is provided in the project description (Section 5.0).
10. Infrastructure	
10.1 <i>The construction of (e) any structure below the high-water mark of the sea;</i>	The proposed development would result in the placement of drilling equipment (wellheads) and production infrastructure (e.g. SPS, SURF, pipelines, Christmas trees, in line tee, flow line end terminations, mooring lines and anchors, etc.) on the seabed / below the high-water mark in the Venus field area. A mooring buoy will also be installed at the nearshore transshipment location.



2.2.2 Legal and Policy Framework for Oil and Gas Projects

Regulation of the Namibian oil and gas industry is the mandate of MIME. The fiscal regime is outlined in the Petroleum (Exploration and Production) Act, 1991 (No. 2 of 1991), the Petroleum (Taxation) Act, 1991 (No. 3 of 1991) and the Petroleum Laws Amendment Act, 1998 (No. 24 of 1998). Administrative provisions are also provided in the Income Tax Act, 1981 (No. 24 of 1981).

2.2.2.1 Petroleum (Exploration and Production) Act, 1991

The Petroleum (Exploration and Production) Act, 1991 (No. 2 of 1991) governs oil and gas exploration and production in Namibia. Section 9 of this Act requires a licence is obtained from the MIME before any reconnaissance, exploration or production operations for petroleum can be undertaken. Prior to the granting of an Exploration or Production Licence, a Petroleum Agreement must be entered into between the Minister and the potential licence in terms of Section 13 of the Act. The Petroleum Agreement (in addition to the relevant environmental legislation referred to above) prescribes that all companies must undertake ESIA's for production activities. Section 38 and Section 53 prescribe the obligations of the holder of an exploration and a production licence, respectively.

In terms of Section 17(1) of the Act, a holder of a licence shall not drill a well less than 1 000 m from the boundary of the area to which the licence relates, except with the approval in writing, of the Minister.

Implications for this project: TEEPNA and its JV partners currently hold a Petroleum Exploration License for Block 2913B and are investigating the feasibility of developing Venus field located within Block 2913B. If the JV partners decide to proceed with the development, this would *inter alia* require a Petroleum Production License (PPL) and an ECC. The current ESIA process is undertaken to inform MIME's and MEFT's consideration of the ECC application (see Section 2.1.2).

In terms of Section 53 read together with Section 38(1)(d) and (e) of the Act, an operator shall “remove ... all structures, equipment and other goods not used or intended to be used in connection with such [exploration] operations” and “take reasonable steps to warn persons ... of any such structures, equipment or other goods of the possible hazards resulting therefrom”. Furthermore, in terms of Section 38(2)(g), an operator must prior to the drilling provide the Commissioner “a report containing particulars of the technique to be employed, an estimate of the time to be taken, the material to be used and the safety measures to be employed in the drilling of such well”.

2.2.2.2 Petroleum (Exploration and Production) Act Regulations, 1999

The Petroleum (Exploration and Production) Act Regulations, 1999, promulgated under Section 76A of the Petroleum (Exploration and Production) Act, 1991, sets out the obligations of the operator, some of which are listed below:

- Take all such precautions as may be necessary to protect the environment and natural resources;
- Provide funds and take measures to ensure the health, safety and welfare of employees and the protection of other persons, property, the environment and natural resources from hazards arising from petroleum activities;
- Undertake ESIA studies ;
- Register the installation and ensure that it has a certificate of fitness;
- Report the location of the installation to the Petroleum Commissioner and ensure that it is published in a “Notice to Mariners”;



- Ensure the installation is properly marked (see International Regulations for Preventing Collisions at Sea as incorporated into the Merchant Shipping Act, 1951);
- Equip the installation with equipment to record environmental data as may be necessary to exercise control over any petroleum activities;
- Ensure hazardous substances are properly transported, handled and stored;
- Ensure an Emergency Preparedness Plan is in place and updated as necessary;
- Establish an appropriate safety zone⁴ and communicate it to the Petroleum Commissioner, and ensure it is published in the “Notice to Mariners”; and
- Communicate any emergency to the Petroleum Commissioner immediately.

Implications for this project: Operator must comply with applicable obligations during all phases of the proposed development and production project. The current ESIA process is undertaken to inform MIME’s and MEFT’s consideration of the ECC application and reflects key applicable obligations in the ESMP.

2.2.2.3 Minerals Policy of Namibia, 2004

The Policy sets out guiding principles for the development of the “mining” sector (which includes mining, energy and oil / gas), to ensure it operates within environmentally acceptable limits. One of the objectives of the Policy is ensuring compliance with national environmental policy and other relevant policies to develop a sustainable mining industry.

The Policy commits MIME to ensuring:

- That the development of the mining industry proceeds on an environmentally sustainable basis;
- That mineral / resource development in proclaimed protected areas commences only when rehabilitation is guaranteed; investigating the establishment of financial mechanisms (environmental trust funds or bonds) for environmental rehabilitation and aftercare in other areas; and
- To developing national waste management standards and guidelines in consultation with the mining industry.

The provisions of this policy have been given effect through the enactment of the Petroleum (Exploration and Production) Act 2 of 1991 and Regulations.

MIME is in the process of drafting a new National Minerals Policy, the “draft National Minerals Policy, 2018”; this Policy notes that minerals are valuable natural resources being the vital raw material for the core sectors of the economy, and that mining must be carried out in an environmentally sustainable manner.

Implications for this project: One purpose of the ESIA is to determine the environmental acceptability of the project.

⁴ The outer boundary of the safety zone must be at a point 500 m from the end of each anchor or the outer edges of the installation and determined with due regard to (1) mining, fishing, tourism and other activities and interests that will be affected and (2) the nature of, and the functions performed by or at that installation (Petroleum (Exploration and Production) Act Regulations, 1999).



2.2.3 Selected Other Laws and Policies Relevant to Oil and Gas Development Projects

Selected other legislation relevant to the proposed activities are summarised in **Table 2-2** below. **Not all items are relevant to the ESIA process, and other legislation may also apply.**

Table 2-2: Selected Sectorial Laws and Regulation

Aspect	Law	Key Provisions
Petroleum sector	Petroleum Products and Energy Act (No. 13 of 1990) and relevant regulations	This Act provides for the application of environmental standards and the avoidance of environmental harm caused by the keeping, handling, conveying, using and disposing of petroleum products.
	Petroleum Taxation Act (No. 3 of 1991)	This Act provides for the levying and collection of petroleum income tax and additional profits tax on income related to exploration, development, and production operations in Namibia. It also addresses incidental matters related to these activities.
	Petroleum Laws Amendment Act (No. 24 of 1998)	This Act amends the Petroleum (Exploration and Production) Act, 1991 so as to, <i>inter alia</i> , make provision for the extension of the duration of exploration licences.
Transport and Maritime sector	Namibian Ports Authority Act (No. 2 of 1994) and Port Regulations	The Act provides for the establishment of the Namibian Ports Authority, which is charged with the management and control of ports and lighthouses in Namibia and the provision of facilities and services related thereto.
	Territorial Sea and Exclusive Economic Zone of Namibia Act (No. 3 of 1990)	This act claims the various maritime zones to which Namibia is entitled under international law (in this case, UNCLOS).
	The Territorial Sea and Exclusive Economic Zone of Namibia Amendment Act (No. 30 of 1991)	This Act changes the extent of the territorial zone to 24 miles.
Pollution	Atmospheric Pollution Prevention Ordinance (Ordinance 11 of 1976)	This Act provides for the prevention of the pollution of the atmosphere.
	Dumping at Sea Control Act (No. 73 of 1980)	This Act provides for the control of dumping of substances in the sea within 12 nautical miles of the low water mark.
	International Convention for the Prevention of Pollution from Ships Act (No. 2 of 1986)	This Act provides for the application of the MARPOL 73/78.
	International Convention relating to Intervention on the	This Act provides for the application of the International Convention Relating to Intervention



Aspect	Law	Key Provisions
	High Seas in cases of Oil Pollution Casualties Act (No. 64 of 1987)	on the High Seas in Cases of Oil Pollution Casualties.
	Prevention and Combating of Pollution of Sea by Oil Act (No. 6 of 1981) and associated Regulations	This Act provides for the prevention and combating of pollution of the sea by oil and determines liability in certain respects for loss and damage caused by the discharge of oil from ships, tankers and offshore installations. The provisions relating to offshore installations only apply to such installations as are situated within 50 nautical miles of the low water mark.
	Marine Notice (No. 2 of 2012): Transfer of Oil Outside Harbours	This notice sets out the requirements to transfer oil within Namibian waters.
Environmental/ Conservation	Marine Resources Act (No. 27 of 2000) and Regulations relating to the Namibian Islands' Marine Protected Area (NIMPA)	This Act provides for the conservation of the marine ecosystem and the responsible utilisation, conservation, protection and promotion of marine resources on a sustainable basis. The Regulations relating to the NIMPA provide with respect to the protection of resources of the Namibian Islands Marine Reserve. The Regulations delineate the protected areas, give coordinates of the All-encompassing buffer zone of the NIMPA, and places restrictions on various activities in the protected area and the buffer zone. These restrictions may need to be taken into consideration depending on where the nearshore transshipment location is located.
	Nature Conservation Ordinance (No. 4 of 1975)	This Ordinance consolidates and amends the laws relating to the conservation of nature; the establishment of game parks and nature reserves; and the control of problem animals (e.g., animals, declared as such by the Minister, which pose a threat to human activities, agriculture or other wildlife).
	Nature Conservation Amendment Act (No. 5 of 1996)	This Act amends the Nature Conservation Ordinance, 1975, so as to insert and substitute certain definitions; to provide for a proper administrative, legal and procedural framework for tourism concessions in protected areas and other State land; to control the import and export of live game or animal, and to increase the penalties; and to provide for incidental matters.
	National Heritage Act (No. 27 of 2004)	This Act provides for, inter alia, the protection and conservation of places and objects of heritage significance. The Act also outlines procedures for declaring and registering heritage places and objects, issuing permits for activities affecting heritage resources, and ensuring their sustainable use..
	Water Resources Management Act (No. 11 of 2013)	This Act provides for the control, conservation and use of water for domestic, agricultural, urban



Aspect	Law	Key Provisions
		and industrial purposes and for the control of certain activities on or in water in certain areas.
Hazardous Substances	Hazardous Substances Ordinance (Ordinance 14 of 1974)	These provide for the control of toxic substances which may cause injury, ill health or death of human beings.
	The Hazardous Substances Ordinance 14 of 1974: Group I Hazardous Substances	
Radiation Sources / Substances	Atomic Energy and Radiation Protection Act (No. 5 of 2005)	These provide for the control of production, handling and safe disposal of radioactive waste/materials to protect human health and the environment from harmful radiation effects.
	Radiation Protection and Waste Disposal Regulations (GN 221-2011 of 2011)	
Labour	Labour Act (No. 11 of 2007)	This Act sets out the fundamental rights of workers and basic conditions for work.
Health	Health Act (No. 21 of 1988)	This Act only relevant in as much as workers must be protected from harm.

2.3 Key Relevant Namibian Policy and Planning Frameworks

Key relevant planning and policy documents are discussed below and inform the analysis of the project's need and desirability in Chapter 4.0.

2.3.1 Energy-Related Plans and Policies

2.3.1.1 White Paper on the Energy Policy 1998

The White Paper on the Energy Policy (1998) is the overarching policy which guides planning in the energy sector. This White Paper embodies a new, comprehensive energy policy aimed at achieving security of supply, social upliftment, effective governance, investment and growth, economic competitiveness, economic efficiency and sustainability. The legislative framework governing upstream oil and gas is well developed, and the White Paper merely clarifies an accepted policy framework which seeks to optimise national benefits while achieving the necessary balance of interests to attract investment. The focus of the White Paper is on creating a policy and legislative framework, which attracts initial investment into the sector, while maintaining options for competition in the future and the fair distribution of economic rents.

2.3.1.2 Namibia's National Energy Policy 2017

The National Energy Policy spells out the Government of Namibia's intent, direction and undertakings regarding the development and future of the Namibian energy sector (MIME, 2017).

For the electricity sector, the key policy thrusts are the development of local generation capacity to improve security of supply through appropriate planning at national level, reviewing the present electricity market model, ensuring the on-going viability and development of the transmission and distribution networks, strengthening the regulatory framework, and shaping the electricity mix of the future (MIME, 2017).



For the upstream oil and gas sector, the policy expressly promotes exploration and production and notes that the “commercial discovery of oil and gas resources would significantly contribute to the Namibian economy, the attainment of national development goals, and improve the livelihoods of present and future generations. It is therefore essential for the Government to promote the country’s exploration potential and attract local and foreign investment in the sector. Since independence, the MME and NAMCOR have actively promoted the country’s exploration, development and production potential, and have attracted major oil industry players, resulting in investments in the Namibian oil and gas industry, which are estimated at N\$ 25 billion. Government is cognisant of the challenges of the oil and gas industry, including its capital intensive and high-risk nature, the lack of exploration successes, and the recent fall in the oil prices. Therefore, a conducive and internationally competitive investment framework that attracts reputable oil and gas companies is critically important. Government will therefore continue to market and promote exploration activities actively and sustainably by attracting local and foreign investment to the sector.”

The Government resolves to:

- Strengthen the national investment climate, to ensure certainty, stability and competitiveness through favourable commercial, legal and fiscal terms.
- Facilitate private sector investments and support the development of necessary expertise in the exploration and development of the country’s oil and gas resources.
- Continue to promote investments in the oil and gas sector at international, regional and national events.
- Encourage collaboration between existing licence holders to carry out joint exploration programmes (MIME, 2017).

2.3.1.3 National Integrated Resource Plan 2022

- Namibia’s National Integrated Resource Plan (NIRP) 2022 is an updated strategic framework for the country’s electricity supply industry. It is a 20-year development plan outlining the country’s energy goals and the steps needed to achieve covering the period from 2022 to 2042:
- Renewable Energy Commitments: The plan includes commitments to add 2 850 MW of renewable energy generation capacity and 650 MW of battery energy storage by 2040.
- Load Forecasting and Supply/Demand Balance: Updated projections for electricity demand and supply, ensuring that future energy needs are met efficiently.
- Policy Scenarios and Investment Choices: Various scenarios and investment options are evaluated to determine the most cost-effective and sustainable energy solutions.
- Integration of Renewable Energy: Continued focus on integrating solar and wind energy into the national grid.
- The NIRP 2022 aims to ensure a reliable, sustainable, and cost-effective energy supply for Namibia, aligning with national policy goals and environmental standards. The Plan specifically notes that it is desirable to make appropriate use of indigenous energy resources in supplying the electricity demand in Namibia.



2.3.2 Economy-Related Policies

2.3.2.1 National Upstream Petroleum Local Content Policy 2025

The Policy, still at a draft stage in March 2025, aims to ensure the full participation of all Namibians in the petroleum sector. In order to maximise the benefit to the country and its population, the policy emphasises the procurement of local suppliers and Namibian citizens across the value chain. The Policy also aligns with current development policies such as the National Development Plan, the National Energy Policy and more.

2.3.2.2 Vision 2030

In 2004, Namibia adopted Vision 2030, which outlines the country's development programmes and strategies to achieve its national objectives. One of the major objectives of Vision 2030 is to *“ensure the development of Namibia’s ‘natural capital’ and its sustainable utilisation, for the benefit of the country’s social, economic and ecological well-being”*.

The vision for non-renewable resources is that Namibia’s mineral resources are strategically exploited and optimally benefited, while ensuring that environmental impacts are minimised. Vision 2030 acknowledges that poorly planned or badly managed mining can result in a great variety of impacts that threaten human health and environmental integrity. Vision 2030 further notes that with EIAs applied during the planning phase and the implementation of ESMPs during operational phase, operations are increasingly better planned and negative impacts can usually be mitigated and localised.

2.3.2.3 Harambee Prosperity Plan (HPP) (2021-2025)

The HPP is a targeted action plan by the Namibian government aimed at accelerating development in key priority areas to achieve prosperity for all Namibians. It complements the long-term goals of the National Development Plans and Vision 2030 by focusing on effective governance, economic advancement, social progression, infrastructure development, and international relations. The plan seeks to enhance service delivery, contribute to economic recovery, and promote inclusive growth.

2.3.2.4 Fifth National Development Plan 2017/18 – 2021/22

Vision 2030 is being implemented through a series of five-year National Development Plans. The Fifth National Development Plan 2017/18 – 2021/22 (NDP5) aims to achieve rapid industrialisation, while adhering to the four integrated pillars of sustainable development:

- Economic Progression;
- Social Transformation;
- Environmental Sustainability; and
- Good Governance.

NDP5 recognises the use of Namibia’s natural resources in an efficient and sustainable way to achieve sustainable development and improve the welfare of the nation’s citizens. In this regard, it emphasises the importance of partnerships between government, the private sector, communities and civil society in ensuring that economic progress is achieved in an environment of social harmony.

It also plans to achieve economic progression by developing value added industrialisation, substituting imports for locally produced goods, creating value-chains of production, and to accelerate Small and Medium Enterprise (SME) development (NPC, 2017).



2.3.2.5 Strategic Plan, 2017/2018 – 2021/2022

In order to achieve the objectives in Vision 2030, the HPP and the NDP5, MIME developed the Strategic Plan (2017/2018 – 2021/2022) with the aim to ensure the development of Namibia's natural capital and its sustainable utilisation for the benefit of the country's social, economic and ecological well-being.

Specifically, the MIME's mission is to effectively regulate activities within the mining and energy sector through the formulation of legislation and policies, to provide services to stimulate sustainable economic development through investment for the benefit of all Namibians, and to generate knowledge and information on natural resources.

Four strategic focus areas, each with key performance indicators and targets, are identified with the plan:

- Socio-economic progression;
- Environmental sustainability;
- Stakeholder relations and cooperation; and
- Good governance.

This plan serves as a blueprint, providing strategic direction to the MIME to achieve its Mandate, Vision, Mission and Strategic Objectives.

2.3.2.6 Namibia's Industrial Policy, 2012 / 2015

In 2012, the then Ministry of Trade and Industry (MTI) developed Namibia's Industrial Policy. Three years after drafting the Industrial Policy, the MTI produced an execution strategy for industrialisation in 2015 called "Growth at Home" (MTI, 2015).

The strategy advocates a targeted approach towards industrialisation. In the first phase of Growth at Home, sectors in which Namibia already has some sort of comparative advantage will be targeted (MTI, 2015). Mining (and other extraction) is identified as one of a number of particular sectors to be targeted. The strategy sets out a broad outline of how downstream industries should be developed to ensure that the job creation and socio-economic benefits which stem directly and indirectly from primary production are maximised (MTI, 2015).

2.3.2.7 Local and Regional Socio-Economic Policy

With respect to regional planning, the socio-economic development objectives of the **Erongo Region** have a special focus on uplifting the standard of living within the region (ERC, 2015). They include the following:

- Ensuring regional and rural economic development;
- Creating employment opportunities;
- Improving infrastructure, with the delivery of basic services to rural areas a priority;
- Co-ordinating training of community members in entrepreneurial skills; and
- Educating the community with regard to the prevalence of HIV/Aids and Tuberculosis (TB) cases.
- Similarly, the Erongo Regional Council (ERC) Strategic Plan for 2017/18-2021/22 lists the following strategic objectives, developed in line with the Government aspirations outlined in Vision 2030:
- Enhance organizational performance;



- Enhance infrastructure development and maintenance;
- Strengthen disaster risk management;
- Accelerate delivery and service of land and housing;
- Facilitate access to improved sanitation; and
- Coordinate economic development.

The strategic socio-economic development objectives for the **//Karas Region** (KRC, 2017) include the following:

- Enhancing spatial planning;
- Improving key infrastructure;
- Providing basic services and housing;
- Enhancing food security;
- Promoting economic opportunities; and
- Ensuring inclusive and equitable quality education for all.

The **//Karas Regional Council** also notes on its webpage that “[t]he region still possesses many untapped raw materials, such as offshore natural gas and other minerals that promise new industries” (KRC, 2015).

The **town councils of both Lüderitz and Walvis Bay** seek to ensure that their economies are well diversified. The Walvis Bay Town Council has pointed out that Walvis Bay, with its deep-water port, ship repair and logistics handling facilities, is particularly well placed to serve an oil extraction industry which could develop in the wake of a significant oil discovery (WBTC, 2017).

2.3.3 Biodiversity-Related Policies

2.3.3.1 National Biodiversity Strategy and Action Plan 1 and 2 (2013-2022)

The National Biodiversity Strategy and Action Plan (NBSAP) 1 and 2 is the key national level implementing instrument of the objectives of the United Nations Convention on Biological Diversity. NBSAP2 sets out the vision for Namibia’s biodiversity to be healthy and resilient to threats, and the conservation and sustainable use are key drivers of poverty alleviation and equitable economic growth, particularly in rural areas.

NBSAP2 has five key strategic objectives, each of which has a number of targets to be achieved by 2022. These objectives are to:

- Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society;
- Reduce the direct pressures on biodiversity and promote the sustainable use of biological resources;
- Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity;
- Enhance the benefits to all from biodiversity and ecosystem services; and
- Enhance implementation of NBSAP2 through participatory planning, knowledge management and capacity building.



2.3.3.2 National Policy on Prospecting and Mining in Protected Areas (2018-2022)

The National Policy on Prospecting and Mining in Protected Areas, 2018, in Namibia aims to balance the country's economic development with the conservation of its rich biodiversity. This policy addresses the management and regulation of mining and prospecting activities within the country's protected areas, which include national parks, nature reserves, and other conservation areas. The policy provides guidelines for decision-making regarding exploration and mining activities within protected areas, ensuring that such activities are conducted in a manner that minimizes environmental impact, protects critical habitats, and maintains the integrity of ecosystems.

2.3.4 Climate Change-Related Policies

2.3.4.1 Namibia's Climate Change Policy Framework

Namibia has a policy framework in place to deal with climate change. The key milestones in Namibia's Climate Change Policy Framework are listed below:

- In 1995 Namibia ratified the United Nations Framework Convention on Climate Change (UNFCCC). The ultimate objective of the Convention is the stabilisation of greenhouse gas (GHG) concentrations in the atmosphere.
- Namibia established the National Climate Change Committee (NCCC) in 2001.
- Namibia developed their National Climate Change Policy in 2010-2011. This document presents information about the main expected impacts of climate change in Namibia and about those most vulnerable. The document also proposes objectives that the Government will aim to achieve through an effective and efficient response to climate change.
- Namibia published a National Disaster Risk Management Plan in 2011. This Plan aims to provide guidance and strengthen national capacity for disaster risk management and to provide a framework for sectoral and regional disaster risk management in Namibia.
- The National Climate Change Strategy and Action Plan (NCCSAP, 2013-2020) lays out the guiding principles responsive to climate change that is effective, efficient and practical. It further identifies priority action areas for adaptation and mitigation.
- A new climate action plan (Intended Nationally Determined Contribution) was submitted to the UNFCCC in September 2015, ahead of the 2015 Paris Agreement. It was converted to a Nationally Determined Contribution in 2016.
- In April 2016 the president of the Republic of Namibia signed the Paris Agreement and followed that up in September 2016 by ratifying the Agreement (see Table 2-3).
- Most recently, in December 2024, Namibia submitted its First Biennial Transparency Report as well as first National Inventory Document (NID) to the United Nations Framework Convention on Climate Change and the Paris Agreement, which contains information on Namibia's emissions and commitments (Government of Namibia, 2024).

2.3.4.2 Namibia's Second Updated Nationally Determined Contribution, 2023

As a signatory to the Paris Agreement, Namibia has committed to reducing its GHG emissions and contributing to the global effort to combat climate change. Namibia prepared and submitted its Intended Nationally Determined Contributions (INDC) in 2015 to conform with decisions 1/CP.19 and 1/CP.20 of the Conference of the Parties (COP). In line with



Article 4 of the Paris Agreement and Decision 1/CP.21 of the United Nations Framework Convention on Climate Change (UNFCCC), Namibia revised the INDC to produce the first Nationally Determined Contribution (NDC) submitted in 2021 and further updated to the Updated NDC in 2023.

Namibia's Second Updated NDC outlines the country's plans to reduce the country's GHG emissions and to adapt to the impacts of climate change. Namibia's Second Updated NDC aims to reduce GHG emissions by 7.67 million t CO₂-e relative to the business-as-usual (BAU) scenario of 31.38 million t CO₂-e by 2030, i.e. to 23.71 million t CO₂-e, while maintaining Namibia's net sink status (Government of Namibia, 2024).

Measures to achieve this reduction, cited by the Government of Namibia (2024) in its First Biennial Transparency Report and Fifth National communication to the UNFCCC include:

- Energy Transition – Accelerating renewable energy adoption, particularly solar and wind, to reduce reliance on fossil fuels.
- Agriculture – Expanding climate-smart agriculture practices to minimize methane and nitrous oxide emissions.
- Forestry – Enhancing afforestation and reforestation initiatives to increase sink capacity by 5.481 million t CO₂e beyond BAU levels.

2.4 Relevant International Laws and Conventions

Relevant international conventions and treaties which have been ratified by the Namibian Government and which have become law through promulgation of national legislation are listed in Table 2-3 below.

Table 2-3: Ratified International Conventions and Treaties

Conventions and Treaties	Summary of legislative provisions
Air and Atmosphere	
Kyoto Protocol on the Framework Convention on Climate Change, 1997	This Protocol was the key instrument on which the 1992 United Nations Framework Convention on Climate Change is based.
Montreal Protocol on Substances that Deplete the Ozone Layer, 1987	This Protocol lays down a timetable for the reduction of controlled substances that deplete the ozone layer and have adverse effects on health and the environment.
Paris Agreement (United Nations Framework Convention on Climate Change), 2015	The Paris Agreement is a comprehensive framework that aims to guide international efforts to limit GHG emissions and to meet challenges posed by climate change. The Paris Agreement was adopted on 12 December 2015 at the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC CoP21). The agreement was signed by Namibia in April 2016. The long-term goals of the Paris Agreement are: • Limit the global temperature increase to below 2°C above pre-industrial levels, while pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels. • Increasing countries' ability to adapt to the effects of climate change and to foster climate resilience. • Encouraging low GHG emissions development that does not compromise food production. • Making finance flows consistent with a pathway towards low GHG emissions and climate resilient development.



Conventions and Treaties	Summary of legislative provisions
	- Reaching a peak in GHG emissions 'as soon as possible', while recognising that the timeframes for achieving this will differ between developed and developing countries. - Achieving carbon neutrality from 2050 onwards. Each individual country is responsible for determining their contribution (referred to as the "nationally determined contribution") in reaching this goal. The Agreement requires that these contributions should be "ambitious" and "represent a progression over time". The contributions should be reported every five years and are to be registered by the UNFCCC Secretariat. Namibia signed the Paris Agreement on 22 April 2016 and it entered into force on the 4 November 2016. As a signatory to the Agreement, Namibia must adopt the agreement within its own legal systems, through ratification, acceptance, approval or accession. Under the Agreement, Namibia must also investigate alternatives to existing industries which have high carbon-emissions. A shift away from coal-based energy production within the energy sector and increased reliance on alternative energy sources, including natural gas as a bridging fuel, is therefore anticipated⁵.
United Nations Framework Convention on Climate Change – UNFCCC, 1992	The United Nations Framework Convention on Climate Change (UNFCCC) objective is to stabilise greenhouse gas concentrations in the atmosphere. The framework sets non-binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms.
Vienna Convention for the Protection of the Ozone Layer, 1985	The Convention is the first global agreement that recognised that the ozone was a serious enough problem to warrant international regulation.
Chemicals and Waste	
Convention on the control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel, 1989)	This Convention was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries. The convention was ratified by Namibia in 1995.
Stockholm Convention on Persistent Organic Pollutants, 2001	This Convention is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health or on the environment.
Flora, Fauna and Protected Areas	
African Convention for the Conservation of Nature and Natural Resources (Algeria, 1968) and the revised version (Maputo, 2003)	The objectives of this Convention are to enhance environmental protection, to foster the conservation and sustainable use of natural resources, and to harmonise and coordinate policies in these fields.
Benguela Current Convention	The objective of the Benguela Current Convention is to promote a coordinated regional approach to the long-term conservation, protection, rehabilitation, enhancement and sustainable use of the

⁵ King & Spalding state that "Natural gas, and in particular liquefied natural gas, has potential to play a role for Africa as a rich and reliable source of energy, which can serve as a bridging fuel on the path to the carbon-neutral goal of the Paris Agreement" (<https://www.kslaw.com/blog-posts/the-paris-agreement-on-climate-change-implications-for-africa>).



Conventions and Treaties	Summary of legislative provisions
	Benguela Current Large Marine Ecosystem, to provide economic, environmental and social benefits. The Benguela Current Convention applies to “all human activities, aircrafts and ships under jurisdiction or control of a Party to the extent that these activities or operations of such aircraft or ship result in or are likely to result in adverse impacts”. The obligations on Namibia under the Convention are to “take all possible steps to prevent, abate and minimise pollution and take the necessary measures to protect the marine ecosystem against any adverse impacts”, such as conducting an ESIA, identifying risk and implementing mitigation measures aimed at preventing pollution or, where such pollution arises, to combat and control those measures.
Convention on the Conservation of Migratory Species of Wild Animals, also known as the Convention on Migratory Species (CMS) or the Bonn Convention, 1983	This Convention is an international agreement that aims to conserve migratory species within their migratory ranges. CMS covers a great diversity of migratory species. The Appendices of CMS include many mammals, including land mammals, marine mammals and bats; birds; fish; reptiles and one insect.
Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000	This Protocol is an international agreement on biosafety as a supplement to the Convention on Biological Diversity effective since 2003. The Biosafety Protocol seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology.
United Nations Convention on Biological Diversity (UNCBD), 1992	The UNCBD has three main goals: (1) the conservation of biological diversity (or biodiversity); (2) the sustainable use of its components; and (3) the fair and equitable sharing of benefits arising from genetic resources. The convention was ratified by Namibia in 1997.
Convention on International Trade of Wild Fauna and Flora Endangered Species (CITES), 1975	CITES is a multilateral treaty to protect endangered plants and animals.
Convention on Wetlands of International Importance (Ramsar Convention), 1971	This Convention is an international treaty for the conservation and sustainable use of wetlands.
International Convention for the Conservation of Atlantic Tunas (ICCAT)	This Convention provides for the management and conservation of tuna and tuna-like species in the Atlantic Ocean and adjacent seas.
Memorandum of Understanding (MoU) concerning Conservation Measures of Marine Turtles of the Atlantic Coast of Africa, 1999	This MoU focuses on the protection of six marine turtle species that are estimated to have rapidly declined in numbers along the Atlantic Coast of Africa.
United Nations Convention to Combat Desertification in those Countries Experiencing serious Drought and/or Desertification, Particularly in Africa, 1994	This is a Convention to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.
Marine Pollution	
International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78)	MARPOL 73/78 was developed by the International Maritime Organization with an objective to minimise pollution of the oceans and seas, including dumping, oil and air pollution. MARPOL is divided into Annexes according to various categories of pollutants, each of which deals with the regulation of a particular group of ship emissions:



Conventions and Treaties	Summary of legislative provisions
	- Annex I: Prevention of pollution by oil and oily water; - Annex II: Control of pollution by noxious liquid substances in bulk; - Annex III: Prevention of pollution by harmful substances carried by sea in packaged form; - Annex IV: Pollution by sewage from ships; - Annex V: Pollution by garbage from ships; and - Annex VI: Prevention of air pollution from ships. All ships flagged under countries that are signatories to MARPOL are subject to its requirements, regardless of where they sail and member nations are responsible for vessels registered on their national ship registry.
International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969 and its protocol (Amends the 1969 Convention with regard to the method of calculation for the limitation of liability)	This Convention provides for a compensation fund for clean-up costs and environmental damage subject to certain conditions and ceilings.
International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention)	This Convention is an international maritime convention establishing measures for dealing with marine oil pollution incidents nationally and in co-operation with other countries.
International Convention on the establishment of an International Fund for Compensation for Oil Pollution Damage (The Fund Convention), 1971	This is an international maritime treaty, which was drawn up as an enhancement to CLC meant to relieve ship owners from unfair liabilities due to unforeseeable circumstances and remove liability caps that some member states thought were too low. The fund is obliged to pay victims of pollution when damages exceed the ship owner's liability, when there is no liable ship owner, or when the ship owner is unable to pay its liability.
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Convention) and 1996 Protocol	The 1996 Protocol deals with the incineration and dumping of waste at sea, including the disposal of exploration / production platforms and dredged material.
International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties, 1969	This Convention is an international maritime convention affirming the right of a coastal State to take such measures on the high seas as may be necessary to prevent, mitigate or eliminate danger to their coastline or related interests from pollution or threat of pollution of the sea by oil, following upon a maritime casualty or acts related to such a casualty.
Protocol on the Intervention on the High Seas in Cases of Marine Pollution by substances other than oil, 1973	This Protocol take such measures on the high seas as may be necessary to prevent, mitigate or eliminate grave and imminent danger to their coastline or related interests from pollution or threat of pollution by substances other than oil following upon a maritime casualty or acts related to such a casualty, which may reasonably be expected to result in major harmful consequences.
International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2017	This Convention aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments.
Marine Safety	
Convention on the International Regulations for Preventing	This Convention sets an international standard for shipping and navigation. It deals with safety at sea issues and prescribes



Conventions and Treaties	Summary of legislative provisions
Collisions at Sea (COLREGS), 1972	international standards for shipping, particularly to reduce the risk of collisions at sea. The rules for the prevention of collisions at sea apply to all vessels using the high seas.
International Convention for the Safety of Life at Sea, 1974 (SOLAS) with its protocol of 1978	This Convention is an international maritime treaty which requires signatory flag states to ensure that ships flagged by them comply with minimum safety standards in construction, equipment and operation.
The International Convention on Load Lines, 1966 and its protocol of 1988	This Protocol was adopted to harmonise the survey and certification requirement of the 1966 Convention with those contained in SOLAS and MARPOL 73/78. All assigned load lines must be marked amidships on each side of the ships engaged in international voyages.
International Convention on Standards of Training, Certification and Watch-keeping for Seafarers, 1978	This Convention sets qualification standards for masters, officers and watch personnel on seagoing merchant ships.
Marine Resources	
Convention for Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central and Southern African Region (Abidjan Convention), 1984	The objective of this Convention is to protect the marine environment, coastal zones and related internal waters falling within the jurisdiction of the States of the West and Central African region.
Convention of the International Maritime Organisation (IMO), 1948	This Conventions deals with the establishment of the IMO which is a specialist United Nations agency dealing with maritime issues, including development of all the marine pollution control conventions.
United Nations Law of the Sea Convention (UNCLOS), 1982	This Convention seeks to establish a comprehensive legal regime to regulate activities on and in relation to the world's oceans and seas, i.e. requiring states to adopt legislation to reduce marine pollution from seabed activities in the Exclusive Economic Zone (EEZ) and on the continental shelf. The convention was ratified by Namibia in 1994.
Archaeology and Cultural Heritage	
Convention concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)	This Convention provides for the identification, protection and conservation of the cultural and natural heritage for future generations.
United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Protection of the Underwater Cultural Heritage, 2001	This Convention is intended to protect all traces of human existence having a cultural, historical or archaeological character, which have been under water for over 100 years. This extends to the protection of shipwrecks, sunken cities, prehistoric art work, treasures that may be looted, sacrificial and burial sites, and old ports that cover the oceans' floors.
Fishing	
Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, 1993	This Agreement promotes compliance with international conservation and management measures by fishing vessels on the high seas.



Conventions and Treaties	Summary of legislative provisions
Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean, 2001	This Convention provides for the long-term conservation and sustainable use of the fishery resources in the Southeast Atlantic Ocean.
Human Rights	
International Labour Organisation (ILO) Convention No. 98 on Right to Organise and Collective Bargaining Convention	This Convention aims to protect workers against anti-union discrimination and ensure their right to organize and bargain collectively. It promotes the establishment of machinery for voluntary negotiation between employers and workers' organizations to regulate employment terms through collective agreements.
ILO Convention 87 on Freedom of Association and Protection of the Right to Organize, 1995	This Convention ensures that workers and employers can freely form and join organizations of their choice without prior authorization. It protects their right to organize, manage their activities, and affiliate with international organizations, free from interference by public authorities.
ILO Convention 29 on Forced Labor	This Convention aims to eliminate all forms of forced or compulsory labour. It defines forced labour as any work or service exacted from a person under the threat of a penalty and for which the person has not voluntarily offered themselves. Namibia ratified this Convention in 2000.
ILO Convention 111 on Discrimination (Employment and Occupation)	This Convention aims to eliminate discrimination in employment and occupation based on race, colour, sex, religion, political opinion, national extraction, or social origin. It promotes equality of opportunity and treatment in access to vocational training, employment, and terms and conditions of employment. Namibia ratified this Convention in 2001.
United Nations (UN) Convention on the Rights of the Child, Article 32.1	This Convention aims to protect children from economic exploitation and hazardous work. It ensures that children are not engaged in work that could harm their health, development, or interfere with their education.
The Right to Work, Article 23 of the Universal Declaration of Human Rights (UDHR)	Article 23 of the Universal Declaration of Human Rights (UDHR) establishes the right of everyone to work, to free choice of employment, to just and favourable conditions of work, and to protection against unemployment. It promotes equality of opportunity and treatment in employment, ensuring equal pay for equal work without discrimination. Additionally, it recognizes the right to form and join trade unions for the protection of one's interest.
Convention on the Elimination of All Forms of Racial Discrimination (CERD)	The Convention aims to eliminate racial discrimination in all its forms and manifestations. It promotes equality and condemns any doctrine of racial superiority. The convention requires states to take measures to prevent and combat racial discrimination and to promote understanding among all races.
Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW)	The Convention aims to eliminate discrimination against women in all areas of life. It promotes gender equality and empowers women by ensuring their rights in political, economic, social, cultural, and civil spheres. CEDAW remains a fundamental instrument for advancing women's rights globally.



2.5 TotalEnergies Commitments and Policies on Health, Security, Safety, Environment and Social Performance

The below information has been supplied by TotalEnergies, derived from their global policies and procedures.

2.5.1 Project Standards for Development Activities

Apart from the requirement to comply with the national legislation described in Section 2.2 above and the conditions of an ECC issued by authorities, TEEPNA complies with a set of corporate specifications regulating environmental and social procedures and reporting requirements for undertaking ESIs on its projects. The proposed project will comply with the General Specification on Environmental Requirements for Project Design and Exploration and Production Activities (GS EP ENV 001).

To reduce any potentially significant impacts of proposed future activities, mitigation measures shall be identified and selected according to the Best Available Techniques (BAT) concept and approved by the Company⁶.

This specification deals with: Environmental Footprint; Flaring and Air Emissions; Fuel Gas and Energy Use; Management of Liquid Effluents; Waste Management; Drill Fluids and Cuttings; Chemicals; Noise; Dust, Odours and Lighting; Spill Response Equipment; and Decommissioning of Installations.

With respect to Oil Spill Contingency Planning and the management of responses related to unplanned events (e.g., well blowout and oils spills), including the assessment of economic effects and related compensation, TotalEnergies subscribes to the International Petroleum Industry Environmental Conservation Association (IPIECA) - International Association of Oil and Gas Producers (IOGP) Good Practice Guide Series. The primary reference document in this regard is the “Economic assessment and compensation for marine oil releases” (2015). TEEPNA would thus plan for and implement responses in terms of this guideline document.

2.5.2 General Specifications for ESIs

This ESIA will be conducted within the framework of Corporate General Specifications for Environmental and Social Impact Assessments, implemented by TEEPNA, including:

- *General Specification for Environmental and Social Impact Assessment Study of Industrial Projects Activities (i.e., GS-GR-HSE-410)*: This document defines the processes and requirements to be implemented for conducting an ESIA. It recognises that the purpose of the ESIA is to ensure that the natural and social environment is given full and proper consideration in the decision-making process with respect to potential activities having possible negative and positive consequences. It outlines the minimum standard required by the Company to assess impacts on the natural and social environment and is adapted to the type and nature of a given project to define the Scope of Work.
- *General Specification for Social Performance – Social Baseline Study (SBS) (i.e., GS EP SDV 101)*: This specification defines the Company requirements for establishing an SBS whose results are integrated in the Social Impact Assessment. This GS specifies the requirements for the content of the baseline studies, phases and expected results. The specification requires local laws and rules to be respected, and for further specific conditions to be added, if necessary.

⁶ “Company” refers to TotalEnergies.



- *General Specification for Sustainable Development – Human Rights Impact Assessment (HRIA) (i.e., GS EP SDV 103)*: This specification defines the Company guidelines for conducting an HRIA on projects where human rights issues are a potential concern. Where relevant, it requires identification of and engagement with stakeholders who are vulnerable to Human Rights abuses and the assessment of human rights impacts resulting from the Company's activities and potential mitigation measures.

2.5.3 HSE Policies and Social Corporate Commitments

TotalEnergies is committed to upholding a number of global policies and principles on its projects. These include the Voluntary Principles for Security and Human Rights, the International Labour Organisation Conventions, United Nations Declaration of Human Rights, the United Nations Guiding Principles on Business and Human Rights, Partnering Against Corruption Initiative and sustainable performance reporting, amongst others.

TotalEnergies also has a Code of Conduct for its staff and supply chain governing health, safety, security, bribery and corruption, and respect for human rights. In Namibia, TEEPNA is committed to conducting its business in a sustainable manner, which provides for and maintains a safe working environment, which is without risk to the wellbeing of its employees, contractors and stakeholders, and which furthermore will have a limiting impact on the surrounding environment. TEEPNA takes the responsibility to apply, drive and sustain the principles listed in its HSE policy (Box 2-1) in order to ensure continued improvement of our HSE performance and impact.

The TotalEnergies Charter of Principles and Guidelines regarding Indigenous and Tribal Peoples sets out its commitment to respect the culture, values and lifestyle of the local communities, and contributes to their economic development while carrying out its business. As such, TotalEnergies endeavours to honour the principles of the charter together with applicable legal standards, while dealing with Indigenous and Tribal Peoples.



Box 2-1: TEEPNA's HSE Policy



TOTALENERGIES EP NAMIBIA B.V.
Exploration & Production

HEALTH, SAFETY & ENVIRONMENT POLICY

TotalEnergies EP Namibia B.V. is committed to conduct its business in a sustainable manner, with commitment to protecting the health and safety of our employees, contractors and other stakeholders, safeguarding the environment and preventing pollution as well as good quality services through implementation of an effective HSE Management system based on competent personnel and pro-active HSE culture.

The Management of TotalEnergies EP Namibia B.V. takes the responsibility to apply, drive and sustain the principles listed in this policy in order to ensure continued improvement of our HSE performance.

IT IS OUR POLICY TO:

- Encourage and promote a positive HSE work culture throughout the organisation, by demonstrating strong visible leadership from management and supervision, and to involve the workforce, to take personal ownership, responsibility and accountability for Health, Safety and the Environment in the workplace.
- Continuously communicate with and consult all personnel, contractors and stakeholders on any HSE related matters.
- Comply with all Local and International Laws and Regulations, as well as all Corporate Policies and Specifications applicable to our operations.
- Incorporate and plan for effective HSE management methods in all ongoing engineering and operations activities.
- Pro-actively identify and implement continuous improvement initiatives by setting measurable HSE targets and objectives, and regularly review our actual performance against these targets and objectives.
- Ensure all people are trained and competent for any task they perform and ensure that such work is performed under the supervision of a person who has been trained to acknowledge the related hazards and has the authority to implement precautionary measures.
- Ensure that all risks associated with our operations are continuously identified, monitored and reviewed in order to mitigate and maintain our risk profiles as low as reasonably possible.
- Provide for appropriate and sufficient resources, including training, in order to achieve targeted performance levels on ongoing bases.
- Work and partner with those industrial and commercial partners who demonstrate a similar commitment to our own HSE visions.
- Implement, maintain and regularly test emergency response and contingency plans.

Every employee, contractor and person acting on behalf of the company, has the responsibility to prevent harm to themselves, others and the surrounding environment, which may be affected by their acts or omissions.

TotalEnergies EP Namibia B.V. is committed to ensure that our resources, organisational strategies and processes are aligned with the goals and objectives set out in this policy, in order to satisfy our stakeholder's needs.

A handwritten signature in blue ink, reading 'Laurant Roché'.

Laurant ROCHE
General Manager

TEPNA/TPOL/HSE/01.01

August 2022



2.5.4 TotalEnergies Sustainability Approach

Aspects from TotalEnergies' sustainability approach are described below.

A process of continuous improvement linked to the sustainable development goals

As part of its transition strategy to achieve its **2050 Net Zero Ambition, together with society**, TotalEnergies has placed **Sustainability at the heart of its strategy, its projects and its operations**. Based on **the values defined in our Code of Conduct**, TotalEnergies' **sustainable development approach** is structured around 4 axes.

TotalEnergies has placed sustainable development in all its dimensions at the heart of its strategy, projects and operations, in order to contribute to the well-being of the planet's populations, and it wants to set the standard in terms of commitment to the Sustainable Development Goals (SDG), adopted in 2015 by the United Nations and its Member States and to which TotalEnergies has committed to contribute since 2016.

TotalEnergies has structured its sustainability approach for conducting its activities so as to contribute to the achievement of the United Nations Sustainable Development Goals (SDGs).

As part of its determination to strengthen its efforts in the segments in which it can act with most authority as an integrated multi-energy Company, TotalEnergies involves its employees in identifying the SDGs on which it can have the greatest impact, in connection with its ambition to reach carbon neutrality (net zero emissions) by 2050, together with society.

TotalEnergies' sustainability approach is based on four pillars summarised in Figure 2-1:

- *Climate and sustainable energy: leading the transformation of the energy model to contribute to the fight against climate change and meet the needs of populations;*
- *People's well-being: being a reference as an employer and responsible operator. TotalEnergies intends on promoting a work environment that combines performance and conviviality and ensuring compliance with human rights in the workplace, both within the Company and among its partners, but also the safety and health of people;*
- *Care for the environment: to be exemplary in the management of the environment and the use of the planet's natural resources. TotalEnergies intends on ensuring that the environmental impacts of all its operations are managed according to the Avoid-Reduce-Offset approach, thereby helping to preserve the environment, biodiversity and freshwater resources. To this end, TotalEnergies promotes the circular economy; and*
- *Positive impact for stakeholders: generating shared prosperity across regions. TotalEnergies aims to be a creator and a driver of positive change for the communities in its host regions.*

TotalEnergies actively works on each of its sustainability pillars in order to make its development a vehicle of progress that benefits as many people as possible and to be a factor of positive change for the societies and regions where it is present. TotalEnergies' purpose is to supply to as many people as possible a more affordable, more available and cleaner energy. As a supporting component of society's evolutions, energy is a fundamental resource for economic, social and human development, which currently faces a twofold challenge: (1) satisfying the energy needs of an ever-growing world population, while (2) reducing global warming. TotalEnergies' intention in becoming a broad energy company is to help meet that challenge in a responsible way, in line with its support of the United Nations Sustainable Development Goals (SDG) since 2016.



Main pillars of this strategy are introduced below. For further information on TotalEnergies' commitments, refer to its website⁷.



Figure 2-1: The axes of TotalEnergies Sustainability Approach.

Support to global initiatives

TotalEnergies is committed to various international initiatives such as the fight against climate change, promotion of social dialogue, preservation of biodiversity, transparency in the conduct of business.

TotalEnergies abides by the principles of the UN Global Compact, a voluntary initiative that encourages businesses worldwide to adopt sustainable and socially responsible policies, focusing on human rights, labour, the environment, and anti-corruption. TotalEnergies is committed to respecting internationally recognized human rights, wherever it operates,

⁷ https://totalenergies.com/system/files/documents/totalenergies_sustainability-climate-2025-progress-report_2025_en.pdf



especially the Universal Declaration of Human Rights, the Fundamental Conventions of the International Labour Organisation (ILO), the UN Guiding Principles on Business and Human Rights, the OECD Guidelines for Multinational Enterprises and the Voluntary Principles on Security and Human Rights (VPSHR).

TotalEnergies is also a signatory of the Oil and Gas Decarbonization Charter (OGDC), a commitment aimed at reducing emissions from oil and gas operations and aiming for zero methane emissions by 2030.

Transparency, a principle of action

TotalEnergies believes that transparency is an essential principle of action in building a trust-based relationship with its stakeholders and enables a path of continuous improvement.

Pending the adoption of an international, standardised non-financial reporting framework, TotalEnergies ensures it is accountable for its performance on the basis of the various commonly used ESG reporting frameworks. As such, TotalEnergies refers to the Global Reporting Initiative (GRI) standards and those of the Sustainability Accounting Standards Board (SASB), for which detailed tables of correspondence are available on its website. TotalEnergies' reporting includes the World Economic Forum's core indicators⁸. Furthermore, TotalEnergies follows the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) for its climate reporting. TotalEnergies provides additional information on its website in pages specifically dedicated to its sustainability development approach.

TotalEnergies' sustainability approach is recognised: in 2021, TotalEnergies was confirmed as a LEAD Company by the UN Global Compact for its full commitment to CSR.

Energy Transition

TotalEnergies' ambition is to become a world-class player in the energy transition. TotalEnergies' Two-Pillar Multi-Energy Strategy consists of developing an integrated and balanced multi-energy transition strategy by profitably growing its energy production, particularly from liquefied natural gas (LNG) and electricity, the two fastest growing energy markets, to create long-term value for its shareholders. In the next decade until 2030, TotalEnergies' sales of oil products are expected to diminish by almost 30% and its sales mix will become 30% oil products, 5% biofuels, 50% natural gas and 15% electricity, primarily of renewable origin. As a result, oil will account for no more than 30% of its total sales, compared to 53% in 2019.

Climate and carbon neutrality ambition

TotalEnergies supports the objectives of the Paris Agreement, which calls for the reduction in greenhouse gas emissions and its goal of limiting the average rise in planetary temperatures to well below 2°C from pre-industrial levels.

TotalEnergies also supports the objective set out in the Paris Agreement of achieving global carbon neutrality – i.e., net zero emissions, which is the balance between GHG emissions and anthropogenic removals in the form of sinks and reservoirs, such as forests, carbon capture and storage facilities.

TotalEnergies aims to reduce direct emissions across their operated facilities and achieve carbon neutrality with society by 2050, with an intermediate target to reduce scope 1+2 emissions by 40% by 2030, compared with 2015 levels. This target is consistent with the roadmap set out in the European Union's "Fit-for-55" package and the IEA's 2023 Net Zero Emission scenario. To make this happen, TotalEnergies is deploying cutting-edge

⁸ Measuring Stakeholder Capitalism: Towards Common Metrics and Consistent Reporting of Sustainable Value Creation, white paper, September 2020.



technology to stop routine flaring, gradually eliminate methane emissions and improve energy efficiency. As far as methane is concerned, United Nations Environment Program has confirmed TotalEnergies' OGMP 2.0 Gold Standard status in 2023, for the 3rd year in a row.

The reduction in direct emissions to be achieved through the following interventions:

- Eliminating routine flaring.
- Aiming for zero methane emissions in existing operations by 2030.
- Improving energy efficiency.
- Reducing our emissions with geological CO₂ storage.
- Developing Nature-Based Solutions to offset our residual emissions.

For further information on TotalEnergies strategy for reducing direct emissions refer to their website⁹.

Sustainable value creation

TotalEnergies' model of value creation is based on integration across the energy value chain, from exploration and production of oil, gas and electricity (including renewables) to energy distribution to the end customer, and including refining, liquefaction, petrochemicals, trading, and energy transportation and storage. This integrated business model enables TotalEnergies to capitalise on synergies among the various businesses, while responding to volatility in feedstock prices. With this integration of its operations across the entire value chain, TotalEnergies can manage the bottom of the cycle more effectively and capture margins when the market improves. This transition will cement the durability and resilience of TotalEnergies' value creation model and bolster its ambition of getting to Net Zero (net zero emission).

Preservation of the Environment

TotalEnergies considers the respect for the environment to be a priority and, therefore, strives to minimise the footprint of its activities by controlling its energy consumption, its emissions in natural environments (water, air, soil), its residual waste production, its use of natural resources and its impact on biodiversity. Prevention and management of accidental pollution risk are covered by a strong policies framework. In 2020, TotalEnergies set itself a new biodiversity ambition to coincide with the preparation of the United Nations' global biodiversity plan, which is based on four core principles, including voluntary exclusion zones on more sensitive areas such as UNESCO World Cultural Heritage sites and Arctic sea-ice regions. Regarding the "circular economy", since 2017, TotalEnergies has focused on waste reduction and valorisation (i.e., increase in the value of), including developing polymers from recycled plastics. In addition, in January 2022, TotalEnergies set a new target for the freshwater resource protection for 2030. The ambition of the Company is to reduce by 20% its freshwater withdrawal in water stress area between 2021 and 2030.

TotalEnergies actively supports several environmental and biodiversity initiatives, including Act4Nature International, the CEO Water Mandate, the Circular Economy Commitment by AFEP (Association Française des Entreprises Privées), and the UN Global Compact Ocean Stewardship Coalition.

Business ethics

TotalEnergies operates in many different countries with disparate and complex economic, social and cultural environments, where governments and civil society have especially high

⁹ <https://totalenergies.com/sustainability/climate-and-sustainability-energy/reducing-our-scope-1-and-2-emissions>



expectations of TotalEnergies as an exemplar. Within this context, TotalEnergies strives to act as an agent for positive change in society by helping to promote ethical principles in every region where it operates. Accordingly, TotalEnergies is committed to respecting internationally recognised human rights wherever it operates. TotalEnergies is also fully committed to fighting corruption and has adopted a policy of zero tolerance in that area.

Participative Stakeholder Engagement

Transparency is an essential factor in building a trust-based relationship with stakeholders and ensuring that a company or project is on a path of continuous improvement.

Dialogue with TotalEnergies external stakeholders is essential for the company to conduct its business responsibly and integrate the long-term challenges of sustainable development in the company's strategy and policies. This dialogue informs TotalEnergies' decision-making, by, in addition to specific studies, helping it identify the non-technical risks and impacts of its operations, including the Human Rights component and, more generally, by providing greater insight into changing societal patterns and expectations.

Transparency

Transparency is an essential factor in building a trust-based relationship with stakeholders. As a permanent member of the Extractive Industries Transparency Initiative (EITI) since its formation in 2003, TotalEnergies fully supports initiatives for greater transparency and accountability. The Extractive Industries Transparency Initiative (EITI) is a global standard for promoting transparency and accountability in the oil, gas, and mining sectors. It requires countries to disclose information along the extractive industry value chain, from the point of extraction to revenue allocation and its contribution to the economy.

As part of EITI, governments are encouraged to ensure that the tax reporting obligations they will impose upon multinational groups are consistent, coordinated and proportionate.

TotalEnergies publishes an annual report covering the payments made by its extractive affiliates to governments and the full list of its consolidated entities, together with their countries of incorporation and of operations in its Universal Registration Document¹⁰.

TotalEnergies also issues a tax transparency report¹¹, which provides additional information on the taxes paid in its main countries of operations on a country-by-country basis. This report aims to offer more detailed information on TotalEnergies' tax position.

¹⁰ https://totalenergies.com/system/files/documents/totalenergies_universal-registration-document-2024_2025_en.pdf

¹¹ https://totalenergies.com/sites/g/files/nytnzq121/files/documents/totalenergies_tax-transparency-report-2023_2025_en_pdf.pdf



3.0 ESIA Approach and Process

This chapter provides the details of the ESIA Project Team and outlines the ESIA assumptions, limitations, approach and process.

3.1 ESIA Project Team

The project team and specialists appointed to undertake the ESIA process are presented in Table 3-1. The CVs for the SLR project team are attached in Appendix A. SLR and specialist consultants have no vested interest in the proposed project other than fair payment for consulting services rendered as part of the ESIA process.

Furthermore, SLR has appointed Dr Peter Tarr of the Southern African Institute for Environmental Assessment (SAIEA) to undertake an independent peer review of the ESIA process and key ESIA reports.

Table 3-1: Details of the ESIA project team and specialists

Company	Name	Qualifications	Experience (years)	Role
ESIA Project Team				
SLR Namibia / Africa	Sue Reuther	MPhil (Environmental Management), University of Cape Town (UCT) BSc Hons (Economics), University College London	20	Project Director and QA/QC
	Alice McGrath	MSc (Biological Sciences), UCT BSc Hons (Ocean & Atmosphere Science), UCT	8	Project Manager and report compilation.
	Jeremy Blood	MSc (Conservation Ecology), University of Stellenbosch	24	Technical advisor and report review
	Robyn Christians	BSc. Murdoch University, Perth LLB, UCT	9	Deputy Project Manager In-country project support, report compilation and liaison with authorities, public consultation
	Kerry Schwarz	BA (Geography), University of Leeds	28	GIS data management and mapping
	Ayanda Mkhwanazi	BSc Hons (Geography), University of the Witwatersrand	9	
Urban Dynamics	Ernst Simon	Masters in Urban and Regional Planning, University of the Free State	37	Stakeholder Engagement
	Heidri Bindemann Nel	Masters in Town and Regional Planning, University of Pretoria	15	



Company	Name	Qualifications	Experience (years)	Role
Specialist Team				
CLS Brasil	Marcelo Cabral	PhD (Coastal and Oceanic Eng.), University de Rio de Janeiro, Brazil	26	Drilling discharge, liquid effluent discharge and oil spill modelling
	Ingrid Trindade	Oceanographer, State University of Rio de Janeiro, Brazil	4	
	Ana Boechat	MSc (Computational Modelling in Environmental Engineering, Federal University of Rio de Janeiro, Brazil)	13	
	João Deboni	Oceanographer, Federal University of Espírito Santo, Brazil	3	
SLR Canada	Jonathan Vallarta	PhD (Underwater Acoustics), Heriot-Watt University	20	Underwater Noise Modelling
	Justin Eickmeier	PhD (Physical Oceanography), University of Delaware, MS (Ocean Engineering), Florida Institute of Technology	10	
SLR Namibia / South-Africa	Alice McGrath	MSc (Biological Sciences), UCT BSc Hons (Ocean & Atmosphere Science), UCT	8	Marine Ecology Impact & Fisheries Impact Assessment
	Michael van Niekerk	MSc (Environmental Science), University of KwaZulu-Natal	17	Climate Change Risk Assessment
	Lisa Ramsay	MPhil and PhD, University of Cambridge	18	Air Emissions Impact Assessment
	Loren Dyer	BsocSci Hons (Geography & Environmental Management), University of KwaZulu-Natal	16	
	Natalie Kohler	BSc Hons (Cell and Environmental Biology) University of KwaZulu-Natal	20	Waste Management Study
	Danie Otto	MSc (Biogeomorphology) University of Johannesburg	30	Closure and Decommissioning Study
Pisces Environmental	Andrea Pulfrich	PhD (Fisheries Biology), Christian-Albrechts University, Kiel, Germany	29	Marine Ecology Impact Assessment
Nuule Research Consultancy	Victoria Erasmus	PhD (Marine Ecology), Rhodes University	15	
Fisheries and Oceanographic Support Services	Dave Japp	MSc. (Ichthyology and Fisheries Science), Rhodes University	37	Fisheries Impact Assessment



Company	Name	Qualifications	Experience (years)	Role
Nuule Research Consultancy	Victoria Erasmus	PhD (Marine Ecology), Rhodes University	15	
Synergy	Edward O'Keefe	Master of Arts in Rural Development (University of East Anglia)	30	Human Rights Screening / Assessment
	Gina Snyman	LLM, (Human Rights), University of Pretoria,	15	
	Xholiswa Khumalo	Masters of Sociology (MA), University of Johannesburg	10	
Namibia Environmental Legal Consulting	Michaela Clayton	BA LLB University of Cape Town	30	
Independent	Robin Sherbourne	MSc Economics, London School of Economics, UK	30	Economics Impact Assessment
Urban Dynamics	Ernst Simon	Masters in Urban and Regional Planning, University of the Free State	37	Social Impact Assessment
	Heidri Bindemann Nel	Masters in Town and Regional Planning, University of Pretoria	15	
Nelson Mandela University	Prof Rose Boswell	PhD Anthropology Vrije Universiteit Amsterdam	28	Cultural Heritage Impact Assessment
EXCEED Energy	Paul Welding	BSc (Mechanical Engineering) University of Aberdeen	29	O&G Engineering Advisor
Southern African Institute for Environmental Assessment	Peter Tarr	PhD (Environmental Management and Planning) University of Aberdeen	+30	Independent peer review of the ESIA process and ESIA reports.

3.2 ESIA Assumptions and Limitations

The assumptions and limitations pertaining to this ESIA are listed below:

- SLR assumes that all relevant information has been provided by the applicant and is correct and valid at the time of conducting the ESIA;
- The ESIA is based on an indicative production well and subsea infrastructure layout. This preliminary layout may, however, be adjusted slightly when the final design is determined based on detailed engineering. Thus, the ESIA will assess generic (representative or reasonable worst-case) locations within the Venus field and nearshore transfer area(s) considering, for example, proximity to sensitive receptors (including protected areas, communities, etc.). This will ensure that the impact assessment assesses a representative or reasonable worst-case layout within the Venus field area or nearshore location(s). Thus, any slight adjustment to the layout is unlikely to affect the findings of the ESIA;
- The indicative technical specifications for the various components and infrastructure are based on generic industry information, previous similar projects and analysis of



site-specific exploration data from the Venus field. It is assumed that the technical specifications on which this ESIA is based are representative to that which will be used during the proposed development;

- This ESIA will consider potential impacts of the proposed activities on the biophysical and social environments that have been identified (during the Scoping Phase) within the activities' area of influence, which encompasses areas affected by:
 - o Activities and facilities that are directly owned, operated or managed by the applicant (including contractors and sub-contractors) as part of the proposed activities;
 - o Indirect impacts on biodiversity or ecosystem services upon which potential affected communities' livelihoods depend; and
 - o Potential unplanned events, which are unintended but may occur as a result of accidents or abnormal operating conditions.
- No significant changes to the Project description or surrounding environment that could substantially influence findings and recommendations with respect to mitigation and management will occur between the submission of the Final ESIA Report and implementation of the proposed Project; and
- The applicant (including contractors and sub-contractors) will undertake the proposed Project in line with Namibian Legislation, international regulations and best practices, as well as the applicable company standards and the Environmental and Social Management Plan (ESMP) compiled as part of the ESIA Report.

These assumptions and limitations are in line with typical assumptions and limitations for (predictive) impact assessments and are not expected to materially affect the confidence in the ESIA results.

3.3 ESIA Objectives

The ESIA process has the following objectives:

- Identify the key environmental and social issues and potential impacts that could result from the proposed activities (during the Scoping Phase);
- Identify feasible alternatives related to the proposed activities (during the Scoping Phase);
- Assess potential impacts of the proposed activities and alternatives during the different phases (during the Impact Assessment Phase);
- Define feasible mitigation or optimisation measures to avoid or minimise potential impacts or enhance potential benefits (during the Impact Assessment Phase);
- Provide the opportunity for I&APs to comment and make input into the ESIA process (during both the Scoping and Impact Assessment phases); and
- Through the above, enable informed, transparent and accountable decision-making by the relevant authorities, as well as the presentation of the findings to the public.

3.4 ESIA Process

As per the Environmental Management Act, 2007 and accompanying Regulations 2012, the ESIA process consists of two phases: Scoping Phase and Impact Assessment Phase (see Figure 3-1).

This ESIA process is currently in the Scoping Phase.





Figure 3-1: Illustration of ESIA Process phases and steps.

Note: Competent Authority is the Ministry of Industries, Mines and Energy (MIME).



3.4.1 Scoping Phase

The objectives of the Scoping Phase are to:

- Confirm the ESIA process to be followed;
- Identify the opportunities for I&AP engagement and comment;
- Clarify the scope of the proposed activities;
- Identify and confirm the activities, technologies employed and alternatives;
- Identify and confirm the area of interest for the activities;
- Identify the key issues to be addressed in the impact assessment phase and the approach to be followed in addressing these issues; and
- Confirm the level of assessment to be undertaken during the ESIA.

The Scoping Phase involves a process of:

- Notifying I&APs of the proposed activities and the steps in the ESIA process;
- Creating an opportunity for I&APs to interact with the ESIA project team; and
- Providing information for I&APs to ensure that all key environmental and social issues are identified.

Key steps (excluding public consultation) of the Scoping Phase are summarised below. The public consultation process is summarised in Section 3.5

3.4.1.1 Project Initiation and Regulatory Engagement

An Application for ECC was compiled and uploaded onto MEFT's online portal. On 25 February 2025 MEFT acknowledged that the application had been registered with application number **APP-005431**. The Application for Environmental Clearance was also submitted to the Petroleum Commissioner (MIME) on 25 February 2025.

3.4.1.2 Baseline Information Collection

SLR commissioned marine ecology, fisheries, climate change, air quality, economic and social specialists to describe the receiving environment, screen for sensitive habitats and identify potential issues and impacts as part of the preparation of the Scoping Report.

3.4.1.3 Compilation and Review of the Draft Scoping Report

The DSR was prepared in compliance with Section 8 of the EIA Regulations 2012 (see Table 3-2). The Regulations make provision for the Scoping Report to include an assessment of impacts and an ESMP if sufficient information is available at the Scoping Phase. However, for the proposed project an assessment was not yet possible due to the scale of the project and as several technical modelling and specialist studies need to be completed to assess the key issues identified. It was also not possible to compile the ESMP at this stage, as the recommended management and mitigation measures will be based on the findings and recommendations of the specialist studies. The specialist studies that will be undertaken and their terms of reference are presented in Chapter 8.0.

The preparation of the DSR was informed by specialist baseline inputs, an Environmental Baseline Survey (EBS) conducted during previous exploration activities in the Venus field (Section 6.2) and a review of previous marine seismic and well-drilling ESIA's undertaken for offshore projects in southern Namibia and the South African West Coast, as well as other



development ESIAs undertaken by the proponent. An independent review of the DSR was undertaken by Dr Peter Tarr of SAIEA (see Appendix B.11).

The DSR was released for a public review and comment period (2 April to 13 May 2025). Steps undertaken as part of the DSR public review process are summarised in Section 3.5.2.

3.4.1.4 Compilation of the Final Scoping Report

This FSR complies with the requirements of Section 8 of the EIA Regulations (see Table 3-2) and has also been informed by comments received on the DSR and issues raised during public meetings. A summary of the issues and concerns raised is provided in Section 3.5.2.3 of this report. All written submissions have been collated (see Appendix B.9), and responded to, in a Comments and Responses Report (see Appendix B.10). Note that confirmation of the receipts and administrative requests were not included in the Comments and Responses Report but were actioned by Urban Dynamics and/or SLR.

3.4.1.5 Completion of the Scoping Phase

As noted in Section 1.2, this FSR has been submitted to MIME for consideration and review. MIME will then forward it and a recommendation to MEFT for a decision on the acceptance or rejection of the report. If the FSR is accepted, the project will proceed onto the Impact Assessment Phase (see Section 3.4.2).

Table 3-2: Requirements of a Scoping Report in terms of the EIA Regulations 2012.

Section 8	Content of Scoping Report	Completed (Y / N)	Section in Scoping Report
(a)	The curriculum vitae of the EAP who prepared the report;	Y	Appendix A
(b)	A description of the proposed activity;	Y	Chapter 5.0
(c)	A description of the site on which the activity is to be undertaken and the location of the activity on the site;	Y	Section 1.1
(d)	A description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed listed activity;	Y	Chapter 6.0 & 7.0
(e)	An identification of laws and guidelines that have been considered in the preparation of the scoping report;	Y	Chapter 2.0
(f)	Details of the public consultation process conducted in terms of Regulation 7(1) in connection with the application, including:	Y	Section 3.5
	(i) the steps that were taken to notify potentially interested and affected parties of the proposed application;	Y	Appendix B
	(ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given;	Y	Appendix B.1
	(iii) a list of all persons, organisations and organs of state that were registered in terms of	Y	



Section 8	Content of Scoping Report	Completed (Y / N)	Section in Scoping Report
	Regulation 22 as interested and affected parties in relation to the application; and		
	(iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;	Y	Appendix B.8, B.9 & B.10
(g)	A description of the need and desirability of the proposed listed activity and any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives have on the environment and on the community that may be affected by the activity;	Y	Chapter 4.0, Section 5.7 and Chapter 6.0.
(h)	A description and assessment of the significance of any significant effects, including cumulative effects, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the proposed listed activity;	Partial	A full assessment of impacts will be included in the ESIA Report. Refer to Chapter 6.0 & Section 8.2 for a description of the key issues to be assessed and the assessment methodology, respectively.
(i)	Terms of reference for the detailed assessment;	Y	Chapter 8.0
(j)	A draft management plan, which includes:		
	(i) information on any proposed management, mitigation, protection or remedial measures to be undertaken to address the effects on the environment that have been identified including objectives in respect of the rehabilitation of the environment and closure;	Partial	
	(ii) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and	Partial	
	(iii) a description of the manner in which the applicant intends to modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation remedy the cause of pollution or degradation and migration of pollutants.	Partial	ESMP will be included in the ESIA Report.



3.4.2 Impact Assessment Phase

3.4.2.1 Specialist Studies

Four technical modelling studies and nine specialist studies will be commissioned to address the key issues that require further investigation and detailed assessment. These include:

- Technical Modelling Studies (see Section 8.1.1):
 - o Drilling Discharges Modelling.
 - o Oil Spill Modelling.
 - o Underwater Noise Modelling.
 - o Liquid Effluent Discharges Modelling
- Specialist Studies / Assessments (see Section 8.1.2):
 - o Marine Ecology Impact Assessment
 - o Fisheries Impact Assessment
 - o Socio-economic Impact Assessment
 - o Cultural Heritage Impact Assessment (intangible)
 - o Human Rights Impact Screening
 - o Air Quality Impact Assessment
 - o GHG Emissions and Climate Change Risk Assessment
 - o Waste Management Study
 - o Closure and Decommissioning Study

The technical modelling studies will predict the potential extent of outputs from the proposed development and associated operations to inform specialist impact assessments. Similarly, the waste management and closure & decommissioning studies will also provide outputs to inform the other specialist studies.

The specialist studies will review modelling output and secondary data to identify and assess potential environmental impacts that may occur as a result of the proposed development activities. These impacts will be assessed according to pre-defined rating scales (Section 8.2). Appropriate mitigation or optimisation measures to avoid and / or minimise potential impacts or enhance potential benefits, respectively, will be recommended, based on the results of the specialists' studies.

Data collected during Environmental Baseline Survey undertaken within Block 2913B (Section 6.2) will be used to inform technical modelling parameters and specialist study baseline descriptions, where suitable.

The terms of reference for all the technical modelling and specialist studies are presented in Section 8.1. The ESIA specialist team is listed in Table 3-1.

3.4.2.2 ESIA Report and ESMP

The technical modelling and specialist study findings and other relevant information will be integrated into a Draft ESIA Report and ESMP, and specialist studies will be included as appendices to that report. The Draft ESIA Report and ESMP will be released for a 21-working day review and comment period (Section 3.5.3).

After closure of the comment period on the Draft ESIA Report and ESMP, all comments received will be incorporated into the Final ESIA Report and ESMP, which will include the final Comments and Responses Report. The Final ESIA Report and ESMP will be submitted



to MIME for consideration and review. MIME will then forward it and a recommendation to MEFT for a decision on the application. The decision taken by MEFT will be distributed to all I&APs registered on the project database.

3.4.2.3 Management of Change

As with most large, complex projects, refinement of the project design is an ongoing and sometimes lengthy process. This ESIA considers the most credible, current “worst-case scenario” when assessing impacts and developing mitigation measures. However, should the project design change after submission of the Final ESIA Report, a Management of Change (MOC) Procedure will be implemented, as agreed with MEFT. The MOC Procedure applies to any changes to the project description (i.e. approved activities), impact assessment and / or mitigation and monitoring measures described in the ESIA Report and associated ESMP.

The level of change, as agreed with MEFT, will determine the action to be taken to ensure the changes do not affect the Project’s ability to meet environmental and social performance requirements outlined in the ESIA Report, ECC and other relevant Namibian legislation (Table 3-3). All future design changes will undergo an “Internal Screening” exercise to determine whether the change triggers a ‘Level 1’ or a ‘Level 2’ change.

Table 3-3 : Proposed Management of Change Procedure

Level of Change	Description of Level of Change and Action
Level 1: Minor Change	Where the change is largely immaterial to the ESIA findings, the listed activities that were applied for are still triggered and it does not affect the Project’s ability to meet environmental and social performance requirements outlined in the ESIA Report and EMP. Assuming the project is approved by MEFT, compliance with the ECC and EMP would need to be externally audited in line with the frequency specified in the ECC and EMP. As part of these external audits, the relevance of the EMP will be reviewed and amendments proposed where necessary. These changes and their evaluation should be detailed in an application for amendment and the EMP revised as appropriate (in terms of Section 29 of the Environmental Management Act, 2007 and Regulation 19 of the EIA Regulations 2012). In terms of Section 39 of the Environmental Management Act, 2007, an ECC may be amended if the amendment will not increase the level or nature of the impact, which impact was initially assessed and considered when application was made for an ECC.
Level 2: Significant Change	Where a future change or upgrade would lead to a significant departure from the base-case or a key aspect of it such that the existing ESIA Report or EMP does not adequately address potential impacts or require additional mitigation. This would imply that either a new listed activity(s) is triggered, or the scope of an approved activity would change. This requires an update of the ESIA Report and ESMP through an amendment application in terms of the Environmental Management Act, 2007 and Regulations 19 and 21 of the EIA Regulations 2012, and submission thereof to MEFT for review and decision.



3.5 Public Consultation Process

This section presents the principles of public consultation and the process undertaken during the Scoping Phase and that proposed for the Impact Assessment Phase.

3.5.1 Principles

The key principles of stakeholder engagement applied in this ESIA process conforms to international standards:

- Providing meaningful information in a format and language(s) that are readily understandable and tailored to the needs of the target stakeholder group(s);
- Providing information in advance of consultation activities and decision-making;
- Disseminating information in ways and locations that make it easy for stakeholders to access it;
- Respect for local traditions, languages, timeframes and decision-making processes;
- Two-way dialogue that gives both sides the opportunity to exchange views and information, to listen, and to have their issues heard and addressed;
- Inclusiveness in representation of views;
- Processes free of intimidation or coercion;
- Clear mechanisms for responding to people's concerns, suggestions, and grievances; and
- Incorporating feedback into project or programme design and reporting back to stakeholders.

3.5.2 Scoping Phase

The steps undertaken for the Scoping Phase included:

- Identification of stakeholders;
- Regulatory engagement;
- Project notification to stakeholders;
- Public disclosure of DSR for review and comment;
- Production of Comments and Response Report; and
- Production of FSR and disclosure for information purposes

3.5.2.1 Stakeholder Engagement Plan

Although not a legal requirement in Namibia, a Stakeholder Engagement Plan (SEP) was prepared to meet good practice requirements. The SEP seeks to define a technically and culturally appropriate approach to consultation and disclosure. The SEP outlines the stakeholder engagement (or public participation) in the ESIA process and describes the approach and methods to be used for stakeholder engagement. It also reflects the considerations underlying the selected approach to the public participation process for this Project, which are based on the nature of the proposed activities, characteristics of stakeholders, legal requirements, and experience on previous comparable processes.

A stakeholder is defined as any external person, group of persons, or organization on which the Project (or activity) has a potential, direct or indirect, positive or negative impact, or one that has a potential, direct or indirect, positive or negative impact on the Project (or activity). It also includes project affected people and project affected communities.



The SEP is a live document that will be updated over the course of the ESIA, when necessary.

3.5.2.2 Stakeholder Identification

A preliminary I&AP database (see Appendix B.1) was compiled based on:

- TEEPNA's existing stakeholder database for southern Namibia;
- SLR's existing databases from other offshore oil and gas ESIA's undertaken in southern Namibia; and
- Urban Dynamics' existing databases for previous offshore and onshore projects in Namibia
- Input from the fisheries specialist in order to ensure the stakeholders and contact details from fisheries sector is comprehensive and up to date.

The initial database focused on Namibian authorities, Non-Governmental Organisations (NGOs), Community-based Organisations, fishing industry associations / companies, adjacent licence holders, other relevant business entities and individuals (general public).

The initial database included **over 600 stakeholders** who may be directly or indirectly affected by the proposed activities. These stakeholders were divided into the following categories:

- Authorities:
 - o Namibian Government (national, regional and local).
 - o Traditional Authorities (//Kharas, Erongo and Hardap Regions).
 - o Maritime Authorities (MWT: Directorate of Maritime Affairs and South African Naval Hydrographic Office (SANHO)).
- Business, Associations and Professional Services:
 - o Fishing associations and companies.
 - o Offshore Oil and Gas Operators.
 - o Logistics and Infrastructure organisations.
 - o Tourism Industry and Associations.
 - o Other Offshore projects in the Area of Interest (AOI).
 - o Commercial Freight Services.
 - o Commercial aviation.
 - o Ocean based Extraction Industry.
 - o Environmental Assessment Practitioners.
 - o Urban and Regional Planners.
 - o Consulting Engineers.
 - o Other Businesses.
- Academia:
 - o Universities and research centres
- Civil Society:
 - o Namibian NGOs.
 - o International NGOs.
 - o Political and Intergovernmental Organisations.



- o Community Based Organisations (CBOs such as civil society groups, development associations, conservation associations, women's groups, fishing or other activity-based groups).
- o Disability based associations.
- o Coastal communities.
- o Artisanal fishermen.
- o Vulnerable and marginalised groups.
- o Youth groups.
- o General Public.

The I&AP database was continually updated during the Scoping Phase and will continue to be updated during the remainder of the ESIA process. Additional I&APs have been added to the initial database based on comments received on public documents and attendance at public meetings. At the time of compiling the FSR there were 2 133 registered I&APs registered on the Project database (see Appendix B.1).

3.5.2.3 Consultation and Disclosure Methods

Pre-Application Meeting with MEFT

A meeting was held with MEFT on **29 January 2025** to provide notification of the proposed activities and TEEPNA's intent to submit an application for ECC, as well as consult on the ESIA process (including associated public participation strategy) and MEFT requirements.

Notification Letter and Background Information Document

All I&APs on the initial project database (see Appendix B.1) were notified via email of the ESIA process and provided with a Background Information Document (BID). A copy of the letter and BID is provided in Appendix B.5 and Appendix B.6, respectively.

While potential I&APs, particularly from vulnerable and disadvantaged communities, may not have access to the internet and email, Namibia has a high level of cell phone usage. In order to facilitate engagement during the Scoping Phase and to register on the Project stakeholder database or provide initial comment, a cell phone number (+264 81 124 5188 or +264 81 354 8251) was provided in all notifications.

Newspaper Advertising

Four sets of advertisements announcing the proposed development activities, the availability of the DSR (see Section 3.5.2.4), the I&AP registration / comment period and in-person engagements (see Section 3.5.2.4) were placed in the following newspapers:

- The Namibian: 17 March, 24 March, 17 April, and 24 April 2025;
- Republikein: 17 March, 24 March, 17 April, and 24 April 2025;
- Sun: 17 March, 24 March, 17 April, and 24 April 2025;
- Allgemeine Zeitung): 17 March, 24 March, 17 April, and 24 April 2025;
- New Era: 17 March, 24 March, 17 April, and 24 April 2025; and
- Namib Times: 20 March, 28 March, 17 April, and 25 April 2025

Proof of placement is provided in Appendix B.2.



Site Notices

Site notices announcing the proposed development activities, the availability of the DSR, the I&AP registration / comment period and in-person engagements were placed at the following locations:

- **Bethanie:** Settlement Office;
- **Luderitz:** Luderitz Town Council;
- **Oranjemund:** Oranjemund Town Council;
- **Windhoek:** Windhoek Central Hospital, Klein Windhoek Woerman Brock, Khomadal Woerman Brock, UN Plaza, Eros Woerman Brock, Olimpia Woerman Brock;
- **Swakopmund:** Swakopmund Municipality, Swakopmund Spar, Swakopmund Woerman and Brock, Veneta Woerman Brock, Mondesa Woerman Brock, Tamarisia Town Hall;
- **Henties Bay:** Henties Bay Municipality, Henties Bay Spar, Henties Bay Woerman Brock, Henites Bay Met Save, Henties Bay Clubhouse (front and back);
- **Walvis Bay:** Walvis Bay Municipality, Walvis Spar, Narraville Woerman and Brock, Kuisebond Woerman Brock, Kuisebmond Pick 'n Pay, Kuisebmond Police Station;

Proof that the site notices were erected is provided in Appendix B.4.

Radio Announcements

Radio announcements were broadcasted on NBC Radio in English, Afrikaans, Damara/Nama, Otjiherero and Oshiwambo to announce the start of the ESIA process, availability of the DSR for registration / comment and in-person engagements. The Broadcast text is provided in Appendix B.3.

Run dates for the radio announcements were as follows with broadcast frequencies in Windhoek:

- National FM (English) 92.9 FM: 25 and 28 March (once a day), 2 and 5 April (once a day), 16, 17, 18, 23, 24 and 25 April 2025 (twice a day);
- Kati FM (Oshiwambo) 97.9 FM: 25 and 28 March (once a day), 2 and 5 April (once a day), 16, 17, 18, 23, 24 and 25 April 2025 (twice a day);
- Hartklop FM (Afrikaans) 89.7 FM: 25 and 28 March (once a day), 2 and 5 April (once a day), 16, 17, 18, 23, 24 and 25 April 2025 (twice a day);
- Omurari FM (Otjiherero) 97.4 FM: 25 and 28 March (once a day), 2 and 5 April (once a day), 16, 17, 18, 23, 24 and 25 April 2025 (twice a day);
- Kaisames FM (Damara/Nama) 98.7 FM: 25 and 28 March (once a day), 2 and 5 April (once a day), 16, 17, 18, 23, 24 and 25 April 2025 (twice a day);
- Radio Wave (English) 96.7 FM: 16, 17, 18, 23, 24 and 25 April 2025 (three times a day).

Availability of the DSR

This DSR was released for a public review and comment period from **2 April to 13 May 2025**. The objective of the DSR review and comment period is to ensure that I&APs are notified about the proposed activities, given a reasonable opportunity to register on the project database and given an opportunity to provide initial comments of the proposed activities and scope of the assessment. Copies of the DSR were made available on the SLR website for download, as well as at the following public locations:

- Walvis Bay Municipality;
- Luderitz Town Council;



- Keetmanshoop //Kharas Regional Council;
- Bethanie Village Council;
- City of Windhoek Customer Care Centre;
- Oranjemund Town Council; and
- Swakopmund Municipal Council

Notification Letter and Non-Technical Summary

All I&APs registered on the initial project database were notified of the availability of the DSR and relating comment period and in-person engagements by means of a notification letter. To facilitate the commenting process, a Non-Technical Summary was also provided in English, Afrikaans, Oshiwambo, Otjiherero and Nama/Damara. A copy of the letter and Non-Technical Summary are provided in Appendix B.5 and B.6.

Notice of the public engagements was also shared with the local authorities/councils for dissemination across their various noticeboards and community groups (WhatsApp, Facebook, LinkedIn).

Public Meetings and Open Days

A total of 16 public meetings and 16 open days were held during the DSR comment and review period (Table 3-4). These were held in Keetmanshoop, Bethanie, Lüderitz, Oranjemund, Windhoek, Swakopmund, Henties Bay, and Walvis Bay. An online meeting was also held for those unable to attend the open days/meetings. Specific details and notice of these meetings were provided in the I&AP notification letter, Non-Technical Summary, advertisements and on the project website.

These engagements were structured as follows:

- **Public Meetings** – A formal presentation session followed by a question-and-answer session. At these meetings, TEEPNA or a JV representative, Urban Dynamics and SLR presented an overview of the proposed activities and ESIA process and provided stakeholders the opportunity to raise any issues or concerns.
- **Public Open Sessions** – An informal poster session where I&APs could attend at any time during the hours indicated and engage with the ESIA team.

In Lüderitz and Walvis Bay, concurrent public meetings and open days were held at different venues and times to encourage attendance and ensure accessibility (Table 3-4). The purpose of these engagements was to provide an overview of the proposed project and ESIA process and provide stakeholders with the opportunity to raise any questions, issues or concerns. All formal meetings were conducted in English, with access to Afrikaans, Damara/Nama, Oshiwambo and Otjiherero materials, facilitators and translators. Posters were available in English and Afrikaans.

Non-Technical Summary documents were available in English, Afrikaans, Oshiwambo, Otjiherero and Nama/Damara). Minutes and attendance registers of these engagements are presented in Appendix B.8.

Table 3-4: Scoping phase public open house and meeting details.

Town/City	Date	Venue	Open House	Meeting
Keetmanshoop	7 April	University of Namibia (UNAM)	13:00 - 17:30	17:30 - 19:30
Bethanie	8 April	Bethanie Community Hall	11:30 - 13:30	13:30 - 15:30
Lüderitz	9 April	New Waterfront Cornelius Frederick Conference Room	13:00 - 17:30	17:30 - 19:30
		Lüderitz Junior Secondary School Hall	09:30 - 14:00	14:00 - 16:00



Town/City	Date	Venue	Open House	Meeting
	10 April	New Waterfront Cornelius Frederick Conference Room	09:00 - 11:00	11:00 - 13:00
		Benguela Community Hall	11:00 - 17:30	17:30 - 19:30
	11 April	New Waterfront Cornelius Frederick Conference Room	11:30 - 14:00	
		St Peters Church Hall	11:30 - 14:00	09:30 - 11:30
	12 April	New Waterfront Cornelius Frederick Conference Room	09:00 - 12:00	
Oranjemund	14 April	Oranjemund Recreation Club	12:30 - 14:30	14:30 - 16:30
Windhoek	22 April	Franco Namibian Cultural Centre (FNCC)	13:00 - 17:30	17:30 - 19:30
	23 April	UN Plaza	13:00 - 19:00	
Swakopmund	28 April	Tamariskia Town Hall		16:00 - 18:00
Henties Bay	28 April	The Clubhouse		16:00 - 18:00
Walvis Bay	29 April	Pelican Bay Hotel	13:00 - 17:30	17:30 - 19:30
		NAMSOV Learn in Peace Centre, Kuisebmond	13:00 - 17:30	17:30 - 19:30
	30 April	Pelican Bay Hotel	09:00 - 11:00	11:00 - 13:00
		Walvis Bay Town Hall	16:00 - 18:00	14:00 – 16:00
Virtual Online	06 May	Microsoft Teams		14:00 - 16:00

Focus Group Discussions

A total of 13 Focus Group Discussions were held during the DSR comment and review period. Key stakeholders in each town were invited to meet with the ESIA team to delve deeper into the issues and concerns of those stakeholders and to ensure maximum support and collaboration on the project.

Focus Group Discussions were held with the following groups:

- Businesses (Keetmanshoop and Windhoek);
- Authorities (Lüderitz and Walvis Bay);
- Youth Groups (Lüderitz and Walvis Bay);
- Small, Medium and Micro Enterprises (Lüderitz);
- Tourism and Business Operators (Lüderitz);
- Civil Society Organisations (Lüderitz);
- Artisanal Fishers (Henties Bay);
- Women's Groups (Lüderitz and Walvis Bay); and
- Topnaar Community Leaders (Walvis Bay).

Minutes and attendance registers of these engagements are presented in Appendix B.8.

The ESIA team arranged Focus Group Discussions with the following key stakeholder groups, however these could not proceed as planned due to non-attendance despite prior confirmations and multiple reminders:

- Fishing Industry and Associations (Lüderitz);
- Civil Society Organisations (Walvis Bay);
- Small, Medium and Micro Enterprises (Walvis Bay); and
- Tourism and Business Operators (Walvis Bay)

The ESIA team will endeavour to engage with these groups in the Impact Assessment Phase.



Dedicated Meetings

A total of 6 Dedicated Meetings were held with specific institutions to delve deeper into the issues and concerns of these specific institutions and to ensure maximum collaboration on the project. Dedicated Meetings were held with the following groups:

- Karas Regional Council;
- Luderitz Town Council;
- Nama Traditional Leaders Association;
- National Planning Council;
- Logistics Contractor; and
- Namibia Investment Promotion and Development Board.

Minutes and attendance registers of these engagements are presented in Appendix B.8.

Comments and Responses Report and Final Scoping Report

Comments received on the DSR have been collated (Appendix B.9) and responded to in a Comments and Responses Report (Appendix B.10). Note that confirmation of the receipts and administrative requests were not included in the Comments and Responses Report but were actioned by Urban Dynamics and/or SLR. Comments received have been considered in updating of the report into this FSR.

The key concerns raised through the public participation process to date include:

- Potential impacts to the marine environment;
- Potential impacts to fisheries;
- Namibia's lack of refining capabilities;
- Potential impacts of an oil spill;
- Job opportunities limited to highly skilled individuals;
- Job opportunities won't go to local people (both national and regional context)

The full submissions and responses (by EAP and applicant) are included in the Comments and Responses Report (Appendix B.10).

Stakeholders on the project database will be notified of the submission of the FSR to MIME and MEFT for consideration and acceptance, and where responses to submitted comments can be viewed.

3.5.3 Impact Assessment Phase

Public consultation tasks proposed for the Impact Assessment Phase include:

- *Release of Draft ESIA Report and ESMP for review and comment:* The Draft ESIA Report and ESMP will be released for a public review and comment period and will be available for download on the SLR website. Hardcopy reports will be available at public venues in Walvis Bay, Lüderitz, Windhoek, Keetmanshoop, Bethanie, Swakopmund and Oranjemund for the duration of the review and comment period.
- *Notification letters:* Notification letters will be emailed to all I&APs registered on the project database. The letter will provide details of the release of the Draft ESIA Report and ESMP, and information on where the report can be reviewed. To provide information in a quick and easily readable format, a Non-Technical Summary will be attached to the email (also available in multiple languages).



- *Radio announcements:* Radio announcements will run during the consultation process for Draft ESIA Report and ESMP, informing stakeholders of the various engagements and where to review the reports.
- *In-person engagements:* Stakeholders will be invited to attend focus group meetings, public meetings and open days..
- *Comments and Responses Report, Final ESIA Report and ESMP:* All comments received on the Draft ESIA Report and ESMP will be collated and responded to in a Comments and Responses Report, which will be appended to the Final ESIA Report and ESMP. Stakeholders on the project database will be notified of the submission of the Final ESIA Report and ESMP to MEFT and where responses to submitted comments can be viewed.
- *Disclosure of decision:* The decision by the MEFT: Environmental Commissioner on the ECC application will be uploaded onto the SLR website for information purposes. All I&APs registered on the project database will be notified via email, SMS or WhatsApp.



4.0 Need and Desirability

This chapter analyses the need for and desirability of the proposed activities based on its ‘fit’ with the policy and planning framework adopted by the Namibian administration, as discussed in Section 2.3. In this context it is noted that:

- The evaluation of merits of national government policy, global trends, geopolitics and feasibility of the proposed activities are complex, evolving and sometimes contradictory, and fall outside of the scope of this project-level ESIA. The analysis thus relies on relevant current commitments, policies and targets as markers against which to evaluate the need and desirability of the proposed activities;
- The analysis does not evaluate the need and desirability from the applicant’s perspective and assumes that the applicant is confident of the economic feasibility of the proposed activities; and
- Need and desirability can relate to different aspects, e.g. social, economic, and environmental aspects, which are not always aligned, and the proposed activities may be needed and desirable in terms of some but not other such aspects.

4.1 Fit of Petroleum Production with the Namibian Planning Framework

Summarising upfront, the following sections show that Namibia’s policies recognise the need to progressively reduce Green House Gas (GHG) emissions, especially from fossil energy, while, at the same time, ensuring a stable, sufficient and affordable energy supply and enabling economic growth to address the critical challenges of unemployment and poverty.

As part of that approach, Namibian policy also promotes the viable and sustainable exploration and production of indigenous petroleum resources to promote greater economic and income diversity, growth and transition to lower-carbon energy sources (such as gas-derived electricity and supplementation of renewables).

The compatibility of project emissions, notably Scope 1 and 2 emissions, with Namibia’s climate change commitments depends on the nature of commitments, plans and policies and progress in decreasing emissions from other sources.

4.1.1 Energy-Related Plans and Policies

The energy-related plans and policies discussed in Section 2.3.1 have identified an existing and continuing demand for hydrocarbon products in Namibia, with an aim of promoting the country’s exploration and production potential.

Policies are careful to frame the need for locally produced hydrocarbon products in the Namibian economy in the context of, and as a supplement to, the desired increase in renewable energy generation capacity. In this sense the use of petroleum products is not deemed contradictory to, and rather supportive of, the continued development of renewable energy in Namibia.

Although gas receives special mention in Namibian policies, it will not be produced as part of the currently proposed Venus development, as the produced gas needs to be re-injected to enhance the production of the oil. Similarly, a lack of refining capacity in Namibia means that the oil that would be produced by the proposed project cannot be bought by a Namibian refinery for the time being.

This means the Venus development project – as currently proposed – may not contribute directly to the furtherance of domestic energy-related plans and policies. It may however,



through demonstrating the viability of developing offshore resources, supporting the establishment of energy specialist companies and generating national income, indirectly contribute to the future investment on specific aspects of the energy policy.

The project is deemed to be in indirect furtherance of specific energy-related plans and policy in Namibia.

4.1.2 Economy-Related Plans and Policies

Economic policies are naturally complex in that they relate to and seek to combine a wide range of objectives, tools and desired outcomes. Promoting economic growth is a key proclaimed focus of the Namibian Government, with a focus on increased energy security, in conjunction with a declared intent to mitigate the effects of climate change and diversify the energy mix away from fossil fuels while exploring the use of natural gas, including indigenous resources, as a less carbon intensive transitional fuel.

Policy clearly lays out the social need for economic development and opportunities, and that this should be achieved through a managed energy transition that includes a mix of energy sources, including fossil fuels for some time, and possibly the production of indigenous oil and gas resources.

The viable and sustainable production of indigenous resources is expected to create a range of benefits that directly and indirectly stimulate government income and economic growth; this will be further evaluated in the Impact Assessment Phase based on specialist findings.

The project is in principle deemed in keeping with and furtherance of economy-related plans and policy in Namibia.

4.1.3 Climate Change-Related Plans and Policies

Similar to economic policies, climate change-related policies seek to accommodate a number of goals, notably low-carbon and socially just and equitable economic growth. Namibia has stated its commitment to reduce GHG emissions through its National Policy on Climate Change and its Second Updated NDC 2023. The country aims to reduce greenhouse gas emissions through accelerating renewable energy adoption, expanding climate-smart agriculture practices and enhancing afforestation and reforestation. These policies emphasize sustainable development, resilience building, and reducing the vulnerability of its population to climate impacts.

Namibia must balance these priorities with its active promotion of oil and gas exploration and production, as it seeks to leverage its natural resources for economic growth, while also addressing the need to reduce GHG emissions. Fundamental issues around the strategy to achieve Namibia's NDC targets are too complex to comprehensively and conclusively analyse at a project level – priorities and strategies need to be decided at a national policy level.

The compatibility of the project with Namibia's climate change-related plans and policies cannot be fully determined at present as such plans and policies are not detailed enough on how to counterbalance increased emissions from production with decreased emissions from other sources.



Project emissions that contribute to Namibia's GHG inventory would include Scope 1 and 2 emissions from production. Scope 3 emissions¹² from oil produced in Namibia but emitted elsewhere would not be reported in Namibia's emissions and thus not reflect in Namibia's commitments under the Paris Agreement (and compliance therewith). The compatibility with Namibia's climate change-related plans and policies will be further evaluated once the estimated project GHG emissions have been calculated during the Impact Assessment Phase.

4.2 Broader Context of Petroleum Exploration and Production

As it is understood, considering that there are no oil refineries in Namibia, the oil produced at the Venus field is destined for export, at least initially. This section provides a broader overview and context of other global and Namibian key aspects in principle associated with the need for and desirability of viable and sustainable hydrocarbon exploration and production, including:

- Context of global and Namibian GHG emissions (Section 4.2.1);
- Status of and outlook for global oil and gas demand and supply (Sections 4.2.2 to 4.2.4); and
- Other considerations (Section 4.2.5).

Summarising upfront, the following sections show that Asia, Europe and North America each account for approximately one third of global CO₂ emissions released from fossil fuels and industry since 1750. Asia accounted for 62% of the global share of CO₂ and 56% of GHG emissions in 2023, with a continued upward trajectory. European and North American CO₂ emissions declined by 37% and 15% relative to their peaks in 1990 and 2005, and in 2023 stood at 14% and 17% of global emissions (or 13% and 15% of total GHG emissions).

Namibia has contributed a negligible amount to global GHG emissions.

Global oil and gas production and consumption is unevenly distributed, and between four and six countries accounted for half of overall oil and gas production and/or consumption in 2023; the United States, Canada, the Russian Federation, China and Saudi Arabia are the overall key suppliers and/or consumers.

There is no universally accepted energy transition path or one-size-fits-all approach, and countries and regions continue to search for, and explore, different means of reaching national and global targets. An energy transition is well underway and underpinned by a variety of factors.

However, empirical evidence shows that hydrocarbon resources continue provide more than half of the world's energy, with stable (oil) or increasing (gas) consumption and production growth trends at present. It is not evident that new oil and gas discoveries in themselves swell oil and gas demand, except where gas discoveries can displace high-carbon-intensity coal in the power sector. Global oil and gas demand growth since 2000 far exceeded exploration activity (Wood Mackenzie, 2024). Renewables, despite impressive growth in

¹² Scope 1 Emissions: These are direct GHG emissions from sources that are owned or controlled by an organisation.

Scope 2 Emissions: These are indirect GHG emissions associated with the purchase of electricity, heat, cooling, etc. Although these emissions occur at the facility where they are generated, they are accounted for in an organisation's GHG inventory because they result from the organisation's energy use.

Scope 3 Emissions: These are all other indirect emissions that occur in the value chain of the reporting company, both upstream and downstream. This includes emissions from activities such as the production of purchased goods and services, business travel, waste disposal, and the use of sold products.



recent decades, contributed only the equivalent of 13% of the global energy sourced from petroleum resources, and 9% of the energy sourced from all fossil fuels.

Renewable electricity generation, and reliability thereof, must increase many-fold to replace the energy currently produced from fossil fuels (not accounting for rising electricity demand due to electrification of sectors, e.g. transport, and from higher-income / more energy-intensive lifestyles across the world). For renewables (and/or other low-carbon sources) to replace (rather than supplement) current fossil fuel sources will likely take some time, and hydrocarbon resources are likely to continue to play a significant role in the interim.

Transition paths and speed will vary across global regions depending on the nature of the economy and current resource use, indigenous or otherwise securely available energy sources, cost of implementing or switching to alternative technologies and capacity to financially or otherwise incentivise or prescribe transitions in energy-intensive sectors.

4.2.1 Context of GHG Emissions

4.2.1.1 Global GHG Emissions

The build-up of GHG in the atmosphere is accepted as the key driver of climate change, which is resulting in variable increases in average temperatures across the globe (see Figure 4-1).

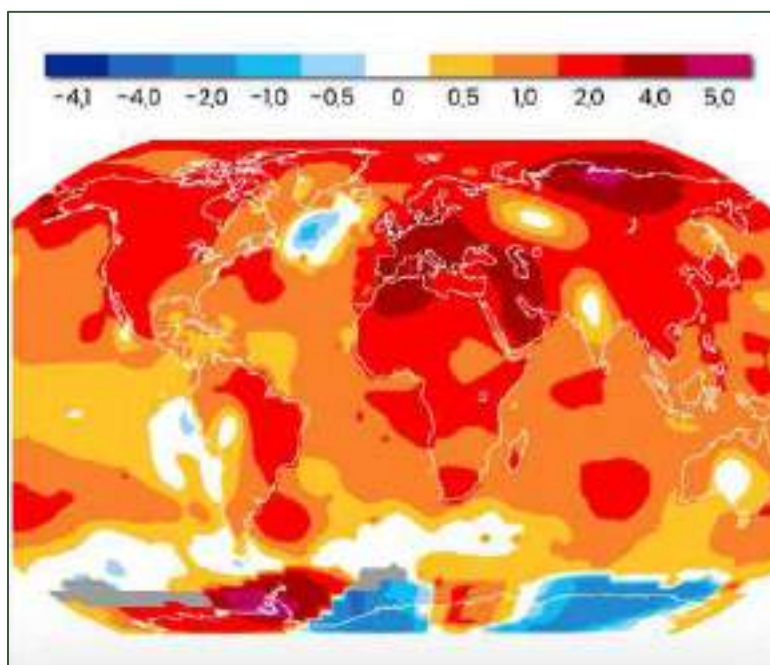


Figure 4-1: Global change in temperatures in the period of June 2017-June 2022 compared to the period of 1951-1980 (in °C).

Source: NASA, cited in The Pioneer (2022)

Annual CO₂ emissions from fossil fuels and industry – which provide an indicator of mostly man-made GHG emission from energy use – have increased from virtually none prior to 1850 to 37.80 billion t in 2023, with the most pronounced increase in CO₂ emissions since the 1950s (see Figure 4-2).



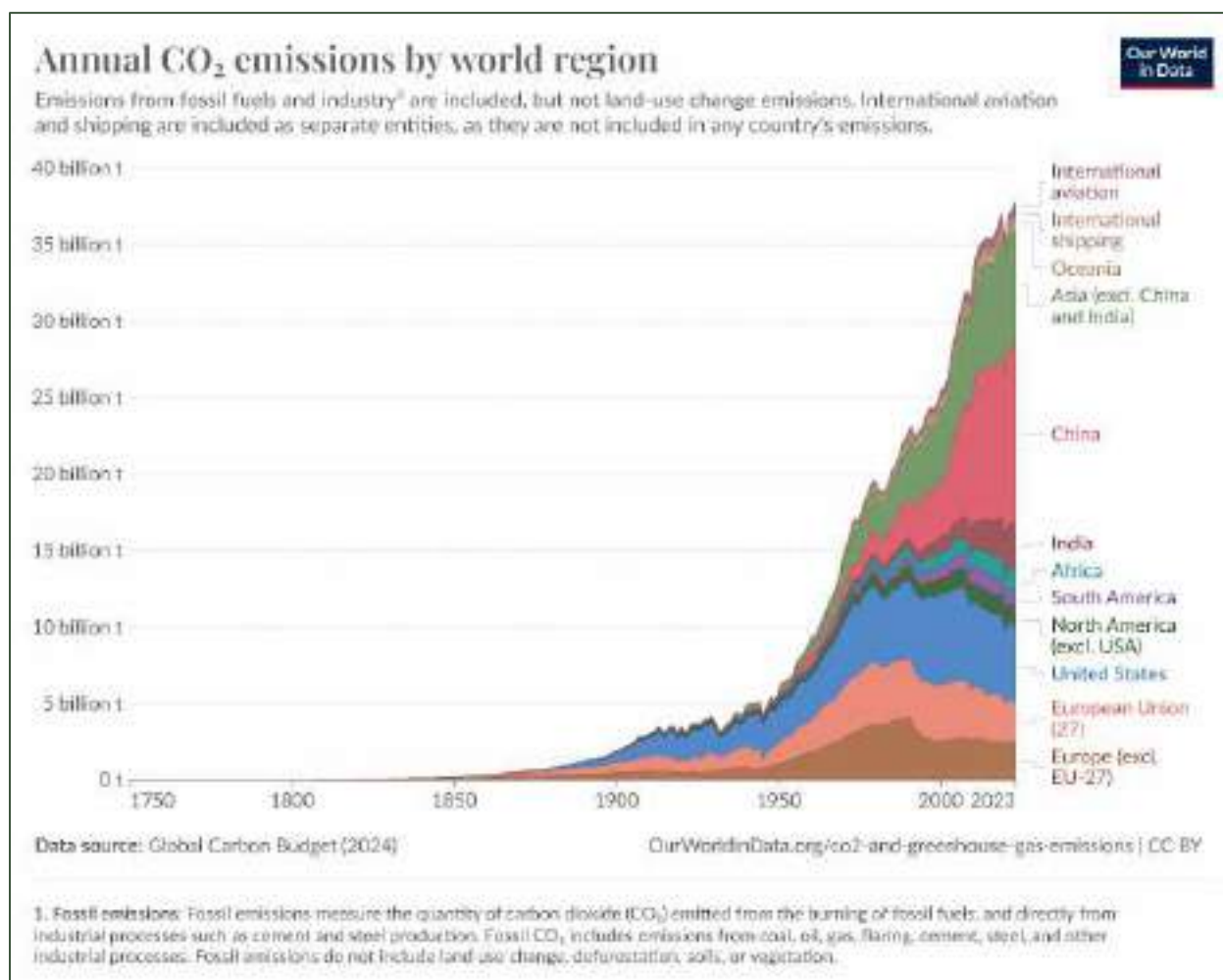


Figure 4-2: Annual CO₂ emissions by region, in absolute volumes

Source: Our World in Data (2024)

Europe and North America dominated CO₂ emissions pre-1950s (see Figure 4-2), emitting a total of 208 billion t CO₂ between 1750 and 1950, which is equivalent to 95% of the 225 billion t CO₂ emitted during that time (see Table 4-1).

By 1950, Asia's share of CO₂ emissions had steadily increased, and the region became the greatest CO₂ emitter in 1992. Since 1992, Asian emissions have tripled, while European and North American emissions declined by 37% and 15% relative to their peaks in 1990¹³ and 2005, respectively.

By 2023, Asian emissions accounted for 60% of global emissions, in line with its share of the global population. Due to the slight actual reduction in European and North American emissions, and due to the considerable increase in Asian (and hence overall) emissions, the share of European and North American emissions has reduced to 14% and 17%, respectively, still above their world population share of 9.1% and 4.7%, respectively. African

¹³ At least half of the ~19% decline in European emissions between 1990 and 2012 was associated with the decommissioning of many industries and restructuring of agriculture in Eastern Europe (including East Germany) after the fall of the Berlin Wall, and the liberalisation of energy markets in the UK which resulted in a fuel switch from oil and coal to gas in electricity production (European Environment Agency, 2014).



and South American emissions are low at 4% and 3%, respectively, and well below their world population shares of 18.6% and 8.1% (see Table 4-1).

Between 2022 and 2023, nominal emissions declined for Europa, North America and Oceania, remained almost the same for Africa and increased for Asia and South America. Global emissions declined by 1.3% from 37 150 to 36 675 million t CO₂.

Emissions from coal account for 41% of global emissions in 2023, followed by oil (32%) and gas (21%) (see Figure 4-6 and Table 4-4).

Over the total recording period (1750 – 2023), Asia, Europe and North America each account for approximately or close to one third of global emissions (see Table 4-1).

Table 4-1: Total CO₂ emissions by region from 1750 to 2023, in million t CO₂

Region	pre-1950	%	post-1950	%	Total	%	2023	%	% of world population in 2024
Africa	1 643	1%	50 788	3%	52 431	3%	1 419	4%	18.6%
Asia	11 938	5%	589 086	38%	601 024	34%	22 600	62%	58.9%
Europe	112 739	50%	434 713	28%	547 452	31%	4 993	14%	9.1%
North America	95 272	42%	401 094	26%	496 366	28%	6 124	17%	4.7%
Oceania	1 722	1%	20 440	1%	22 162	1%	430	1%	0.6%
South America	1 526	1%	44 644	3%	46 170	3%	1 109	3%	8.1%
Total	224 840		1 540 765		1 765 605		36 675		

Source: Our World in Data (2024)

Total GHG emissions, which mainly include CO₂, methane¹⁴ and nitrous oxide¹⁵ from all sources (including land-use change), are approximately double total CO₂ emissions over the reporting timeframe¹⁶. In 2023, total GHG emissions exceeded CO₂ emissions by 47% (see Table 4-1 vs Table 4-2).

The most notable difference between the relative contributions to total GHG and CO₂ emissions is the higher relative contribution to GHG by Africa and South America (see

¹⁴ Methane is primarily produced by agriculture (notably livestock and rice cultivation), biomass burning, decomposition of organic waste in landfills and as fugitive emission in fossil fuel production. Methane is a much stronger greenhouse gas than CO₂: over a 100-year timescale it is 28 times as potent as CO₂. Despite contributing a small amount of greenhouse gas emissions in terms of mass, methane has been responsible for around one-quarter of radiative forcing since 1750. Methane is a very 'short-lived' greenhouse gas: the average 'lifetime' of methane in the atmosphere is around 12 years. This means that reductions in methane *emissions* quickly result in reductions in the methane *concentrations* in the atmosphere (Our World in Data, 2024).

¹⁵ Most nitrous oxide emissions come from agriculture, notably the application of (synthetic and organic) nitrogen fertilizers to soils, which makes more nitrogen readily available for microbes to convert to N₂O (because not all of the applied nutrients are taken up by crops). Nitrous oxide is a much stronger greenhouse gas than CO₂: over a 100-year timescale it is 265 times as potent as CO₂. The average 'lifetime' of nitrous oxide in the atmosphere is around 121 years, typically shorter than CO₂ (which can persist for centuries or even thousands of years), but longer than methane (Our World in Data, 2024).

¹⁶ Measured in CO₂-equivalents over a 100-year timescale. Carbon dioxide is the most important greenhouse gas, but not the only one. To capture all greenhouse gas emissions, researchers express them in "carbon dioxide equivalents" (CO₂eq). This takes all greenhouse gases into account, not just CO₂. To express all greenhouse gases in carbon dioxide equivalents (CO₂eq), each one is weighted by its global warming potential (GWP) value. GWP measures the amount of warming a gas creates compared to CO₂. CO₂ is given a GWP value of one. If a gas had a GWP of 10 then one kilogram of that gas would generate ten times the warming effect as one kilogram of CO₂. (Our World in Data, 2024)



Table 4-2 and Figure 4-3). This most likely reflects lower fossil fuel use, but higher incidence of land use changes (such as deforestation), agricultural activities that contribute to higher methane and nitrous oxide emissions, higher methane emissions from waste, and higher incidence of biomass burning, which releases methane and nitrous oxide.

Table 4-2: Total GHG emissions by region from 1850 to 2023, in million t CO₂-equivalent

Region	pre-1950	%	post-1950	%	Total	%	2023	%	% of world population in 2024
Africa	52 107	6%	226 270	9%	278 377	8%	4 662	9%	18.6%
Asia	201 231	23%	1 013 586	38%	1 214 817	34%	29 987	56%	58.9%
Europe	273 680	31%	589 350	22%	863 030	25%	6 734	13%	9.1%
North America	264 523	30%	535 056	20%	799 579	23%	7 849	15%	4.7%
Oceania	18 341	2%	48 362	2%	66 703	2%	727	1%	0.6%
South America	64 383	7%	235 264	9%	299 648	9%	3 858	7%	8.1%
Total	874 266		2 647 889		3 522 155		53 817		

Source: Our World in Data (2024)

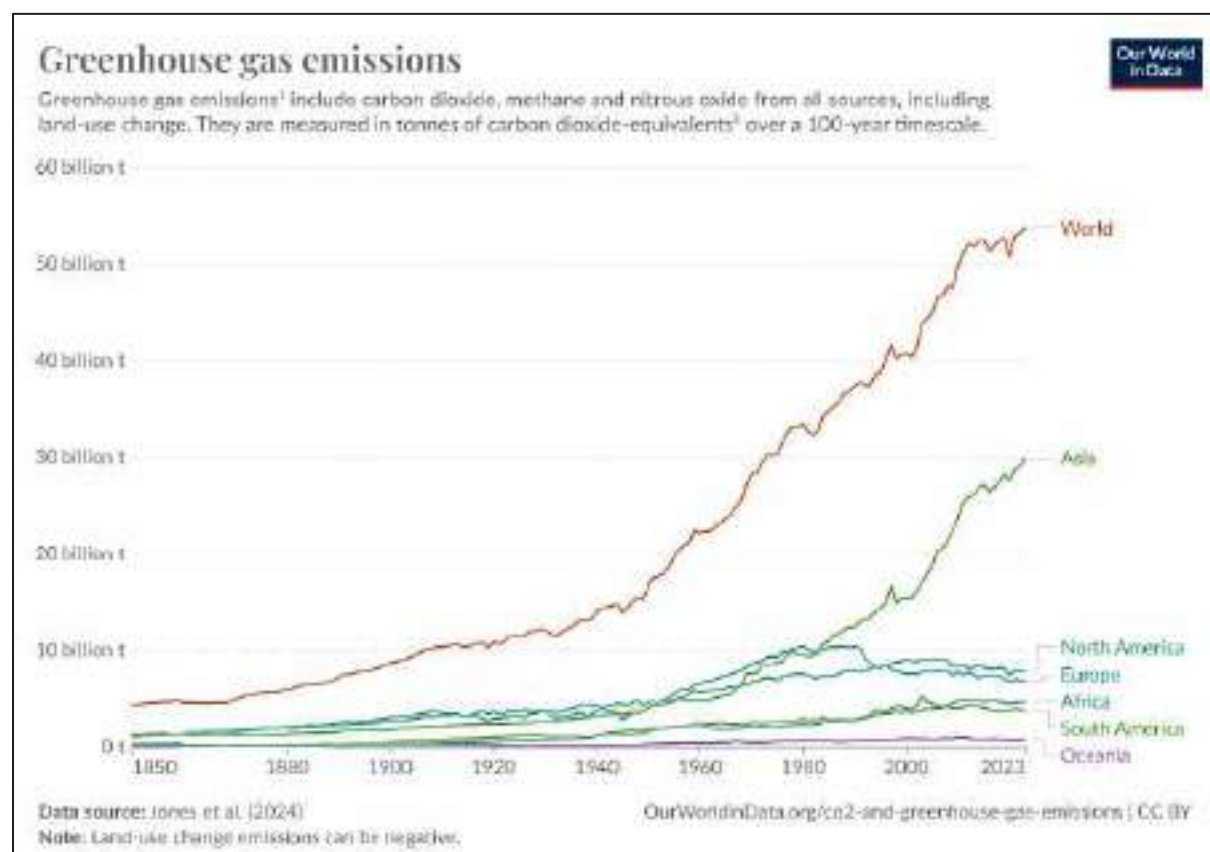


Figure 4-3: Annual GHG emissions by region, in absolute volumes

Source: Our World in Data (2024)



4.2.1.2 Namibian GHG Emissions

Namibia's recorded contribution to global CO₂ emissions is 0.01% (90 million t CO₂), while total GHG account for ~0.03% of global (991 million t CO₂-e). In 2023, Namibia's CO₂ emissions of 4.17 million t were 0.01% of the global emissions for that year, while total GHG emissions of 22.6 million t CO₂-e accounted for 0.04% of global (see Table 4-3). Figure 4-4 shows first a gradual increase in Namibian GHG emissions which becomes more pronounced from the 1940s onwards, with fluctuations but an overall upward trend.

Average *per capita* GHG emissions in 2023 were 1.4 t in Namibia (7.5 t for total GHG), down from a high of 1.7 t per capita in 2015 (or 19.9 t in 1970 for GHG).

Table 4-3: Namibian total CO₂ and GHG emissions in million t CO₂-e

	pre-1950 ¹⁷	%	post-1950	%	Total	%	2023	%	% world population
CO ₂	0	0.00%	90	0.01%	90	0.01%	4.2	0.01%	0.03%
GHG	140	0.02%	851	0.03%	991	0.03%	22.6	0.04%	

Source: Our World in Data (2024)

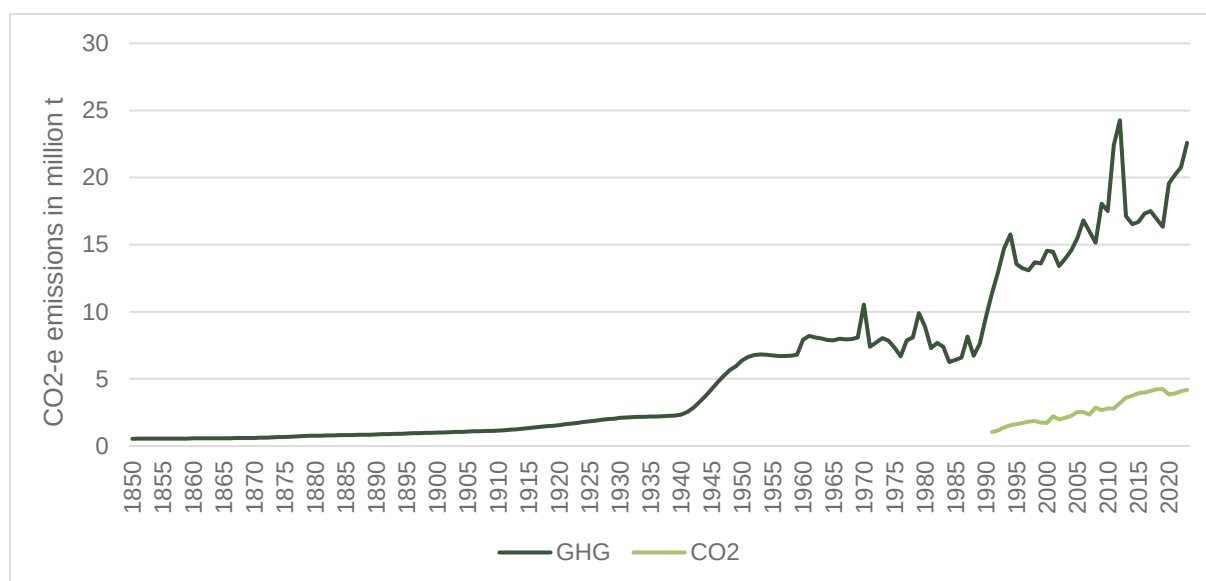


Figure 4-4: Namibian annual CO₂ and GHG emissions in million t CO₂-e

Source: Our World in Data (2024)

Due to its small population, low industrialisation and limited agricultural activities, Namibia has not materially contributed to African CO₂ emissions, which have grown 1 395% since 1950 (see Figure 4-5).

¹⁷ CO₂ from 1991, GHG from 1850



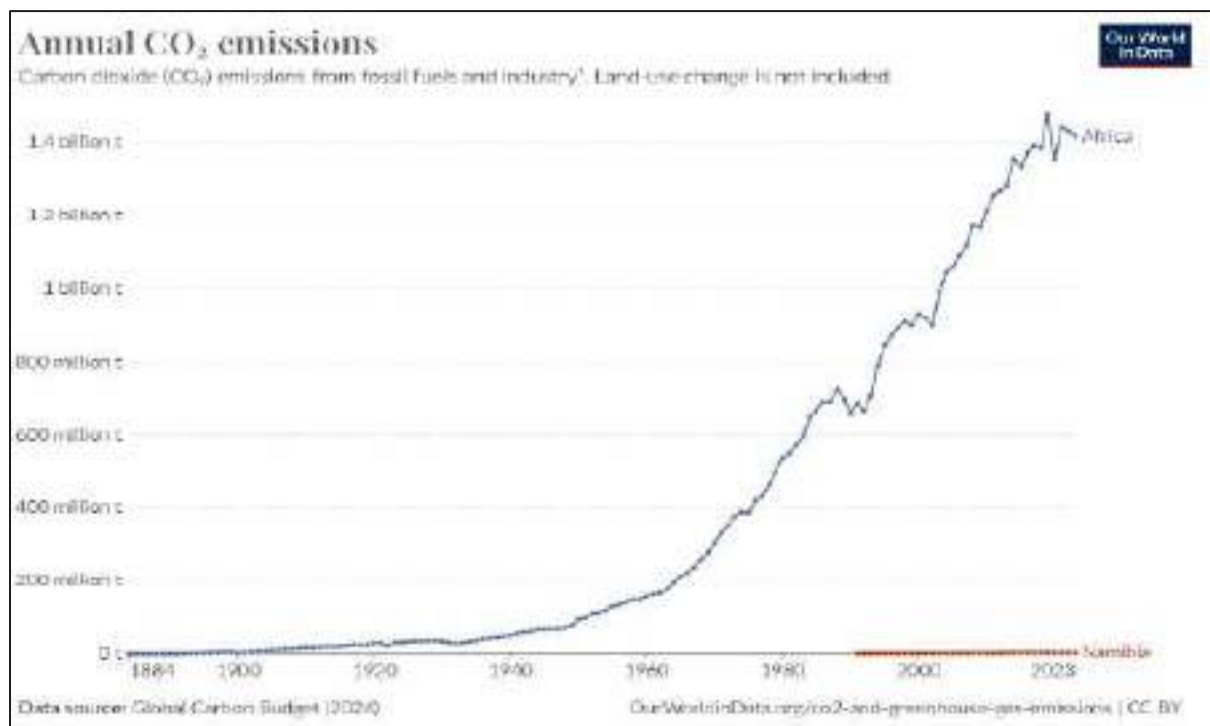


Figure 4-5: Namibian and African CO₂ emissions 1884 – 2023

Source: Our World in Data (2024).

Some 84.7% of Namibian CO₂ emissions are from oil consumption (see Section 4.2.2.2), which is more than double the world average of 32.3% of CO₂ emissions arising from oil. Coal contributes a very small percentage to Namibian CO₂ emissions (3.4%), as most electricity – much of it coal-based from South Africa – is imported and emissions thus arise elsewhere. Cement production contributed a relatively high share (12%) to national CO₂ emissions (see Table 4-4 and Figure 4-6).



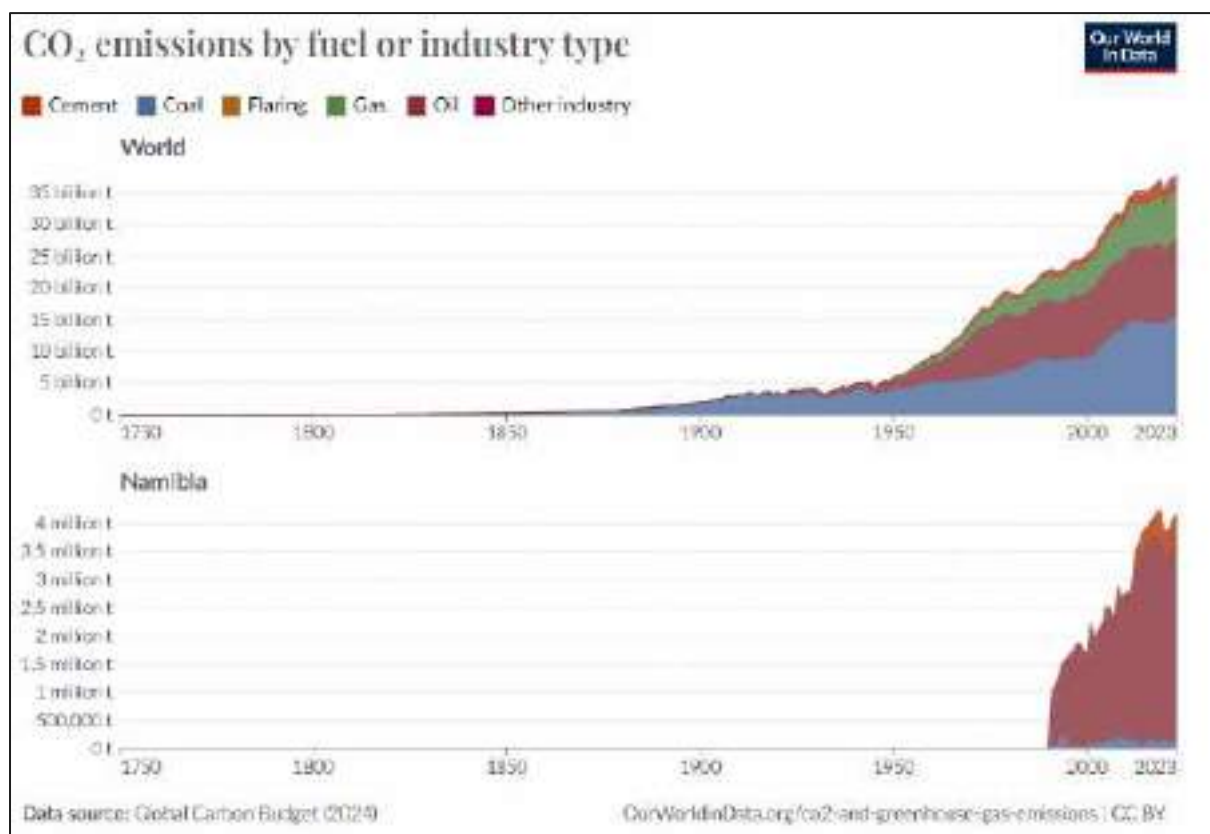


Figure 4-6: CO₂ emissions by fuel or industry type – World and Namibia

Source: Our World in Data (2024)

Table 4-4: CO₂ emissions by fuel or industry type – World and Namibia, 2023 (in million t CO₂)

Emission source	World	%	Namibia	%
Coal	15 401	40.8%	0.14	3.4%
Oil	12 209	32.3%	3.53	84.7%
Gas	7 900	20.9%	-	0%
Cement	1 569	4.2%	0.50	12.0%
Flaring	410	1.1%	-	0%
Other industry	301	0.8%	-	0%
Total	37 790		4.17	

Source: Our World in Data (2024)

Namibia reports that it remains a net carbon sink, primarily due to carbon sequestration in the Land Use, Land Use Change, and Forestry (LULUCF) sector. The updated GHG Inventory for the period 1990–2022, prepared using IPCC 2006 guidelines, provides detailed emissions and removal data across sectors (MEFT, 2023). Key reported trends include (Government of Namibia, 2024):

- Total Emissions - Emissions have remained stable at approximately 20 million t CO₂e.



- Energy Sector - Fossil fuel use in electricity generation and transportation contributed to a significant rise in emissions, underscoring the need for renewable energy deployment.
- LULUCF Sector - Carbon removals increased by 45% over the reporting period, driven by afforestation, sustainable forest management, and reduced deforestation.
- Agriculture - Methane and nitrous oxide emissions from livestock and fertilizer use have shown moderate growth.
- Waste Sector - Emissions from solid waste disposal and wastewater treatment have also grown but remain a smaller proportion of total emissions.

Namibia's Second Updated NDCs are laid out in Section 2.3.4.2 and envisage a reduction of GHG emissions by 7.67 million t CO₂-e relative to the business-as-usual scenario of 31.38 million t CO₂-e by 2030, i.e. to 23.71 million t CO₂-e, while maintaining its net sink status (Government of Namibia, 2024), partly through accelerating renewable energy adoption.

The current GHG emissions trend in Namibia is upward, and the 2023 GHG emissions of 22.6 million t CO₂-e lie close to the upper range of the 2030 target.

4.2.2 Current Energy, Oil and Gas Consumption

4.2.2.1 Global Consumption

Fossil fuel consumption remains high globally, and the share of fossil fuels in overall energy provision remained steady at 81.5% in 2023 (slightly down from 81.8% in 2022, but slightly increased contribution of 505 Exajoules compared to 494 Exajoules in 2022 due to overall growth of energy consumption) (see Figure 4-7 and Table 4-5):

- Oil continues to provide nearly one third (31.7%) of the world's energy consumed, and consumption remained stable with a 0.1% increase in 2023;
- Coal provided 26.5% of global energy in 2023, with a small decrease of 0.2% in 2023; and
- Natural gas provided 23.3% of energy in 2023 and consumption remained stable with 0.2% decrease in 2023.

Low-carbon energy sources (renewables, nuclear and hydro) jointly produced 18.5% of global energy in 2023 (or 115 Exajoules), a slight increase from 18.2% in 2022:

- Renewables provided 8.2% of overall energy consumed in 2023 and have become the fourth largest energy source – but provide less than a 10th of the energy produced by fossil fuel sources (see Table 4-5). Renewables showed the largest growth of 12% from 2022 to 2023, albeit off a small basis and down from 13% growth the year before. Renewables (primarily solar) accounted for some ~75% of *new* capacity installed globally in 2021, followed by gas, which accounted for ~10% of new installed capacity (see Figure 4-8).
- Other low-carbon energy sources include hydropower (6.4% of energy production in 2023) and nuclear power (4% in 2023).



Table 4-5: Energy sources globally 2022 – 2023, in Exajoules

Energy source	2022	% of total	2023	% of total	Growth 2022-2023
Oil	190.69	31.6%	196.43	31.7%	3.01%
Coal	161.47	26.7%	164.03	26.5%	1.59%
Natural Gas	141.89	23.5%	144.37	23.3%	1.75%
Renewables	45.18	7.5%	50.58	8.2%	11.95%
Hydro electric	40.68	6.7%	39.65	6.4%	-2.53%
Nuclear energy	24.13	4%	24.57	4.0%	1.82%
Total	604.04		619.63		2.58%

Source: Energy Institute (2024)

Regionally, fossil fuels provided between 69% (in Europe) and 98% (in the Middle East) of energy in 2023 (see Figure 4-9 and Table 4-6), with energy predominant sourced from:

- Coal in the Asia Pacific Region;
- Oil in North America, South and Central America, Europe and Africa; and
- Natural Gas in the Commonwealth of Independent States (CIS) Region and the Middle East.

Table 4-6: Share of fossil, renewable and low-carbon energy sources by region in 2023

Fuel source	North America	South and Central America	Europe	CIS	Middle East	Africa	Asia Pacific
Fossils	79%	64%	69%	89%	98%	90%	84%
Renewables	9%	13%	15%	0%	1%	3%	8%
Hydro and nuclear	12%	23%	16%	11%	2%	8%	8%

Source: Energy Institute (2024)



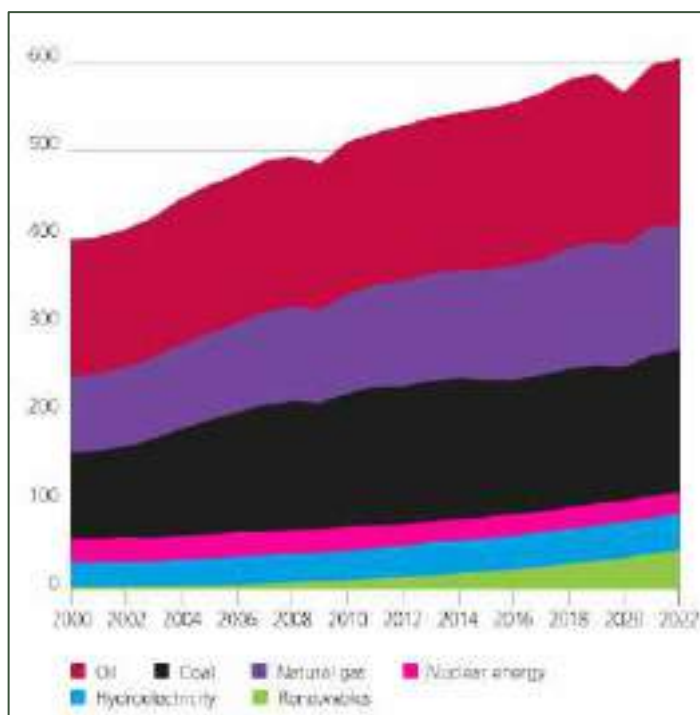


Figure 4-7: Global energy sources 2000-2023, in Exajoules

Source: Energy Institute (2024)

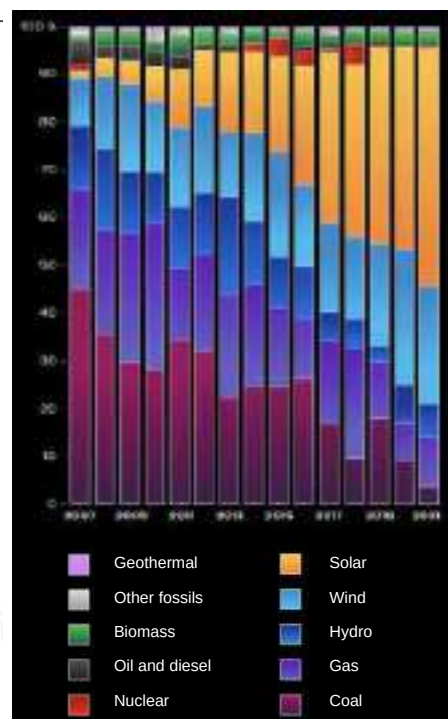


Figure 4-8: New generation capacity installed globally (percent), 2007-21

Source: The Pioneer (2022)

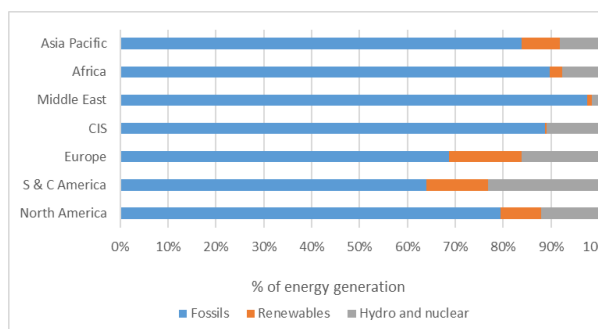
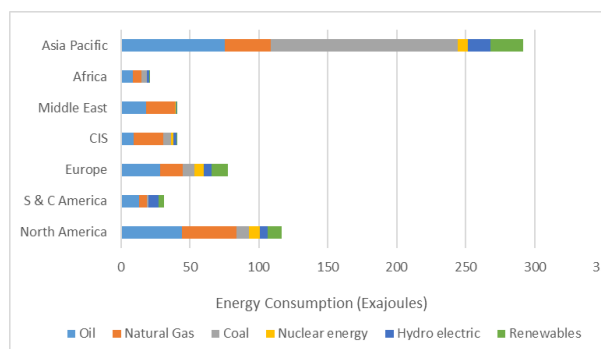


Figure 4-9: Energy sources per region in 2022 (absolute and relative)

Source: Energy Institute (2024)

Oil and gas consumption have increased considerably. From 1965 to 2023, global oil consumption grew by 224% from 31 to 100 million bbl/day and gas consumption grew by 536% from 61 to 388 bcf/day (see Figure 4-10).

Year-on-year consumption growth remains somewhat volatile, as it is heavily influenced by global economic activity, but year-on-year consumption growth rate has generally declined from ~5% in the mid-1960s to closer to ~0% – 2% in 2023 (see Figure 4-11). As such, while growth has slowed, it has remained overall positive. Oil consumption has remained stable in recent years, while gas consumption still continues to grow.



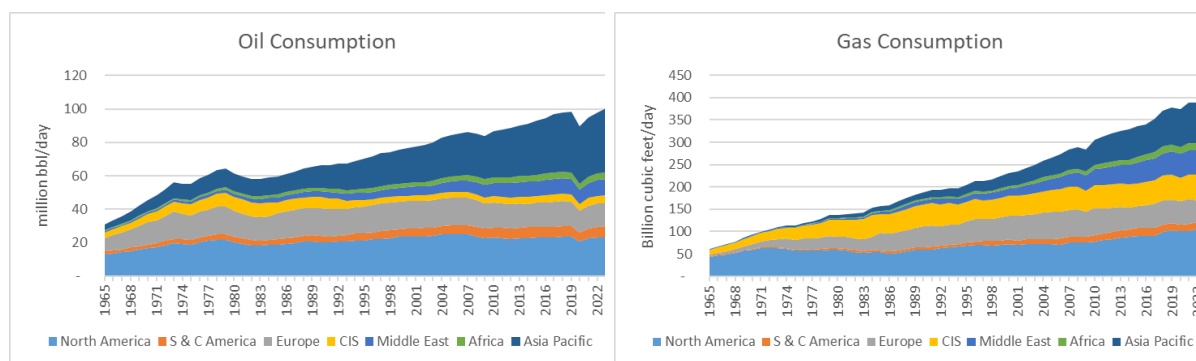


Figure 4-10: Global oil and gas consumption 1965 to 2023

Source: Energy Institute (2024)

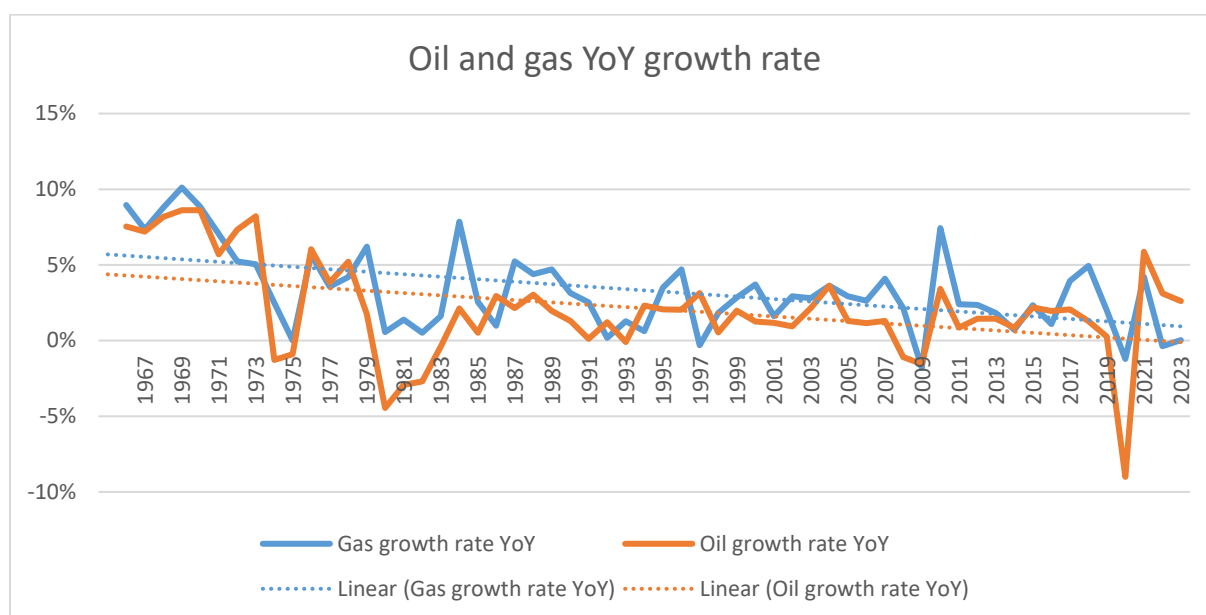


Figure 4-11: Year on year growth rate of oil and gas consumption globally

Source: Energy Institute (2024)

Six countries (the United States, China, India, Saudi Arabia, Russian Federation and Japan) accounted for half of the world's oil consumption in 2023, with the 20 largest oil consumers accounting for 75% of total consumption. Half of the top 20 consumers had average annual increases in oil consumption between 2013 and 2023, while 11 of them showed an increase from 2022 to 2023, likely as a result of economic recovery after the Covid-19 pandemic (see Table 4-7).

The United States account for a quarter of global oil consumption between 1965 and 2023, followed by China at 7.1%, Japan at 6.6%, the Russian Federation (including USSR) at 6.3% and Germany at 3.7%. All other countries contributed less than 3% to global oil consumption of that timeframe.



Table 4-7: List of 20 largest oil consumers in 2023

Country	Consumption in 2023 (million bbl/day)	Share of global Consumption 2023	Growth (pa) in consumption 2013-23	Total consumption 1965 – 2023 (million bbl/day)	Share of global consumption 1965 - 2023
United States	19	18.9%	0.5%	1 030	24.7%
China	17	16.5%	4.6%	305	7.3%
India	5	5.4%	3.8%	120	2.9%
Saudi Arabia	4	4.0%	1.6%	103	2.5%
Russian Federation	4	3.6%	1.2%	134	3.2%
Japan	3	3.4%	-3.1%	278	6.7%
South Korea	3	2.8%	1.3%	87	2.1%
Brazil	3	2.6%	-0.3%	92	2.2%
Canada	2	2.3%	-0.3%	116	2.8%
Mexico	2	2.0%	-1.0%	89	2.1%
Germany	2	2.0%	-1.8%	153	3.7%
Iran	2	1.8%	-0.4%	65	1.6%
Indonesia	2	1.6%	0.2%	50	1.2%
France	1	1.3%	-1.7%	108	2.6%
United Kingdom	1	1.3%	-1.1%	100	2.4%
Thailand	1	1.2%	0.6%	36	0.9%
Spain	1	1.2%	0.6%	63	1.5%
Italy	1	1.2%	-0.3%	99	2.4%
Singapore	1	1.4%	1.7%	35	0.8%
United Arab Emirates	1	1.1%	3.0%	23	0.6%

Source: Energy Institute (2024)

Five countries (the United States, Russian Federation, China, Iran and Canada) accounted for half of the world's gas consumption in 2023, with the 20 largest oil consumers accounting for 72% of total consumption. Fifteen of the top 20 consumers had average annual increases in oil consumption between 2013 and 2023 (see Table 4-8), while only seven of them showed an increase from 2022 to 2023.

The United States account for more than a quarter of global gas consumption between 1965 and 2023, followed by the Russian Federation (including USSR) at 12.1%, China at 3.4% Canada at 3.3%, and Iran at 3.2%. All other countries accounted for less than 3% of global gas consumption in that timeframe.

Table 4-8: List of 20 largest gas consumers in 2023

Country	Consumption in 2023 (bcf/day)	Share of global Consumption 2023	Growth (pa) in consumption 2013-23	Total consumption 1965 – 2023 (bcf /day)	Share of global consumption 1965 - 2023
United States	86	22.1%	2.3%	3429	27.2%
Russian Federation	44	11.3%	0.7%	1526	12.1%
China	39	10.1%	8.9%	426	3.4%
Iran	24	6.1%	4.8%	404	3.2%
Canada	12	3.0%	1.4%	415	3.3%



Country	Consumption in 2023 (bcf/day)	Share of global Consumption in 2023	Growth (pa) in consumption 2013-23	Total consumption 1965 – 2023 (bcf /day)	Share of global consumption 1965 - 2023
Saudi Arabia	11	2.8%	1.8%	261	2.1%
Mexico	9	2.4%	2.3%	232	1.8%
Japan	9	2.3%	-2.9%	336	2.7%
Germany	7	1.9%	-1.2%	371	2.9%
United Arab Emirates	7	1.7%	0.3%	164	1.3%
United Kingdom	6	1.6%	-1.8%	354	2.8%
India	6	1.6%	2.5%	131	1.0%
South Korea	6	1.5%	0.9%	111	0.9%
Egypt	6	1.5%	1.9%	118	0.9%
Italy	6	1.5%	-1.3%	271	2.1%
Turkey	5	1.2%	1.0%	93	0.7%
Thailand	5	1.2%	-0.4%	108	0.9%
Uzbekistan	5	1.2%	0.1%	160	1.3%
Algeria	5	1.2%	3.7%	112	0.9%
Malaysia	5	1.1%	0.3%	115	0.9%

Source: Energy Institute (2023)

4.2.2.2 Namibian Consumption

Namibia's energy consumption profile is dominated by oil and biofuels, followed by hydropower and renewables. Coal only plays a negligible role in the consumption profile because the majority of Namibia's electricity is currently imported, most of it coal-generated electricity from South Africa, which does not reflect in the Table 4-9.

Table 4-9: Energy sources Namibia 2021 – 2022 in Exajoules

Energy source	2021	% of total	2022	% of total	Growth 2021-2022
Oil	0.0500	62.1%	0.0440	60.2%	-12.0%
Bioenergy (biomass)	0.0228	28.3%	0.0241	32.7%	5.7%
Hydropower	0.0057	7.1%	0.0028	3.8%	-50.9%
Renewables	0.0015	1.9%	0.0021	2.9%	40%
Coal	0.0005	0.6%	0.0003	0.4%	-40%
Total	0.0805		0.0730		-8.9%

Source: IEA (2023)

Namibia consumes ~26 000 barrels of oil per day or ~9.5 million barrels annually. This is a nearly four-fold increase from 1991, when oil consumption was 6 900 barrels per day (Worldometers, n.d.).

In Namibia, oil and petroleum products - including petrol, diesel, illuminating paraffin, jet fuel, and liquefied petroleum gas (LPG) - are consumed across various sectors:

- **Transportation:** The transport sector is the largest consumer of petroleum products, with petrol and diesel used extensively in vehicles transporting people and goods across Namibia's vast distances. Jet fuel is critical for aviation, particularly at Hosea Kutako International Airport and regional airports. Fuel oil is also extensively used for marine transport, especially in Walvis Bay's shipping and fishing industries.



- **Electricity Generation:** Namibia imports most of its electricity, mainly coal generated from South-Africa, but relies on diesel-powered backup generators, particularly in off-grid and rural areas. Diesel is also used in emergency power supply situations.
- **Industrial Use:** LPG is used in manufacturing, mining, and agricultural processing. The mining sector, a major contributor to Namibia's economy, depends on petroleum products for machinery operation and power generation in remote sites.
- **Household Use:** Illuminating paraffin is used in some rural households for lighting and cooking, while LPG is a popular choice for heating and cooking in urban and semi-urban areas, particularly where electricity access is limited or unreliable.
- **Construction:** Bitumen, derived from petroleum, is critical for road construction, essential to connect Namibia's distant communities.

Namibia's natural gas consumption is negligible despite proven (but untapped) natural gas reserves.

4.2.3 Current Oil and Gas Supply

4.2.3.1 Global Supply

Overall global oil and gas supply mirror the consumption patterns described in Section 4.2.2.1 and have increased by 203.1% from 32 to 96 million bbl/day respectively between 1965 to 2023 for oil and by 315% from 94 to 394 bcf/day between from 1970 to 2023 for gas (see Figure 4-10). This is not surprising, and small differences in the pattern would account for storage of surplus produced resources.

Year-on-year production growth remains somewhat volatile, as it is heavily influenced by global economic activity, but year-on-year production *growth* rate trend has generally declined from ~4% per annum in 1970 to ~0% – 2% in 2023 (see Figure 4-12). As such, while the production *growth trend* has slowed, it has remained overall positive. While oil production has become more stable, gas production trend is still continuing to grow.

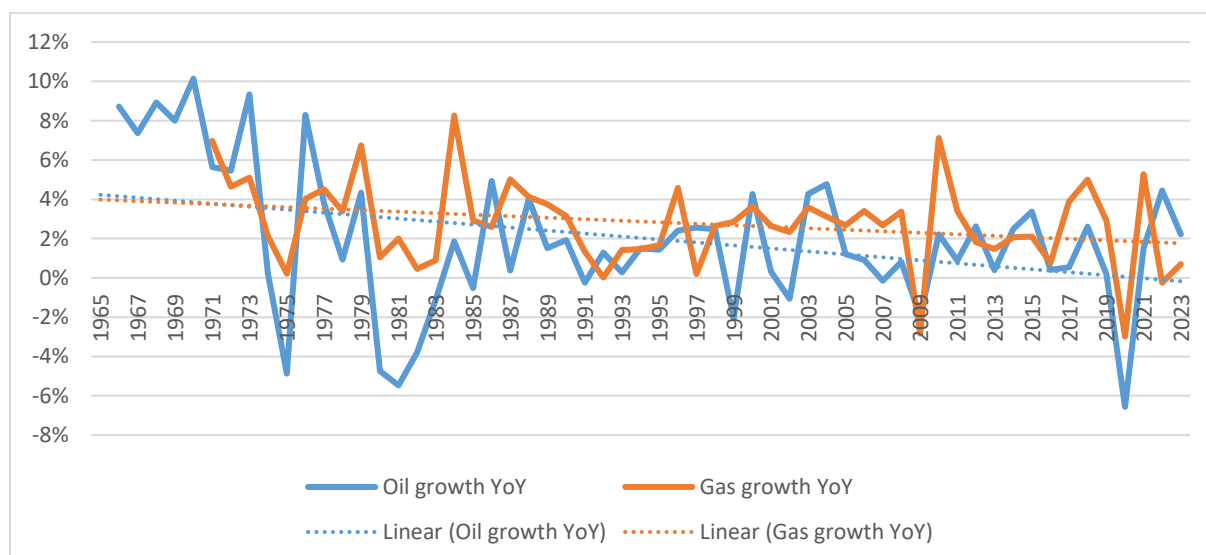


Figure 4-12: Year on year growth rate of oil and gas production globally

Source: Energy Institute (2024)

Oil production is regionally uneven. Four countries (the United States, Saudi Arabia, Russian Federation and Canada) accounted for half of the global oil production in 2023, and 20 countries accounted for 90% of global oil production in 2023. The United States, Saudi



Arabia and the Russian Federation have produced the most oil between 1965 and 2023, accounting for a 36% of global oil production over that timeframe (see Table 4-10 and Figure 4-13).

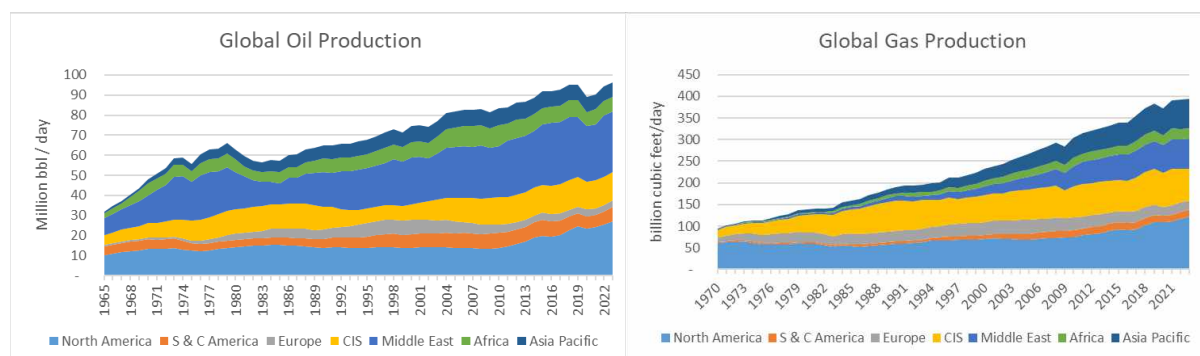


Figure 4-13: Global oil and gas production 1965 / 1970 to 2022

Source: Energy Institute (2024)

Between 2013 and 2023, 12 of the 20 largest gas producers increased their average annual production rates, including the largest oil producers, notably the United States (annual average increase of 6.7%), Brazil (5.2%) and Argentina (5.2%). Per annum production decreased most in Nigeria (-3.8%), Mexico (-3.4%), and Angola (-4.0%) during that time (see Table 4-10).

Table 4-10: List of 20 largest oil producers in 2023

Country	Production in 2023 (million bbl/day)	Share of global production 2023	Growth (pa) in production 2013-23	Total production 1965 – 2023 (million bbl/day)	Share of global production 1965 - 2023
US	19.4	20.1%	6.7%	600	14.6%
Saudi Arabia	11.4	11.8%	-	498	12.1%
Russian Federation	11.1	11.5%	0.2%	371	9.0%
Canada	5.7	5.9%	3.5%	159	3.9%
Iran	4.7	4.8%	2.6%	220	5.4%
Iraq	4.4	4.5%	3.5%	134	3.3%
China	4.2	4.4%	-	162	3.9%
UAE	3.9	4.1%	1.0%	136	3.3%
Brazil	3.5	3.6%	5.2%	68	1.7%
Kuwait	2.9	3.0%	-0.7%	135	3.3%
Mexico	2.0	2.1%	-3.4%	139	3.4%
Norway	2.0	2.1%	0.9%	94	2.3%
Kazakhstan	1.9	2.0%	1.0%	45	1.1%
Qatar	1.8	1.8%	-0.9%	51	1.3%
Nigeria	1.5	1.6%	-3.8%	106	2.6%
Algeria	1.4	1.5%	-0.5%	79	1.9%
Libya	1.3	1.3%	2.0%	89	2.2%
Angola	1.2	1.2%	-4.0%	44	1.1%
Argentina	1.1	1.1%	5.2%	37	0.9%
Oman	1.0	1.1%	1.1%	38	0.9%

Source: Energy Institute (2024)

Gas production is even more regionally uneven than oil production. Two of the four largest oil producers, the United States and the Russian Federation, accounting for over 40% of



2023 production. The 20 largest gas producers jointly accounted for 86% of global gas production in 2023. The United States and the Russian Federation also account for 42% of all gas produced between 1965 and 2023 (see Table 4-11 and Figure 4-14).

All except four of the 20 largest gas producers have continued to increase their average annual production rates between 2013 and 2023, most significantly in Australia, China. Gas production has only declined in Indonesia, Mexico, Uzbekistan and the Russian Federation between 2013 and 2023 (see Table 4-11).

Table 4-11: List of 20 largest gas producers in 2023

Country	Production in 2023 (bcf/day)	Share of global production 2023	Growth (pa) in production 2013-23	Total production 1965 – 2023 (bcf/day)	Share of global production 1965 - 2023
US	100.2	25.5%	4.7%	3043.5	24.7%
Russian Federation	56.7	14.4%	-0.5%	2180.5	17.7%
Iran	24.4	6.2%	4.8%	414.1	3.4%
China	22.7	5.8%	6.8%	300.9	2.4%
Canada	18.4	4.7%	2.3%	672	5.5%
Qatar	17.5	4.5%	0.8%	293.6	2.4%
Australia	14.7	3.7%	9.6%	220.4	1.8%
Norway	11.3	2.9%	0.7%	290.3	2.4%
Saudi Arabia	11.0	2.8%	1.8%	260.2	2.1%
Algeria	9.8	2.5%	2.5%	303.5	2.5%
Malaysia	7.8	2.0%	1.1%	199.1	1.6%
Turkmenistan	7.4	1.9%	2.6%	214.7	1.7%
Indonesia	6.2	1.6%	-1.9%	261.0	2.1%
Egypt	5.5	1.4%	0.6%	129.5	1.1%
UAE	5.4	1.4%	0.4%	157.6	1.3%
Uzbekistan	4.3	1.1%	-2.3%	185.1	1.5%
Nigeria	4.2	1.1%	2.8%	88.3	0.7%
Oman	4.2	1.1%	3.4%	69.6	0.6%
Argentina	4.0	1.0%	1.9%	133.5	1.1%
Mexico	3.4	0.9%	-3.8%	165.1	1.3%

Source: Energy Institute (2024)

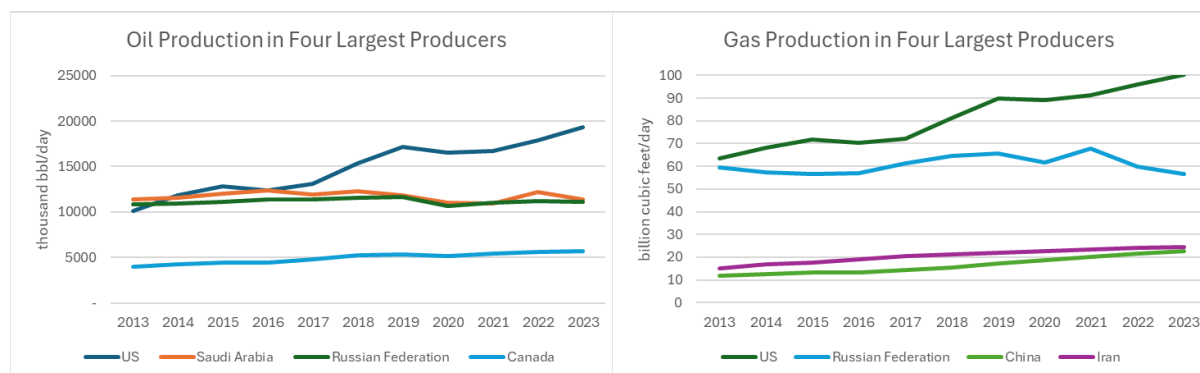


Figure 4-14: Global oil and gas production 2013 to 2023 in the four largest producers

Source: Energy Institute (2024)



Overall exploration activity has declined in recent years compared with previous decades, as fewer wells were drilled (see Figure 4-15), while the average volume of resource found per well drilled (including dry wells) remains stable at ~30 million boe. Wood Mackenzie (2024) states that global oil and gas demand growth since 2000 far exceeded exploration activity. Since 2000, an overwhelming majority of large discoveries lie in deepwater basins (see Figure 4-16) (Wood Mackenzie, 2024).

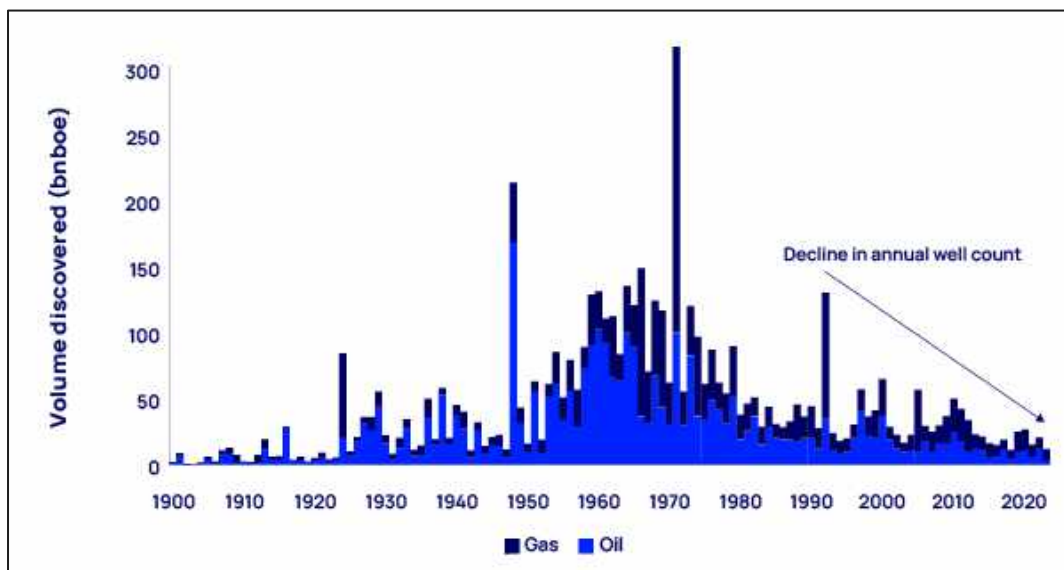


Figure 4-15: Volume of conventional oil and gas discoveries since 1900

Source: Wood Mackenzie (2024)

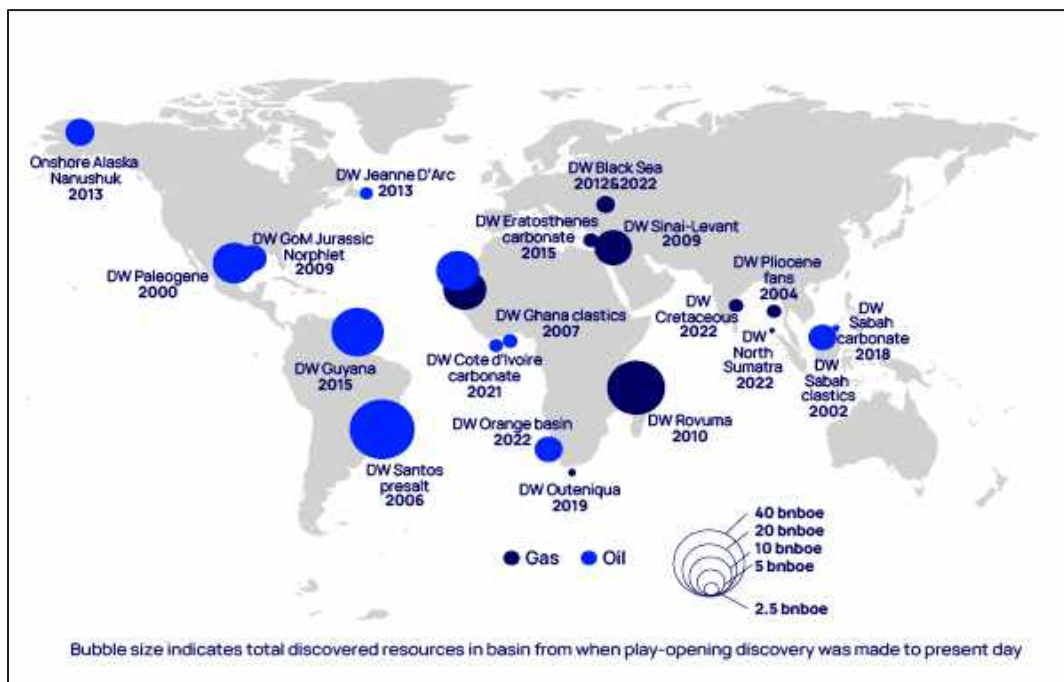


Figure 4-16: Location and volume of oil and gas discoveries since 2000

Source: Wood Mackenzie (2024)

Note: DW means Deep Water



High impact exploration¹⁸ is expected to remain stable in 2025 compared to previous years, with 65-75 high impact wells expected to be drilled worldwide in 2025 (compared to 66 to 83 high impact wells drilled annually between 2020 and 2024, see Figure 4-17) (Offshore Magazine, 2025).

Exploration focus areas in 2025 include the West Coast of central and southern Africa, east and north coasts of South America, the Gulf of Mexico, the North / Norwegian Sea, the China South Sea, Bengal Sea and the Black Sea (see Figure 4-18).

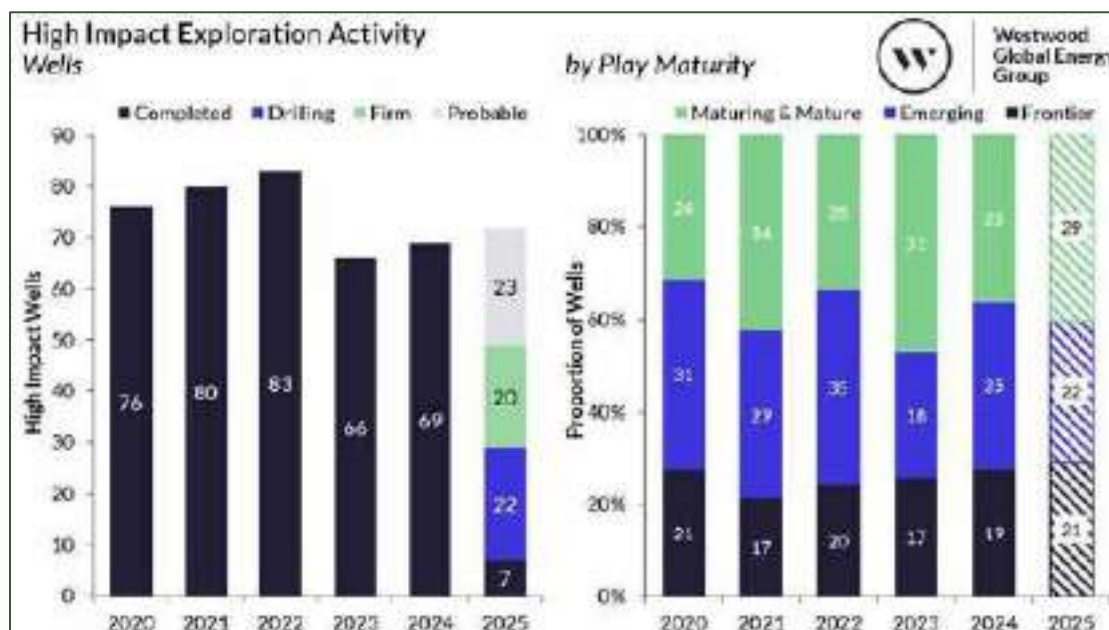


Figure 4-17: High impact well drilling activity 2020 – 2025¹⁹

Source: Offshore Magazine (2025)

¹⁸ High impact exploration refers to drilling activities aimed at discovering large, commercially viable quantities of oil and gas. These explorations target significant resources that can justify the development of new infrastructure and have the potential to transform the energy landscape of a region, and that only begin to add revenues several years into the future.

¹⁹ Frontier is defined as having no production from similar reservoirs in the same basin. Emerging relates to areas where initial exploration has identified potential hydrocarbon resources. Mature refers to formations that have been extensively explored and developed over a long period.



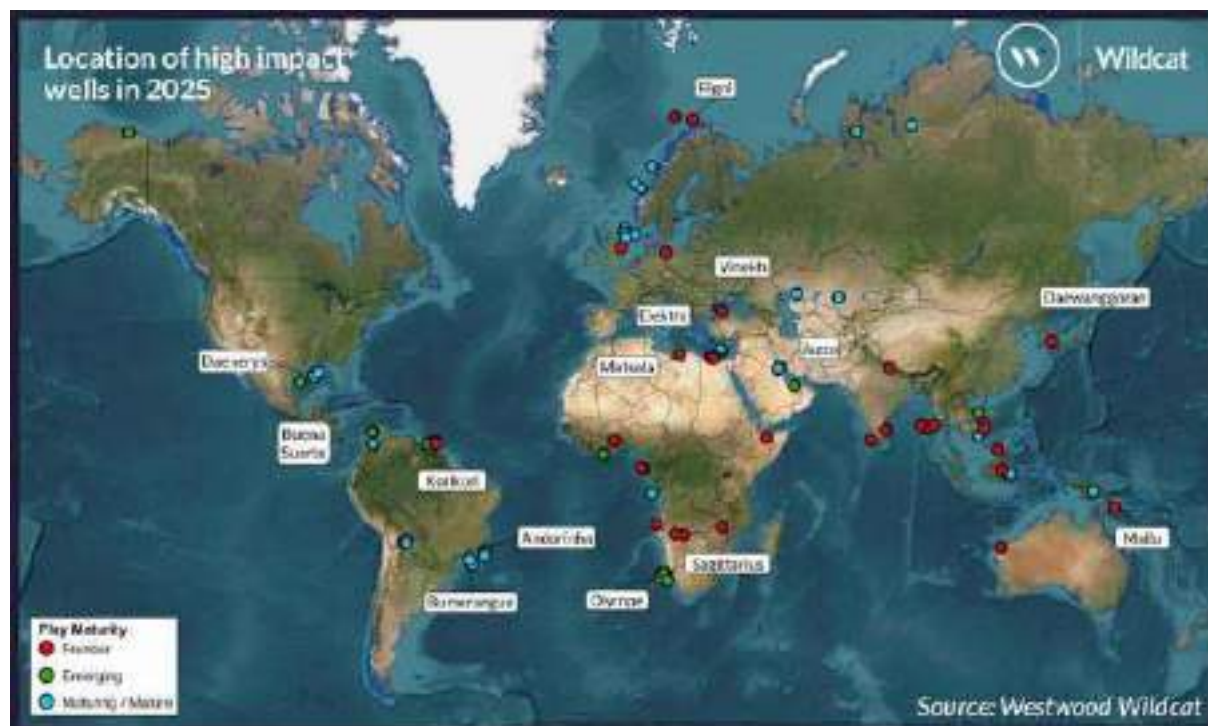


Figure 4-18: Expected high impact well drilling focus in 2025

Source: Offshore Magazine (2025)

Reasons for continued high impact exploration cited by (Wood Mackenzie, 2024) include:

- Improvement of portfolio quality by adding more “advantaged barrels” (oil and gas resources that are economically attractive and environmentally favourable) even with retreat from oil and gas under an accelerated energy transition scenario (with production growth or replacement secondary considerations in many cases); and
- Lower scope 1 and 2 emissions in new fields thanks to modern decarbonisation technologies and higher facilities throughput²⁰, while retrofitting old fields is expensive.

4.2.3.2 Namibian Supply

Namibia imports virtually all oil consumed in the country, primarily through the Port of Walvis Bay. In 2023, petroleum imports through Walvis Bay increased to 1 192 286 tons, from 796 277 tons in 2022, highlighting the growing role of fuel imports (New Era, 2024). Oil is imported primarily from South Africa, the Middle East, Asia, and Europe. As Namibia has no refining capacity, it is dependent on the import of refined petroleum products (ICLG, 2023).

²⁰ With minimal influence on demand, such benefits are limited to upstream scope 1 and 2 emissions rather than the order-of-magnitude larger scope 3 emissions. New fields about to begin production in the next few years will average scope 1 and 2 emissions intensity of 17 kgCO₂e/boe over 2025-30, compared with existing supply from mature fields averaging 28 kgCO₂e/boe. If exploration through the current decade provides the anticipated 12% of global oil and gas supply and displaces existing supply options with emissions intensity typical of older fields, then global scope 1 and 2 emissions in 2030 would reduce by ~6%, or 100 Mtpa CO₂e. Deepwater projects on average enjoy high recovery per well and tend to have lower emissions intensity than shelf and onshore projects (Wood Mackenzie, 2024).



Historic and recent offshore oil and gas discoveries have not yet translated into domestic production and supply.

4.2.4 Outlook for Oil and Gas Consumption and Energy Supply

Demand for oil and gas is difficult to forecast, as it depends on a wide range of factors such as economic activity and (energy) consumption (as a function of population growth and per capita income / consumption), performance of other energy technologies and degree of electrification of various sectors.

At the 28th Convention of Parties (COP28) held in September 2023, parties adopted a decision on the first Global Stocktake under the Paris Agreement, which recognizes the need for deep, rapid, and sustained reductions in GHG emissions in line with 1.5°C pathways and *inter alia* calls on parties to contribute, in a nationally determined manner, to global efforts on:

- Tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030;
- Accelerating efforts towards the phase down of unabated coal power;
- Accelerating efforts globally towards net zero emission energy systems, utilizing zero- and low-carbon fuels well before or by around mid-century;
- Transitioning away from fossil fuels in energy systems, in a just, orderly, and equitable manner, accelerating action in this critical decade, so as to achieve net zero by 2050 in keeping with the science;
- Accelerating zero- and low-emission technologies, including, *inter alia*, renewables, nuclear, abatement and removal technologies such as carbon capture and utilization and storage, particularly in hard-to-abate sectors, and low-carbon hydrogen production;
- Accelerating and substantially reducing non-carbon-dioxide emissions globally, including in particular methane emissions by 2030;
- Accelerating the reduction of emissions from road transport on a range of pathways, including through development of infrastructure and rapid deployment of zero and low-emission vehicles; and
- Phasing out inefficient fossil fuel subsidies that do not address energy poverty or just transitions, as soon as possible with developing countries taking the lead (IISD, 2023) (UNFCCC, 2023).

COP29, held in November 2024, further developed a number of the themes discussed at COP28, and reached agreement on (UNFCCC, 2024) (WEF, 2024):

- Tripling climate finance to developing countries, from the previous goal of USD 100 billion annually to USD 300 billion annually by 2035, for which delivery is led by developed countries. Further, parties should secure efforts of all actors to cooperate and scale up finance to developing countries, from public and private sources, to USD 1.3 trillion per year by 2035; and
- How carbon markets will operate under the remaining sections of Article 6 of the Paris Agreement, to make country-to-country trading and a carbon crediting mechanism fully operational.



Key decisions on agreements around fossil fuel transition, mechanisms for scaling and distributing funds, and linking biodiversity with climate action remained unresolved and were postponed to COP30 scheduled for November 2025.

The United States Energy Information Agency (US EIA) published an International Energy Outlook in 2023, which is based on a set of policy-neutral baselines that focus on the current trajectory of the global energy system (US EIA, 2023).

The Outlook expects global energy intensity (energy required for a unit of production) will decline by 35%²¹ from 2020 to 2025. It also predicts that energy-related carbon intensity (the amount of CO₂ emitted per energy unit) will reduce by 14%²². At the same time, the Outlook expects increasing population and incomes (see Figure 4-19) to offset the effects of declining energy and carbon intensity on emissions.

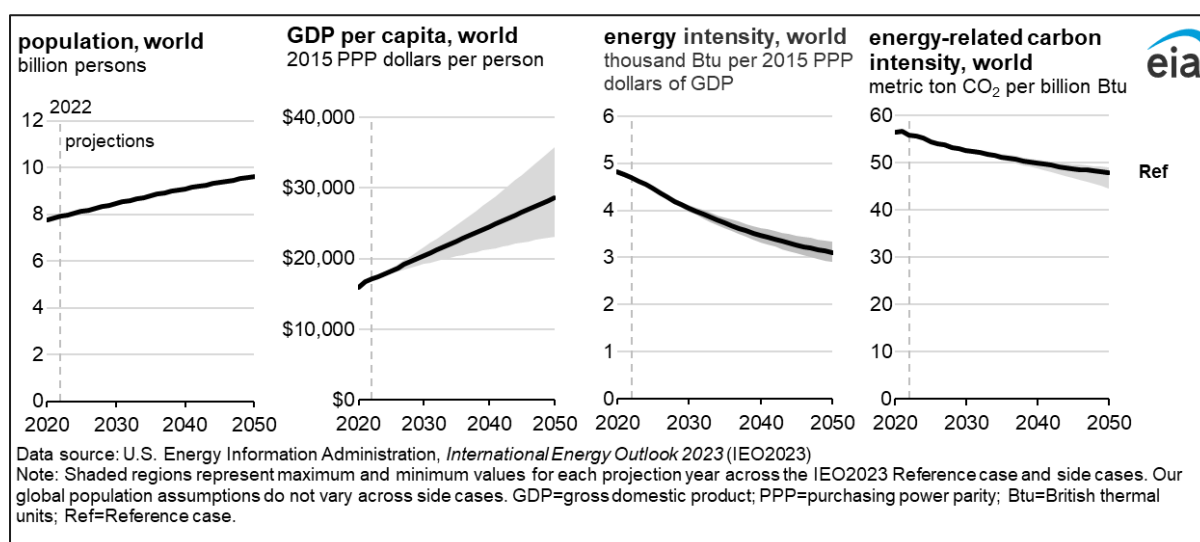


Figure 4-19: Predicted outlook for global population, GDP per capita, energy intensity and energy-related carbon intensity to 2050

Source: US EIA (2023)

While energy provided by non-fossil fuels is expected to more than double by 2050 relative to 2022 (from ~110 quads²³ to ~250 quads), fossil fuel use is also expected to remain at least equal to 2022 levels in the low projection (at ~500 quads), and to grow by ~20% (to ~600 quads) in the reference case (see Figure 4-20).

Compared to 2022, coal consumption is expected to remain approximately the same or reduce slightly by 2050, while oil (and oil products) and gas would provide the majority of energy supply, coupled with pronounced growth in wind and solar (see Figure 4-21).

²¹ From ~48 000 to ~31 000 British thermal units (Btu) per 2015 purchasing power parity (PPP) dollars of Gross Domestic Product (GDP)

²² From ~56 to 48 t CO₂ per billion Btu

²³ 1 quad = 1 quadrillion (10¹⁵) BTUs = 1.055 exajoules (EJ)



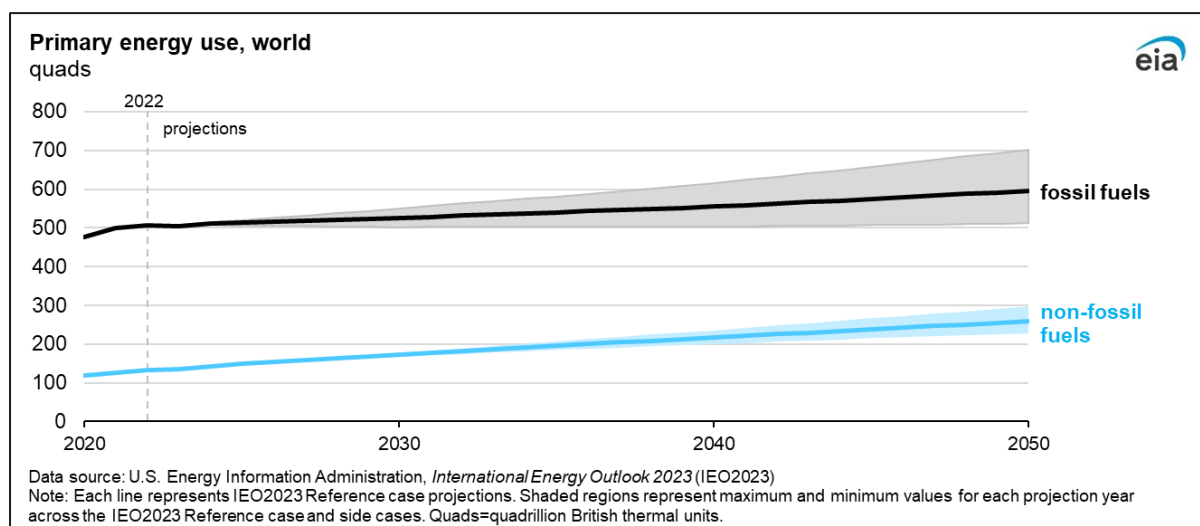


Figure 4-20: Outlook for global primary energy use to 2050

Source: US EIA (2023)

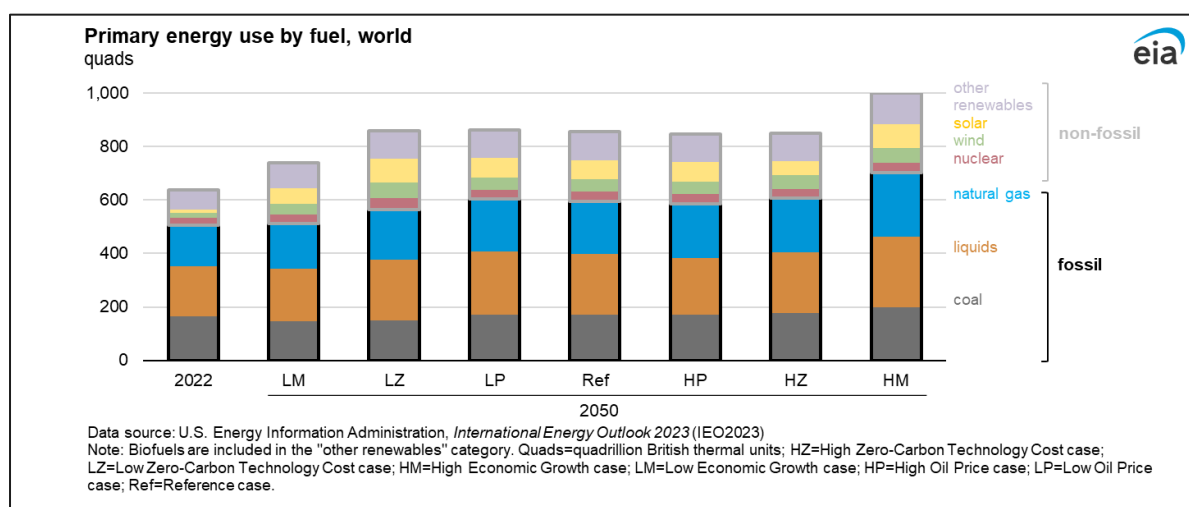


Figure 4-21: Outlook for the global primary energy mix for different scenarios in 2050

Source: US EIA (2023)

This Outlook further notes that:

- The shift to renewables to meet growing electricity demand is driven by regional resources, technology costs and policy. For example, the speed and level of electric vehicle penetration will depend on policy incentives, battery costs, efficiency standards and electricity prices (see Figure 4-22). While coal-fired and liquid-fired electricity generation capacity²⁴ is expected to decrease by 2050, the degree to which new renewable electricity generation capacity will outweigh new fossil fuel (particularly gas)-based generation depends on economic growth, technology and price factors (see Figure 4-23);

²⁴ Electricity generation only accounts for a portion of overall energy consumption, currently in the region of ~20%; this will increase as sectors and processes are increasingly electrified, which also increases the absolute demand for electricity.



- Energy security concerns hasten a transition from fossil fuels in some countries, although they drive increased fossil fuel consumption in others, e.g. due to poor (remaining) indigenous fossil fuel resources a transition to low carbon resources is faster in Western Europe, India and China than in Africa (see Figure 4-24), while Asia and Europe may import more natural gas to meet growing demand, mostly supplied from the Middle East (see Figure 4-25); and
- New policies, geopolitical events, and technology breakthroughs will happen that shift the trajectory of the global energy system and add uncertainty to any projection.

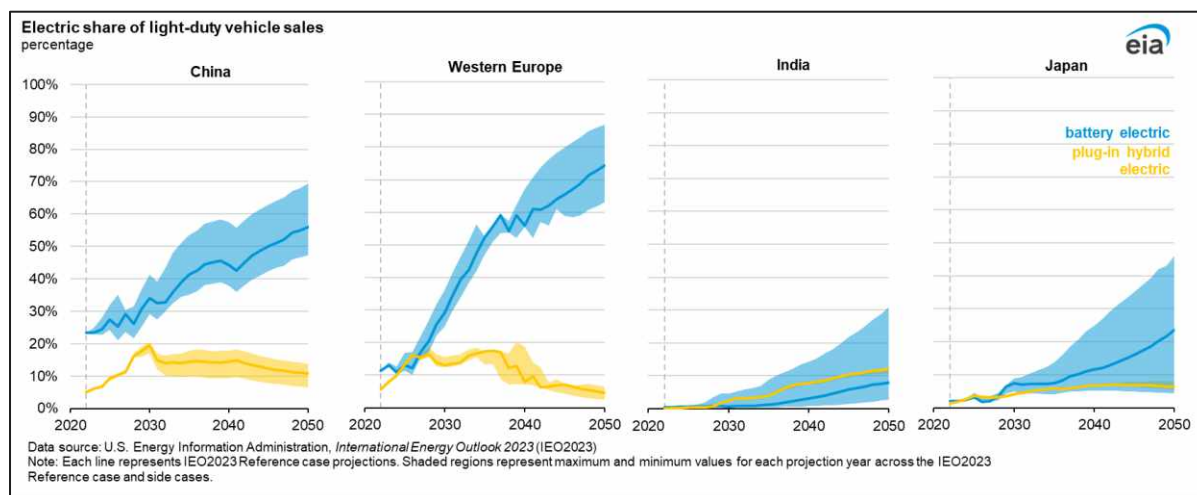


Figure 4-22: Projection for electric vehicle penetration in selected regions by 2025

Source: US EIA (2023)

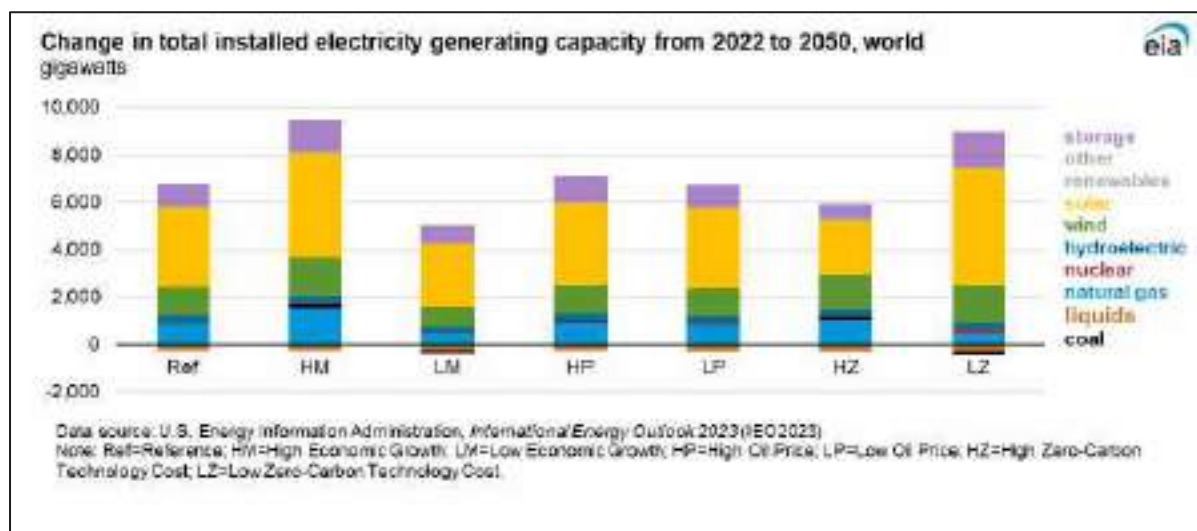


Figure 4-23: Projection for change in global electricity generating capacity (2050)

Source: US EIA (2023)



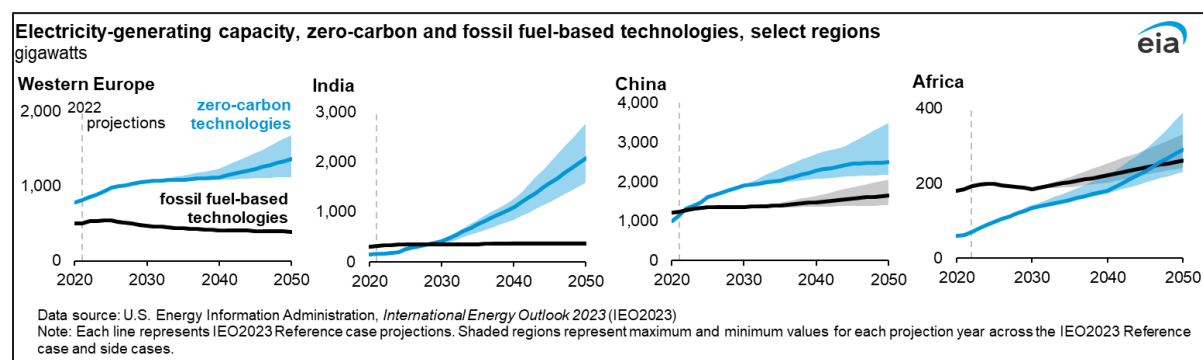


Figure 4-24: Possible technologies trajectories in selected regions 2020 – 2050

Source: US EIA (2023)

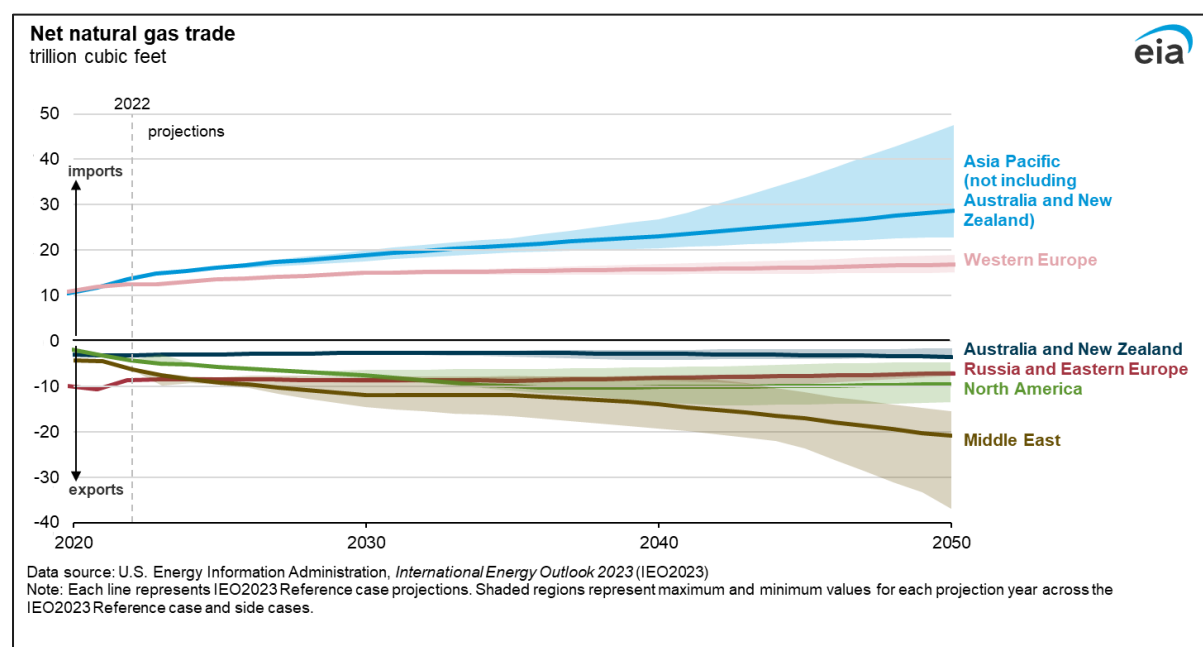


Figure 4-25: Outlook for natural gas trade 2020 – 2050

Source: US EIA (2023)

Wood Mackenzie (2024a) also anticipates that energy intensity will reduce in future: while GDP growth of 96% between 2000 and 2024 resulted in end-use energy demand growth by 64%, anticipated further GDP growth of 81% between 2024 and 2050 is expected to further increase end-use energy demand by only 19%, of which ~40% each are used in the Asia Pacific region and Europe, Middle East and Africa region, with the remainder 20% used in the Americas.

Wood Mackenzie (2024a) reports a somewhat lower global energy demand of ~450 EJ (~426 quads) in 2025 than US EIA (2023), and projects overall energy demand by 2050 to either increase by ~15% to ~515 EJ (488 quads) in the base case or decrease by ~15% to ~380 EJ (~360 quads) in the net zero case. This is considerably lower than US EIA (US EIA, 2023) projections and based on an assumption that each unit of electricity generated from renewable sources displaces three times as much in fossil fuel demand (see Figure 4-26), possibly due to efficiency gains, though such a displacement ratio (i.e. renewables reducing overall energy demand) is not universally accepted.



On that basis, Wood Mackenzie (2024a) predicts a steeper decline in oil and gas use to 2050 than US EIA (2023), but anticipates oil and biofuels demand of ~30 to ~95 million bbl per day and gas demand of ~2 000 to 4 500 billion m³ per day in 2050 (see Figure 4-27).

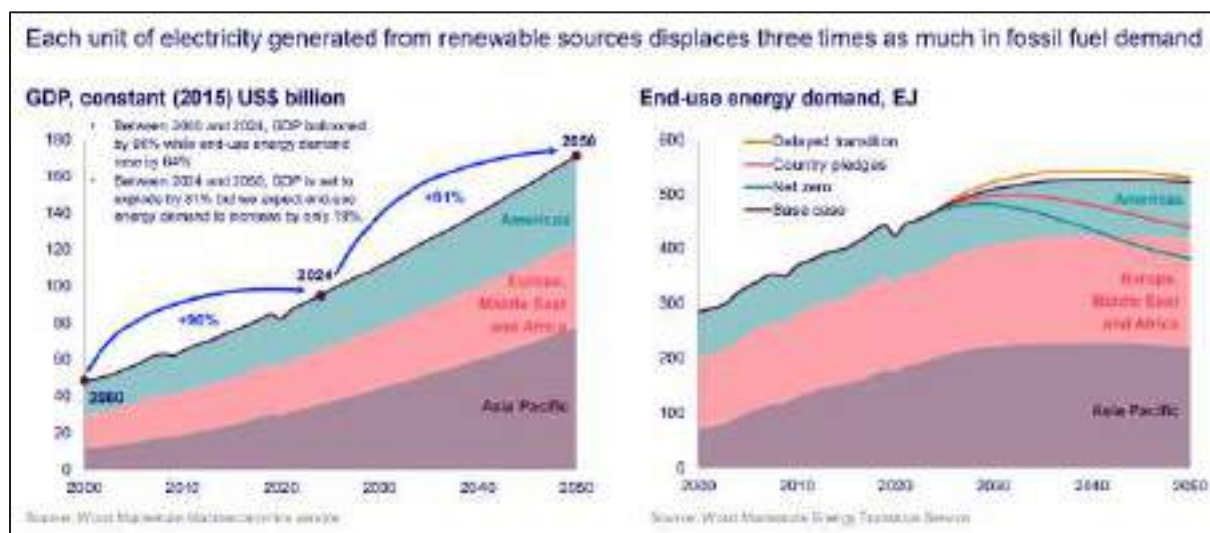


Figure 4-26: Projected development of energy demand to 2050

Source: Wood Mackenzie (2024)

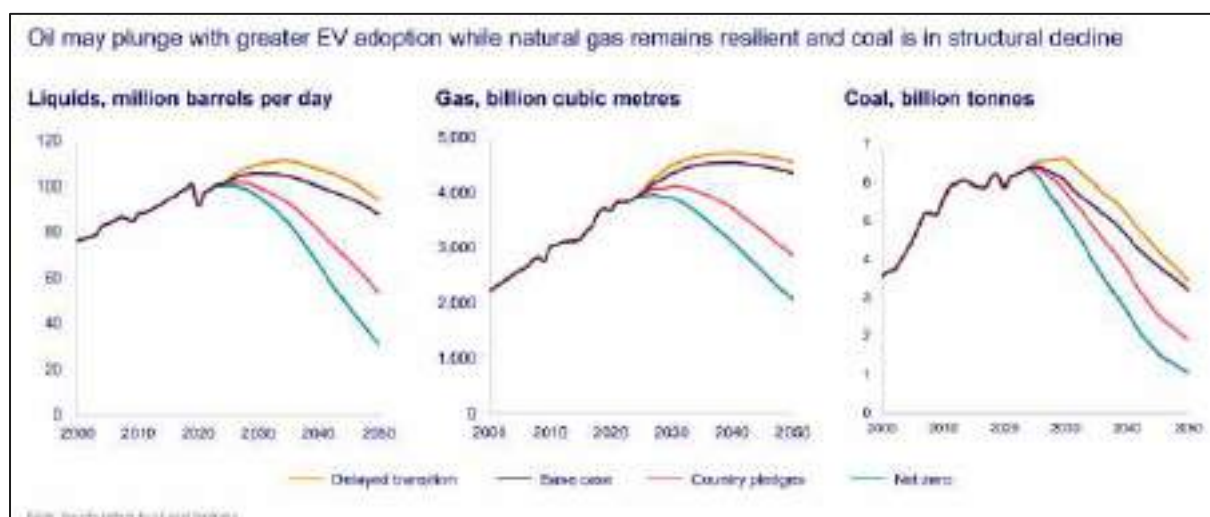


Figure 4-27: Projected development of oil and gas demand to 2050

Source: Wood Mackenzie (2024)

4.2.5 Other Considerations

Other potential considerations that inform the desirability of certain energy forms and sources are briefly discussed below; they are complex and continuously evolving topics that affect a range of national policy aspects and decisions.

4.2.5.1 Energy Security

Recent geopolitical events have again demonstrated the vulnerability of countries highly dependent on energy imports to fluctuating supply and prices and possible associated shocks. As noted in Section 4.2.4, energy security concerns are likely to hasten a transition



from fossil fuels to low carbon resources in those countries without an indigenous or otherwise secure supply of such resources, while they drive increased fossil fuel consumption in other countries (notably those with an indigenous or secure supply). Determining the appropriate future energy mix is a key task of national governments.

4.2.5.2 Economic Contribution

While importing energy effectively represents a leak of national funds to suppliers of the resource, domestic production could contribute to some job and income creation in Namibia, as well as government income in the form of taxation and royalties, provided that indigenous production is competitive, which must be determined by the producers. Determining appropriate contractual and taxation regimes of any extractive industry is a key task of national governments.

4.2.5.3 Stranded Assets and Liabilities

Companies should make financial provision for the closure and decommissioning of projects at any time of its lifecycle, and/or to attend to potential pollution events. The risk of not being able to fully recover investment in the project is that of the company. As noted in Section 4.2.4, there is very limited sight of new policies, geopolitical events and technology breakthroughs that shift the trajectory of the global energy system.

4.3 Preliminary Conclusion on Need and Desirability

Fundamental issues around energy mix and transition are too complex to comprehensively and conclusively analyse at a project level – policy priorities are decided and set at a national policy level.

The analysis of Namibian policy shows that it aims to progressively reduce GHG emissions while, at the same time, ensuring a stable and sufficient energy supply and enabling just and inclusive economic growth, in part through exploitation of indigenous petroleum resources. Production of indigenous hydrocarbon resources is in principle compliant with and in direct or indirect furtherance of several energy, economy and resource-related policies and plans. Compatibility with climate change-related policies and targets depends on the nature of commitments, plans and policies and progress in decreasing emissions from other sources.

Given the importance of energy to economic activity and growth, and the importance of economic growth to ensuring a prosperous and stable society in Namibia, coupled with the complexity and fluidity of global trends and supply chains, retaining optionality and diversification in national income, economy and energy supply appears desirable in itself.

Empirical data indicates that hydrocarbon resources are critical to the global and Namibian energy supply at present, and that they are likely to remain an important source of energy for some time to come, even in the light of intense efforts to develop alternative low- or no-carbon energy sources, given the low penetration thereof in the energy mix at present.

Notwithstanding the likely continued demand for (and supply of) hydrocarbon resources globally and in Namibia, and the in-principle compliance of the project with Namibian policies, the need and desirability of a *particular* activity (or project) is also determined by the acceptability of residual environmental and social impacts of the proposed activities; these indicate the sustainability of a specific activity or project, which is an important criterium of policy.

While Section 4.1 discusses the in principle fit of the proposed project with Namibian policy and principles, and Section 4.2 discusses the broader context and outlook of petroleum demand and supply, the biophysical and socio-economic impacts of the proposed project will be assessed during the Impact Assessment Phase. This will inform the evaluation of the



sustainability of this particular project, and the need and desirability of this proposed development project will be re-evaluated on that basis in the ESIA Report.



5.0 Description of the Proposed Activities

5.1 Project Overview

This section provides an overview of the key characteristics of and approach to the project. Key terms mentioned below are further explained in Section 5.1.4. More detail on the approach to the project, for each project phase, is provided in Sections 5.2 to 5.5.

5.1.1 Field and Resource Characteristics

The Venus field development occupies an area of ~165 km² on the seabed, with the maximum development footprint extending ~20 km in a NW-SE direction and ~15 km in a E-W direction (see Figure 5-1). The water depth is ~3 000 m and relatively constant across the development footprint, with a variance of ~100 m across the field. Reservoir average depth is ~6 000 m TVDSS (meters True Vertical Depth Subsea), comprised of ~3 000 m water depth and ~3 000 m drill depth. The resource to be produced is light oil.

5.1.2 Production Approach

The **key components** involved in the installation and operation of the proposed Venus field development and production are summarised below and conceptually shown in Figure 5-2:

- Up to 40 subsea wells are envisaged, to be drilled up to ~3 000 meters below the seabed, comprised of around 20 Oil Producer (OP) and 20 Gas Injection (GI) wells
- Subsea infrastructure, which includes all infrastructure and equipment located on the seabed used to extract hydrocarbons from the reservoir and transport it to the Floating Production Storage and Offloading unit (FPSO), will be comprised mainly of:
 - o Up to 40 electro-hydraulic Xmas trees placed on wellheads (see Section 5.1.4.1)
 - o Approximately 25 In Line Tees (ILTs) (see Section 5.1.4.2) / Flow Line End Terminations (FLETs) for flowline tie-in and end-points (see Section 5.1.4.3)
 - o For production:
 - Two production rings (north and south), approximately 60 km in length in total, connecting the OP wells to each other and the FPSO risers via 12" Nominal Diameter piggable flowlines (see 5.1.4.4)
 - Four Steel Lazy Wave Risers (SLWR), around 5km long, connecting the OP wells and production flowlines to the FPSO (see Section 5.1.4.5)
 - o For gas injection:
 - Two SLWR risers, around 5km long, connecting the FPSO to the GI flowlines and wells
 - Two 12" Nominal Diameter flowlines (north and south) some 35 km long and connecting risers to the GI wells
 - o Two umbilical networks (see Section 5.1.4.6) (north and south) some 75 km long and shared between production and injection circuits



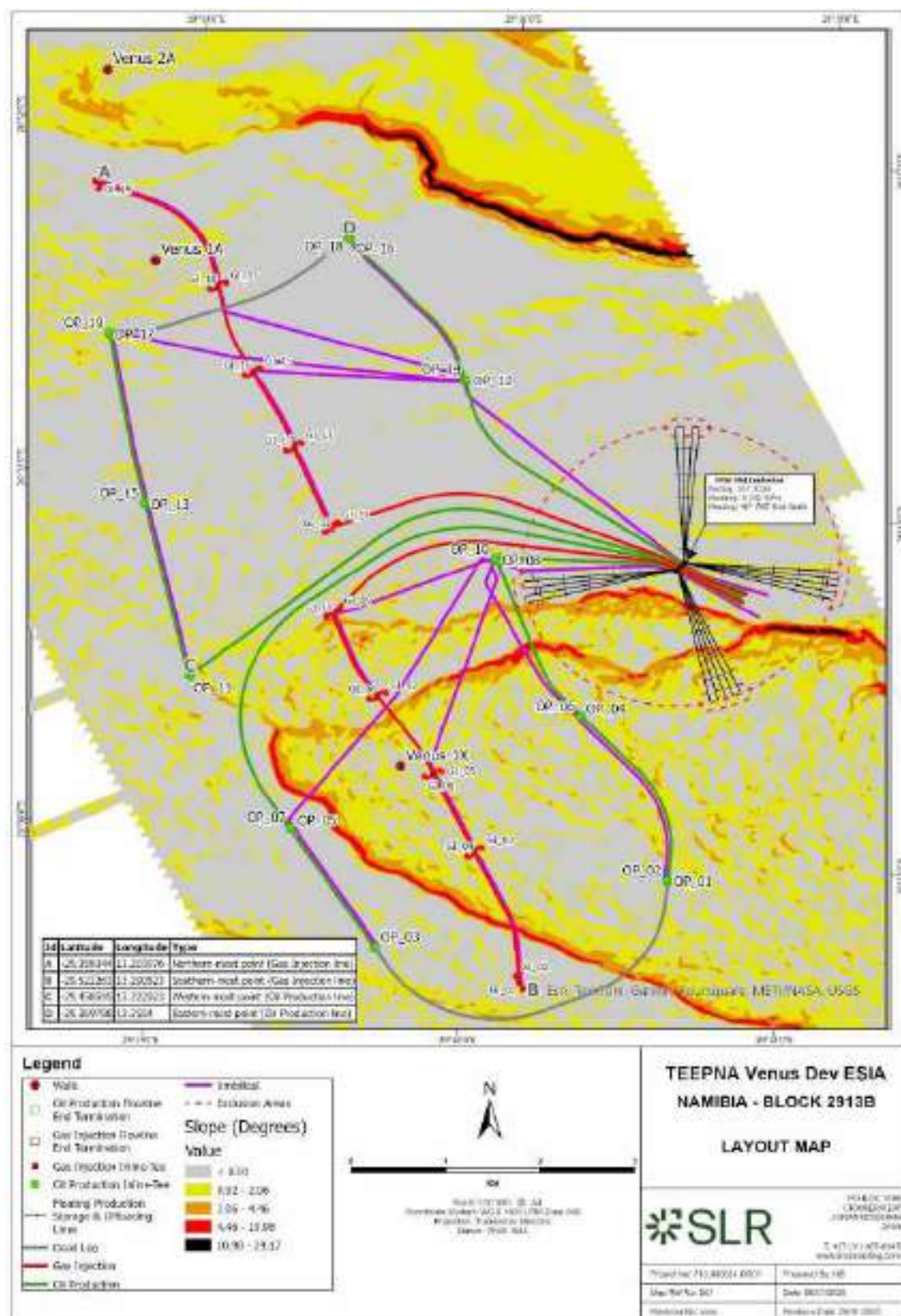


Figure 5-1: Provisional Subsea Production System layout showing the oil production, gas injection, umbilical and mooring lines layout.



- An all-electric Floating Production Storage and Offloading (FPSO) vessel will be moored to the seabed with up to 18 mooring lines (each in the order of 2.5 to 3 km long). The FPSO production capacity would be up to 160 thousand barrels of oil per day (kbopd) and circa 2 million barrels of oil (Mbo) storage tank. The FPSO will process, store, and offload the oil treated onboard the FPSO.
- Dynamically Positioning Shuttle Tankers (DPSTs) (see Section 5.4.4) will be used to offload the oil from the FPSO. Two dedicated DPSTs are expected to be required during the first years while production is higher, reducing to one DPST thereafter once production declines (see Section 5.4.1).
- After offloading the oil from the FPSO, the DPST will sail to a nearshore transshipment location where it will offload the oil to a conventional tanker, which will then move the oil to its final destination.

The overall **approach to production** is summarised below shown in Figure 5-3. The project entails only offshore activities:

- OP wells on the seabed produce fluid (a mixture of oil, gas and water) which is transported via the flowlines and risers to the FPSO moored at the production site.
- On the FPSO, the produced fluid is separated into its components (see Section 5.4.2) and managed as follows:
 - o Gas:
 - Approximately 15 MMscfd is expected to be used in the onboard gas turbines to power the FPSO
 - Remainder is reinjected into the reservoir via the gas riser and flowlines and GIs to enhance oil production.
 - Zero routine and continuous flaring thanks to a closed flare system coupled with a venting recovery unit
 - o Water:
 - Produced water is treated on the FPSO and discharged overboard with an oil content below 15 mg/L. A low produced water rate of 10 000 barrel/day is expected (though the treatment facility will have a design capacity of 15 000 barrel/day).
 - o Oil:
 - Oil is stored on the FPSO and then offloaded from the FPSO to a DPST.
 - The DPST will sail to a calmer nearshore area (see Section 5.3.5) and transfer the oil to a conventional tanker which then moves the oil to its destination (see Section 5.4.4).

The project will be serviced from existing ports and marine/aviation support bases.



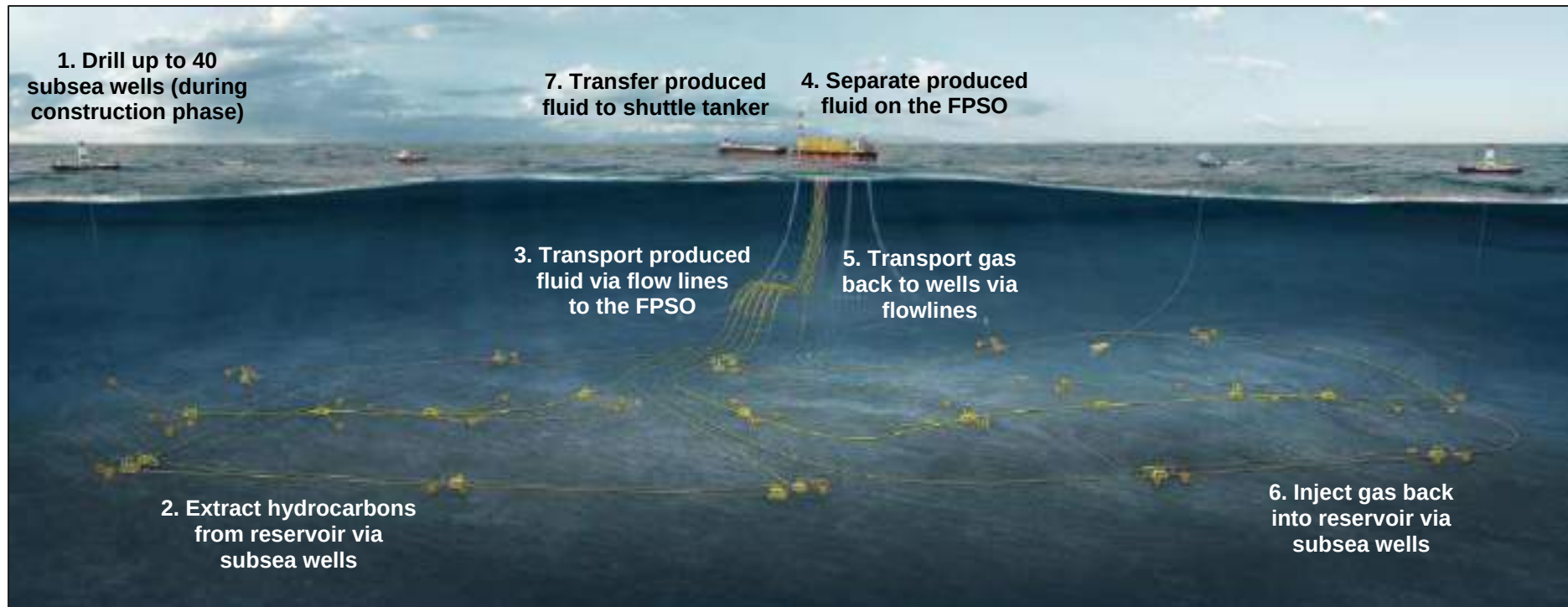


Figure 5-2: Concept of oil production at the offshore Venus field

This is a schematic and it does not aim at representing the number of wells and subsea equipment for this project.



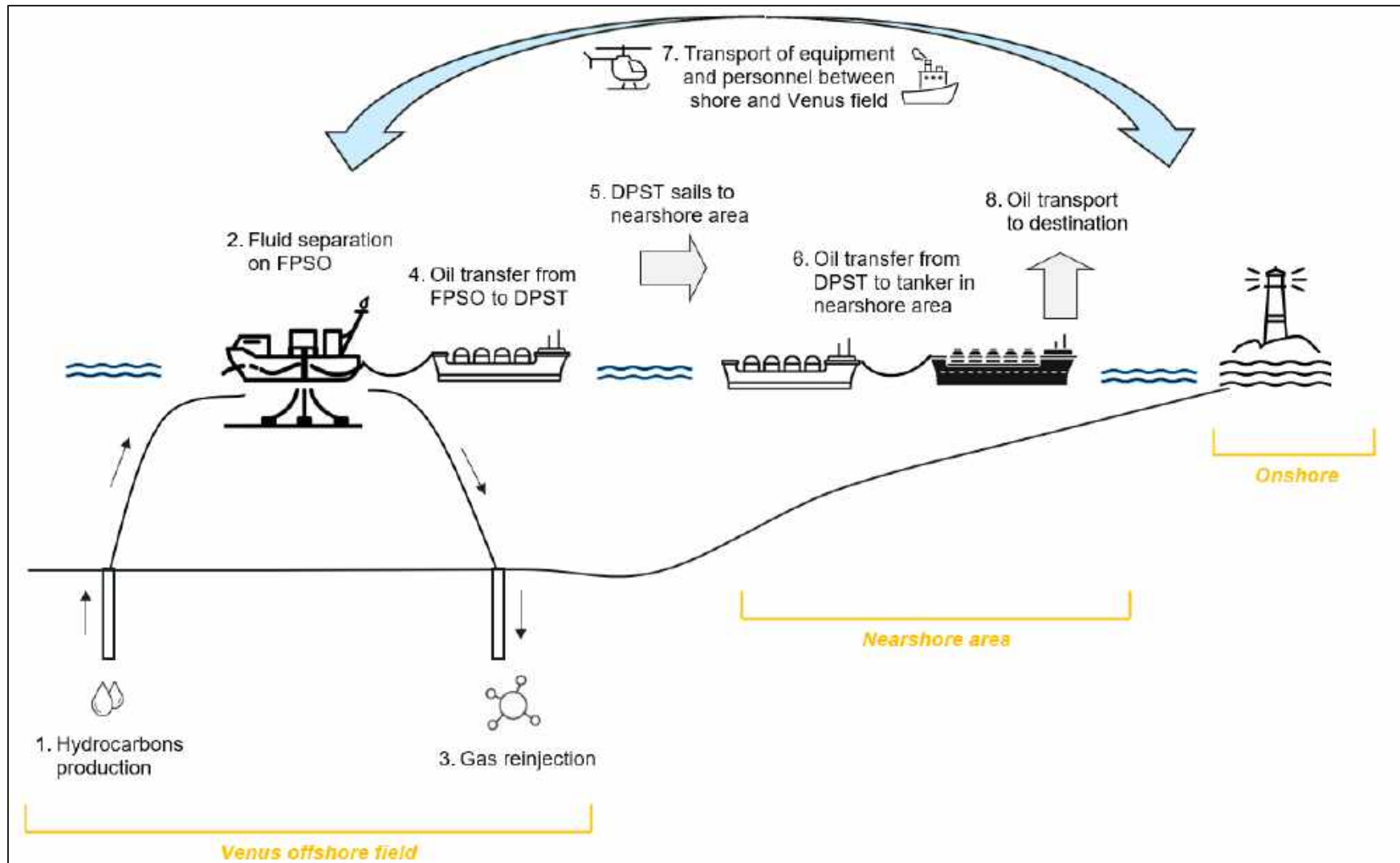


Figure 5-3: Schematic of oil production at the offshore Venus field.



5.1.3 Project Timeline

Key anticipated planning and milestones of the Venus Production project are listed below:

- Project preparation and decision-making:
 - o Front-End Engineering Designs (FEED): Q2 – Q4 2025
 - o ESIA submission to authorities: Q4 2025
 - o Final Investment Decision (FID)²⁵ could be made in 2026
- Project installation:
 - o Overall Project installation: expected to take some 5 years from FID to start of first production, however drilling and subsea equipment installation will continue beyond first production for another 1.5 to 2 years.
 - Well drilling: drilling operations are expected to commence ~18months after FID and are planned to last for up to 4 years
 - Offshore installation (including first arrival of subsea equipment and subsequent onshore preparation)²⁶: from ~ 1 year after FID and to last for around 5 years. The offshore installations at the Venus site will take place mainly during the austral summer periods due to metocean condition constraints
- Production:
 - o 20 to 30 years



Figure 5-4: Anticipated project timeline

5.1.4 Explanation of Key Terms

5.1.4.1 Xmas Tree

A Xmas Tree refers to a complex arrangement of equipment installed on the seafloor atop the wellhead (see Figure 5-5), where the:

- Wellhead is the structural component that supports the well and houses the Blow Out Preventer (BOP) during drilling.
- Xmas Tree is installed after drilling is complete and focuses on production management.

²⁵ A Final Investment Decision (FID) is a critical milestone in the development of large-scale projects, particularly in industries like energy, construction, and mining. It represents the formal approval by a project's developers to proceed with the project, committing the necessary capital resources to move from the planning stages to execution. The FID typically follows extensive feasibility studies, preliminary designs, and Front-End Engineering Designs (FEED). Once the FID is made, it signals the transition to the implementation or construction phase of the project.

²⁶ Installation of umbilicals, flowlines and risers plus Xmas tree, mooring and hook-up of FPSO



The primary role of a Xmas Tree is to manage the flow of hydrocarbons from the well, ensuring safe and efficient production. A Xmas Tree includes the following components:

- Valves that control the flow of hydrocarbons.
- Gauges that monitor pressure and temperature within the well.
- Chokes that regulate the flow rate, preventing excessive pressure.
- Connectors that facilitate connections to pipelines and other equipment.

A Xmas Tree has the following functions:

- Safety functions: can shut the well in case of emergency situations.
- Flow Regulation: control the flow of oil and gas, ensuring optimal production rates.
- Pressure Monitoring: constantly monitor the pressure within the well to prevent blowouts or failures.
- Injection Management: allow for the injection of fluids (like water or gas) to enhance recovery rates.
- Maintenance and Testing: enable regular testing and servicing to maintain operational integrity.

Subsea Xmas trees are specifically designed for underwater installations and engineered to withstand high-pressure conditions and are crucial for offshore drilling operations.

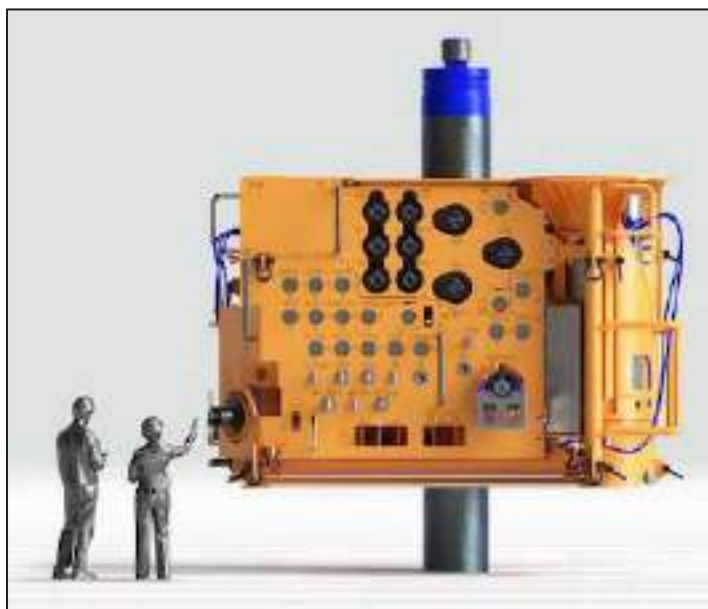


Figure 5-5: Conceptual design of a Xmas Tree and wellhead

Source: (EPC Land, n.d.)

5.1.4.2 In-line Tee (ILT)

In-line Tee (ILT) is an integrated equipment package that creates a branched line tie-in point along a pipeline. By creating a tee along the pipeline, the operator can plan for tie-in points to fit future expansion plans (Oil States, n.d.).



5.1.4.3 Flow Line End Terminations (FLETs)

Flow Line End Terminations (FLETs) are typically used in new construction where a flow line terminates or needs to be jumpered to another location, such as other flowlines or a riser. A FLET is the end or termination of a flow line (see Figure 5-6) (Oil States (2), n.d.).



Figure 5-6: Example of a Flow Line End Termination module

Source: (EAB Engineering, n.d.)

5.1.4.4 Flowlines Pigging

Pigging is an essential process in the oil and gas industry used to maintain the integrity of pipelines and flowlines. Over time, lines are subject to wear and tear and can develop cracks, dents, or corrosion. Flowlines can also accumulate buildup from the products they transport, leading to reduced efficiency, slower movement, and blockages.

The deepwater production environment is characterized by low seafloor ambient temperatures, high tubing head flowing pressures, and higher external hydrostatic (water column) pressure. The high external pressure has a direct impact on the mechanical design of the flowline/pipeline, while the low ambient temperature generally has a larger impact on the hydraulics of a flowline/pipeline. Solid deposition can occur at steady and transient states and can build up into restrictions and blockages in the reservoirs, well bores, flowlines, risers and process facilities (OffshoreMag, 2001). This includes paraffin build-up in flowlines installed in cold sea bottoms, especially if paraffins and asphaltenes of high molecular weight are present in the oil that is transported (Gomes, Pereira, & Line, 1994).

Flow assurance is a common issue in design consideration for almost all producing areas, both onshore and offshore, but is most critical in deepwater and ultra-deepwater regions. Flowlines and risers are often insulated, and chemical injection umbilicals are required. Pigging facilities are incorporated for routine as well as intervention pigging (OffshoreMag, 2001).

Pipeline pigging is a technique designed to address pipeline issues, ensuring that pipelines continue to function smoothly. The process involves using a specialized cylindrical or spherical device, known as a “pig,” to clean, inspect, or perform other maintenance tasks inside a pipeline. The pig is propelled through the pipeline by the pressure of the product being transported, such as oil or gas, or through the use of a cable.



The pig is typically injected into the pipeline using a device called a pig launcher and removed using a pig receiver. As it travels through the pipeline, it serves various purposes depending on its type, from cleaning debris to inspecting the internal surface of the pipe (EPC Land (2), n.d.).



Figure 5-7: Insertion of a “pig” into a pipeline (left) and a wire brush cleaning pig (right)

Source: (EEST, n.d.) (left), TotalEnergies (right)

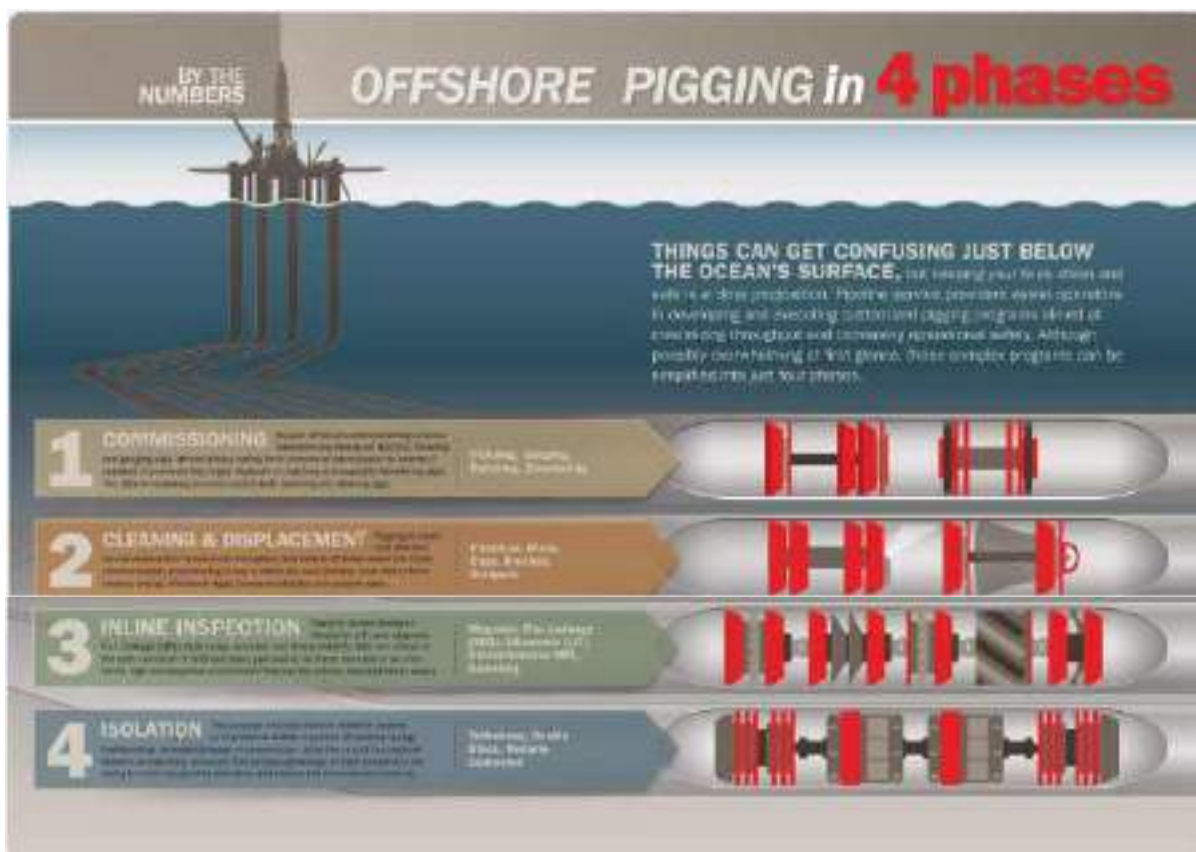


Figure 5-8: Applications for offshore pipeline pigging

Source: (Williamson, 2014)



5.1.4.5 Steel Lazy Wave Risers (SLWRs)

Offshore risers are vertical or near-vertical pipelines that connect subsea equipment, such as wells, to surface facilities such as platforms or FPSOs. They serve as conduits for the transportation of hydrocarbons.

Beyond fluid transport, risers are designed to handle significant mechanical stresses, temperature variations, and corrosive environments while maintaining integrity under varying load conditions.

For the Venus development, considering the harsh environment, Steel Lazy Wave Risers (SLWRs) will be used as follows:

- Production Risers: carry hydrocarbons from subsea wells to the FPSO.
- Gas Injection Risers: delivering gas from the FPSO to subsea reservoirs to enhance the oil production.

The SLWR configuration is achieved by introducing buoyancy modules into a steel catenary riser (SCR) - the addition of buoyancy to the riser provides the unique “lazy wave” shape (see Figure 5-9) and reduces the dynamic stresses at the touchdown zone, acting as a damper and isolating the floater motions from the critical touchdown area. This results in generally better overall performance than an SCR configuration in dealing with vessel motions and waves (ASME, 2014) (Felisita, Gudmestad, Karunakaran, & Martinsen, 2017).

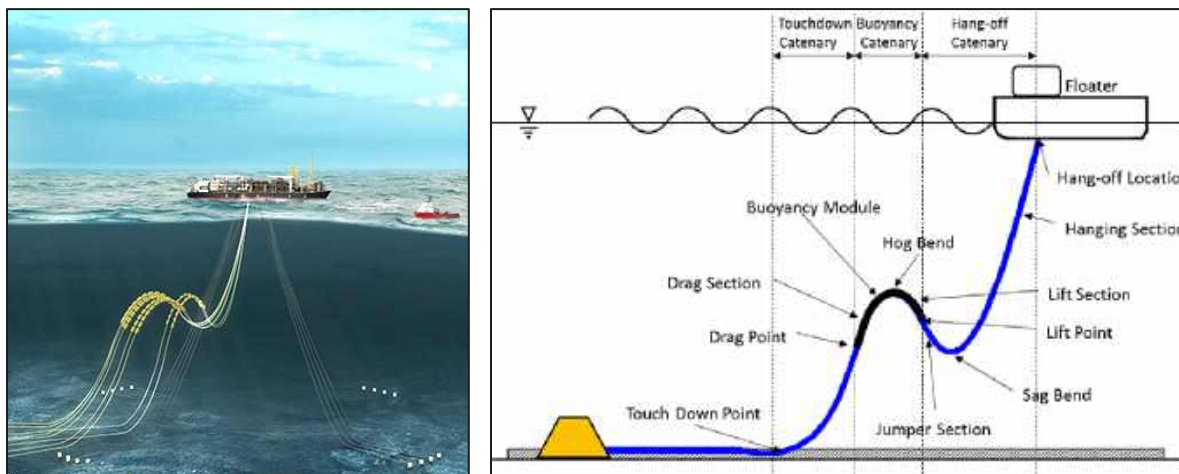


Figure 5-9: Conceptual design of a SLWR

Source: TotalEnergies (left), (Semantic Scholar, 2018) (right)

5.1.4.6 Umbilicals

Umbilicals in the oil and gas industry refer to specialised cables or hoses designed to transfer power, fluids, and control signals between surface facilities and various underwater equipment such as subsea production systems, sensors, and control modules.

Umbilicals are typically composed of multiple components, including electrical conductors, hydraulic lines, chemical lines and fiber optic cables, bundled together in a protective outer sheath. These umbilicals play a crucial role in enabling efficient and reliable communication, power supply, and fluid transfer for subsea operations in the oil and gas sector.

Applications of umbilicals in offshore oil and gas industry include:

- Connection between the surface facilities (like oil platforms or FPSO) and the subsea equipment located underwater.



- Power transmission from the surface to the subsea equipment, enabling them to function.
- Fluid transfer of e.g. hydraulic and chemical injection fluids to the subsea equipment.
- Control signal transmission between the surface and subsea equipment through fiber optic signals to control and monitor the equipment remotely.
- Communication between the surface and subsea equipment.

Key attributes of umbilicals in the oil and gas industry include:

- Protection: They are designed with layers of protective coatings and armor wires to withstand harsh offshore conditions like high pressure, extreme temperatures, and corrosive environments.
- Flexibility: Umbilicals are flexible enough to accommodate movement and dynamic forces in the offshore environment.
- Durability: The construction of umbilicals used in the oil and gas industry ensures reliability over long distances. Their lifespan in oil and gas operations can range up to the order of 30 years.
- Customizable: They can be designed and manufactured to meet the specific requirements of a particular subsea production system.
- Remote monitoring: Offshore umbilicals in the oil and gas industry can be equipped with sensors. This enables remote monitoring of a subsea production system.
- Corrosion resistance: Oil and gas umbilicals are resistant to corrosion in offshore conditions (EZConnect, 2023).

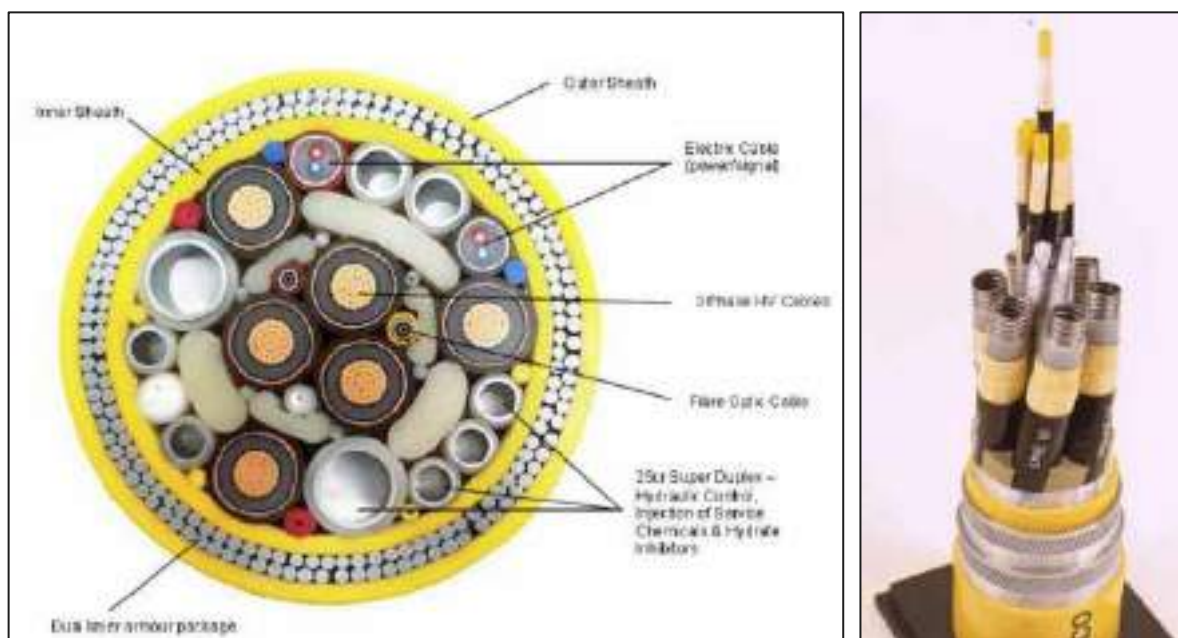


Figure 5-10: Examples of umbilicals

Source: (Johnson & Collins, 2020)

5.1.4.7 FPSO

A Floating Production Storage and Offloading (FPSO) (see Figure 5-11) vessel allows oil production without construction of pipeline to onshore facilities. More than 270 FPSOs are operating worldwide.



FPSOs are normally used in deep-water fields or remote locations, where conventional offshore platforms cannot be installed.

FPSOs have a mooring system that comprises of mooring lines, anchors, and connectors and holds the vessel in place against forces, waves, winds, and currents. The FPSO topside is the hydrocarbon processing unit at the top. The FPSO hull is used for oil storage. The connection to the subsea wells is made through flexible steel reinforced risers designed to absorb any motion of the vessel by waves (see Section 5.1.4.5).

An FPSO typically contains a range of equipment and system, such as:

- Gas, Water and Oil Separator
- Gas Dehydration, Compression Treatment and Injection Units
- Seawater, Chemical and Produced Water Treatment Units
- Power Generation Unit
- Cargo, Propulsion, Storage, Ballast and Boilers
- Accommodation
- Helicopter deck
- Oil storage in the hull

Hydrocarbons (mixtures of oil, water, and gas) produced in the subsea wells are carried onboard the FPSO through flowlines and risers. These hydrocarbons get separated into oil, water, and gas at the FPSO topside production facility.

Separated treated crude oil is stored in the hull and then offloaded to tankers.



Figure 5-11: Example of an FPSO

Source: TotalEnergies

5.1.5 Rationale for Proposed Production Approach

Considering the water depth of ~ 3 000 meter at Venus field and the distance to shore of ~300km, an FPSO is the only option to produce the oil.



The most appropriate recovery mechanism for Venus oil production was carefully studied and several options were considered, including for example natural depletion as well as gas and water injection. The work done on the dynamic reservoir simulations concluded that full gas reinjection is required to enhance the oil production.

When using an FPSO, the produced oil is initially stored in the FPSO hull until it is offloaded to tankers. Due to the metocean conditions at Venus field, the produced oil will be initially transferred to a Dynamic Positioning Shuttle Tanker (DPST), which will act as a shuttle between the FPSO and the nearshore transshipment area. After offloading the oil from the FPSO, the DPST will sail to a nearshore area, where it will be possible to transfer the oil to a conventional tanker for onward transport to the buyer.

5.2 Development Drilling

5.2.1 Overall Drilling Approach

5.2.1.1 Well Locations

The project has defined all development wells based on downhole targets, which is necessary to define the subsea associated infrastructure. It is typical that the design and layout may continue to be fine-tuned as the project progresses towards a project execution.

Two types of wells are planned to be drilled, Oil Producers (OP) and Gas Injectors (GI) wells; both of these are drilled into the Venus oil-bearing reservoir at a depth of ~3 000 m below seabed.

To minimize the subsea footprint and overall infrastructure installed on the seabed, it is common to cluster the wells and to connect them to a common drilling centre. For Venus, the concept selected is to cluster the wells in pairs, using ILTs (see Section 5.1.2), i.e. two wells of similar type (either OP or GI) are drilled close to each other and tied to the same manifold:

- OP wells (shown in green in Figure 5-1) that form a pair are connected by ILT with rigid jumpers²⁷.
- GI wellheads (shown in red in Figure 5-1) will be connected by flexible jumpers, allowing each pair to be located at longer distances (1 km or more).

5.2.1.2 Well Drilling Sequence

Up to three drilling rigs could be active simultaneously to drill the development wells; potentially starting 18 months after FID, and drilling operations could continue for around 4 years.

Each drilling rig will drill both wells in a pair, or two pairs of wells, in a single campaign as described below:

- Drill top hole²⁸ (riserless stage):

²⁷ ILTs are connection points used in subsea oil and gas production systems to link wellheads to flowlines and risers. Jumpers are the short, rigid pipes that connect these components

²⁸ The top hole refers to the initial (riserless – see Section 5.2.4) phase of drilling a well, i.e. drilling the uppermost section of the wellbore. The top hole is usually drilled to a relatively shallow depth compared to the total depth of the well and with a larger diameter bit to accommodate the installation of surface casing.



- o Drill top hole of first well and install 36" conductor and 20" surface casing (36" and 20" riserless stage²⁹) (e.g. Well 1) (discharge of cuttings and associated muds to seabed)
- o Move the rig to the pair's other well and drill the top hole and install 36" conductor and 20" surface casing (e.g. Well 2)
- o Move the rig to the neighbouring pair and drill the top hole and install 36" conductor and 20" surface casing for each of those two wells (e.g. Well 3 and Well 4)
- Complete well drilling (riserless stage):
 - o Remain with the rig at the location of the well last drilled (e.g. Well 4) and:
 - Exchange the drilling bit (to a smaller diameter bit for deeper sections), drilling tools, mud system etc – as required for the deeper well sections of that well
 - Install a Blow-Out Preventer (BOP) (see Section 5.2.8.1) and drilling riser (which connects the subsea wellhead to the drill ship)
 - Drill well to its full depth
 - Complete well
 - Clean-up (when needed), test (when needed) and suspend well. For some of the wells, the well will need to be cleaned up to rig, while the remaining could be cleaned up directly to the FPSO once the necessary facilities are commissioned and in place. Some OP wells will also require a brief well test before connecting the well to the FPSO. This is described further in the subsequent sub-sections.
 - o Disconnect and move the rig back to other well of the same pair (Well 3) and drill, complete, test (when needed) and suspend well
 - o Disconnect and move the rig back to initial well pair (Well 1 and Well 2) and drill, complete, test (when needed) and suspend those wells as well
- Initiate drilling campaign on the next pair (or two pairs) of wells.

The distance between the rigs will vary over time, and the rigs can work in relatively close proximity of each other at times.

The average drilling per well is expected to take around 75 days, as an order of magnitude indication. Drilling is expected to take place continuously (year-round).

5.2.1.3 Well Architecture

OP and GI wells have essentially the same architecture (see next section), requiring the same approach to drilling and generating approximately the same volume of cuttings.

The well design depends on factors such as planned depth and reservoir pore pressure. A base case architecture and order of magnitude lengths per section are indicated below in Table 5-1.

²⁹ The uppermost well section (at the seabed) is 36 inches (90 cm) in diameter. Deeper sections of the well have an increasingly smaller diameter.



Table 5-1: Example of Well architecture.

Drill Section	Hole diameter (in)	Pipe diameter (in)	Indicative length of section (m)
Riserless stage			
1	36"	36"	80
2	26"	20"	1 100 – 1 200
Risered stage			
3	17.5"	14"	1200
4	13.5"	10.75"	1200
5	9.5"	Upper completion (tubing): OP 5.5" and GI 6-5/8" Lower completion (sand screens): OP and GI 6 5/8"	2 000 – 2 500

5.2.2 Description of Drilling Equipment and Bases

This section describes the main drilling equipment / components.

5.2.2.1 Drilling Unit (Rig)

Well drilling will most likely be undertaken using a dynamically positioning drillship; the final drilling unit will be selected depending on availability and final design specifications. A drillship is a fit for purpose-built drilling vessel designed to operate in deep water conditions. The drilling (derrick) area is normally located towards the centre of the ship with support operations from both sides of the ship using fixed cranes. A drillship has considerable storage capacity and is independently mobile.



Figure 5-12: Example of a drilling unit (drill ship)



Alternatively, a dynamically-positioned semi-submersible drilling unit could be used, which is essentially a drilling rig located on a floating structure of pontoons. When at the well location, the pontoons are partially flooded (or ballasted), with seawater, to submerge the pontoons to a pre-determined depth below the sea level where wave motion is minimised. This gives stability to the drilling vessel, thereby facilitating drilling operations.

A temporary safety zone of minimum 500 m radius around the drilling unit will be enforced at all times during operation and will be described in a Notice to Mariners as a navigational warning. Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part B, Section II, Rule 18), a drilling unit that is engaged in underwater operations is defined as a “vessel restricted in its ability to manoeuvre”, and power-driven and sailing vessels must give way to such vessels. Fishing vessels are required to keep out of the way of the well drilling operation and observe the operational safety zones. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel used for the purpose of exploiting the seabed falls under the definition of an “offshore installation” and as such it is protected by a 500 m safety zone.

5.2.2.1 Support Vessels

Each drilling unit will be supported / serviced by two to three platform support vessels (PSV) operating with regular trips, to facilitate the transportation of goods, equipment, tools and waste between the drilling unit and the onshore logistics base.

A support vessel will always be on standby near the drilling units to provide support for firefighting, oil containment / recovery, rescue in the unlikely event of an emergency and supply any additional equipment that may be required. Support vessels can also be used for medical evacuations or transfer of crew if needed.



Figure 5-13: Examples of platform supply vessels



5.2.2.1 Onshore Logistics Base

Onshore logistics is expected to be provided from Lüderitz (which is closest) and further support from Walvis Bay (where other facilities may be located).

The shore bases will provide for the storage of materials and equipment (including pipes, drilling fluid, cement, chemicals) that will be transported by sea to / from the drilling rig/s, and quay space for loading and offloading. The shore base will also be used for coordination of support services: accommodation, waste management services, bunkering vessels, and stevedoring / customs clearance services.

It is anticipated that the ports will have the necessary service infrastructure required to provide the necessary onshore support in place and it will not be required to add any additional permanent onshore infrastructure for the project.

5.2.3 Mobilisation for Drilling

The mobilisation phase will entail the required notifications, establishment of the onshore base, appointment of local service providers, procurement and transportation of equipment and materials from various ports and airports, accommodation arrangements and transit of the drilling unit and support vessels to the drilling area. This phase will also include obtaining the required permits and permissions to commence with operations.

The drilling rigs and supply vessels will sail to the well site. Ballast water discharge will follow the requirements of the International Maritime Organisation's (IMO) 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments.

Drilling materials, such as casings, mud components, cement and other equipment and materials will be brought into the country or procured locally if possible. Equipment will be transferred between the onshore logistics base and the drilling unit by the supply vessels.

5.2.4 Description of Well Drilling

5.2.4.1 Drilling Stages

The well will be created by drilling an initially shallow hole into the seafloor with a drill bit attached to a rotating drill string, which crushes the rock into small particles, called "cuttings". After the initial hole is drilled, casings (sections of steel pipe) are placed in the hole and permanently cemented in place (cementing operations are described below). The next (deeper and narrower) section of the well is then drilled and casing cemented in place. This is repeated until the well has reached the desired depth. The hole diameter decreases with increasing depth (see Figure 5-14).

The casings provide structural integrity to the newly drilled wellbore, in addition to isolating different geological formations from each other and from the surface. With these zones safely isolated, and the formation protected by the casing, the well will be drilled deeper with a smaller drill bit and also cased with a smaller sized casing. For the current project, it is anticipated that there will be four sets of subsequently smaller hole sizes drilled inside one another, each cemented with casing, except the last phase that will remain an open hole without casing.



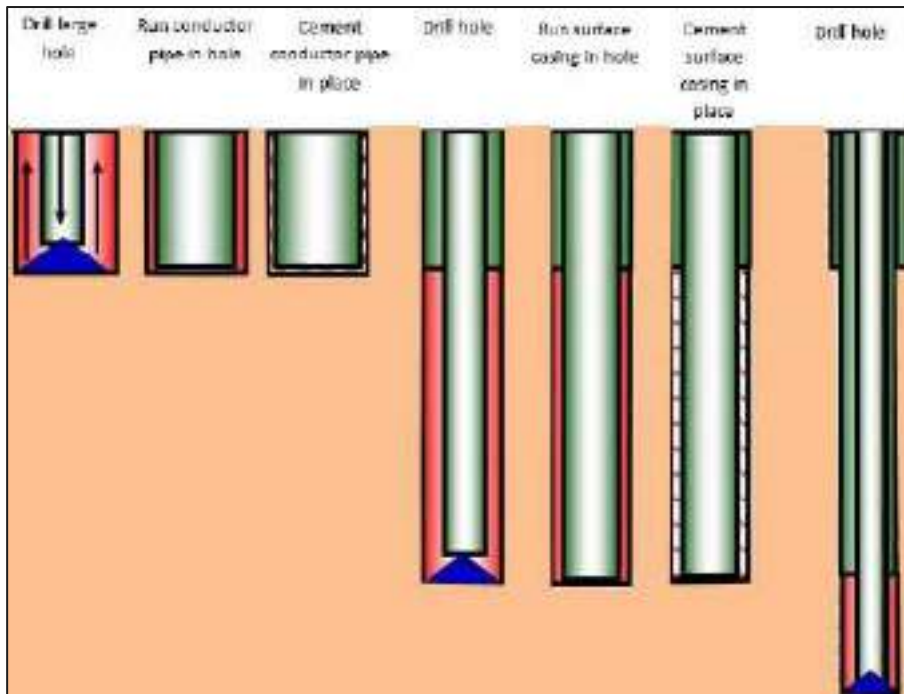


Figure 5-14: Simplified view of well drilling stages.

Adapted from Nergaard, 2005

The two key stages of drilling are the top hole / riserless (when the riser is not in place) and risered drilling stages (see Figure 5-15).

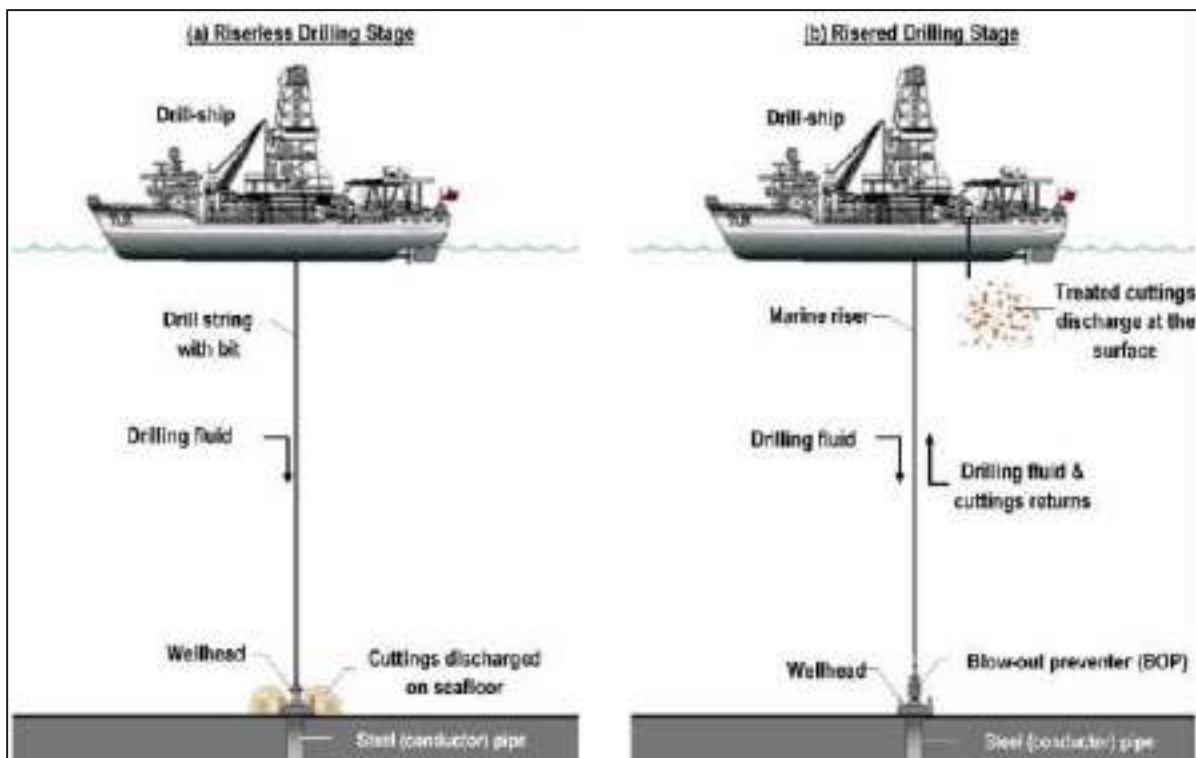


Figure 5-15: Drilling stages: (A) Riserless drilling stage; and (B) Risered drilling stage.

Source: <http://www.kochi-core.jp/cuttings/>



Initial (Riserless) Drilling Stage

The process of preparing the first section of a well is referred to as “spudding” (i.e. the process of beginning to drill a well). Sediments just below the seafloor are often very soft and loose, thus to keep the well from caving in and to carry the weight of the wellhead, a 36-inch diameter structural conductor pipe is installed. Jetting is the primary means of setting the 36 inches where no cement is required. If jetting fails then the hole is drilled to 42-inch and then the 36-inch conductor is installed and then cemented.

When the conductor pipe and low-pressure wellhead are at the correct depth (~80 m deep depending upon substrate strength), a new drilling assembly will be run inside the structural conductor pipe and the next hole section will be drilled by rotating the drill string and drill bit.

Below the conductor pipe, a hole of approximately 26 inches in diameter will be drilled with a length of ~1 100 to 1 200 m. The rotating drill string causes the drill bit to crush rock into small particles, called “cuttings”. While the wellbore is being drilled, drilling fluid is pumped from the surface down through the inside of the drill pipe, the drilling fluid passes through holes in the drill bit and travels back to the seafloor through the space between the drill string and the walls of the hole, thereby removing the cuttings from the hole. At a planned depth, the drilling is stopped and the bit and drill string is pulled out of the hole. A surface casing of 20-inch diameter is then placed into the hole and secured into place by pumping cement through the casing at the bottom of the hole and back up the annulus (the space between the casing and the borehole). The 20-inch casing will have a high-pressure wellhead on top.

These initial hole sections will be drilled using seawater (with viscous sweeps) and Water Based Mud (WBM) (see Section 5.2.4.4). All cuttings and WBM from this initial drilling stage will be discharged directly onto the seafloor adjacent to the wellbore.

Risered Drilling Stage

The risered drilling stage (refer to Figure 5-15) commences with the lowering of a Blow-out Preventer (BOP) and installing it on the wellhead (see Section 5.2.8.1). A lower marine riser package is installed on top of the BOP and the entire unit is lowered on riser joints. The riser isolates the drilling fluid and cuttings from the environment, thereby creating a “closed loop circulation system”.

Drilling is continued by lowering the drill string through the riser, BOP and casing, and rotating the drill string. During the risered drilling stage, should the WBMs not be able to provide the necessary characteristics, a low toxicity Non-Aqueous Drilling Fluid (NADF) (see Section 5.2.4.4) could be used. The drilling fluid emerges through nozzles in the drill bit and then rises (carrying the rock cuttings with it) up the annular space between the drill string and the sides of the hole, casing and riser to the drilling unit.

The cuttings are removed from the returned drill mud and discharged overboard after treatment (see Section 5.2.7).

5.2.4.2 Cementing

Cementing is the process of pumping cement slurry through the drill pipe and / or cement stinger at the bottom of the hole and back up into the space between the casing and the borehole wall (annulus). Cement fills the annulus between the casing and the drilled hole to form an extremely strong, nearly impermeable seal, thereby permanently securing the casings in place. To separate the cement from the drilling fluid to minimise cement contamination a cementing plugs and/or spacer fluids are used. The plugs are pushed by the drilling fluid to ensure the cement is placed outside the casing filling the annular space between the casing and the hole wall.



Cementing has four general purposes: (i) it isolates and segregates the casing seat for subsequent drilling, (ii) it protects the casing from corrosion, (iii) it provides structural support for the casing, and (iv) it stabilises the formation.

To ensure effective cementing, an excess of cement is often used to account for uncertainties of the borehole diameter. Until the marine riser is set, excess cement from the first casings emerges out of the top of the well onto the seafloor. This cement does not set and is slowly dissolved into the seawater.

Offshore drilling operations typically use Portland cements, defined as pulverised clinkers consisting of hydrated calcium silicates and usually containing one or more forms of calcium sulphate. The raw materials used are lime, silica, alumina and ferric oxide. The cement slurry used is specially designed for the exact well conditions and temperatures encountered.

Additives can be used to adjust various properties in order to achieve the desired results. There are over 150 cementing additives available. The amount (concentrations) of these additives generally make up only a small portion (<10%) of the overall amount of cement used for a typical well. Usually, there are three main additives used: retarders, fluid loss control agents and friction reducers. These additives are polymers generally made of organic material and are considered non-toxic.

Once the cement has set, a short section of new hole is drilled, then a pressure test is performed to ensure that the cement and formation are able to withstand the higher pressures of fluids expected to be encountered from deeper formations.

5.2.4.3 Mud Logging

Evaluation of the petro-physical properties of the penetrated formations is carried out routinely during the drilling operation. Mud logging involves the examination of the drill cuttings brought to the surface by the drilling fluid. Mud logging also monitors for hydrocarbon gases that relate to changes in formation pressure and the volume or rate of returning fluid, which can aid in controlling the well, and to the intersection of reservoir rocks.

5.2.4.4 Well Logging and Profiling

Well logging involves the insertion of specialised instruments into a borehole to determine the properties of the geological formations penetrated by the well bore, using:

- Logging While Drilling (LWD) will be conducted with logging tools incorporated into the drill string that provide critical real-time well information.
- Wireline logging, performed by lowering a logging tool (or a string of one or more instruments) into the well bore after removal of the drill string, and recording petrophysical properties using a variety of sensors.

Both methods may be employed to varying degrees.

Wireline logging and LWD involve the use of sealed radioactive sources in tools kept in specially designed secured (locked) storage containers. The radioactive material is encapsulated in ceramic cylinders and sheathed in several layers of stainless steel. The size of the sealed sources is ~4" length x 1" (diameter) to 7" (length) x 1.5" (diameter) and radiation levels are very low³⁰.

Drilling units have special storage locations designated for radioactive containers and only certified logging engineers are allowed to handle the radioactive devices.

³⁰ From 0.1-2 curies (Ci) with a 0.5 – 200 milliroentgens per hour (mR/hr) maximum radiation level at the source surface to 3-20 Ci with a 50-200 mR/hr maximum radiation level at the surface



Vertical Seismic Profiling (VSP) may be undertaken as part of the conventional wireline logging programme when the well reaches target depth to generate a high-resolution seismic image of the geology in the well's immediate vicinity. The VSP images are used for correlation with surface seismic images and for forward planning of the drill bit during drilling.

A zero-offset VSP uses a small sound source (sound pressure generating), which is operated from the drilling unit. The sound source is made up of several sound sources with a total array volume of between 750 and 1 200 cubic inches (CUI). The sound source is deployed between 7 m and 10 m below sea level and has a source pressure of 2 000 pounds per square inch (psi).

During VSP operations, a string of receivers (usually four to five) is placed in a section of the borehole and the sound source is discharged approximately five times at 20 second intervals. The generated sound pulses are reflected through the seabed and are recorded by the receivers to generate a profile along a 60 to 75 m section of the well. This process is repeated as required for different stations in the well and it may take typically nine hours to complete approximately 250 pulses, depending on the well's depth and number of stations being profiled.

5.2.4.5 Well Completion, Clean-Up and Testing

Once the wells have been drilled to final depth in the reservoir, the lower completion (section across the reservoir) and thereafter the upper completion (production tubing and safety isolation valve) will be run.

- The lower completion design is still under study, however the base case is to use Stand Alone Screens (SAS) which will allow the flow of the well effluent while providing a barrier to sand production (reservoir fine particles) in the form of a steel mesh.
- Once the lower completion is in place, the upper completion is run, which is comprised of the production (5-12") or injection (6-5/8") tubing, together with downhole temperature and pressure gauges as well as safety valves (such as the Tubing Isolation Valve, TIV, and the Tubing Retrievable Surface Controlled Subsurface Safety Valve, TR-SCSSV) to allow downhole isolation of the reservoir if needed.

Figure 5-16 shows the potential lower and upper completion design (design work ongoing) for both the OP and GI wells.

Following the completion operations, it is anticipated that some OP wells will be cleaned-up through the drilling rig, as the FPSO will not be yet on location. The exact number is still under review. GI wells will be cleaned-up before and after commencement of production from the FPSO. Well clean-up refers to the process of removing drilling fluids, debris, and other contaminants from the wellbore to prepare it for production, involving the following steps:

- Flowback: The well is allowed to flow back to the surface, bringing with it the drilling fluids, cuttings, and other debris.
- Separation: The flowback fluids are separated into their constituent parts, such as gas, oil, water, and solids.
- Disposal or treatment: The separated fluids and solids are either treated for reuse or disposed of according to environmental regulations



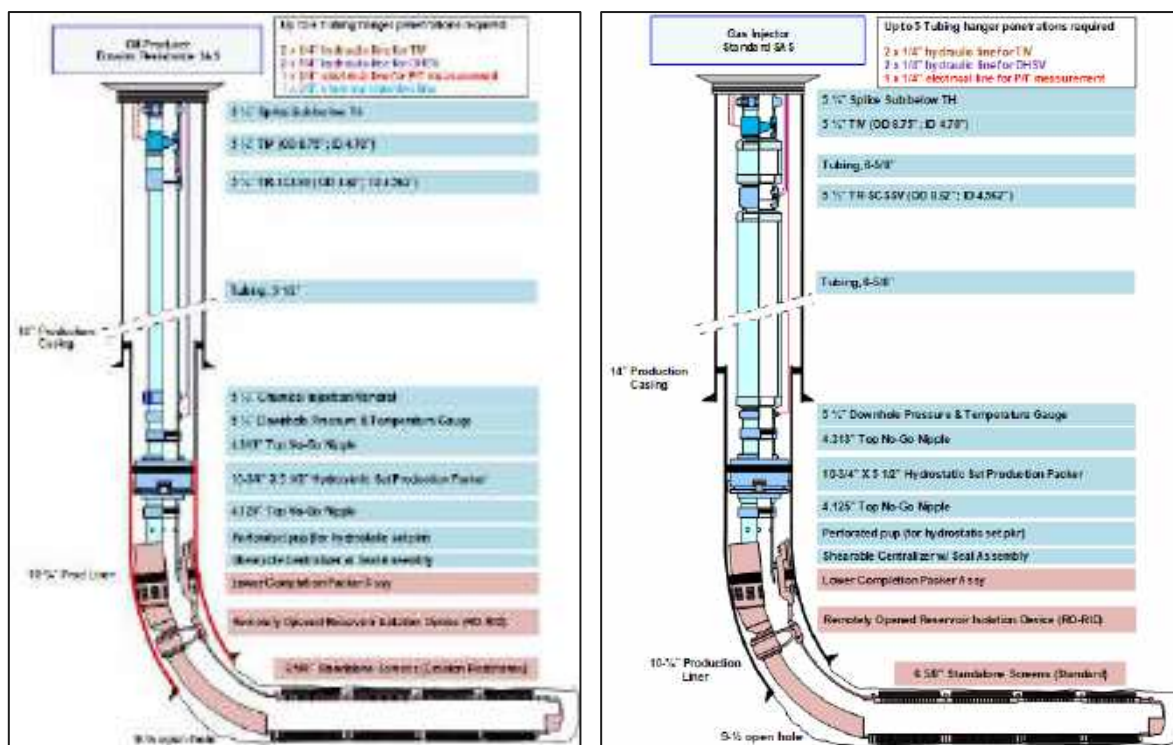


Figure 5-16: Potential lower and upper well completion design

Source: TotalEnergies

Wells drilled after first oil will likely be cleaned-up to the FPSO.

It is anticipated that some OP wells may also need to be tested on the rig to determine the well performance characterisation prior to connecting the well to the FPSO for production. This is the equivalent of performing a well test on exploration and appraisal well operations. The exact number of wells to be tested is still under review. During testing, hydrocarbons are burned via a flare boom to maximise combustion of the hydrocarbons. The flare boom extends to a safe distance from drilling unit. The duration of the test will be minimised as much as possible.

5.2.4.6 Well Suspension

Once wells are completed and until they are connected to the FPSO, they will be temporarily suspended by introducing treated brine, which will protect them from any pressurised formations. The type of brine to be used will still need to be further studied and defined, however typical suspension brines could include calcium bromide, calcium chloride or sodium chloride brine. In addition, small quantities of other additives, such as monoethylene glycol (MEG) for example, could be added (still to be defined). Discharge of well suspension fluids to sea is not planned except in case of emergency.

The wells will be isolated using the isolation valves located in the upper completion and a corrosion cap will be installed on the subsea wellhead to seal the well until the Xmas Tree is installed later (using a separate installation vessel) and the FPSO is in place.

5.2.5 Drilling Fluids or Muds

Drilling fluid is a complex mixture of fluids, solids and chemicals that are carefully tailored to provide the correct physical and chemical characteristics required to safely drill the well. The main functions of drilling fluid or drilling mud (terms used interchangeably) are to:



- Provide sufficient hydrostatic pressure to control subsurface pressures and prevent kicks or blow-outs;
- Maintain a stable wellbore and prevent deterioration of the open hole, such as collapsing;
- Transport the cuttings to the surface;
- Cool and lubricate the drill bit and drill string (reduce friction);
- Power the mud motors / downhole tools during the drilling process;
- Regulate the chemical and physical characteristics of returned mud slurry on the drilling unit; and
- Displace cements during the cementing process.

Two types of drilling fluid may be used during offshore drilling, namely Water-Based Mud (WBM) and Non-Aqueous Based Mud (NABM), or Non-Aqueous Drilling Fluid (NADF) as it is hereafter referred to. For this project, it is proposed to use WBM during the riserless drilling stage (the stage where a large-diameter pipe, the riser, connecting the well to the drilling unit has not yet been put in place) and either WBM or NADF during the risered drilling stage.

All drilling chemicals proposed for the Venus development wells will be selected according to lowest toxicity, lowest bioaccumulation potential and highest biodegradation, and are selected in accordance with the pre-screening scheme based on the OSPAR³¹ methodology.

5.2.5.1 Water-Based Muds

Due to the variability in conditions that can be encountered, drilling fluid mixtures vary to some extent. Typically, the major ingredient making up 85 to 90% of the total volume of a WBM is freshwater and / or seawater.

The remaining 10 to 15% of the volume of WBMs typically comprise barite, potato or corn starch, cellulose-based polymers, xanthan gum, bentonite clay, soda ash, caustic soda and salts (these are usually either potassium chloride [KCl], Calcium chloride [CaCl₂] or sodium chloride [NaCl]). Other minor additives may be used in special circumstances such as citric acid for pH control; or polyethylene glycol butyl ether for clay inhibition, amongst others.

Details for some of these are provided below:

- Barite (barium sulphate) is an inert compound used as a weighting agent
- Potato or corn starch and other cellulose-based polymers are used to control the rate of filtration of water in the mud into the formation being drilled by forming a thin filter cake on the borehole wall
- Xanthan gum and minor amounts of bentonite clay are used to provide viscosity and impart rheological properties (i.e. materials responding with plastic/liquid flow or flow

³¹ The OSPAR Commission is an international organization that works to protect and conserve the marine environment of the North-East Atlantic. It was established through the merger of the 1972 Oslo Convention, which focused on preventing marine pollution from dumping, and the 1974 Paris Convention, which addressed land-based sources of marine pollution and the offshore industry.

The Commission consists of 15 governments (Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom) and the European Union.

The OSPAR Convention, adopted in 1992, unified and updated these earlier agreements. It also introduced new measures to protect marine biodiversity and ecosystems from non-polluting human activities.

Namibia is not a member of OSPAR and thus OSPAR rules do not apply, but they provide a good indication of the environmental acceptability of a product.



of matter as a “soft solid”) to the mud for cuttings transport, as well as to provide gel strength for cuttings suspension

- Caustic soda (sodium hydroxide) is used to maintain the required pH in the drilling fluid
- KCl, CaCl₂ or NaCl (table salt) are used to reduce the swelling tendencies of clays being drilled and help to maintain a stable wellbore

All chemicals to be used will have associated Material Safety Data Sheet (MSDS) or other bioassay information for ecotoxicology data, where applicable. Selection of constituents will follow best industry practices and will consider ecotoxicity, biodegradability and bioaccumulation criteria.

5.2.5.2 Non-Aqueous Drilling Fluids (Non-Aqueous Based Mud)

NADF may have to be used during the riser drilling stage (“closed loop system”) to:

- Provide optimum wellbore stability and enable a near gauge hole to be drilled;
- Reduce torque and drag in high angle to horizontal wells;
- Minimise damage to reservoirs that contain clays that react adversely to WBM; and
- Obtain irreducible water saturation log data for gas reservoirs.

The main chemicals typically used in a NADF are presented in Table 5-2.

Table 5-2: Main chemicals used in a non-aqueous drilling fluid.

Material	Description
Base fluid	Non-aqueous drilling fluids use base fluids with significantly reduced aromatics and extremely low polynuclear aromatic compounds. New systems using vegetable oil, polyglycols or esters have been and continue to be used.
Brine phase	CaCl ₂ , NaCl, KCl.
Gelling products	Modified clays reacted with organic amines.
Alkaline chemicals	Lime e.g., Ca(OH) ₂ .
Fluid loss control	Chemicals derived from lignites reacted with long chain or quaternary amines.
Emulsifiers	Fatty acids and derivatives, rosin acids and derivatives, dicarboxylic acids, polyamines.

Adapted from: Swan et al., 1994

Drill cuttings that derive from the reservoir section contain residual base fluids, which cannot be removed easily. The trend in the industry has been to move towards low toxicity NADF (Group III NADF) that are biodegradable with a lower aromatic content and will not persist in the long-term.

Three types of NADF are generally used for offshore drilling, 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 NADF is 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 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 NADF (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 of less than 0.001% and total aromatic contents less than 0.5%. This group includes Synthetic Oil-Based Mud or synthetic-based muds, 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).

For the current project, if NADF is confirmed, the operator is planning to use a Group III type NADF.

5.2.6 Resource Requirements

5.2.6.1 Personnel

The majority of the workforce involved in the drilling activities will comprise highly specialised skilled staff. Whenever possible, the use of local workers will be prioritized. Each drilling rig usually accommodates around 150 to 200 workers at the same time. Offshore workers on drilling rigs typically remain on board for 4 weeks, which is followed by 4 weeks off duty. Up to 3 drilling rigs are expected to drill up to 40 wells in total.

Each drilling rig is expected to be supported by two support vessels, which will be used to transfer equipment between shore and the drilling unit. Each support vessel usually accommodates circa 15 workers at the same time.

Transportation of personnel to and from the drilling rig will be done by helicopter, with circa 5 helicopter trips per week between each drilling rig and the helicopter support base most likely in Luderitz. When multiple rigs will be present, helicopter trips will be optimised to minimise the number of trips.

Accommodation in Windhoek or Lüderitz during crew changes may be required for incoming or departing offshore staff.

5.2.6.2 Water

The drilling campaign will use an estimated 675 m³ of fresh water per week for water supply, cement and mud preparation. Fresh water will be produced onboard the drilling unit via seawater desalination.

5.2.6.3 Fuel

Low sulphur (0.5%/50ppm) Marine Gas Oil (MGO) will be used as fuel for all vessels. Fuel will preferentially be obtained locally and transported to the drilling unit by the supply vessels. Jet-A1 fuel will be used for helicopters.

5.2.6.4 Explosive and Radioactive Materials

The drilling unit will be equipped with a secure store for explosives, plus igniter, booster, detonator and detonating cord. The drilling unit will also ensure proper storage of radioactive materials.



5.2.7 Discharges, Emissions and Wastes

5.2.7.1 Discharges to Sea

All vessels will have equipment, systems and protocols in place for prevention of pollution by oil, sewage and garbage in accordance with international MARPOL requirements. Any oil spill related discharges would be managed by an Oil Spill Contingency Plan (OSCP) that the Operator will be required to compile and shared with government prior to drilling. When onshore treatment or disposal is needed, only onshore licenced waste disposal sites and waste management facilities will be used.

Anticipated sources of discharges to sea are summarised in Table 5-3.

Table 5-3: Estimated sources of anticipated discharges to sea

Discharge stream	Source	Discharge criteria
From drilling-related activities		
Drill cuttings and mud	Drill cuttings, which range in size from clay to coarse gravel and reflect the types of sedimentary rocks penetrated by the drill bit, are the primary discharge during well drilling. During the riserless drilling stage, all cuttings and associated WBM will be discharged directly onto the seafloor adjacent to the wellbore. During the risered drilling stage the operator will treat cuttings on the drillship and then discharge the treated cuttings overboard, where they are dispersed by the current and settle to the seafloor. Discharge at any one location is intermittent, as actual drilling operations are interspersed with cementing and other technical work that does not generate cuttings.	Reduce oil content to below 6.9% Oil on Cuttings (OOC) by weight using shakers and a centrifuge
Cement and cement additives	During cementing of the surface casing, excess cement emerges out of the top of the well and onto the seafloor to ensure that the conductor pipe is cemented all the way to the seafloor.	None
BOP hydraulic fluid	The BOP control system will use hydraulic fluids to actuate the BOP valves. It is anticipated that BOP testing will take place twice for each well (for safety reasons).	BOP fluids completely biodegrade in seawater within 28 days.
From vessels		
Ballast water	Ballast water is used during routine operations to maintain safe operating conditions onboard a ship by reducing stress on the hull, providing stability, improving propulsion and manoeuvrability, and compensating for weight lost due to fuel and water consumption. While it is essential for safe operations, discharge of ballast water can pose a risk to the receiving environment when discharged due to foreign marine species (e.g., bacteria and larvae) being carried in a ships' ballast water from one location to another when mobilising the drilling unit to site.	Ballast water is discharged subject to the requirements of the 2004 International Convention for the Control and Management of Ships' Ballast Water and Sediments. The Convention stipulates that all ships are required to implement a Ballast Water Management Plan and that all ships using ballast water exchange will do so at least 200 nautical miles (nm) ($\pm$ 370 km) from nearest land in waters of at least 200 m deep when



Discharge stream	Source	Discharge criteria
		arriving from a different marine region. 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 ($\pm$ 93 km) from the nearest land and preferably in water at least 200 m in depth. Project vessels must comply with this requirement.
Slops from vessel machinery spaces	Slops includes primarily bilge water (drainage water that collects in a ship's bilge space ³²) and possibly lab effluent, which can contain some oily and other contaminants from e.g. machinery onboard.	In accordance with MARPOL Annex I, bilge water will be retained on board until it can be discharged to an approved reception facility, unless it is treated by an approved oily water separator to <15 ppm oil content and monitored before discharge. The residue from the onboard oil/water separator will be treated / disposed of onshore at a licenced hazardous waste treatment facility. Bilge water is discharged in accordance with MARPOL 73/78 Annex I.
Deck drainage	Deck drainage consists of liquid waste resulting from rainfall, deck and equipment washing (using water and a water-based detergent). In areas of the drilling unit where oil contamination of rainwater is more likely (i.e. the rig floor), drainage is routed to an oil / water separator / the bilge for treatment before discharge in accordance with MARPOL Annex I (i.e. 15 ppm oil and grease maximum). There will be no discharge of free oil that could cause either a film, sheen or discolouration of the surface water or a sludge or emulsion to be deposited below the water's surface.	Only non-oily water (i.e. <15 ppm oil and grease, maximum instantaneous oil discharge monitor reading) will be discharged overboard. If separation facilities are not available (due to overload or maintenance) the drainage water will be retained on board until it can be discharged to an approved reception facility. The oily residue from the onboard oil / water separator will be treated / disposed of onshore at an approved hazardous waste treatment facility.
Brine	Seawater is desalinated on the drill ships for potable and other purposes. The waste stream from the desalination plant is brine (concentrated salt), which is produced in the reverse osmosis process. The brine stream contains high concentration of salts and other concentrated impurities that may be found in seawater. Water chemical agents will not be used in the treatment of seawater and therefore the brine is a natural salt in concentrated state. Approximately 35 g of salt for each litre of water produced will be discharged to sea.	None

³² The bilge is the lowest compartment on a ship, below the waterline, where the two sides meet at the keel



Discharge stream	Source	Discharge criteria
Food wastes	Food waste from the galley on vessels	The disposal into the sea of food waste is permitted, in terms of MARPOL Annex V, when it has been comminuted or ground to particle sizes smaller than 25 mm and the vessel is <i>en route</i> more than 3 nm (approximately 5.5 km) from land. Disposal overboard without macerating is permitted for moving vessels greater than 12 nm (approximately 22 km) from the coast. On the drilling units, all food waste will be macerated to particles sizes <25 mm.
Sewage and grey water	Discharges of sewage (or black water) and grey water (i.e. wastewater from the kitchen, washing and laundry activities and non-oily water used for cleaning) will occur from vessels intermittently throughout the project and will vary according to the number of persons on board.	Grey water may be discharged to sea (without treatment) providing no floating matter or sheen is observable. Black water will be treated onboard in accordance with MARPOL 73/78 Annex IV prior to discharge. Effluent to comply with the following criteria: • Biological Oxygen Demand (BOD) of <25 mg/l (if the treatment plant was installed after 1/1/2010) or <50 mg/l (if installed before this date) • Minimal residual chlorine concentration of 0.5 mg/l • No visible floating solids or oil and grease

5.2.7.2 Noise Emissions

The key sources of underwater noise during drilling are described below and are expected to result in variable sound levels, depending on the operational status at any one time:

- *Vessel propeller and positioning thrusters*: Noise from propellers and thrusters is predominately caused by cavitation around the blades whilst transiting at speed or operating thrusters under load to maintain a vessel's position. The noise produced by a drilling unit(s)' dynamic positioning systems can be audible for many kilometres. Noise produced is typically broadband noise, with some low tonal peaks. The supply vessels will also contribute to an overall propeller noise generation.
- *Well logging*: Some VSP will be undertaken to generate a high-resolution image of the geology in the well's immediate vicinity. VSP is described in Section 5.2.4.4.
- *Helicopter noise*: Underwater noise due to helicopters is limited, as broadband noise generated underwater by helicopters flying at altitudes of 150 m or more is expected to be ~109 dB re 1 µPa (Richardson et al. 2013) at the most-affected point, which is broadly in line with ambient levels and considerably less than underwater noise generated by vessels – it can thus be considered negligible in terms of the overall noise levels. Helicopter noise can significantly affect fauna out of water (e.g. on the coast).



5.2.7.3 Air Emissions

The principal sources of emissions to air from the proposed drilling activities will be from fuel combustion (see Section 5.2.6.3) and well flow testing (flaring), if any.

Typical combustion products from fuel combustion include sulphur oxides (SO_x), oxides of nitrogen (NO_x, N₂O), carbon dioxide (CO₂), carbon monoxide (CO), volatile organic compounds (VOC), Methane (CH₄), non-methane volatile organic compounds (NMVOC) and particulate matter (PM).

5.2.7.4 Light Emissions

Operational lighting will be required on the drilling units and supply vessels for safe operations and navigation purposes during the hours of darkness. Where feasible, operational lights will be shielded in such a way as to minimise their spill out to sea.

5.2.7.5 Waste Management

The operator is striving to reduce waste generation, increase reuse and recycling, and move away from landfilling and incineration without energy recovery (where technically and economically feasible). A Waste Management Plan will be developed which describes how the waste streams will be managed according to the framework principles. All the external waste management facilities will be assessed and approved prior to the start of drilling. Any export of waste streams will be organised in compliance with the Basel Convention.

Wastes (other than discharges to sea mentioned in Section 5.2.7) will be transported to shore for further treatment and disposal at appropriately licensed facilities. On vessels these waste streams will be segregated, packed, labelled and transported under a manifest to shore. In the port, the waste will be unloaded from the support vessel, checked and transported by a licensed waste contractor to the final treatment and disposal facilities.

If needed extra waste treatment (separation, sorting, shredding, compacting, etc.) will be carried out to optimise the reuse and recycling opportunities. Only the non-recyclable portion will be sent to a licenced waste management facility for final disposal.

Any bulk volumes of NADF remaining at the end of well drilling will either be shipped for onshore treatment and disposal through a licenced waste disposal company or re-used during any other drilling campaigns.

Waste types and management expected during drilling are summarised in Table 5-4. Waste treatment and disposal methods will be continuously assessed based on available techniques and facilities.

Table 5-4: Waste types and management associated with well drilling

Category	Waste Type	Treatment / destination
Non-hazardous	General domestic waste	Landfill
	Wood Paper Plastic Scrap metal	Recycling facilities
Hazardous	Oil rags and oil filters Used oil Batteries Medical waste Oil water (slops) Electric and electronic waste	Approved Hazardous waste treatment facilities
	Other (waste water, waste oil, etc.)	Approved Hazardous waste treatment facilities



5.2.8 Emergency Prevention and Response

5.2.8.1 Prevention

Although the probability of a well blow-out³³ is extremely low (global data maintained by Lloyds Register, cited in IOGP Report 434-02, indicates that frequency of a blowout from normal exploration wells is in the order of 1.4×10^{-4} per well drilled³⁴), it is a worst-case scenario that provides the greatest environmental risk during drilling operations. The operator will have a Blow-Out Contingency Plan (BOCP) in place that sets out its detailed response plan and intervention strategy, to be implemented in the unlikely event of a blow-out.

The primary safeguard against a blow-out is the column of **drilling fluid** in the well, which exerts hydrostatic pressure on the wellbore. Under normal drilling conditions, this pressure should balance or exceed the natural rock formation pressure to help prevent an influx of gas or other formation fluids. As the formation pressures increase, the density of the drilling fluid is increased to help maintain a safe margin and prevent an influx of formation fluids ("kicks" or "blow-outs"). However, if the density of the fluid becomes too heavy, the formation can break down and fracture. If drilling fluid is lost in the resultant fractures, a reduction of hydrostatic pressure occurs which can lead to an influx from a pressured formation. Therefore, maintaining the appropriate fluid density for the wellbore pressure regime is critical to safety and wellbore stability.

Abnormal formation pressures are detected by primary well control equipment, which generally consists of two sets of pit level indicators and return mud-flow indicators with one set manned by the drill crew and the other by the 'mud logger'. The 'mud logger' also has a return mud gas detector, which monitors return mud temperature and changes in shale density for abnormal pressure detection. The drilling fluid is also tested frequently during drilling operations and its composition can be adjusted to account for changing downhole conditions.

The likelihood of a blow-out is further minimised by installing a specially designed safety equipment called a **Blow-Out Preventer (BOP)** (see Figure 5-17), which is a secondary control system. BOPs contain a stack of independently operated cut-off mechanisms, so there is redundancy in case of failure, and the ability to work in all normal circumstances with the drill pipe in or out of the well bore. The BOP is installed on the wellhead (on the seabed) and is designed to close in the well to prevent the uncontrolled flow of hydrocarbons from the reservoir in case the pressure of the reservoir exceeds the pressure of the drilling fluid in the reservoir resulting in hydrocarbons entering the wellbore. If this cannot be controlled, hydrocarbons could eventually exit the wellbore into the marine environment / atmosphere. Hence, the BOP system plays a key role in preventing potential risks to people, the environment and equipment. The BOP will undergo a thorough inspection prior to installation and will be subsequently pressure and function tested on a regular basis during operations aligned with industry best practices.

³³ The uncontrolled release of crude oil and/or natural gas from a well after pressure control systems have failed and is the worst case in the loss of well control.

³⁴ This equates to $1.4 \times 10^{-4} \times 100 = 0.000014\%$, or one blow-out in approximately 7 143 wells drilled.



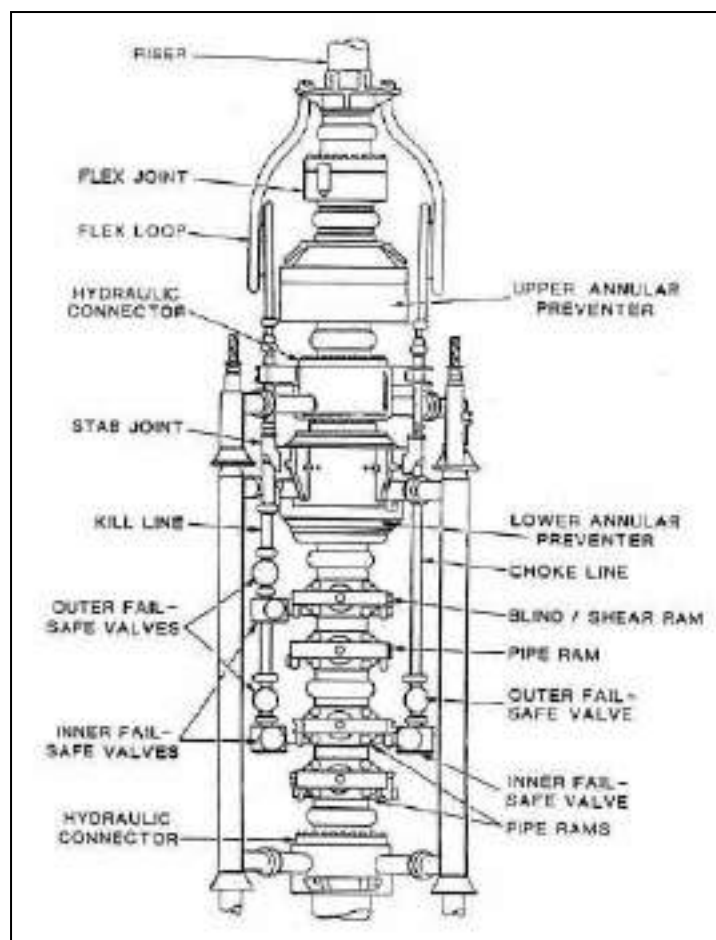


Figure 5-17: Schematic of a typical subsea BOP stack.

Source: CCA & CSM, 2001

The BOP stack usually consists of the following:

- *Annular preventer:* The annular-type blow-out preventer can close around the drill string, casing or a non-cylindrical object, such as a Kelly (i.e. a piece of equipment shaped like a pipe that is used in drilling). The drill pipe, including the larger-diameter tool joints (threaded connectors), can be "stripped" (i.e. moved vertically while pressure is contained below) through an annular preventer by careful control of the hydraulic closing pressure. Annular BOPs are typically located at the top of a BOP stack, with one or two annular preventers positioned above a series of several ram preventers.
- *Ram type preventers:* Ram type preventers are similar in operation to gate valves but use a pair of opposing steel plungers or rams. The rams extend toward the centre of the wellbore to restrict flow or retract open in order to permit flow. There are four common types of rams or ram blocks used in a BOP stack (or combination thereof):
 - o Pipe rams close around a drill pipe, restricting flow in the annulus (ring-shaped space between concentric objects) between the outside of the drill pipe and the wellbore, but do not obstruct flow within the drill pipe. Variable-bore pipe rams can accommodate tubing in a wider range of outside diameters than standard pipe rams, but typically with some loss of pressure capacity and longevity



- o Blind rams (also known as sealing rams), which have no openings for tubing, can close off the well when the well does not contain a drill string or other tubing and seal it
- o Shear rams cut through the drill string or casing with hardened steel shears
- o Blind shear rams (also known as shear seal rams or sealing shear rams) are intended to seal a wellbore, even when the bore is occupied by a drill string, by cutting through the drill string as the rams close off the well

In deeper offshore operations, there are several ways in which a BOP can be controlled, including (in order of priority):

- Electrical control signal, which is sent from the surface through a control cable (MUX cable). Functioning valves on the stack release high pressurised hydraulic fluid to function the rams or annulars. This method allows for multiple commands to be sent via a single conductor very rapidly.
- Acoustical control signal, which is sent from the surface via a modulated / encoded pulse of sound transmitted by an underwater transducer. This new technique allows for communication with the subsea BOP without the need of an umbilical.
- ROV intervention, which mechanically controls valves and provides hydraulic pressure to the stack (via “hot stab” panels).
- Emergency Disconnect System - in the event the rig loses communication with the subsea BOP, then the BOP will automatically close the blind shear rams. High pressurised hydraulic fluid (released from accumulator bottles) is used to engage the shear rams.
- Emergency Disconnect Package (EDP) - Lower Riser Package (LRP) systems are used in subsea well interventions to provide well control and safety. The EDP allows for quick disconnection in case of an emergency, while the LRP provides a secure connection between the riser and the subsea wellhead.
- A Rig BOP might be used for major well workovers or interventions that require heavy equipment and extensive well control measures.

5.2.8.2 Response

The operator also has access to multiple companies providing emergency response support. It is a member of Oil Spill Response Limited (OSRL), which provides the use of globally advanced capping stacks and other response equipment (e.g., dispersants, booms, and dispersant spray equipment including aircraft) in the event of a well blow-out. Capping stacks are designed to shut-in an uncontrolled subsea well in the unlikely event of a blow-out. OSRL has one of its 10K³⁵ capping stacks housed at its Saldanha Bay base on the West Coast of South Africa (see Figure 5-18). The capping stack is available for global mobilisation and transportation by sea and/or air in the event of an incident.

³⁵ 10 k refers to a pressure rating of 10 000 pounds force per square inch (psi).





Figure 5-18: Example of an Oil Spill Response Limited Capping Stack.

Source: <https://www.oilspillresponse.com/services/subsea-well-intervention-services/capping>

The **capping stack** would only be deployed in a situation where the BOP has failed to serve its purpose and a blow-out has occurred. It is a piece of equipment that is placed over the blown-out well as a “cap”. Its purpose is to stop or redirect the flow of hydrocarbons and to buy time for engineers to permanently seal the well. It weighs as much as 100 tonnes and requires co-ordinated logistical planning and execution in quickly transporting it to the emergency location.

Before a capping stack arrives, an ROV would be deployed to inspect the seabed site for engineers to confirm precisely what equipment is needed. Any debris would then be removed and the wellhead prepared. After the equipment arrives, the capping stack would be carefully manoeuvred into place over the wellhead. The stack’s valves would be closed to cap the well (“cap only”) or, if necessary, the flow will be redirected to surface vessels through flexible pipes and risers (“cap and flow”).

The mobilisation of these and other incident response equipment and services will be contained in the operator’s OSCP and BOCP.

Dispersants can play a role in managing oil spills from a blowout. Dispersants are chemical agents designed to break up oil spills into smaller droplets. This facilitates natural processes to degrade the oil (e.g. through) microbial degradation and reduces the likelihood of oil reaching the shore. Dispersants are either applied to oil on the sea surface (via spraying from airplanes or vessels) or subsurface (injected directly at the wellhead). Dispersants can also have negative environmental consequences, and their use must be carefully considered based on the specific circumstances of the spill, including the type of oil, sea conditions, and environmental sensitivities.

Physical barriers, such as containment booms, are also used both offshore and nearshore to contain oil spills. Floating barriers are deployed around a spill to prevent the surface oil from spreading from or to an area or redirect it to an area where it can be more easily collected. Once the oil is contained, skimmers are used to remove the oil from the water surface.



5.3 Facilities Installation and Commissioning

5.3.1 Description of the Subsea Production System

The subsea production system allows three-phase fluid (oil, water, and gas) to flow from the wellbore to the FPSO for processing and the produced gas to flow from the FPSO to the Gas Injection (GI) wells. The Venus subsea production system will be made up of a north section and a south section each with a production ring, an injection line, and an umbilical line (see Section 5.1.2).

5.3.1.1 Design Philosophy

The production subsea system will be designed to a pressure rating of 10 000 psi, which will withstand the full shut-in pressure from the production wells, and the gas injection components to withstand the highest required injection pressures.

For the subsea production network, thermal wet insulation is considered for both the flowline and riser systems to allow for safe arrival temperature in steady-state conditions (with respect to hydrates and wax formation prevention) and safe preservation management in case of a full field shutdown. No insulation is needed for the gas injection subsea lines, as the gas is treated and dehydrated on the FPSO prior to re-injection.

For all subsea structures, the piping, valves and other critical equipment (e.g. sensors) will be protected against dropped objects.

The design life of the subsea system components is 20 years. A design life does not indicate the pipeline and associated structure will be depleted, failure-prone, or require replacement after 20 years. For this project, the 20-year design life assumes the systems, components, and structures will perform their primary functions with acceptable safety, regulatory, and environmental performance, and will not experience large failures, require extensive replacements, or need significant repairs. In case of production lasting more than 20 years, technical assessment will be performed to ensure design life can be extended and, where necessary, mitigations will be put in place (upgrades, repairs, replacement, etc.)

Figure 5-19 shows a typical subsea system (not specific to Venus).

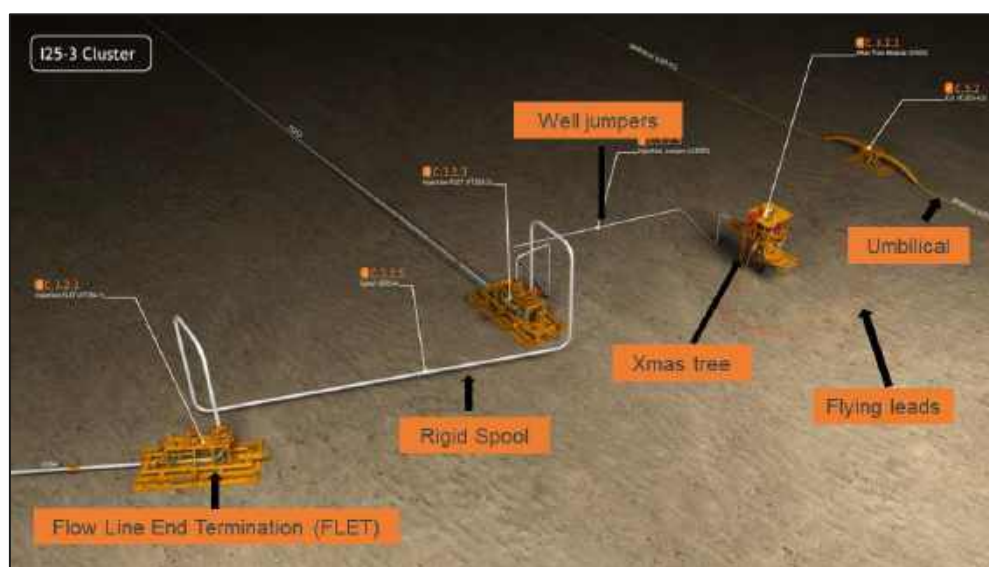


Figure 5-19: Example of a typical subsea system

Source: TotalEnergies



5.3.1.1 Production Network

Each of the production rings (north and south) will be made up of a flowline that connects the production wells. The 12-inch flowline will be made of carbon steel and wet insulation and configured in a loop to allow the circulation of dead oil in the event of a production shutdown and to perform pigging. The provisional layout of the production network is shown on Figure 5-1. The production rings will be approximately 60 km long.

A subsea Christmas tree (tree) positioned at the top of each well contains pressure control valves and chemical injection ports. The tree may also be equipped with instrumentation for pressure and temperature monitoring of the produced fluids. Each tree is approximately 5 m by 4 m by 4 m in size and weights approximately 50 tons.

In line tees (ILTs) and flowline end termination (FLETs) will be used along the flowlines to connect wells. These are subsea structures designed to attach the flowline end and are then lowered to the seabed in the desired orientation. A jumper (a short pipe connector) is then used to tie-in the ILT or FLET to other subsea structures (e.g., tree, manifold).

5.3.1.2 Gas Injection Network

The north and south sections will also each have a gas injection line. These lines will be 12" carbon steel. The gas injector wells will be connected through several ILTs / FLETs along the injection lines. The layout of the injector network is shown on Figure 5-1.

The injection wells would have the same architecture as production wells, including installation of a tree at the top of each well for pressure control, pressure and temperature monitoring. Each well has jumpers connecting the subsea tree to the ILT/FLET.

5.3.1.3 Umbilical

There will be two umbilical networks, one for each section (north / south). An umbilical is a bundled arrangement of tubing and electrical conductors in an armored sheath that is installed from the FPSO to the subsea production system equipment. The umbilicals supply electric and hydraulic power for wellhead or ILT/FLET control functions for the subsea production and safety equipment (tree, valves, etc.) as well as chemicals to suppress the formation of scale and hydrates in the production stream.

Dedicated tubes in an umbilical are used to monitor pressures and inject fluids (chemicals such as methanol) from the FPSO to critical areas within the subsea production equipment. The umbilical lines also carry bidirectional communications and control instructions between the FPSO, wellhead and downhole devices.

Each section umbilical will be made up of a dynamic umbilical plus static production and gas injection umbilicals (see Figure 5-10).

5.3.2 Installation of the Subsea Production System

5.3.2.1 General Approach

The installation of a subsea production system typically follows a specific sequence to ensure efficiency and safety. The likely order of installation is as follows:

1. Subsea mudmats are installed first to provide a foundation and structure for the rest of the equipment.
2. Flowlines are laid together with ILT and FLET, to connect the subsea wells to the production facility.
3. Umbilicals are installed to provide power, control, and communication between the subsea equipment and the surface facilities.



4. Xmas Trees are installed on the wellheads to control the future flow of oil and gas from the wells.
5. Risers are then installed to transport the produced fluids from the seabed to the surface facilities.
6. Jumpers are installed between ILT/FLET and Xmas trees.

The proposed installation phase is composed of two campaigns most likely to be planned during austral summer, when the weather and sea conditions are more favourable. The general intention in terms of planning is:

- During the 1st campaign/season, the flowlines and infrastructure will be laid, as well as umbilicals.
- During the 2nd installation campaign/season, the rest of flowlines will be laid, connected to each other and to the FPSO, which will arrive in the 2nd installation season. The remainder of the umbilicals will also be laid, connected to each other and to the FPSO.

Ensuring that subsea components are accurately placed on the seabed requires detailed surveys of the seabed, which have been conducted, and the use of various techniques and equipment, including:

- Installation vessels equipped with dynamic positioning system to maintain their position precisely over the installation site.
- ROVs equipped with cameras, sonar, and manipulator arms to assist in the precise placement and connection of subsea equipment.
- Acoustic Positioning Systems that use acoustic signals to determine the exact location of subsea equipment. Transponders are placed on the seabed and on the equipment, and the signals are used to triangulate the position with high accuracy.
- Pre-lay Guidance Systems for the installation of flowlines and umbilicals, using a combination of GPS, acoustic positioning, and ROVs to ensure the lines are laid along the predetermined path.

It is anticipated that the installation of the subsea equipment will require the following installation vessels:

- 1st campaign: J-Lay vessel, Flex-Lay vessel and Construction vessel
- 2nd campaign: J-Lay vessel, Flex-Lay vessel and two Construction vessels

A preliminary campaign, with only one Construction vessel, is planned prior to the two main campaigns, to pre-install transponders of the Acoustic Positioning Systems.

5.3.2.2 Flowline Laying

Flowlines will be laid by specialised installation vessels. On the flowline installation vessel, each pipe section will be welded to the preceding one. The welded joints will be visually inspected, and integrity tested using non-destructive testing techniques³⁶. The weld area will then be coated for protection with anti-corrosion material.

The flowlines will be installed using the J-lay method, which is used to install rigid pipelines in deep water. In a J-Lay system, pipe stems, consisting of up to six pipes with a total length of 72 m, are lifted and welded to the sea-going pipe in a nearly vertical slope.

³⁶ Non-Destructive Testing (NDT) will involve the use of radiography. The Project will follow standard industry practices to manage any workforce exposure to radiation sources.



The angle of the slope is set so that it is in line with the overhead of the pipe to the seabed. In this way, bending of the pipe is minimized. The J-Lay method is very suitable for deep water because the pipe leaves the laying system in a nearly vertical position and the flowline is bent only once during installation (on the seabed) (Wermac, n.d.) (see Figure 5-20). The flowlines will be laid directly on the seabed and will not be trenched; FLET and ILT are laid together with the flowline.

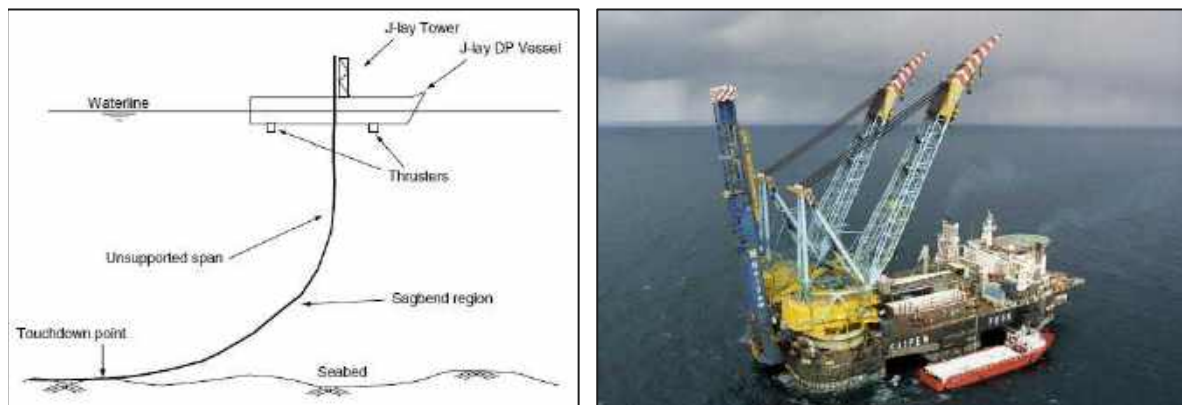


Figure 5-20: J-lay pipeline installation method and vessel example

Source: (Wermac, n.d.)

During the offshore installation campaigns, the pipe-lay operation will be continuous, with the vessel moving progressively forward as sections of the pipe are welded, inspected, coated on board and then deployed to the seabed. The vessel will be held in position by dynamic positioning. Weather permitting, pipeline sections or structures will be delivered to the installation vessel by supply vessels. If not possible, the installation vessel will depart the Venus field to load line pipes and structures in sheltered area.

5.3.2.3 Installation of Other Subsea Equipment

Other components of the subsea production system, such as Xmas trees, jumpers, etc will be installed using crane from a construction vessel. The subsea components will be tested to verify integrity after installation, and subsea protection will be installed where required.





Figure 5-21: Example of a subsea construction vessel

Source: Boskalis

Umbilicals are installed by Flex-lay vessel (see Figure 5-22) which has a dynamic positioning system to maintain precise positioning during installation, specialized lay systems such as carousels or reels to store and deploy the umbilicals, ROVs and cranes to assist in the installation and connection of umbilicals and advanced monitoring and control systems ensure the umbilicals are laid accurately and safely.



Figure 5-22: Example of a flex-lay vessel

Source: (Johnson & Collins, 2020)

5.3.3 FPSO

5.3.3.1 Description of the FPSO

A floating production storage and offloading (FPSO) unit will be used for production and processing of produced fluids and storage of produced oil until it can be offloaded. This will allow oil production without construction of pipeline to onshore facilities.



The FPSO facility will be designed and constructed primarily to perform the following functions:

- Maintain safety and welfare of all personal on board
- Ensure facilities availability is kept at design target
- Provide power and all other utilities required to perform functions of FPSO
- Minimise release of hydrocarbons, release of Green House Gas (GHG) and impact on the environment
- Receive produced fluids from the fields
- Process the produced fluids to required specifications
- Store processed crude oil
- Offload processed crude oil
- Process produced water and discharge overboard within the specified hydrocarbons limits
- Inject produced gas back to reservoir

The FPSO facility design and construction will follow the selected Classification Society's rules for FPSOs and will comply with applicable international maritime conventions, industry codes and standards, relevant local laws and regulations, and other requirements of the selected Flag state as applicable.

The FPSO is custom-built for the Venus Project and key features are summarised in Table 5-5.

Table 5-5: Key FPSO characteristics

Aspect	Design characteristic
Production capacity	160 000 barrels per day of oil
Produced water treatment capacity	15 000 barrels/day
Gas separation capacity	550 MMscfd
Storage capacity	About 2 million barrels
Power generation capacity	Three open cycle high-efficiency gas turbines plus one spare with WHRU Powered by approx. 15 MMscfd of the produced gas High availability target of 95%
Crew capacity	~160 personnel
Mooring	18 mooring lines (polyester ropes with short chain sections at the end) each 2.7 km long Suction pile anchors or Vertical Load Anchors (VLA) Designed for 100-year Return Period Metocean condition

Separate areas would be identified for power generation and electrical room, laydown and chemical storage, oil treatment, and gas treatment and compression (see Figure 5-23).



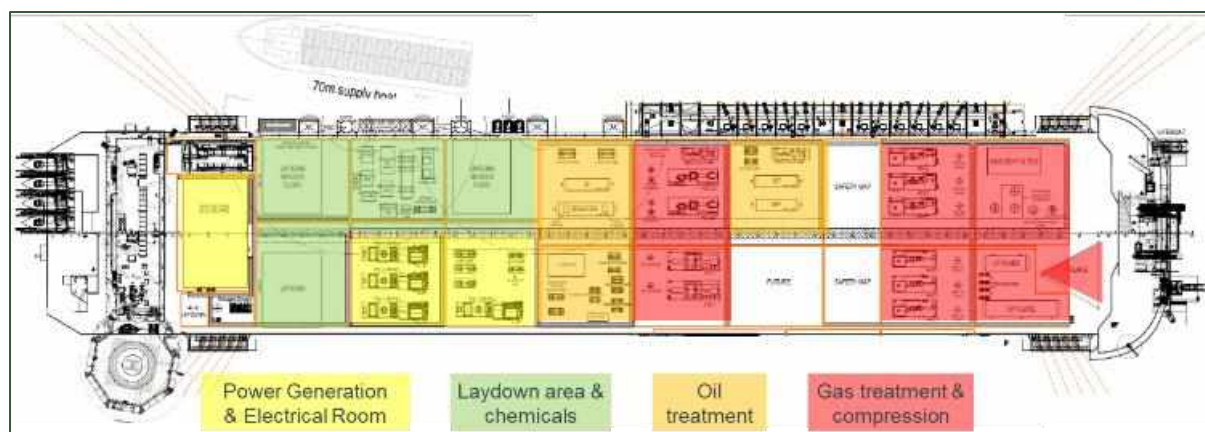


Figure 5-23: Potential FPSO layout (example only)

The FPSO will be spread moored (moored by mooring lines connected to anchors from the four corners of the vessel) in a four-group arrangement to maintain the vessel in a fixed wave-facing orientation.

Six rigid risers that transport products to and from the vessel will be suspended from a single riser bay on the west side of the vessel. The risers' Touch Down Point (TDP) will be ~3 km from the FPSO. Laydown area and cranes will be located on the west side at a minimum safe distance of the risers. Living quarters will be located upwind.

The FPSO topsides design uses an interconnected module concept where process equipment is packaged in modules. The design concept maximises pre-commissioning and functional testing of the modules prior to arrival offshore Namibia.

The FPSO has been designed to reduce the carbon footprint to the extent practicable (see Section 5.6).

Safety systems on the FPSO will include the following:

- Fire-fighting system
- Fire and gas detection systems: These include fire and smoke detectors located throughout the topsides and living quarters and wired centrally with alarms sounding in the central control room, which will activate the general alarm system on the FPSO. Gas detectors are placed in areas where gas might be released or could accumulate.
- Blanket gas generation: To prevent fires, the cargo tanks will normally be blanketed with hydrocarbon gas that is supplied from the fuel gas system. The inert gas generator is only used to blanket the tanks if the fuel gas system is offline or prior to tank entry. Other spaces, including the methanol tanks, will be blanketed by nitrogen, which is produced by routing compressed air through the nitrogen membrane package.
- Lifeboats and life rafts: Freefall lifeboats will be placed at the aft of the FPSO. A fast rescue boat will also be provided, complete with a launching and retrieving system. Life rafts with escape chutes systems are provided at fore and aft.

5.3.3.2 Installation of the FPSO

The FPSO will be constructed outside of Namibia and towed to the final location. The FPSO will arrive for installation, hook-up, and commissioning fully fabricated and preassembled.

The FPSO orientation heading is anticipated as 40 / 45 degrees from the North. The heading of the FPSO (see Figure 5-24) for the spread moored solution is based on:



- The waves direction: to limit the waves effect on the FPSO hull (fatigue), the FPSO heading must be aligned (as far as possible) with the waves prevailing direction.
- The wind and current directions: that may influence approach and station keeping of the DPST during offloading operations.

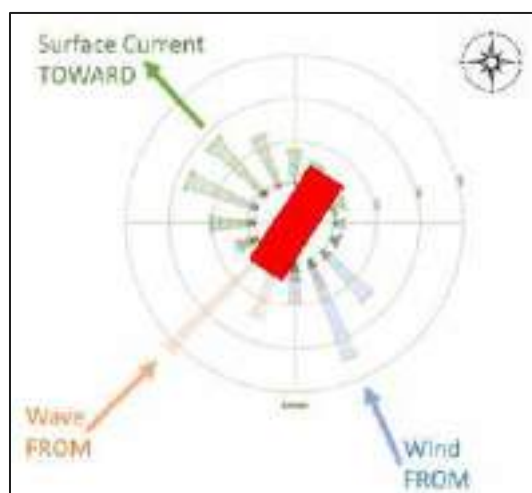


Figure 5-24: Illustration of FPSO heading

The FPSO's 18 anchors (suction piles or vertical load anchor) and mooring lines ensure the FPSO remains securely moored in place even in challenging deep water environments. Engineering is performed taking into account seabed characteristics and metocean data.

Anchors and mooring lines are installed before the FPSO arrives. Anchors are transported to site on installation vessels equipped with heavy lifting cranes and specialized equipment to handle the anchors. Example of suction piles are shown in Figure 5-25 and the installation process of suction piles is shown in Figure 5-26.

The installation process is closely monitored using ROVs and/or subsea sensors. The data is transmitted to the surface vessel, where operators can make real-time adjustments to ensure proper installation.

Mooring lines are connected to the installed anchors using subsea connectors or shackles. The mooring lines are deployed from the installation vessels and laid out along the seabed.

When the FPSO arrives at the site, the mooring lines are recovered by surface vessel using winch and ROVs. The FPSO is hooked up to the pre-installed mooring lines. Typically, four tugs are required for the hook-up operations to hold FPSO position on site, while an installation vessel is used to ensure the connection of the chains with the FPSO and the appropriate tensioning through the in-line tensioner.

After hook-up of the mooring lines to the FPSO, risers are connected.

It is anticipated that FPSO installation will require the following vessels during part of the austral summer installation campaigns:

- One installation vessel (equipped with heavy lifting crane) to install mooring lines
- One installation vessel (equipped with heavy lifting crane) for FPSO hook-up
- Four ocean-going tugs for 3 weeks for FPSO hook-up





Figure 5-25: Example of a suction pile

Source: (Wikipedia, 2024)

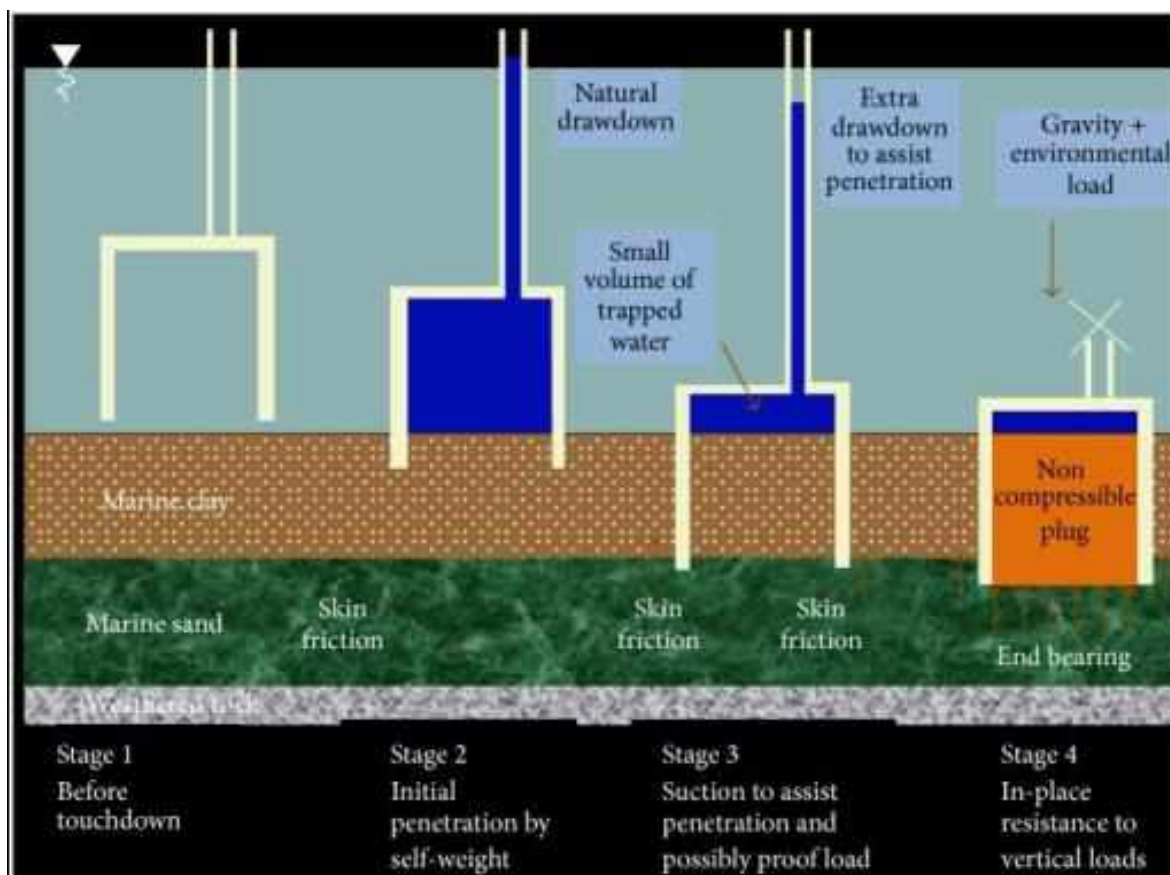


Figure 5-26: Process to install a suction pile

Source: (Wikipedia, 2024)



5.3.3.3 Commissioning and Start-up of the FPSO

Commissioning will consist in a comprehensive series of dynamic and energized checks and tests to be carried out in order to demonstrate and ensure that the facilities are ready to operate safely and steadily in compliance with project specifications.

Commissioning phase will include four main types of activity:

- Preliminary checks to ensure that the construction and mechanical completion works are completed and documented.
- Functional tests to prove that each plant elementary function performs properly.
- Piping and vessels preparations of the pipe work to prove tightness and ability to receive live fluids safely (such as piping drying-out, process leak testing and inerting, or loading of various chemicals).
- Operational tests to prove the readiness of the equipment for continuous operation by running them during a significant period of time.

The commissioning will be validated upon successful completion of all these activities, including if required, the operational tests with hydrocarbons and hazardous material to allow start-up activities during which "Utility" and "Process" packages and equipment are gradually put into service.

Gas compression commissioning activities will require start-up flaring when performing each compression unit operational test. Limited additional start-up flaring may also occur during final complete start-up and other tests (ESD, etc.).

5.3.4 Commissioning of Flowlines

Once laid on the seabed, and to prevent corrosion and inhibit bacteria growth, flowlines will be chemically treated from a subsea pigging unit. At this stage, the production and gas injection flowlines and risers will be gauged, cleaned and hydrostatically tested with this chemically treated sea water.

Once connected to the FPSO, the flowlines will be tested to a minimum of 125% of the design pressure for a minimum of 24 hrs.

The gas injection flowlines will be dewatered through up to 2 off pig runs:

- For the two gas injection lines, the entire volume will be discharged at seabed level for each of the up to two dewatering runs
- Discharge will be done for one flowline first, then for the second flowline a few weeks later, at flowline end.

As the production lines are a closed-loop system, the commissioning fluid in the production lines will be returned to the FPSO, treated by the FPSO process system, and either discharged or sent for storage in the FPSO ballasting tanks.

5.3.5 Nearshore Transshipment

Due to metocean conditions in the Venus area, Dynamically Positioning Shuttle Tankers (DPST) will be used to offload the oil from the FPSO. After loading the oil from the FPSO, the DPST will sail to a nearshore transshipment location. There it will connect to a conventional tanker that is moored at a dedicated mooring buoy. The DPST will then transfer the oil to the conventional tanker. The conventional tanker will then take the oil from the nearshore area to its final destination.

The nearshore area is being selected based on metocean information and criteria such as:

- Availability of a sheltered area to allow safe approach and mooring



- Safety of location to allow for pilot and surveyor boarding of vessels
- Water depth of 28 m to 40 m to install a mooring buoy and allow access of the required vessels
- Availability of sufficient space to allow tug assistance for manoeuvring, flexible hose connections and oil transfer

A mooring buoy will be installed at the transshipment area.

The transshipment area will likely be located in coastal waters near Walvis Bay, some 5 to 10 km from the coast (at a depth of ~30 to 40 m). Locations closer to Lüderitz have also been assessed.

5.3.6 Resource Requirements

5.3.6.1 Personnel

During this phase, the majority of the workforce will comprise highly specialised skilled staff on the installation and support vessels. At peak, it is estimated that up to 1 000 personnel will be working offshore at the same time notably during the two austral summers periods over 2 years when installation activities will mainly take place.

Onshore logistics will be mainly provided from Lüderitz (which is closest) and Walvis Bay (where main construction facilities are located).

5.3.6.2 Water

Most vessels involved in the installation activities will assure their own freshwater supply produced directly offshore. Specific activities, for example FPSO commissioning activities such as leak test or process safety test may require *ad hoc* quantity of fresh water which may not be able to be produced directly offshore. For these activities, freshwater could be sourced from onshore providers and transported to the Venus field by supply vessels. Smaller vessels may also need to source freshwater from shore.

5.3.6.3 Fuel

Low sulphur (0.5%/50ppm) Marine Gas Oil (MGO) will be used as fuel for all vessels. Fuel will preferentially be obtained locally and transported to the installation vessels by the supply vessels. Jet-A1 fuel will be used for helicopters.

5.3.7 Discharges, Emissions and Wastes

5.3.7.1 Discharges to Sea

All vessels will have equipment, systems and protocols in place for prevention of pollution by oil, sewage and garbage in accordance with international MARPOL requirements. In the unlikely event of a spill, it would be managed by an Oil Spill Contingency Plan (OSCP) that the Operator will be required to compile and share with government prior to activity. Onshore licenced waste disposal sites and waste management facilities will be identified, verified and approved prior to commencement of installation operations.

Anticipated sources of discharges to sea are summarised in Table 5-6.



Table 5-6: Estimated sources of anticipated discharges to sea from project utilities installation and commissioning

Discharge stream	Source	Discharge criteria
From installation and commissioning-related activities		
Production lines Hydrostatic test and dewatering	Filling production lines with treated seawater up to 1.2 times of flowline volume, which equates to 20% of volume at seabed	None
	Production lines are a closed-loop system, and the hydrostatic testing fluid in the production lines will be returned to the FPSO, treated, and then discharged overboard.	Water with maximum 15mg/L Oil content
Gas Injection lines Hydrostatic test and dewatering – release directly to sea	Filling injection lines with treated seawater up to 1.2 times of flowline volume, which equates to 20% of volume at seabed Thereafter another two times full volume at seabed using a combination of MEG (15 m ³) and methanol (5 m ³) per flowline, with release spread over several weeks Hydrotest fluid contains a combined biocide (< 500 ppm), oxygen scavenger (< 100 ppm), dye at 100 ppm, and methanol or ethylene glycol.	None
Umbilical commissioning	Umbilicals filled with 50% MEG and 50% freshwater	None
From FPSO		
Ballast water	For transit, FPSO will comply with IMO Ballast Water Management Convention. On site, FPSO remaining always at same location, no ballast water treatment is applied.	As per Table 5-3
Oily water from vessel machinery spaces	Oily bilge water from machinery space are discharge only in compliance with IMO MARPOL Annex I	The bilge water is treated and only water with oil content below 15 mg/l is sent overboard. Alternatively, bilge water is transfer to FPSO slops tanks for further treatment.
Deck drainage	Drains on deck are segregated between non-hazardous and hazardous open drains. In case of heavy rains, the design shall ensure that only water is released overboard. Greasy water is transferred to hull slop tanks for further treatment.	As per Table 5-3 After treatment, water with maximul oil content 15mg/L is rejected overboard.
Cooling water	Temperature increase is controlled to ensure the hot water rejected will not harm the environment	As per Table 5-3
Brine	Seawater is desalinated on the FPSO for potable and other purposes. The brine stream contains high concentration of salts and other concentrated impurities that may be found in seawater. Approximately 35 g of	None



Discharge stream	Source	Discharge criteria
	salt for each litre of water produced will be discharged to sea	
Food wastes	Food waste from the galley	The disposal into the sea of food waste is permitted, in terms of MARPOL Annex V, when it has been comminuted or ground to particle sizes smaller than 25 mm and the offshore platform is located more than 12 nm from nearest land.
Sewage and grey water	Discharges of sewage (or black water) and grey water (i.e. wastewater from the kitchen, washing and laundry activities and non-oily water used for cleaning) will occur intermittently throughout the project and will vary according to the number of persons on board.	Grey water may be discharged to sea (without treatment) providing no floating matter or sheen is observable. Only environmental friendly cleaning products are used to limit impact to the environment. Black water will be treated onboard in accordance with MARPOL 73/78 Annex IV prior to discharge. Effluent to comply with the following criteria: • Biological Oxygen Demand (BOD) of <25 mg/l • Minimal residual chlorine concentration of 0.5 mg/l • No visible floating solids or oil and grease

5.3.7.2 Noise Emissions

Vessel engines are the key noise sources anticipated for the installation and commissioning phase.

5.3.7.3 Air Emissions

The principal sources of emissions to air during installation and commissioning will be from fuel combustion (see Section 5.2.7.3).

5.3.7.1 Light Emissions

Operational lighting will be required on the vessels for safe operations and navigation purposes during the hours of darkness. Where feasible, operational lights will be shielded in such a way as to minimise their spill out to sea.

5.3.7.2 Waste Management

Notes in Section 5.2.7.5 also refer. Waste types and management expected during installation and commissioning are summarised in Table 5-7.



Table 5-7: Waste types and management associated with installation and commissioning

Category	Waste Type	Treatment / destination
Non-hazardous	General domestic waste and recyclables	Landfill
Hazardous	Oil rags and oil filters, used oil, batteries, medical waste, oil water (sludge), electric and electronic waste	Hazardous waste treatment facilities

5.3.8 Emergency Prevention and Response

All vessels will have equipment, systems and protocols in place for prevention of pollution by oil, sewage and garbage in accordance with international MARPOL requirements. Any vessel oil spill related discharges would be managed by an Oil Spill Contingency Plan (OSCP) that the Operator will be required to compile and share with government prior to installation and commissioning activities.

All vessel owners will have emergency procedures in place identifying accident scenarios and responses.

Specific coordination documents will be established between the various vessels and operators to define role and responsibilities in event of emergency.

5.4 Production

5.4.1 Production Profile

Oil production will be the highest in the first years, during the “plateau” period. The FPSO design capacity is planned at 160 kbopd, which will be the max possible rate per day (average per day will be lower considering an expected operating efficiency of circa 95%, i.e. an average daily production rate of circa 150 kbopd). Production will progressively decline thereafter for the remaining life of the field.

Similarly, the amount of gas produced will be constrained by the FPSO design capacity (planned at 550 MMscfd), but the maximum gas rate (taking into account operational efficiency) is expected to be reached after few years and then sustained at this level through the life of the field. All gas, less the amount used for powering the FPSO (circa 15MMscfd), will be reinjected.

5.4.2 Subsea Production System Operation and Maintenance

The flowlines will be protected by a high integrity polyethylene coating together with a sacrificial anode cathodic protection system.

Corrosion inhibitor, methanol, scale inhibitor and water-based hydraulic fluid will be added to the production stream via the umbilicals before it passes through the pipelines to minimise internal corrosion.

Leak detection is monitored by several methods, including alerts for high and low pressure, temperature and/or flow. Pipeline and associated subsea equipment will be externally visually inspected with ROV typically every 3 years. In-line inspection with intelligent pigging will be performed typically every 5 years. Cathodic protection system efficiency will be monitored on a daily basis and subsea measurement shall be done by ROV typically every 9 years.

Pigging of flowlines will be as follows:



- Production loops – permanent pig traps installed topsides to allow bidirectional operational pigging for cleaning and intelligent pigging for inspection
- Gas injection lines – no permanent pigging facilities but provision and space to install temporary pig traps (subsea receiver and/or topsides launcher)

5.4.3 Processing on the FPSO

Key processes that will take place on the FPSO during production are summarised below.

Oil / water / gas separation: An inlet manifold will be in place to receive produced fluid from the reservoir (consisting of oil, gas, and water) via the production flowlines and risers, and to route the fluid to the FPSO processing facilities. In first stage separator (HP separator) and test separator, the produced fluid will be separated into liquid and gas. The liquid will then be sent to subsequent separators. Separated (“produced”) water will be sent to decanting and water polishing tanks to allow water separation and treatment so it can be rejected to sea at a maximum rate of 15 mg/l of oil in water. Final crude oil from the separation / stabilisation process will be sent to the crude oil storage tanks in the FPSO hull ready to be offloaded.

Gas processing: The purpose of the FPSO gas-processing system is to condition the associated produced gas to the appropriate specification prior to re-injection into the reservoir. The gas-processing system will consist of the following subsystems:

- Flash gas compressor – recovers and compresses flash gas from the medium-pressure (MP) separator, low-pressure (LP) separator and low-low-pressure (LLP) to be mixed with the gas from the high-pressure (HP) separator.
- Gas dehydration – removes water vapor from gas to prevent hydrate formation in the gas injection systems where HP gas will cool to seabed temperatures.
- High-pressure (HP) gas compression – compresses dehydrated gas from the HP separator and test separators and the flash gas compressor to an inter-stage pressure.
- Fuel gas – provides fuel gas to all electrical power generation gas turbines and all other LP gas users (pressure control of vessels, etc.).
- Injection gas (GI) compression – compresses discharge gas from the HP gas compressors to an appropriate pressure level where it can be re-injected into the reservoir. The GI re-injection gas is routed to the gas injection risers and then directed to the subsea injection wells.

Any produced gas (other than what is consumed as fuel / utility gas on the FPSO) will be re-injected back into the reservoir; no continuous operational flaring will be permitted.

During equipment maintenance and process upsets, including start-up and shutdown scenarios, part or all of the off-gas from the separation / stabilisation process may be sent to the High Pressure (HP) or Low Pressure (LP) flare systems. Flaring could be temporary and non-routine.

Produced water treatment: The produced water treatment system will be designed to collect produced water from process facilities and treat the water for discharge overboard via a dedicated caisson. Dispersed oil in water content will be no higher than 15 mg/l, which is more stringent target than that of the OSPAR Recommendation 2001/1 (amended by 2006/4 and 2011/8). An online oil in water monitoring system will be in place to ensure specification is met.

Key FPSO utility systems are summarised below.

Process cooling: Cooling of process streams via a closed-loop, water-based cooling medium system is required to dissipate heat generated by the oil and water treatment systems, compression systems, and miscellaneous utility systems. The seawater lift system



will supply the required seawater for cooling the cooling medium closed-loop. Process hydrocarbon fluids will not come into contact with this seawater. While the lifted seawater will be discharged after heat exchange with the cooling medium closed-loop. There will be no routine discharge of cooling medium.

Process heating: A process heating system is required as part of the crude oil treatment process to achieve the required crude oil specifications. A closed-loop, water-based heating medium system will be used to add heat to the incoming production stream. Waste heat from the power generation system will be used as the source of heat.

Flaring system: A closed flare system, also known as a Flare Gas Recovery System (FGRS), will be designed and employed to ensure there is no continuous operational flaring. Re-injection of produced gas will be carried out under routine conditions.

A flare system will also be in place for the collection and safe disposition of produced hydrocarbon gases during emergency process upsets (compressor trips, facility shutdown, inventory blowdown). Start-up of the FPSO is a critical period due to the unavailability of the compression chain, where the availability of the flare system will be required.

Topsides and subsea chemical injection: The FPSO will have storage and injection facilities to inject the required amounts of chemicals and methanol into the production fluids to support production operations, both for subsea chemical injection requirements and for topsides chemical injection requirements.

Air: An air compression system will be provided to supply hull and topsides equipment. Compressed air is required primarily for the operation of control valves and other process instrumentation requirements.

Nitrogen: Instrument air will feed the nitrogen generation system. Nitrogen will be provided as required for purging, inerting, and blanketing, and as required for miscellaneous utilities.

Drains: The topsides will be equipped with the following drain systems:

- Closed drain system – used to collect drain fluids from large hydrocarbon vessels and high-pressure gas vessels and route them back into the process.
- Open drain system – used to collect spillage, overflow, washdown from equipment and rain / deluge water. Consists of:
 - o Hazardous open drains – used to collect drain fluids (e.g. oil contaminated waters) from hydrocarbon areas and route them to the slop tank in FPSO hull.
 - o Non-hazardous open drains – used to collect drain fluids (e.g. rainwater) from non-hydrocarbon areas and route them to the slop tank in the FPSO hull or directly overboard in case of excessive drain rates.

The oil and water in the slop tank will be gravity-separated by a minimum residence and retention time. Once separated, the oil will be skimmed off the top and sent to the cargo tanks and the water will be discharged overboard to residual oil and grease in water discharge specifications. Overboard discharge of oily water streams from the FPSO hull will be in line with MARPOL 73/78 Annex I (oil in water content < 15 mg/l).

Other utility systems: A minimum of two deck cranes will be provided for supply boat offloading and materials handling and to support general maintenance activities. Workshops, a laboratory capable of checking the properties of the produced and injection fluids as well as select discharges for compliance, a medical facility, and a storage facility for supplies and spare parts will also be provided. Heating, ventilation, and air conditioning systems will be provided for buildings and enclosures.

Integrated Control and Safety System (ICSS): Monitoring and control of the FPSO production operations will be performed by an ICSS. Located in the main control room of the FPSO, the ICSS will include process shutdown, emergency shutdown, and fire and gas



systems to protect the facilities and personnel. These systems will interface with a public address and general alarm system to provide distinct audible and visual alarm notification. The ICSS includes the following subsystems:

- Process Control System (PCS) – will perform primary process control, monitoring, and data acquisition functions
- Safety Instrumented System (SIS) – will implement functions for abandoning the host facility, emergency shutdown, fire and gas detection, and process shutdown. Also included in the SIS will be a shutdown function for the subsea control / safety system. The SIS will provide detection, logic sequencing, and actuation of devices to place the facility in a safe state.
- Alarm management system
- Operator graphics / consoles
- Third-party interfaces to packaged systems (such as compressors, subsea, marine, etc.).

Communication systems: Telecommunications equipment will be installed on the FPSO to enable safe operation of the facilities in normal and emergency conditions. This equipment will allow communication with the shorebase, support vessels, helicopters, DPST, as well as communication within the FPSO.

5.4.4 Transfer and Transport of Produced Fluids

Due to the challenging weather and sea conditions in the offshore Venus field, the produced oil will first be offloaded from the FPSO to a Dynamic Positioned Shuttle Tanker (DPST), which provides a more secure connection with the FPSO, and then to Conventional Tankers (CT) in a sheltered nearshore area. In fact, a DPST has more ability to keep its position whatever the weather conditions are than a Conventional Tanker (CT); this is why it is called Dynamic Positioned (DP) tanker. It is safer and it is a mitigation to the risk of a conventional tanker collision with FPSO due to bad weather conditions for example. This methodology is commonly used in areas with challenging weather conditions – such as North Sea and Brazil for example.

5.4.4.1 Offshore Transfer from FPSO to Shuttle Tanker

The DPST is equipped with a bow loading arrangement. This ensures a safe connection between the DPST and FPSO in case of ship's motions due to potential challenging metocean conditions on Venus site (see Figure 5-27).

Connection between the FPSO and DPST is made during daytime. The offloading of ~1 million barrels (~160 000 m³) load takes ~24 hours.

Automated systems and continuous visual watch are used to identify potential disconnection during transfer, including at night with proper lighting.



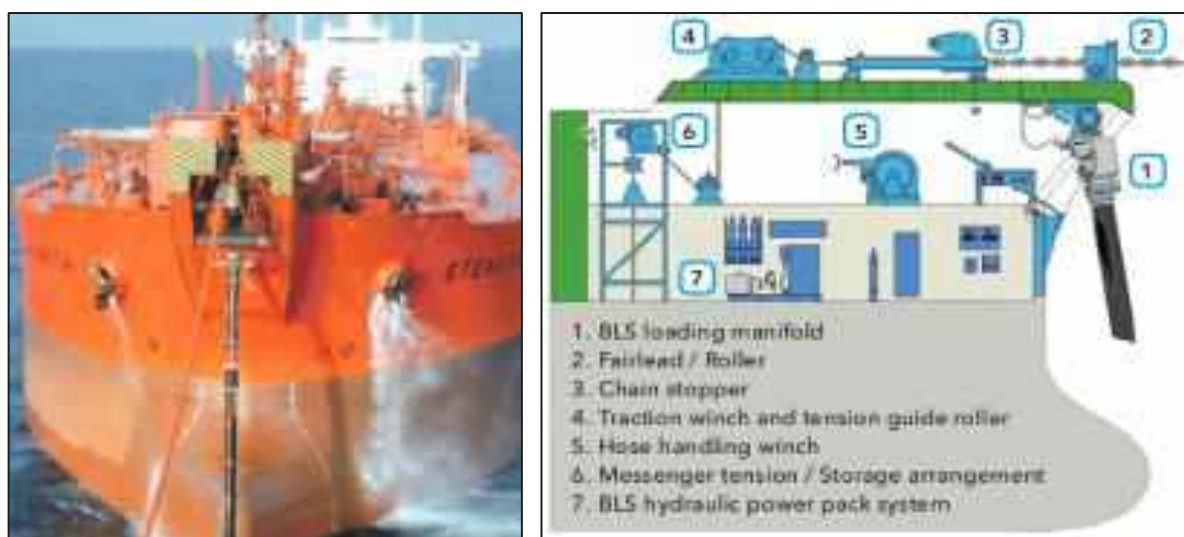


Figure 5-27: DPST bow loading arrangement

In the early production period, two dedicated DPSTs will rotate between the FPSO at the Venus field and the nearshore transfer area. At peak operations, it is expected that one transfer between the FPSO, DPST and conventional tanker will take place per week. After some years, when production reduces, one dedicated DPST will be used. The DPST remains in Namibian Exclusive Economic Zone (EEZ) water at all times.

5.4.4.2 Nearshore transshipment from Shuttle Tanker to Conventional Tanker

After offloading the oil from the FPSO, the DPST will transit to a nearshore area to transfer the oil to a conventional tanker.

Conventional tankers will typically arrive anywhere from 1 day to several hours ahead of the scheduled loading time, as a function of weather and ocean conditions. To accommodate these vessels, a mooring buoy will be established at the selected nearshore area. When the tanker is ready to approach, a mooring master will board the conventional tanker to guide the conventional tanker to the floating terminal and to support the connection and offloading operation.

Once both vessels have arrived at the transshipment area and either the DPST or the conventional tanker is secured to the mooring buoy, the DPST will transfer oil directly to the conventional tanker. Tug support will be required during operations for mooring and hose connections (see Figure 5-28). A stand-by tug may be required to ensure safety of the terminal.

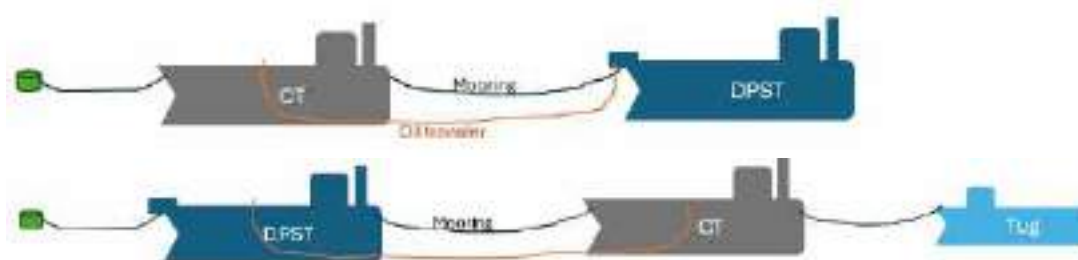


Figure 5-28: Possible configurations for transfer from DPST to CT

Connection between the DPST and the conventional tanker is made during daytime. The transfer of ~1 million barrel load takes ~24 hours. Automated systems and continuous visual



watch are used to identify potential disconnection during transfer, including during night with proper lighting.

Conventional tankers will be owned/operated by others and will not be dedicated to the Project, but must comply with international design requirements, such as a double-hulled design. Conventional tankers calling the terminal will be approved by TotalEnergies Vetting department.

5.4.5 Resource Requirements

5.4.5.1 Personnel

The production phase is estimated to generate some 600 direct jobs:

- Maximum FPSO crew capacity of 160
- Crew on support vessels, including DPST
- Onshore support

The majority of the workforce will comprise highly specialised skilled staff on the FPSO and support vessels.

The use of local labour will be prioritised whenever possible.

Transportation of personnel to the FPSO will be by helicopter, through an estimated 3 to 4 helicopter trips per week between the FPSO and the helicopter support base, most from likely Lüderitz.

Onshore project support staff will be either based in Windhoek and at the onshore logistics support base.

5.4.5.2 Water

During production, the FPSO will use freshwater produced onboard the FPSO via seawater desalination.

5.4.5.3 Fuel

The FPSO will be powered by a portion of the produced gas. Low sulphur (0.5%/50ppm) Marine Gas Oil (MGO) will be used for the DPST. Fuel will preferentially be obtained locally and transported to the installation vessels by the supply vessels.

5.4.6 Discharges, Emissions and Wastes

5.4.6.1 Discharges to Sea

All vessels will have equipment, systems and protocols in place for prevention of pollution by oil, sewage and garbage in accordance with international MARPOL requirements. Any oil spill related discharges would be managed by an Oil Spill Contingency Plan (OSCP) that the Operator will be required to compile and share with government prior to activities. Onshore licenced waste disposal sites and waste management facilities will be identified, verified and approved prior to commencement of production operations.

Anticipated sources of discharges to sea are summarised in Table 5-8.



Table 5-8: Estimated sources of anticipated discharges to sea

Discharge stream	Source	Discharge criteria
Produced water ³⁷	Project generates very little produced water as the resource has a low water content. Contains oil and grease and residual production and water treatment chemicals Discharged at increased temperature of 45°C at point of discharge.	Less than 15 mg/l hydrocarbon content (TPH, Total Petroleum Hydrocarbon) IFC guideline – temperature rise <3°C at 100 m from discharge point
Hydraulic fluid (water soluble and low toxicity)	Control system process and subsea system	None
	BOP system testing	None
Bilge from vessel machinery spaces	As per Table 5-6	As per Table 5-6
Deck drainage	As per Table 5-6	As per Table 5-6
Cooling water	As per Table 5-6	As per Table 5-6
Brine	Seawater is desalinated on the FPSO and for potable and other purposes. The brine stream contains high concentration of salts and other concentrated impurities that may be found in seawater.	None
Food wastes	Food waste from the galley on the FPSO and support vessels	As per Table 5-6
Sewage and grey water	Discharges related to crew on the FPSO and other project vessels	As per Table 5-6

5.4.6.2 Noise Emissions

Vessel engines are the key noise sources anticipated for the production phase.

5.4.6.3 Air Emissions

The principal sources of emissions to air from production and operations activities will be from:

- Fuel combustion (see Section 5.4.5.3)
- Emergency / abnormal operations flaring during start-up and process upsets (routine operational flaring not permitted)
- Fugitive emissions and small-scale venting discharges

Emissions from visiting oil tankers are outside the scope of this assessment as these vessels are not owned or controlled by the Operator.

³⁷ Produced water is a sometimes large corrosive byproduct to oil and gas processing on floating production installations that generally contains salt, dissolved solids, suspended oil, grease, dissolved hydrocarbons, and metals. The water is produced along with oil and gas that is brought to surface and treated through the processing equipment. Gravity separation, flotation separation, and hydrocyclone technology are the standard treatment methods to process produced water. The two forms of disposal are to discharge to sea after treatment or re-inject into the reservoir. Discharge to sea is strictly governed at a local and international level. Primarily, regulations typically allow for less than 30 ppmv oil in water content. Though this number varies from location, some local regulatory agencies have more stringent requirements, and the industry is attempting to lower this requirement further (ABS, 2022)



5.4.6.4 Light Emissions

Operational lighting will be required on the FPSO and support vessels for safe operations and navigation purposes during the hours of darkness. Where feasible, operational lights will be shielded in such a way as to minimise their spill out to sea.

5.4.6.5 Waste Management

Notes in Section 5.2.7.5 also refer. Waste types and management expected during production are summarised in Table 5-9.

Table 5-9: Waste types and management associated with production

Category	Waste Type	Treatment / destination
Non-hazardous	General domestic waste, e.g. e.g. non-hazardous packaging, edible oil and grease, absorbents / filters, alkaline batteries (without mercury), organic waste	Landfill
	Recyclables, e.g. metal, paper / cardboard, plastic, wood, glass	Recycling facilities
Hazardous	Oil rags and oil filters, used oil, batteries, medical waste, oil water (slops), electric and electronic waste	Hazardous waste treatment facilities
	Waste from maintenance pigging of flowlines (e.g. waxes)	Hazardous waste treatment facilities
	Sand (possibly including Naturally Occurring Radioactive Material (NORM))	Hazardous waste treatment facilities

5.4.7 Emergency Prevention and Response

Flowline leaks are very rare, with an annual frequency of average pipeline failure of 0.00042 failures per km-year in 2012, a slight decrease from 0.00049 failures per km-year in 2001 (PARLOC, 2001, 2012, 2015) cited in (Kenny S. , 2018)³⁸.

Failures are most likely during during and shortly after pipeline construction and installation (where the cause may be attributed to inherent defects, errors, and omissions that are generally identifiable, and for the most part, preventable) and at the end of life period (due to fatigue) (see Figure 5-29) (Kenny S. , 2018).

The major hazards for offshore pipelines include corrosion failure (e.g., internal, external - ~50% for pipelines in the Gulf of Mexico), mechanical damage (e.g., trawl gear, anchors, dropped objects - ~15%), construction and material failure (e.g., weld, fitting, clamp - ~10%),

³⁸ According to the UK Health and Safety Executive (HSE UK, 2011) there were about 1 978 incidents involving offshore hydrocarbon releases between 2001 and 2011 in the UK continental shelf (Aljaroudi, 2015), which has an offshore pipeline network of ~15 000 km (Gordon & Paterson, 2020).

As per the US Pipeline & Hazardous Materials Safety Administration (PHMSA, 2014), there were about 306 offshore pipeline incidents in the U.S in the past 10 years, of which 71 involved hydrocarbon releases (Aljaroudi, 2015), for an offshore pipeline network of ~45 000 km in the Gulf of Mexico (Kenny S. , 2018).



natural hazards (e.g., wave, geotechnical – 10%), and other unknown factors (Kenny S. , 2018).

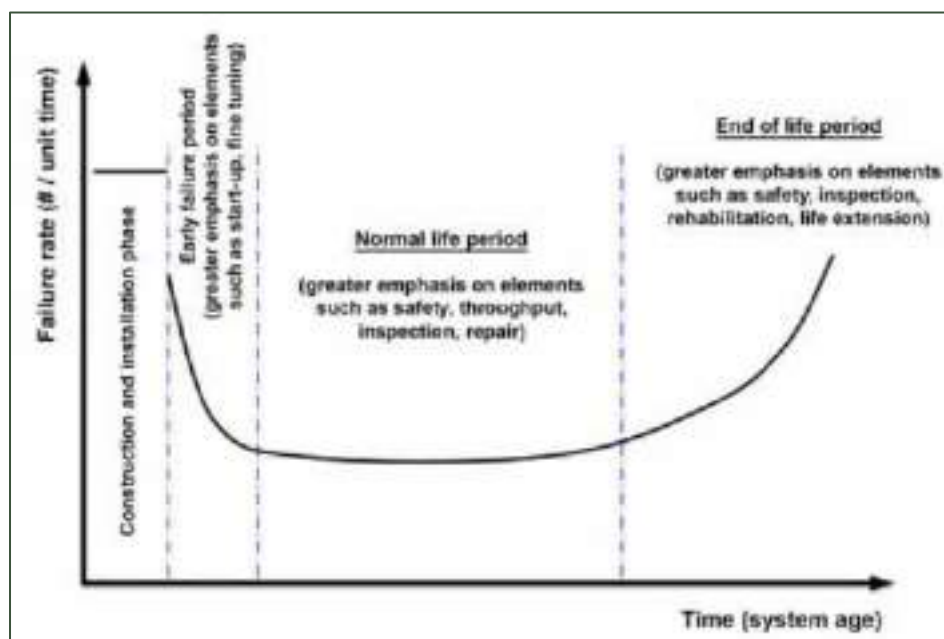


Figure 5-29: Pipeline system failure rates over time

Source: (Kenny S. , 2018)

The Venus project has a relatively short combined flowline and riser network of ~125 km, located at a depth of ~3 000 m. As such, the water column exerts a hydrostatic pressure of ~300 bar at the seabed.

The hydrostatic pressure at the seabed exceeds the internal operating pressure of the flowline and in the event of an **oil flowline leak** the seawater would push into the flowline rather than the oil flowing out provided the wells can be shutdown at Xmas tree. As such, the risk of sustained oil loss due to oil pipeline rupture is extremely low.

Gas, however, is compressed (injected) at pressure that exceeds the hydrostatic pressure, and the rupture of a **gas injection flowline** would mean that the pressure of gas in the pipeline exceeds the hydrostatic pressure of the water column and that gas escapes.

As detailed in Section 5.4.3, the FPSO production operations will be monitored and controlled through an ICSS. The ICSS will include process shutdown, emergency shutdown, and fire and gas systems to protect the facilities and personnel. Amongst other functions, the SIS will implement functions for emergency shutdown, fire and gas detection, and process shutdown for FPSO and subsea systems. The SIS will provide detection, logic sequencing, and actuation of devices to place the facility in a safe state.

5.5 Decommissioning

The Venus Project facilities will be decommissioned at the end of field life. Any extension will necessitate a full asset integrity review including equipment design and maintenance strategy.

Decommissioning is the process of safely dismantling and removing offshore installations, such as the FPSO, wells and subsea production system once they are no longer productive. It includes plugging wells, removing structures, and restoring the site as close as possible to its natural state based on a Net Environmental Benefit Analysis.



The Asset Retirement Obligation (ARO) entails the legal and financial responsibility for companies to decommission and restore the site, in accordance with the legal requirements of Namibia. Companies must recognize and account for these obligations in their financial statements where applicable.

Decommissioning would take place once the production of the field ceases, i.e. circa 20 to 21 years after first production, if no field life extension is pursued. Decommissioning planning is in the early conceptual phase where preliminary estimates and plans are made to inform initial budgets and assess feasibility.

In advance of the completion of the Venus production operations stage, the operator will prepare a detailed decommissioning plan for the facility in compliance with the contracts and licenses governing the Project and laws and regulations in effect at that time, while also considering the technology available at that time. The development of abandonment procedures will involve authority reviews and approvals and allow for the full consideration of environmental impacts of removal options, including benefits associated with leaving some facilities and structures in place at the time of abandonment.

At present, it is anticipated that that decommissioning will involve the following aspects, though these will be developed further at a later stage:

- Flush and clean subsea network from FPSO
- Isolate FPSO from subsea network and gas free the FPSO
- Disconnect risers and umbilicals from the FPSO
- Disconnect the FPSO from the mooring system, recover top chains and mooring lines. Bottom chain and mooring piles may remain in the seabed to limit soil disturbance and GHG linked to the pile removal operation
- FPSO is then towed to an approved recycling facility for cleaning and recycling if it cannot be re-used, in line with the IMO Hong Kong Convention³⁹ and applicable regulations for transboundary waste transfer, ensuring that the FPSO will be recycled by facilities that are compliant with the IMO Convention standards and EU Regulations standards. This includes the requirement to use only approved recycling facilities that possess an approved Ship Recycling Facility Plan (SRFP) to ensure that ships are recycled in a safe and environmentally sound manner and all products from the dismantling are properly managed (recycled or treated)
- The removal of underwater / seabed installations including risers, flowline and ILT/FLET, jumpers, Xmas-tree, umbilicals shall be considered on a case-by-case basis following a comparative assessment between removal or abandonment at seabed
- Plug and abandonment of development wells following standard procedures. Typical abandonment activities include displacing the well with inhibited fluids (to prevent tubular metal corrosion) and isolating all the zones of interest (formations containing fluids) from the surface. Cement plugs will be used to isolate the wells. The plugs will be designed to withstand the conditions generated by the geological formations. All cement plugs will be pressure / weight tested. Wellheads will not be recovered as

³⁹ The 2009 IMO Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, commonly known as the Hong Kong Convention, is an international treaty that sets standards for the recycling of ships, including FPSO units, and requires *inter alia* removing hydrocarbons and other hazardous materials from the FPSO and ensuring that the recycling process follows the safety and environmental standards set by the convention. The convention will enter into force on 26 June 2025 following its ratification by the required number of countries.



they are in water depths more than 500 m (in line with the Operator's internal standards)

It is currently anticipated that it will require approximately 14 days of drillship time to complete the decommissioning process for each well.

5.6 Project Financing

Each JV partner has specific economic criteria to be met to support FID. The capital expenditure (CAPEX), ahead of first oil, will be financed by the paying partners.

Carried partners will not finance any CAPEX upfront but will finance their shares from future revenues from the development once they accrue.

The applicable tax regime in Namibia will provide tax revenues to the government.

5.7 Project Alternatives

"Alternatives" to a proposed activity are generally defined as feasible and reasonable different means of meeting the general purpose and requirements of the activity, which may include activity, site, design or layout or technology alternatives. The 'No-Go' or 'No Project' alternative will also be considered. Not all categories of alternatives are applicable to all projects.

The consideration of alternatives is also inherent in the development of the project design and the identification of mitigation measures. Numerous alternatives were identified and considered during the early feasibility and design screening phases of the project. Several of these alternatives were not considered viable options by the proponent for reasons summarised in Table 5-10. Alternatives that are considered viable and assessed in the ESIA are also indicated.

Table 5-10: Summary of key project alternatives considered to date

Aspect	Alternative	Consideration in ESIA	Key reason for screening out
Activity alternatives			
Resource	Production of oil	To be assessed in the ESIA	n/a
	Production of gas	Screened out during the early development feasibility studies (see Section 5.1.5)	The re-injection of the associated gas is essential to enhance the oil production. Water injection was also studied as an alternative for oil recovery, but screened out due to likelihood of not achieving adequate level of injectivity due to low permeability reservoir.
No-Go alternative	Option of not proceeding with project, i.e. status quo as described in the baseline	To be assessed in the ESIA	n/a
Operational alternatives			
	Reinjection of associated gas	To be assessed in the ESIA	n/a



Aspect	Alternative	Consideration in ESIA	Key reason for screening out
Management of associated gas	Flaring of associated gas	Screened out during project design	Not considered an environmentally acceptable option and not in line with the GFMR / TotalEnergies policies for new developments
Oil transfer between FPSO and conventional tanker	Offshore	Screened out during project design	Discarded for metocean and safety reasons, as standard offloading in tandem or using an offloading buoy in the field will not provide sufficiently safe operation with harsh environmental conditions.
	Offshore and nearshore - described in Section 5.4.4	To be assessed in the ESIA	n/a
	Onshore	Screened out during project design	Deemed to have a higher environmental footprint in a more sensitive nearshore area, and anticipated project lifetime considered short for permanent onshore facility
Nearshore oil transfer approach	With Floating Storage and Offloading unit (FSO)	Screened out during project design	Would require permanent vessel with limited operation time
	Without FSO - described in Section 5.4.4.2	To be assessed in the ESIA	n/a
Site or location alternatives			
Well locations	Currently anticipated locations are shown in Figure 5-1 and will continue to be refined during technical modelling	Representative layout to be assessed in the ESIA	n/a
Nearshore transshipment location	Northern area (in the Walvis Bay region)	To be assessed in the ESIA Locations are still being studied, considering metocean conditions, environmental aspects, logistics requirements and available infrastructure	n/a
	Southern area (in the wider Lüderitz region)		



Aspect	Alternative	Consideration in ESIA	Key reason for screening out
Design or technology alternatives			
FPSO capacity	160 kbopd / 550 MMscfd / 2Mbo storage	To be assessed in the ESIA	n/a
	Higher or lower capacity	Screened out during project design	Base case of 160 Mbod determined based on various liquids and gas production handling capacity configurations, reservoir studies and modelling work is ongoing
Anchoring of FPSO	Suction pile anchor	To be assessed in ESIA (see Section 5.3.3.2)	n/a
	Vertical Load Anchor (VLA) or SEPLA anchor	To be assessed in ESIA (see Section 5.3.3.2)	n/a
	Other anchoring methods (e.g. anchor piles)	Screened out during feasibility study	Not deemed the most effective or least impact method
Treated drill cuttings disposal methods	Disposal at sea	To be assessed in ESIA	n/a
	Disposal onshore	Screened out during project design	For onshore disposal, the treated drill cuttings will need to be transferred to shore by PSV. Considering the distance (approx. 300 km) between Venus field and shore, this would create additional emissions. Moreover, once onshore, further transportation may be required to reach the waste facility. Hence, not only does this option leads to additional emissions, but it also creates additional safety risk related to the handling of the cuttings.
Well abandonment	Leave wellheads in place	To be assessed in ESIA	n/a
	Remove wellheads from seafloor	Screened out during project design	Standard practice for deep-water wells. Given water depth in Venus field and lack of demersal fishing in the area, no impact is expected on these sectors
FPSO power source	Gas-powered (using a portion of the produced gas)	To be assessed in ESIA	n/a



Aspect	Alternative	Consideration in ESIA	Key reason for screening out
FPSO power source	Renewable sources	Screened out during project design	Power from renewable sources or via connection to the shore are not feasible due to total power requirement, need for reliable power supply, distance to shore and the lack of existing infrastructure Gas turbine generators are the most feasible solution given their relative low footprint and weight and readily available gas from the production stream
FPSO power generation equipment	Open Cycle Gas Turbine (OCGT) with Waste Heat Recovery Unit (WHRU)	To be assessed in ESIA	n/a
	Combined Cycle Gas Turbine (CCGT)	Screened out during project design	CCGT requires more equipment that needs space and adds weight to the FPSO, considerably raising operational costs. OCTG with WHRU is a much more space, weight and cost-effective solution.



6.0 Description of the Receiving Environment

Block 2913B is located offshore the southern coast of Namibia close to the marine border with South Africa (see Figure 1-1). This chapter provides a description of the attributes of the physical, biological, socio-economic and cultural receiving environment of the licence area and region surrounding the licence block. An understanding of the environmental and social context and sensitivity within which the proposed activities would be located is important to understanding the potential impacts.

The descriptions of the physical and biological environments along the southern and central Namibian coast primarily cover the offshore and coastal area from Walvis Bay in the north to the Orange River mouth in the south, although where appropriate reference is made to the entire Namibian coastline.

6.1 Area of Influence

The area of influence of the proposed project activities defines the spatial extent of the baseline information and can be separated into the area of influence for planned operations and for unplanned events, as summarised below:

- **The area of influence (planned operations)** will be re-confirmed based on the results of the underwater noise and drilling discharge modelling, as well as the marine ecology and fisheries assessments and includes:
 - o Block 2913B, specifically the area of the Venus field (Figure 1-1), within which production activities will take place, including all production and injection wells, SPS, SURF and the FPSO mooring area;
 - o The nearshore transshipment area, where oil will be offloaded from the DPST to a conventional tanker;
 - o The Port of Lüderitz and Walvis Bay where onshore support activities will be located;
 - o Marine traffic routes between Lüderitz / Walvis Bay and the Venus field area;
 - o Airspace between airport (at Lüderitz / Oranjemund) and the Venus field for helicopter-based crew changes;
 - o Areas (or zones of impact) where marine resources, such as commercial fishing stocks and marine mammals, may be affected by the proposed activities, e.g. due to underwater noise and safety exclusion zones; and
 - o Coastal communities in the broader //Karas Region and Erongo Region, potentially socio-economically impacted by the proposed activities.
- **The extended area of influence in the case of any unplanned events occurring** will be confirmed at the ESIA stage, mainly based on the oil spill modelling results, and may include coastal and nearshore areas that could be affected in the unlikely event of a spill or well blow-out.

6.2 Environmental Baseline Surveys

Various environmental surveys (called Environmental Baseline Surveys, EBS) have been undertaken by the JV, in partnership with Benthic Solutions Limited (BSL), in Block 2913B since 2018 (see Table 6-1 and Figure 6-1). The objectives of these surveys were to characterize the baseline conditions for future measurement of trends, describe the benthic habitats and epifauna present, and highlight any sensitive habitats and/or species within a well site or larger the area before any operations (BSL, 2019a; 2023a; 2023b). For the



Venus-1X area, where was the first well drilling campaign within Block 2913B, an Environmental Post Operation Survey (EPOS) was also performed a few months after the completion of well drilling in early March 2022.

The results from these environmental surveys have been used to inform the baseline description chapter.

6.2.1 Environmental Baseline Surveys

- The first EBS was conducted at the Venus-1X well site (Proposed Well Location; PWL) from 23 October to 5 November 2018. The survey comprised seabed sampling at eight sampling stations, and water column sampling and profiling at two sampling stations. Stations followed a cruciform survey design around the Venus-1X well site out to 500 m, with additional sampling sites located 1 km, 2 km and 3 km downstream along the surface Benguela Current (BSL, 2019a).
- The EBS for Venus-1A PWL area was conducted between 26 July and 9 August 2022. Seabed sampling was undertaken at 20 sampling stations at the Venus-1A PWL area, located around 15 km north-west of the Venus-1X well location. Seabed footage was obtained at one station and seawater sampling was undertaken at two stations from three depths (near seabed, mid-water and surface) (BSL, 2023a).
- The EBS for Block 2913B, with denser sampling in the Venus field area, was undertaken between 7 and 30 September 2022. Forty-six seabed stations were sampled across the Block with video footage obtained at nine stations and seawater sampling taking place at five stations (BSL, 2023a).

6.2.2 Post-drill Survey or EPOS

The EPOS for Venus-1X was carried during the overall Block 2913B EBS with eight dedicated seabed stations near to the 2018 sampled locations, one water station and two video footages around seven months after well completion. Findings showed there were negligible changes in the initial characteristics and no notable impact on the macrofaunal community post drilling (BSL, 2023b).

Table 6-1: Summary of the sampling activities conducted during the Environmental Surveys undertaken in Block 2913B.

Environmental Surveys	Survey Period	Sampled Well	Sampling Conducted
2018 Venus-1X EBS	23 October – 5 November 2018	Venus-1X PWL	Seabed (n = 8) Water (n = 2) Seabed Footage (n = 6).
2022 Venus-1A EBS	26 July - 9 August 2022	Venus-1A PWL	Seabed (n = 20) Water (n = 2) Seabed footage (n = 1).
2022 Block 2913B EBS	7 - 30 September 2022	-	Seabed (n = 46) Water (n = 5) Seabed Footage (n = 9).
2022 Venus-1X EPOS	20, 21, 29 September 2022	Venus-1X FWL	Seabed (n = 8) Water (n = 1) Seabed Footage (n = 2).



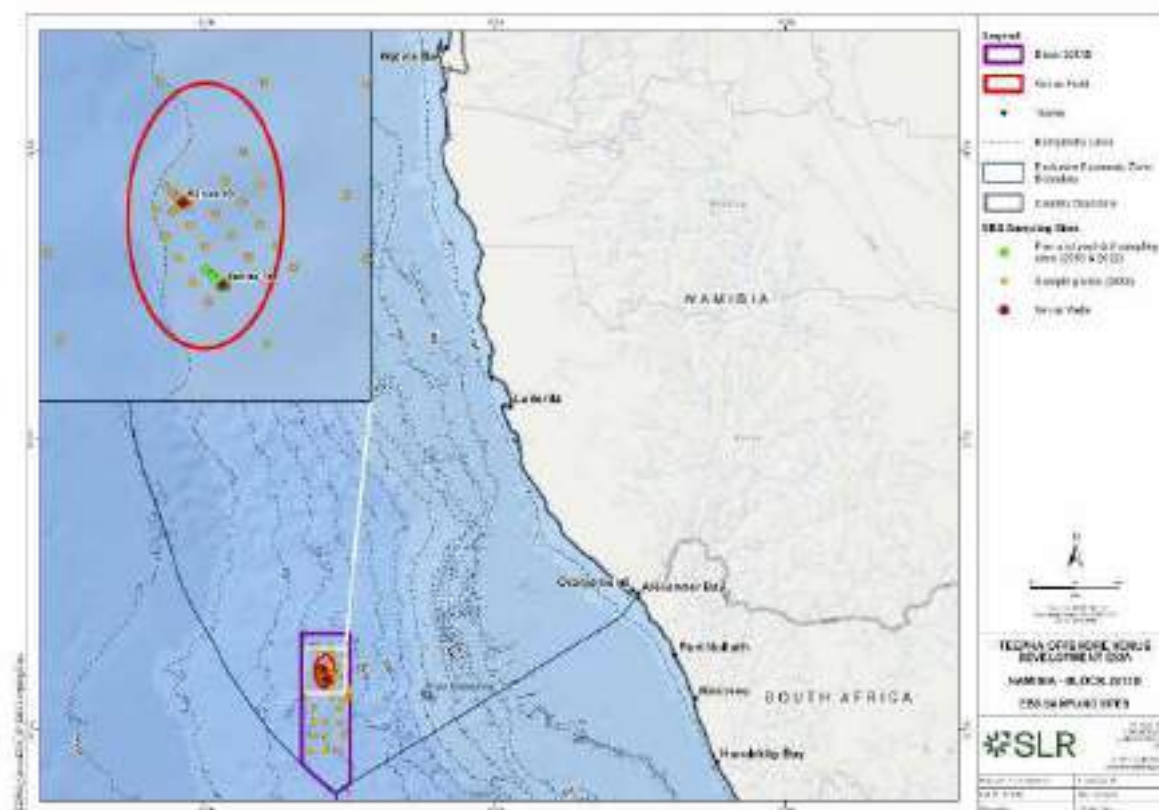


Figure 6-1: Environmental surveys sampling locations, 2018- 2022.

Source: (BSL, 2019a; 2023a; 2023b)

6.3 Geophysical Characteristics

6.3.1 Bathymetry

The continental shelf along the Namibian coast varies in width and depth. Offshore of the Orange River mouth, the shelf is wide (230 km) and characterised by well-defined shelf breaks. Northwards, it reaches its narrowest point (90 km) off Chameis Bay, before widening again off Lüderitz and Walvis Bay (Rogers J. , 1977). For benthic ecosystem classifications, the continental shelf is divided into an inner shelf and an outer shelf at a depth of 150 m. The shelf edge extends to the shelf break at depths between 350 - 500 m. The inner shelf has a relatively steep gradient to approximately 100 m depth, after which the gradient decreases and undulates to depths of approximately 200 m. North of Chameis Bay, the shelf edge and break is relatively deep (400 - 450 m). The variable topography of the shelf is important for near shore circulation and for fisheries (Shannon & O'Toole, 1998). Beyond the shelf break (350 - 500 m), the slope is divided into upper and lower sections at 1 800 m, before forming the deep-sea abyss (>3 500 m) (Sink, et al., 2012; Holness, et al., 2014). **Block 2913B is located along the upper slope and within the deep-sea abyss (Figure 6-3).**

Seismic and bathymetric datasets have revealed several features within Block 2913B, where variability in seabed erosion has resulted in defined bathymetric boundaries, which in turn are likely to affect localised habitat types. Conspicuous features include mass gravitational flow features, escarpments, eroded plateaus and sedimentary basins (AECOM, 2019; SLR, 2020).

Banks along the continental shelf and within the larger project area include the Orange Bank (Shelf or Cone), a shallow (160 - 190 m) zone that reaches maximal widths (180 km)



offshore of the Orange River inshore of Block 2913B, and Child's Bank, a rounded, flat topped, sandy plateau located on the edge of the continental shelf approximately 150 km offshore in South African waters. Child's Bank rises from a depth of approximately 350 m to less than 200 m at its shallowest point and is considered a major bathymetric feature of the West Coast margin (Dingle, 1973; Birch & Rogers, 1973; De Wet, 2013).

Tripp Seamount is a geological feature situated approximately 230 km offshore of southern Namibia in water depths of 1 000 m. It is a roughly circular feature with a flat apex as shallow as 150 m deep, which drops steeply on all sides. Tripp Seamount is located approximately 85 km east of Block 2913B. Further an unnamed bathymetric feature is situated 36 km east of Block 2913B rising from depths of 2 000 m (Figure 6-3).

6.3.2 Shelf Geology and Seabed Geomorphology

As part of the Marine Spatial Planning (MSP) process in Namibia, the marine geology of the Namibian continental shelf and geomorphic seafloor features within the EEZ were mapped (MFMR, 2021) (Figure 6-3 and Figure 6-4). This process identified a single canyon within the block; however, this canyon was not subsequently identified by any environmental baseline surveys completed within the block (Section 6.2). No additional geomorphic features were identified within the block.

The inner shelf is underlain by Precambrian bedrock (also referred to as Pre-Mesozoic basement), whilst outer shelf area is composed of Cretaceous and Tertiary sediments (Dingle, 1973; Birch, Rogers, Bremner, & Moir, 1976; Rogers J. , 1977; Rogers & Bremner, 1991). As a result of erosion on the continental shelf, the unconsolidated sediment cover is generally thin, often less than 1 m. Sediments are finer seawards, changing from sand on the inner and outer shelves to muddy sand and sandy mud in deeper water. However, this general pattern has been modified considerably by biological deposition (large areas of shelf sediments contain high levels of calcium carbonate) and localised river input. An approximately 500 km long mud belt (up to 40 km wide, and of 15 m average thickness) is situated over the outer edge of the middle shelf between the Orange River and St Helena Bay in South Africa (Birch, Rogers, Bremner, & Moir, 1976; Meadows, Dingle, Rogers, & Mills, 1997; Meadows, Rogers, Lee-Thorp, Bateman, & Dingle, 2002; Herbert & Compton, 2007). These biogenic muds contribute to the formation of low-oxygen waters and sulphur eruptions off central Namibia (see Section 6.4.9). Offshore of the mud belt, the composition changes to muddy sands, sands and gravels before changing back to mud-dominated seabed beyond the 500 m contour. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous ooze.

Pre- and post-drilling environmental surveys conducted in Block 2913B and the proposed development area (Section 6.2) recorded a generally homogeneous habitat throughout the survey areas (BSL, 2019a; 2023a; 2023b). The sediments were predominantly fine-grained, with negligible gravel content both before and after drilling.

Sediment samples collected during the pre-drilling EBS in the Venus area were classified into two Folk⁴⁰ categories ('sandy mud' and 'mud'):

- **Overall, pre- and post-drill samples collected at the Venus-1X well site were classified as 'Sandy Mud', with seabed sediments being 'Very poorly sorted', indicating no change in the sediment properties following drilling activities.**
- Pre- and post-drilling video footage recorded across the Venus-1X PWL survey area revealed evidence of bioturbation (i.e. disturbance of sedimentary deposits by living

⁴⁰ The Folk classification system categorizes marine sediments based on their grain size and composition. This system divides sediments into several categories considering a combination of the components (gravel, sands and fines), the ratio of sand : mud and percentage of gravel within the sediment. 'Sandy Muds' and 'Muds' have a <1% gravel composition and 1:1 or lower ratio of sand : mud.



organisms) with evidence of mounds and feeding depressions and spirals, although no discernible species could be identified (Figure 6-2).

- The Total Organic Carbon (TOC) content of the sediments was consistent between pre- and post-drill surveys. TOC levels were comparatively low, suggesting an organically deprived environment in which the carbon flux from near surface productivity is not strong. This is expected in offshore sediment habitats far removed from productive coastal upwelling.

6.3.3 Sedimentary Phosphates

Phosphorite, sedimentary rock with 5%-20% phosphate content, is found in the marine environment as nodular hard ground or layers on continental shelves and slopes (Morant 2013). These deposits serve as a record of climate-linked palaeoceanographic changes in upwelling systems. The Benguela Upwelling System, one of the world's most productive, hosts significant phosphorite deposits over a 24 700 km² area on the Namibian shelf, generally occurring to depths of ~350 m (Compton & Bergh, 2016). It is estimated that the total resource is 7 800 million tonnes with an average grade of 19% per weight of P₂O₅ (Compton & Bergh, 2016).

The phosphorite deposits on the open shelf form when phosphate precipitates as calcium phosphate due to intense upwelling and temperature changes, which reduces phosphate solubility in oceanic waters. This precipitation occurs at the sediment-water interface, aided by the decay of siliceous phytoplankton. The resulting phosphates combine with calcium from calcareous foraminiferal and coccolithophorid debris, forming phosphatised lime-rich muds. These muds eventually solidify through secondary calcium phosphate replacement (francolite), creating a continuous layer of phosphate rock on the seafloor sediments (Birch G. , 1990; Morant, 2013).

Marine phosphates offshore of Namibia were first discovered and regionally mapped in the late 1960s and 1970s, with subsequent exploratory work undertaken in the 1990s, 2000s and present. Phosphorite deposits on the Namibian continental shelf are found in various locations and depths: concretionary phosphorite and pelletal phosphorite are located on the middle shelf south and north of Walvis Bay, while 'rock phosphate' is predominantly found on the middle and inner shelves north of Walvis Bay. Additionally, coarsening-upward pelletal phosphorite sand deposits, several meters thick, are present on the middle to outer shelf at depths of 190 m to 350 m offshore of Lüderitz and Walvis Bay.

The Venus field is in water depths of approximately 3 000 m, as such the presence of pelletal and glauconitized pelletal phosphate deposits within the project development area is deemed unlikely, with none recorded during environmental surveys. However, depending on the location to be selected, nearshore transshipment operations may take place in areas with these features.





Figure 6-2: Example images from pre- and post-drilling video surveys of the Venus 1X area, with evidence of biogenic activity (bioturbation).

Source: BSL (Post-Drill Environmental Survey: Venus-1X (Block 2913B). Environmental Post-Operations Survey Report, 2023b)



Summary of the key geophysical characteristics of the study area

Block 2913B is situated offshore on the upper slope and within the deep-sea abyss, in water depths ranging from 2 600 to 3 300 m. The region's geological features include Child's Bank in South African waters and Tripp Seamount in Namibia, which have been mapped for Marine Spatial Planning purposes. Block 2913B is 85 km west of Tripp Seamount and 200 km northwest of Child's Bank. Due to its offshore location (> 240 km from the coast at its closest point) the Licence Block sediments are dominated by muds and sandy muds, with photographic and environmental survey data showing a generally homogeneous habitat.

Notably, the continental shelf hosts extensive phosphorite deposits, formed by upwelling-induced phosphate precipitation. **Block 2913B does not overlap with these phosphate-rich rocks.**



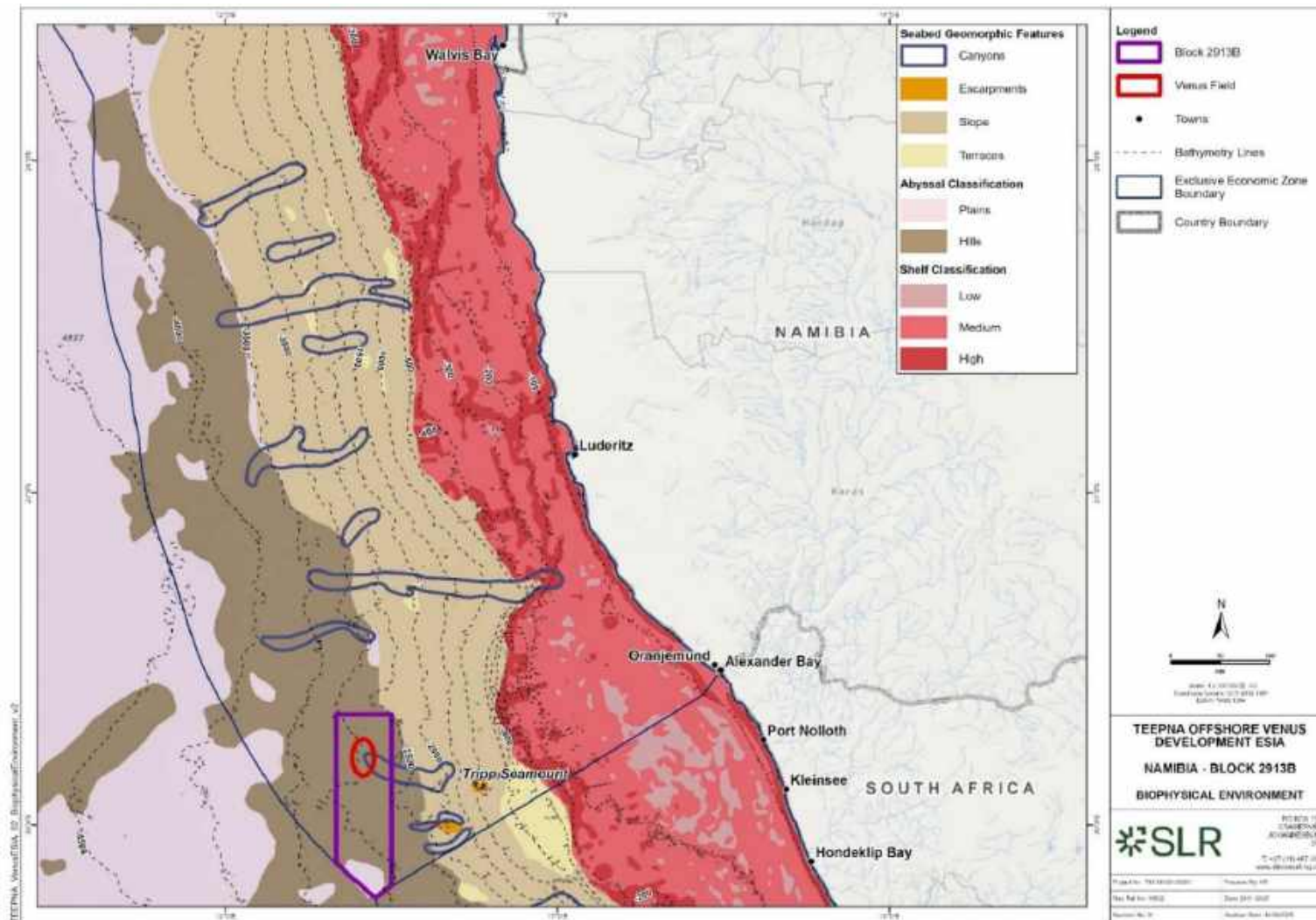


Figure 6-3: Block 2913B (purple polygon) and Venus development field (red circle) in relation to seabed geomorphic features off Namibia.

Source: Adapted from MFMR (2021) and MARISMA (2022).



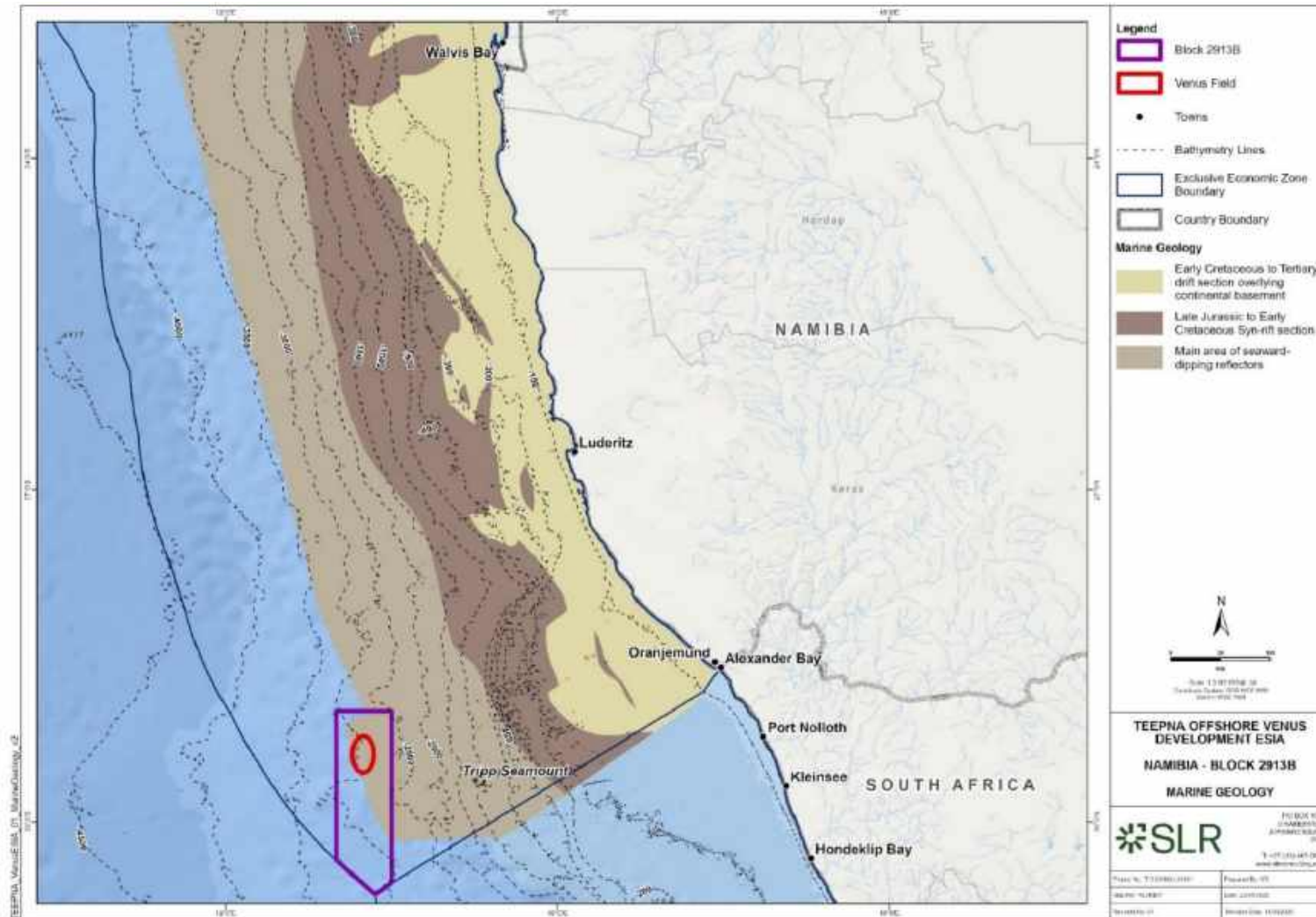


Figure 6-4: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the marine geology of the Namibian continental shelf.

Source: Adapted from MFMR (2021).



6.4 Biophysical Characteristics

6.4.1 Climate

The Namibian coastline has hyper-arid conditions with low, unpredictable winter rains, and strong predominantly southerly or south-westerly winds. North of Lüderitz, summer rains prevail, and further out to sea, a south-easterly wind component is prominent. Winds reach a peak in the late afternoon and subside between midnight and sunrise.

Frequent fog occurs along the coast, about 50-75 days per year, mainly from February through May. The fog lies close to the coast extending about 20 nautical miles (~35 km) seawards (Oliver, 1992; 1995). This fog bank is dense and hugs the shoreline, reducing visibility to less than 300 m.

Average annual rainfall in Namibia is extremely variable, ranging from 650 mm in the northeast to less than 50 mm in the southwest, with mean annual rainfall of 278 mm across the country (World Bank Group, 2021). Mild temperatures prevail year-round, averaging around 16°C along the southern coast and increasing inland up to 22°C in the north (Barnard, 1998; World Bank Group, 2021). In winter (June to August), hot easterly 'Berg' winds from the desert can cause significant daily temperature shifts, with temperatures reaching up to 30°C during such events (Shannon & O'Toole, 1998).

6.4.2 Wind Patterns

Winds are one of the main physical drivers of the nearshore Benguela region, both on an oceanic scale, generating the heavy and consistent south-westerly swells that impact this coast, and locally, contributing to the northward-flowing longshore currents, and being the prime mover of sediments in the terrestrial environment.

The prevailing winds in the Benguela region are influenced by the South Atlantic subtropical anticyclone, eastward-moving mid-latitude cyclones south of southern Africa, and the seasonal atmospheric pressure patterns over the subcontinent. The South Atlantic anticyclone strengthens and extends furthest south during the austral summer but weakens and moves north-westward in winter. This results in substantial differences between summer and winter wind patterns in the region.

Nearshore and continental winds generally lower as compared to areas further offshore, with the deflection of winds close to land resulting in the predominance of south-easterly, southerly and south-westerly winds. The coastal stretch from the Orange River mouth to Lüderitz is recognised as the windiest section along the Namibian coastline (Environmental Information Service, 2022).

Ambient wind statistics at the Venus field were modelled using a 41-year CFSR/CFSv2 database (RPS, 2025). This study found that the annual average ambient wind speed was 7.53 m/s, with maximum speeds reaching 22.2 m/s. The predominant wind directions were south-east and south-south-east (RPS, 2025)

During summer, wind is strongest with southerlies dominating most of the time, sometimes exceeding 20 m/s (Figure 6-5). These southerly winds bring cool, moist air to the coast and drive the large-scale upwelling of nutrient-rich bottom waters which defines the region in summer. These strong equatorward winds are interrupted by passing coastal lows which cause periods of calm or north/northwest wind conditions.

Winter remains dominated by southerly winds, but the proximity of winter cold-front systems introduces a significant north-westerly component. This change in conditions results in a cessation of upwelling, movement of warmer mid-Atlantic water shoreward and a breakdown of the strong thermoclines which typically develop in summer. In winter, calms are more frequent and wind speeds generally don't reach the summer's maximum levels. Larger



swells occur in winter then the westerly winds align with the prevailing south-westerly swell direction.

In autumn and winter, strong offshore berg winds can occur. These easterly winds can exceed 13 m/s and create sandstorms, which severely limit visibility at sea and on land. These winds, though intermittent for about a week, play a major role in transporting sediment into the coastal marine environment, carrying sediment up to 150 km offshore (Thalerwa, et al., 2005; Figure 6-6). Organic input is discussed further in Section 6.4.8.

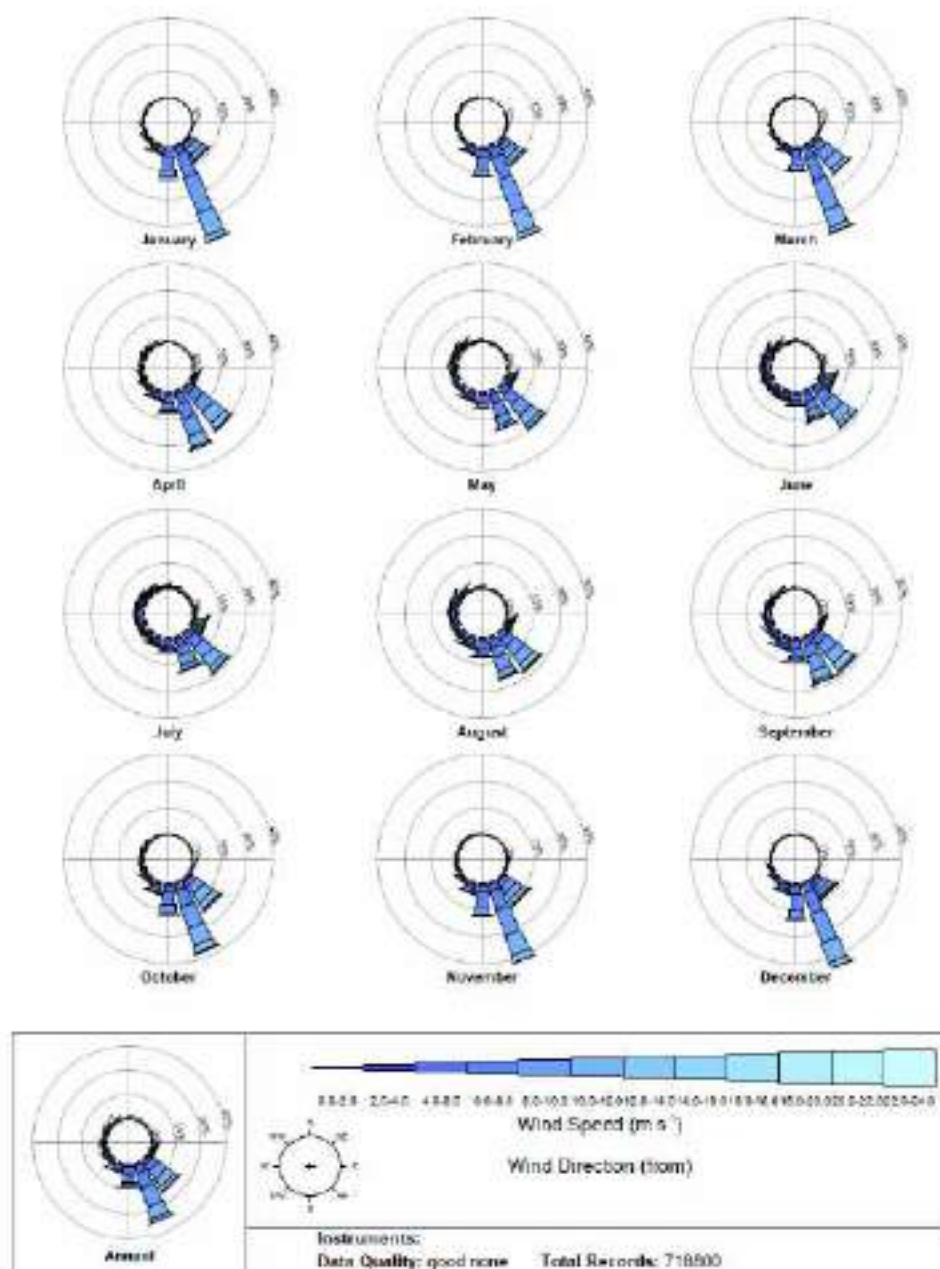


Figure 6-5: Wind data by month for a grid point (13°15'37"E; 29°28'37"S) within Block 2913B

Source: RPS (2025). Data from for years1979 to 2019.



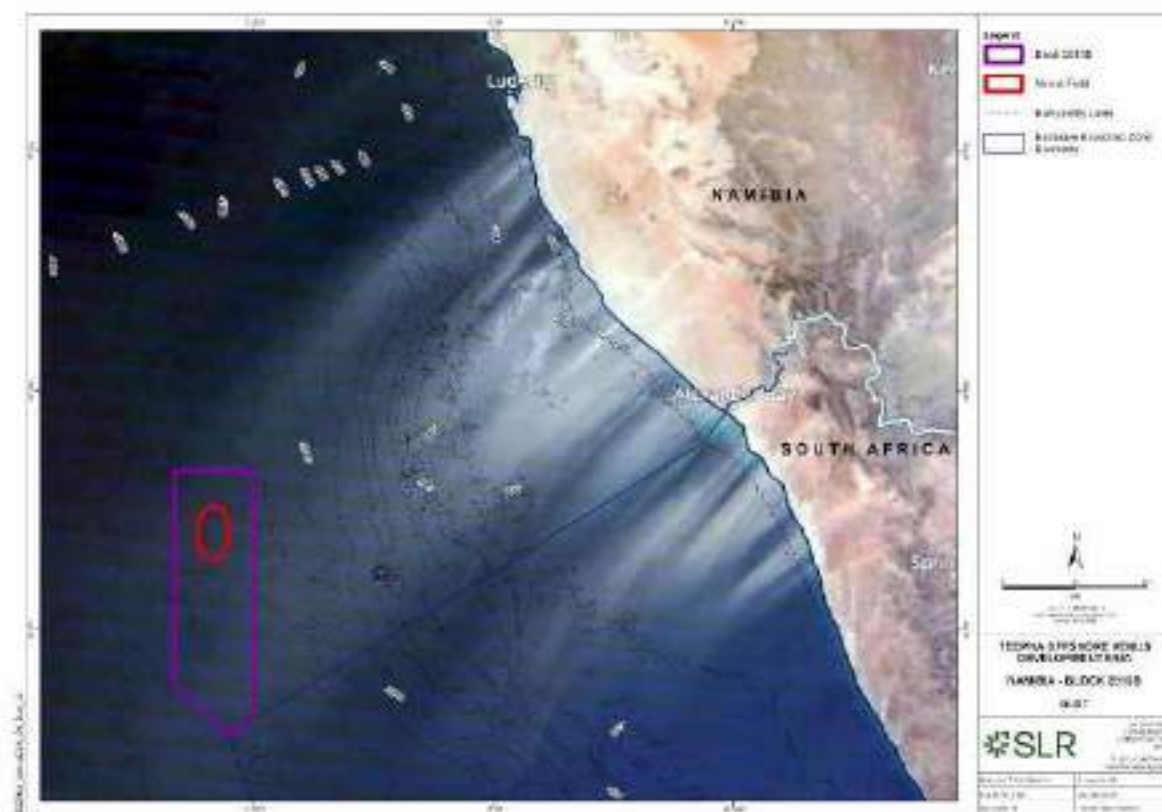


Figure 6-6: Satellite image of aerosol plumes blown offshore during a northeast 'berg' wind. The estimated position of Block 2913B (purple polygon) and the Venus development field (red circle) has been indicated.

Source: www.earthdata.nasa.gov/worldview/worldview-image-archive/dust-blows-off-coast-namibia-south-africa.

6.4.3 Large Scale Circulation and Currents

The Namibian coastline is heavily influenced by the Benguela Current. Current velocities on the continental shelf typically range between 10-30 cm/s (Boyd & Oberholster, 1994). In the south, the Benguela Current spans 200 km in width, expanding rapidly northwards to 750 km. The barotropic current is primarily driven by wind and alternates between poleward and equatorward directions for short fluctuation periods (3-10 days) (Shillington, et al., 1990; Nelson & Hutchings, 1983; Hutchings, et al., 2009) (Figure 6-7). However, the long-term flow average is approximately north-west alongshore. Near the bottom shelf, the flow is mainly poleward (Nelson, Poleward motion in the Benguela area. , 1989) with typically low velocities around 5 cm/s. The poleward flow becomes more consistent in the southern Benguela.

The Benguela Current is characterised by coastal upwelling, which supplies nutrients to surface waters, resulting in high biological productivity and abundant fish stocks. Prevailing longshore winds move nearshore surface water offshore, causing colder, deeper water to upwell closer to the coast. Although upwelling intensity varies with seasonal wind patterns, the most intense upwelling occurring where the shelf is narrow, and winds are strong.

The Lüderitz upwelling cell is the most intense, extending seaward for nearly 300 km and drawing water from depths of 300-400 m (Longhurst, 2006). Water mass analysis revealed discontinuities in central and intermediate layers along the shelf north and south of Lüderitz (Duncombe Rae, 2005). This area forms a significant environmental barrier separating the northern and southern Benguela sub-systems (Ekau & Verheye, 2005; Lett, Veitch, Van Der Lingen, & Hutchings, 2007).



Modelled operational currents based on measurements recorded at the Venus field indicate that surface and near surface (5 m below sea level) currents are primarily towards the west-northwest and northwest, with average speeds of 0.26 m/s. Current speeds decrease with depth to ≤ 0.05 m/s near the seabed (2 000-3 000 m deep), flowing predominantly towards the south (RPS, 2025) (Figure 6-8).

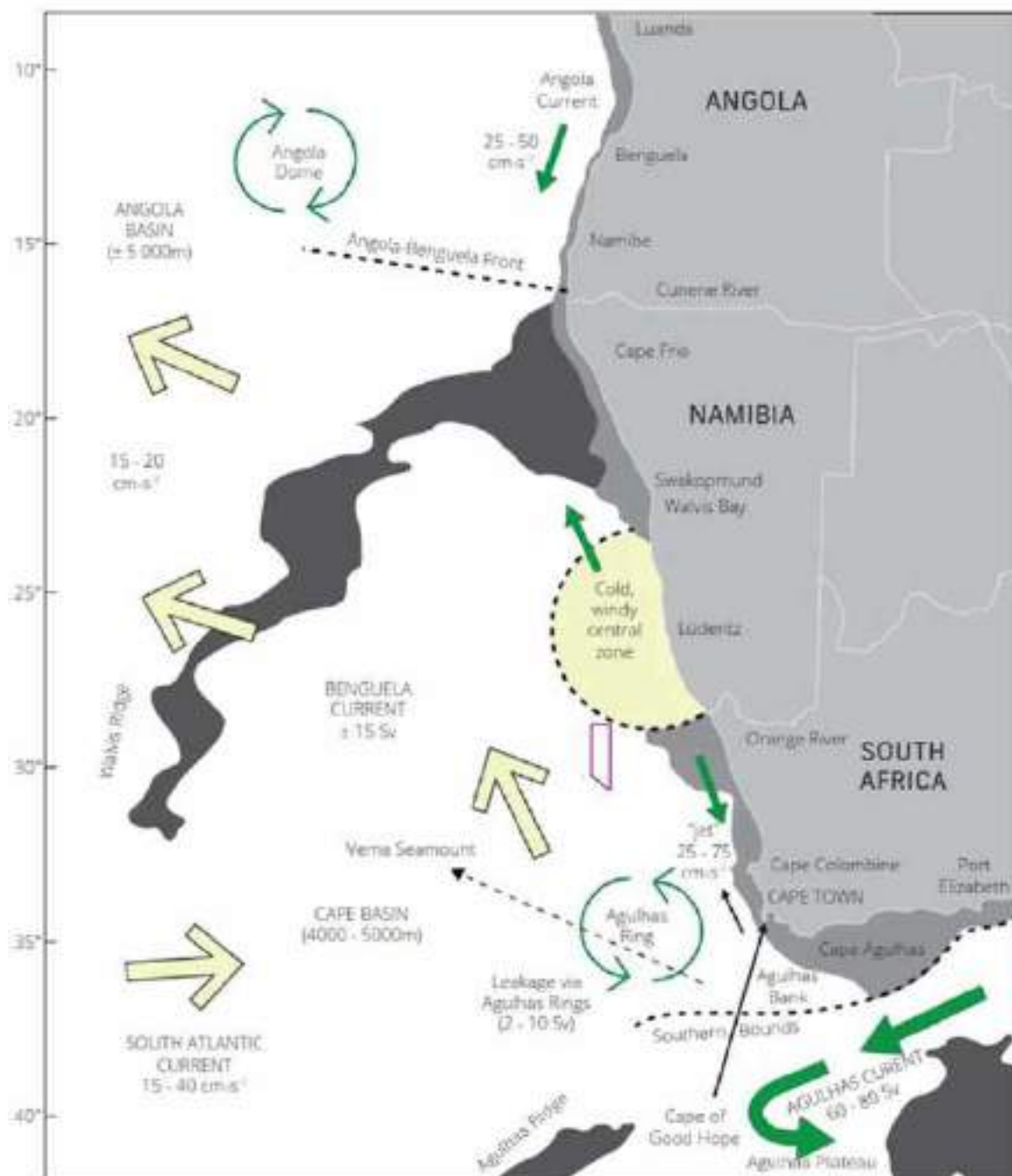


Figure 6-7: Major features of the predominant circulation patterns and volume flows in the Benguela System. The estimated position of Block 2913B (purple polygon) has been indicated

Source: Adapted from Shannon et al. (2006) and MFMR (2018). Light grey indicates continental shelf, with dark grey representing the location of offshore ridges and plateaus (Walvis Ridge, Agulhas Ridge and Agulhas Plateau).



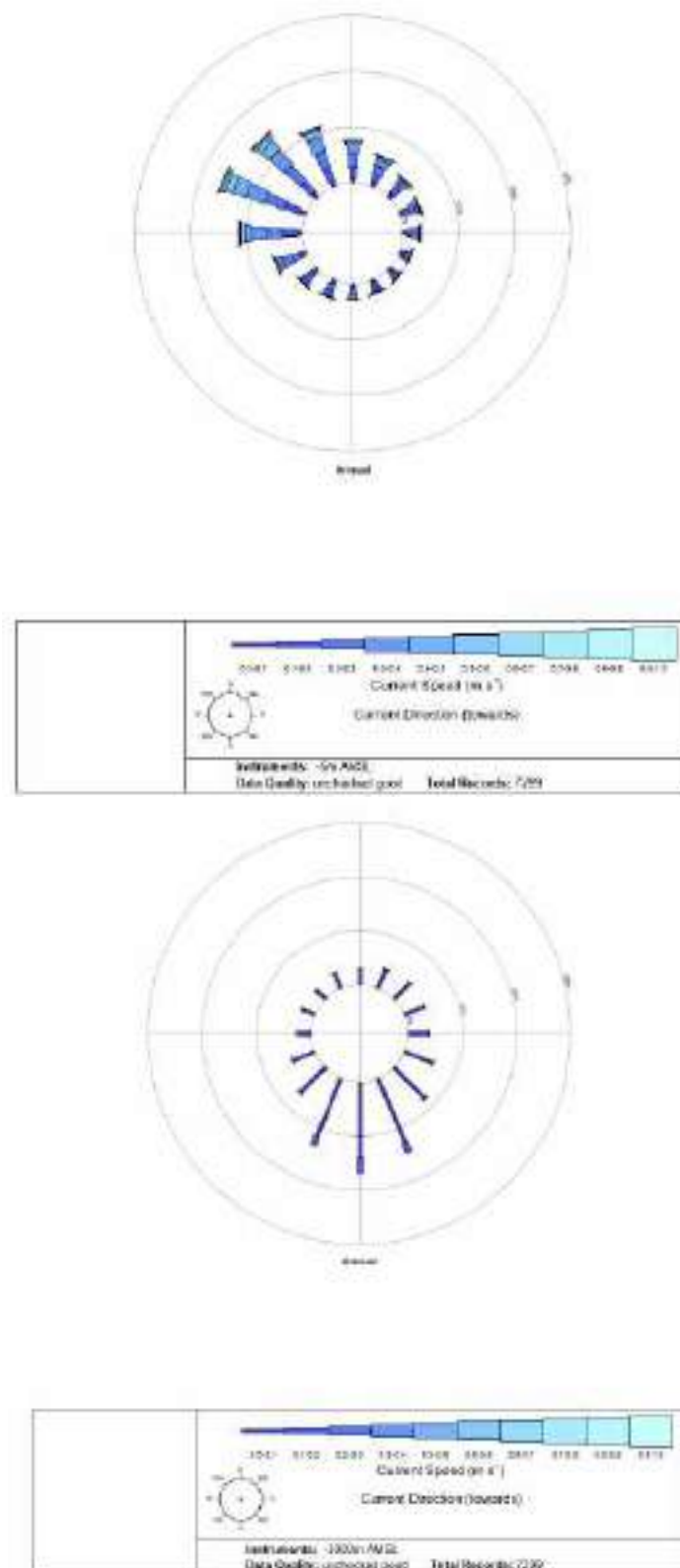


Figure 6-8: Surface (-5 m)(top) and seabed (- 3 000 m)(bottom) annual current data for years 1993 to 2012 for a grid point (29° 26' 24" S 13° 16' 48") within Block 2913B.

Source: RPS 2025



6.4.4 Waves and Tides

The Namibian coast is exposed to strong wave action, typically rated between 13-17 on a 20-point exposure scale (McLachlan, 1980). These major swells are primarily generated in the roaring forties and locally driven by persistent southerly winds.

Throughout the year, the wave regime along the Namibian coast remains relatively consistent, predominantly coming from the south-west-south direction, with a slight increase in winter. The median significant wave height is 2.4 m, with the main peak wave energy period around 12 seconds. Longer period swells (11 to 15 seconds) generated by mid-latitude cyclones occur about 25-30 times annually, originating from the south-south-west sectors. The largest waves recorded along the Namibian coastline reach heights of 4-7 m during these events. In winter, heavy south-westerly storms can bring waves exceeding 10 m, often accompanied by wind speeds of up to 100 km/h. Generally, wave heights decrease with depth and alongshore distance.

In contrast, spring and summer swells are smaller, typically averaging around 2 m and lacking the extreme heights of winter swells. Summer also features a more pronounced southerly swell component, characterized by shorter wave periods (~8 seconds) and steeper profiles, primarily induced by wind (CSIR, 1996). These southerly wind-induced waves, although less powerful, work in tandem with the strong southerly winds of summer to create northward-flowing nearshore surface currents. This combination of currents, wind, and waves results in significant nearshore sediment mobilization and northward transport.

The average annual significant wave height (sea and swell) at the Venus field is 1.73 m (RPS, 2025). The waves predominantly originate from the south-south-west to south-west directions (RPS, 2025).

In common with the rest of the southern African coast, tides are semi-diurnal, with a total range of approximately 1.5 m at spring tide, but only 0.6 m during neap tide periods.

6.4.5 Water Characteristics

South Atlantic Central Water (SACW) comprises most of the seawater in the project area, either in its pure form in deeper regions or when mixed with upwelled water of the same origin on the continental shelf (Nelson & Hutchings, 1983). Salinity levels in these waters vary between 34.5 ppt and 35.5 ppt (Shannon V., 1985). Full seawater profiles were sampled during environmental baseline surveys of Block 2913B (Section 6.2). Levels varied in the first 100 m water depth (35.4 to 35.5 PSU), rapidly declining between 100 m and 600 m to a minimum salinity of 34.3 to 34.4 PSU, before increasing (~35 PSU) at 2 000 m and remaining constant at the seabed (BSL, 2019a; BSL, 2023a; BSL, 2023b).

On the southern Benguela's continental shelf seawater temperatures typically vary between 6°C and 16°C. Well-developed thermal fronts mark the seaward boundary of the upwelled water. These fronts generate characteristic upwelling filaments, occurring as cold surface streamers, about 50 km wide and extending beyond the normal offshore limits of the upwelling cell. Such fronts usually persist for few days to several weeks, with the filamentous mixing zone extending up to 625 km offshore. Studies have shown changes in sea surface temperatures in large areas of the Benguela region over the last 30 years (Rouault, Penven, & Pohl, 2009; Belkin, 2009), including warming of substantial areas off Namibia.

Environmental surveys conducted in Block 2913B (Section 6.2) revealed that the upper 50 m of the water column were well mixed, with temperatures exceeding 17°C. A consistent mixing zone was observed in the upper layers, followed by a rapid temperature drop to approximately 5°C at the bottom of the thermocline layer (600 m). The temperature then gradually transitioned to 2.3 to 2.5°C at a depth of 3 000 m (BSL, 2019a; BSL, 2023a; BSL, 2023b).



The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, particularly near the seafloor. SACW itself exhibits depressed oxygen concentrations (oligoxic: ~80% saturation value), with even lower levels (<40% saturation) and hypoxia occurring frequently (Bailey, Beyers, De, & Lipschitz, 1985; Chapman & Shannon, 1985; Monteiro & van der Plas, 2006; Monteiro P. M., et al., 2006).

The Dissolved Oxygen (DO) profiles from environmental surveys completed within Block 2913B (Section 6.2) were found to be similar. The top 100 m water depth remained relatively stable with 93% DO, which steadily decreased to 70% by 200 m and reached a minimum of 40% around 900 m. Notably the profile steadily increases from 1 400 m, reaching 48% at 2 000 m, before declining again to 38% at 3 000 m (BSL, 2019a; 2023a; 2023b).

Nutrient concentrations of upwelled water attain 20 μM nitrate-nitrogen, 1.5 μM phosphate and 15-20 μM silicate, indicating nutrient enrichment (Chapman & Shannon, 1985). This is mediated by nutrient regeneration from biogenic material in the sediments (Bailey, Beyers, De, & Lipschitz, 1985). The actual nutrient concentrations can vary widely, depending on phytoplankton uptake influenced by phytoplankton biomass and production rate. The range of nutrient concentrations can thus be large but, in general, concentrations are high near the coast (see Section 6.4.6).

Considering the offshore location of Block 2913B, nutrient levels are expected to be low. This was confirmed by water samples collected within the Venus field during pre- (2018 Venus-1X EBS) and post-drill (2022) environmental surveys (Section 6.2), which found Orthophosphate (PO_4) levels to be relatively consistent between surveys, ranging from 0.12-0.22 mg.l^{-1} (BSL, 2019a; 2023a; 2023b). Nitrate concentrations at the Venus field were variable across environmental surveys with higher concentrations (0.83-6.35 mg.l^{-1}) recorded post-drill (2022 Venus-1X EPOS) as compared to pre-drill (2018 Venus-1X EBS) concentrations (<0.20 mg.l^{-1}). Nitrite levels were below the limits of detection (<0.01 mg.l^{-1}) across all surveys. Total Nitrogen was consistent across the Venus field sampling sites with low levels recorded both pre- (2018 Venus-1X EBS; mean < 0.04%) and post-drilling (2022 Venus-1X EPOS; mean 0.06%) (BSL, 2019a; 2023a; 2023b).

6.4.6 Upwelling and Plankton Production

The cold, upwelled water is rich in inorganic nutrients, the major contributors being various forms of nitrates, phosphates and silicates (Chapman & Shannon, 1985). During upwelling the comparatively nutrient-poor surface waters are displaced by enriched deep water, supporting substantial seasonal primary phytoplankton production. This, in turn, serves as the basis for a rich food chain up through zooplankton, pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (hake and snoek), mammals (primarily seals and dolphins) and seabirds (penguins, cormorants, pelicans, terns and others). High phytoplankton productivity in the upper layers again depletes the nutrients in these surface waters. This results in a wind-related cycle of plankton production, mortality, sinking of plankton detritus and eventual nutrient re-enrichment occurring below the thermocline as the phytoplankton decays.

The project area is located well offshore of coastal upwelling cells (Figure 6-9), with waters expected to be nutrient poor (as discussed in Section 6.4.5).

Chlorophyll-a is a photosynthetic pigment found in phytoplankton and can be used as an indication of marine productivity and nutrient enrichment, including the effects of coastal upwelling cells. Due to differing survey methods, surveys to quantify chlorophyll-a levels between pre- and post-drill surveys are restricted, with Chlorophyll-a levels falling below the levels of detection (<7 $\mu\text{g.l}^{-1}$) for the pre-drill EBS (BSL, 2019a). **Analysis of water samples collected during the 2022 environmental survey recorded relatively low levels of chlorophyll-a throughout the water column (0.001-0.06 $\mu\text{g.l}^{-1}$)** (BSL, 2023a; BSL, 2023b). As is expected, chlorophyll-a levels were highest at the surface (0.2 to 0.4 $\mu\text{g.l}^{-1}$) (BSL, 2023a; BSL, 2023b).



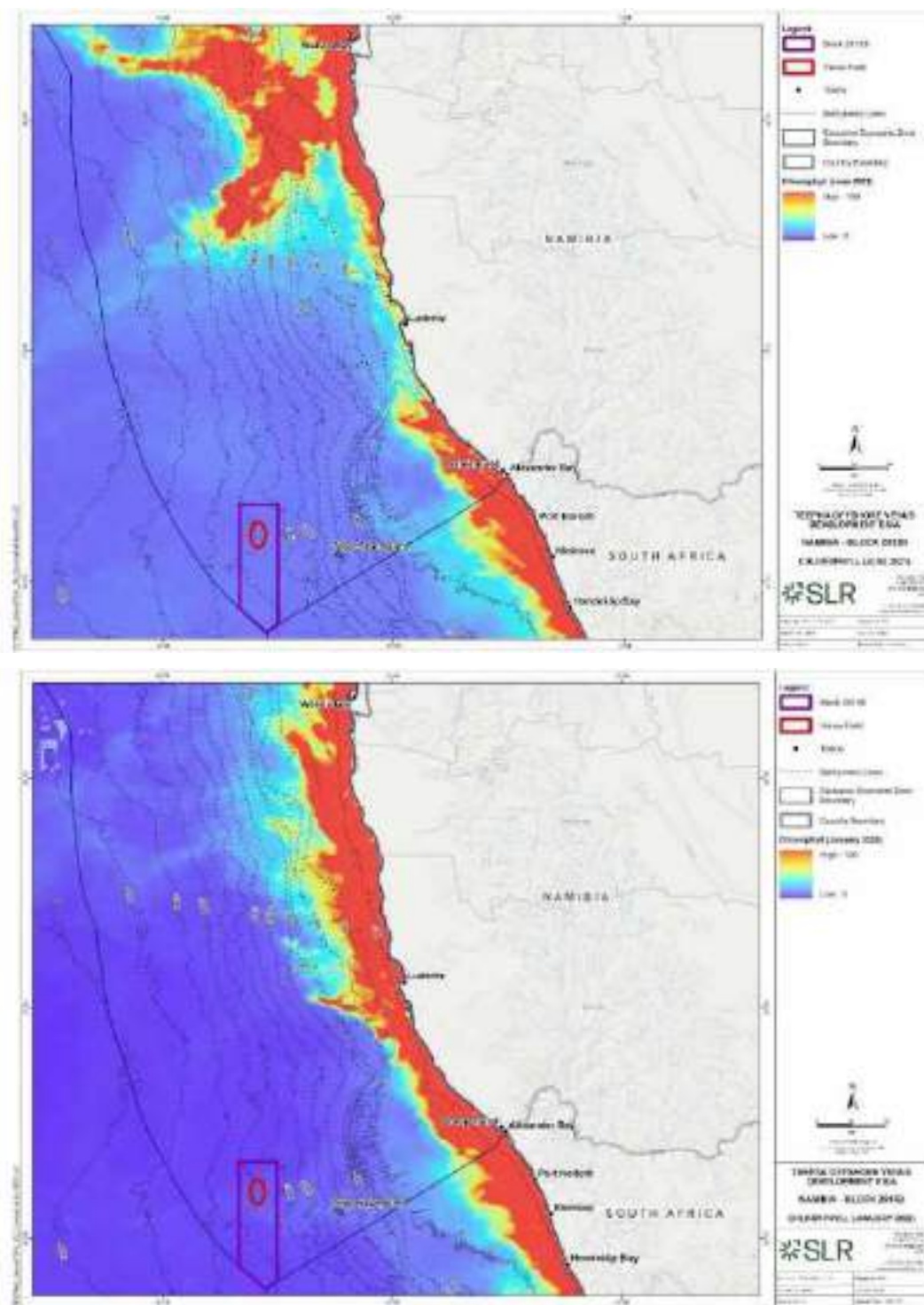


Figure 6-9: Chlorophyll a level off West Coast in relation to Block 2913B (purple polygon) and Venus development field (red circle) for June 2021 (top) and January 2022 (bottom).

Source: AQUA MODIS, NASA [Chlorophyll from Aqua MODIS, NASA Polar Map Preview on PolarWatch \(noaa.gov\)](https://polarwatch.nasa.gov/)



6.4.7 Turbidity

Turbidity is a measure of the level of suspended particulate matter in seawater, affecting water clarity and light penetration. Total Suspended Particulate Matter (TSPM) comprises Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM):

- POM includes detritus, bacteria, phytoplankton and zooplankton, and serving as food for filter-feeders. Coastal POM levels are influenced by seasonal microphyte production during upwelling events.
- PIM, mostly of geological origin consisting of fine sands, silts and clays. Off the Namibian coast, the coastal PIM load is strongly related to natural riverine inputs. Additionally, 'berg' winds can contribute sediment levels comparable to the annual Orange River inputs (Shannon & Anderson, 1982; Zoutendyk P. , 1992; Zoutendyk P. , 1995; Shannon & O'Toole, 1998; Lane & Carter, 1999).

Suspended particulate matter concentrations in shallow coastal waters vary spatially and temporally, ranging from a few mg/l to several tens of mg/l (Bricelj & Malouf, 1984; Berg & Newell, 1986; Fegley, MacDonald, & Jacobsen, 1992). Typical Benguela current system measurements suggest coastal and continental shelf sediment concentrations are generally <12 mg/l outside major flood events, showing significant longshore variation. However, under strong wave conditions, high tides, storms, or floods, higher PIM concentrations have been reported.

In the nearshore areas off the southern Namibian coast, turbidity primarily results from redistributing inner shelf sediments by long-period Southern Ocean swells. The Benguela Current velocities (10-30 cm/s) can resuspend and transport considerable quantities of sediment equatorward. Under relatively calm wind conditions, however, much of the suspended fraction (silt and clay) that remains in suspension for longer periods becomes entrained in the slow poleward undercurrent (Shillington, et al., 1990; Rogers & Bremner, 1991). The northward littoral drift of coarser bedload sediments, parallel to the coastline, occurs due to south-westerly swells and wind-induced waves. Longshore sediment transport is notably higher in the surf-zone due to breaking waves that suspend and mobilize sediment (Smith & Mocke, 2002).

On the inner and middle continental shelf, currents are insufficient to transport coarse sediments, and resuspension and shoreward movement mainly occurs during storm conditions (see also Drake, et al., 1985; Ward, 1985).

In the offshore waters of Block 2913B, Total Suspended Solids (TSS) were found to be variable but low, ranging from <5mg.l⁻¹ for all water depths sampled during the 2018 Venus-1X environmental survey to 18mg.l⁻¹ within the post-drill surface waters sampled during the 2022 Venus-1X EPOS. The increased surface TSS likely reflects a higher phytoplankton abundance and wave-driven turbidity. Overall, water column profiling found that turbidity (NTU) remained low (0.02 NTU) and constant from 100 m water depth to the seabed, with a slight increase in the upper water column and surface waters (BSL, 2019a; BSL, 2023a; BSL, 2023b).

6.4.8 Organic Inputs

As detailed in Section 6.4.6, the coastal upwelling region in the Benguela current is an area of particularly high natural productivity. Balanced ecosystem models estimate that during the 1990s, the Benguela region sustained biomasses of 76.9 tonnes/km² of phytoplankton and 31.5 tonnes/km² of zooplankton alone (Shannon, Moloney, Jarre, & Field, 2003). Natural mortality affects these species, with approximately 36% of phytoplankton and 5% of zooplankton sinking to the seabed annually.

This annual influx of millions of tons of organic material onto the seabed significantly impacts the ecosystems of the Benguela Current. It supports the food requirements of benthic



communities in sandy-mud habitats, contributing to the high organic content of the region's muds. As most of this organic detritus is not directly consumed, it enters the seabed decomposition cycle, leading to oxygen depletion in deeper waters.

The Benguela system is also known for red tides (dinoflagellate and/or ciliate blooms), commonly referred to as Harmful Algal Blooms (HABs) (see Shannon & Pillar, 1985; Pitcher, 1998). These red tides can grow to substantial sizes. Toxic dinoflagellate species can poison fish and shellfish, while the breakdown of organic-rich material from both toxic and non-toxic blooms results in subsurface water oxygen depletion. HABs are discussed further in Sections 6.4.9 and 6.5.3.1. **HABs are mainly associated with inshore upwelling cells and are unlikely to occur in the offshore waters of Block 2913B and Venus field. However, nearshore transshipment operations may take place in waters associated with these events.**

6.4.9 Low Oxygen and Hypoxic Events

The Benguela system's continental shelf waters consistently exhibit low oxygen levels, often falling below 40% saturation (e.g., Visser, 1969; Bailey, et al., 1985) low oxygen concentrations are primarily attributed to remineralisation of nutrients in the bottom waters (Chapman & Shannon, 1985), especially in areas with carbon-rich mud deposits. As the mud patches are unevenly distributed on the shelf, specific regions tend to experience lower oxygen levels. The primary areas of low-oxygen water formation off southern Namibia are the Orange River Bight and off Walvis Bay (Chapman & Shannon, 1985; Bailey, 1991; Shannon & O'Toole, 1998; Bailey, 1999; Fossing, Ferdelman, & Berg, 2000). The spatial distribution of oxygen-poor water in these regions can vary in the short and medium term.

Periodic low-oxygen events nearshore can have devastating effects on marine communities, leading to rock lobster strandings and mass mortalities of marine life and fish (Newman & Pollock, 1971; Matthews & Pitcher, 1996; Pitcher, 1998; Cockcroft, Schoeman, Pitcher, Bailey, & Van Zyl, 2000). These events result from the development of anoxic conditions due to the decomposition of large quantities of organic matter generated by algal blooms. These blooms typically occur during summer-autumn (February to April) but can also develop in winter during 'berg' wind periods when extended calm, warm, and windless conditions prevail.

Seafloor hypoxia, especially off central Namibia, is closely linked to the production of toxic hydrogen sulphide and methane within organically rich, anoxic muds following the decay of expansive algal blooms. Under severe oxygen depletion, anaerobic bacteria in the anoxic seabed muds generate hydrogen sulphide (H₂S) gas (Brüchert, et al., 2003). Periodically, this gas is released from the muds in 'sulphur eruptions,' leading to upwelling of anoxic water and the formation of surface slicks of sulphur-discoloured water (Emeis, et al., 2004; Ohde, Siegel, Reibmann, & Gerth, 2007). **These events typically occur inshore and off the central Namibian coastline and are unlikely to occur within Block 2913B and the Venus field, however may occur within the nearshore transshipment area.**

6.4.10 Natural Hydrocarbon Seeps

A study by January (2018) identified hydrocarbon seeps and gas escape structures in the Orange Basin area. Large fluid seep/pockmark fields of varying morphologies were also reported in South African waters over 500 km south of Block 2913B by Palan (2017).

Petroleum discharges, both from natural seeps at the seabed and discharges occurring during the production and transport of petroleum are a common source of toxic substances in marine ecosystems (NRC 2003a). An analysis by TEEPNA of 2016 and 2021 satellite imagery detected several oil spills from boats corresponding with the orientation of the main shipping lanes along the south-western African coast. No anomaly centre points were, however, identified in the vicinity of adjacent Block 2912 that could be considered as potential oil seeps.



Summary of the key biophysical characteristics of the study area

Block 2913B is located in a deep-water environment that lies well offshore of more coastal upwelling cells and areas of high productivity. Swells throughout the year come predominantly from a south and south-southwest direction with average significant wave height of 1.73 m.

The project area also lies well offshore of the areas periodically affected by low-oxygen, high nutrient and high-turbidity conditions. EBS results indicate that the offshore waters of Block 2913B are comparatively clear and nutrient poor.

6.5 Biological Characteristics

The project area lies within the cold temperate Namaqua Bioregion, which stretches from Sylvia Hill, north of Lüderitz in Namibia, to Cape Columbine in South Africa (Emanuel, Bustamante, Branch, Eekhout, & Odendaal, 1992; Lombard, et al., 2004). Block 2913B is situated within the marine Namib Biozone (De Cauwer, 2007), which stretches from the shelf edge to the Namibian EEZ border (Figure 6-10). As discussed in Section 6.4.6, the dominant coastal, wind-driven upwelling along the Namibian coastline plays a pivotal role in shaping the marine ecology of the Benguela region.

Marine communities along the Namibian coast are widespread but vary based on substrate type and depth zone. These communities encompass hundreds of species and exhibit significant temporal and spatial fluctuations, even at small scales.

In the marine environment, habitats are specific physical areas where organisms live, such as sandy beaches or rocky shores, with each habitat providing the conditions necessary for the survival of particular species. Ecosystem types are broader categories that describe the ecological characteristics and functions of these habitats. This classification helps in understanding and managing marine biodiversity.

The seabed communities in Block 2913B lie within the Namib Lower Slope Ecosystem (Figure 6-11). The benthic and coastal ecosystem types of Namibia were mapped as part of the Benguela Current Commission's Spatial Biodiversity Assessment (BCC-SBA) (Holness, et al., 2014) to develop assessments of the ecosystem threat status and ecosystem protection level. Submarine canyons were also mapped as biodiversity features, although descriptions of their geographical situations were not sufficiently accurate for inclusion in the benthic habitat map⁴¹ (Figure 6-11). The benthic and coastal ecosystems were subsequently assigned an ecosystem threat status based on their level of protection and ecological condition (Table 6-2). Further information of the delineation/classification of ecosystem types, as well as assessment of their threat status, is presented in Holness et al. (2014).

Block 2913B and the Venus field overlaps with the Namib Lower Slope ecosystem, which is classified as 'Least Threatened'.

⁴¹ Possible marine canyons identified by the international Deep Ocean project mapped them as lines. The lines were buffered by 5 km to ensure that both the canyon and its associated adjacent ecosystems were included.



Table 6-2: Ecosystem types, threat status and size for marine ecosystem types on the Namibian coast (adapted from Holness et al. 2014).

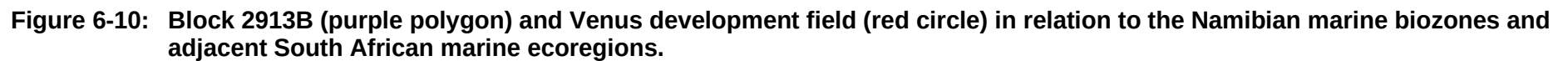
Ecosystem Type		Threat Status	Area (km ²)
1	Namib Abyss	Least Threatened	80 094
2	Namib Lower Slope	Least Threatened	1 380 13
3	Namib Upper Slope	Least Threatened	59 066
4	Namib Seamount	Least Threatened	26 83
5	Namaqua Shelf Edge	Endangered	44 40
6	Namaqua Outer Shelf	Least Threatened	175 29
7	Namaqua Inner Shelf	Least Threatened	69 48
8	Namaqua Inshore	Vulnerable	445
9	Lüderitz Shelf Edge	Critically Endangered	8 755
10	Lüderitz Outer Shelf	Vulnerable	18 470
11	Lüderitz Inner Shelf	Least Threatened	6 291
12	Lüderitz Islands	Least Threatened	1 332
13	Lüderitz Inshore	Least Threatened	356

Note: Habitat potentially affected by proposed drilling and production activities are in **bold**.

The typical biological communities found in the habitats represented in Block 2913B are briefly described below, highlighting dominant, commercially valuable, and conspicuous species, as well as potentially vulnerable species that may be impacted by the proposed development project.

Nearshore transshipment operations may take place in one of several ecosystem types located along the Namibian coastline. The ecosystem types potentially affected by the proposed transshipment operations will be confirmed and fully assessed once confirmed.







6.5.1 Demersal Communities

6.5.1.1 Benthic Invertebrate Macrofauna

The benthic biota of unconsolidated marine sediments comprises mainly invertebrates that either live on the sediment surface (epifauna) or within the sediment (infauna). These are further categorized by size into meiofauna (<1 mm), macrofauna (> 1 mm) and megafauna (>10 mm). Benthic macrofauna are essential for various ecological functions, including the remineralization of organic matter and maintaining sediment stability. They also serve as a food source for commercially important fish species and other higher trophic level organisms. Due to their relatively limited mobility and seasonal permanence, these organisms offer valuable insights into historically recent (months) environmental conditions and changes therein serving as indicators for assessing environmental impacts (Gray, 1974; Warwick, 1993; Salas, Marcos, Patricio, Perez-Ruzafa, & Marques, 2006). Temperature, depth, hydrogen sulphide and dissolved oxygen seem to be significant forces shaping macrozoobenthic communities within the Namibian shelf (Amorim & Zettler, 2023). Benthic megafauna include large organisms such as demersal fish, crabs, shrimp, starfish, sea urchins, gastropods and are typically predators on macrobenthos and scavengers.

Numerous studies have been conducted to assess the continental shelf benthos offshore of South Africa and Namibia (Steffani & Pulfrich, 2004; Steffani & Pulfrich, 2007; Atkinson, 2009; Atkinson, Field, & Hutchings, 2011; Steffani, 2011; Steffani, 2012a; Steffani, 2012b; Steffani, 2014; Karenyi, 2014; Steffani, Sedick, Rogers, & Gibbons, 2015; Biccard & Clark, 2016; Biccard, Clark, & Brown, 2016; Duna, et al., 2016; Karenyi, Sink, & Nel, 2016; Biccard, et al., 2017; Biccard A. , et al., 2018; Gihwala, et al., 2018; Biccard A. , et al., 2019; Gihwala, et al., 2019). These have been focused on mining, pollution or demersal trawling impacts on the continental shelf and in nearshore regions. For a review of the benthic macroinvertebrates present inshore of the 1 000 m depth contour in South Africa, the reader is referred to the comprehensive field guide compiled by Atkinson & Sink (2018).

Polychaetes, crustaceans and molluscs make up the largest proportion of individuals, biomass and species on the west coast of southern Africa. The distribution of species within these communities are inherently patchy reflecting the high natural spatial and temporal variability associated with macro-infauna of unconsolidated sediments (Kendall & Widdicombe, 1999; Van Dalfsen, et al., 2000; Zajac, et al., 2000; Parry, Kendall, Pilgrim, & Jones, 2003; Kenny, Rees, Greening, & Campbell, 1998), with evidence of mass mortalities and substantial recruitments recorded on the South African West Coast (Steffani & Pulfrich, 2004).

Karenyi et al. (2016) found that off the Namaqualand Coast, South Africa, species richness increases from the inner shelf across the mid-shelf and is influenced by sediment type. The highest total abundance and species diversity was measured in sandy sediments of the mid-shelf. Biomass is highest in the inshore (± 50 g/m² wet weight) and decreases across the mid-shelf averaging around 30 g/m² wet weight. Similarly recent benthic sampling along the Namaqua inner shelf ecozone, offshore southern Namibia, yielded an average biomass of 31.6-38.9 g/m² (Biccard, et al., 2020).

This is contrary to (Christie, 1974) who found that biomass was greatest in the mudbelt at 80 m depth off Lamberts Bay in South Africa, where the sediment characteristics and the impact of environmental stressors (such as low oxygen events) are likely to differ from those off the northern Namaqualand coast. Sheltered bays along the West Coast of South Africa yielded notably higher biomass (846.53-970.78 g/m²) (Clark, et al., 2020).

In areas of frequent oxygen deficiency, benthic communities will be characterised either by species able to survive chronic low oxygen conditions, or colonising and fast-growing species able to rapidly recruit into areas that have suffered oxygen depletion. The



combination of local, episodic hydrodynamic conditions and patchy settlement of larvae will tend to generate the observed small-scale variability in benthic community structure. On the continental shelf slope and deeper regions, near-bottom conditions are oligoxic (Berg et al. 2015), with benthic communities characterised by greater stability and longer-lived species.

Amorim & Zettler (2023) provide a comprehensive study on the distribution of macrofaunal assemblages of the Oxygen Minimum Zone (OMZ) in the northern Benguela system off Namibia, using samples collected along three transects at depths between 25 m and 1 523 m. In general, the study reported high total biomass compared to OMZs worldwide. The assemblages on the shelf break (132 and 306 m) displayed intermediate diversity, abundance and biomass, and diversity was highest within the shallower and deeper assemblages. Biomass levels generally decreased offshore.

Information on the benthic fauna of the lower continental slope and abyss (beyond 1 800 m depth) is largely lacking due to limited opportunities for sampling. However, deep water benthic sampling has been undertaken within Block 2913B, and adjacent Blocks 2913A and 2914A located east of Block 2913B (SLR, 2022, 2023, 2024a, 2024b).

Dominant taxa observed across Licence Block 2914A (200 m to 1800 m deep), included brittlestars (*Ophiuroidea*), sea pens (*Pennatuloidae*) and sea cucumbers (*Holothuroidea*, including *Benthothuria* sp., *Benthodytes* sp. and *Enypniastes eximia*), with evidence of infaunal taxa found. Two macrofaunal communities, associated with Tripp Seamount and soft-substrate habitats, respectively, were identified in Block 2913A (~400 to 2 600m deep). Dominant taxa across the survey area were associated with soft sediment habitats, with Annelid genus *Spiophanes* and *Diopatra* identified as the most abundant (SLR, 2024a). Similar communities were observed in Block 2913B, which is expected as conditions in such deep-water habitats tend to be uniform (low temperatures and low oxygen concentrations characteristic of the SACW).

Benthic surveys in Block 2913B (2 600-3 300 m deep) revealed consistent yet impoverished (low diversity and abundance) macrofauna dominated by polychaetes, molluscs, and crustaceans (BSL, 2019a; BSL, 2023a; BSL, 2023b). The deposit-feeding polychaete, *Spiophanes* sp., was the most abundant species, highlighting the prevalence of deposit feeders in soft sediments. Additional dominant polychaetes recorded included *Aricidea* (*Acmira*) simplex, *Myriochele* sp., *Leanira quatrefagesi* and *Opheliidae* sp., with molluscs (*Microgloma mirmidina*, *Pristigloma nitens* and *Axinulus* sp.) also found to dominate. In addition, crustaceans and echinoderms were observed. Overall, a similar number of species were identified during both the pre- and post-drill surveys (2018 Venus-1X EBS and 2022 Venus-1X EPOS) of the Venus field area (pre-drill mean $16 \pm 7SD$; post-drill mean $18 \pm 4SD$) (BSL, 2019a; 2023a; 2023b). Except for the carnivorous polychaete *Glycera capitata*, most species were suspension or deposit feeders typical of soft unconsolidated sediments.

All pre- and post-drill stations surveyed across the Venus-1X and Block 2913B area were representative of the habitat ‘Atlantic abyssal mud’ (EUNIS: MG62), based on the European Nature Information System (EUNIS)⁴² classification, particle size analysis, macrofauna return and video footage/photographic evidence. Atlantic abyssal mud habitats are described by EUNIS as “Deep-sea mud sediments have a diverse infaunal community dominated by polychaetes. Epifauna tends to be sparse, mobile species, but aggregations of

⁴² The EUNIS marine habitat classification system categorizes and describes various marine habitats, providing a hierarchical framework that supports biodiversity monitoring, and environmental reporting. The EUNIS classification system uses several input variables including physical characteristics, biological features, environmental parameters and geographic information.



erect fauna such as glass sponges, sea pens and soft corals can occur" (BSL, 2019a; 2023b).

Examples of the macroinvertebrate infauna of the project area are illustrated in Figure 6-12.



Figure 6-12: Examples of benthic macroinvertebrate specimens recorded within Licence Block 2913B (BSL, 2019a).

6.5.1.2 Deep-water Coral Communities

There has been increased interest in deep-water corals in recent years because of their likely sensitivity to disturbance and their long generation times. These benthic filter-feeders typically occur at depths exceeding 150 m, with some species recorded as deep as 3 000 m. They vary in size, forming either reefs or smaller solitary structures. Corals enhance biodiversity by adding structural complexity to otherwise uniform seabed habitats (Breeze, Davis, Butler, & Kostylev, 1997; MacIsaac, Bourbonnais, Kenchington, Gordon, & Gass, 2001). Deep-water corals thrive beneath the thermocline, where a consistent supply of concentrated particulate organic matter is maintained by strong currents and eddies formed over topographic features. Nutrient seepage from the substratum further promotes



settlement (Hovland, Vasshus, Indreeide, Austdal, & Nilsen, 2002). The productive and substantial shelf areas in the Benguela region have potential to support rich, cold water, benthic, filter-feeding communities. Evidence from video footage taken on hard-substrate habitats at depths of 100-120 m off southern Namibia suggests that sensitive gorgonians, octocorals and reef-building sponges occur on the continental shelf. Additionally, a recent EBS undertaken in adjacent Block 2913A, identifying gorgonian corals (Octocorallia), hydrocorals (Anthoathecata), stony corals (Scleractinia), zoanthids, and possible black coral (Antipatharia) at depths between approximately 160-2 600 m (SLR, 2024a). Additionally, small stony corals (Scleractinia) and raised coral rubble outcrops were identified at Tripp Seamount at depths between 160-500 m (located 85 km east of the Licence Block) (SLR, 2024a). Similar communities could be expected near topographic features at these depths.

During a habitat assessment within Licence Block 2914A (located 48 km inshore of Block 2913B), dead fragments of what was thought to be hard coral were identified from two of the shallower stations in the north-east of the survey area, but there was no evidence of living hard coral from these or other stations (SLR, 2024b). Fossilised cold water coral reefs are known to occur on the Namibian shelf at water depths of between 160 m and 270 m; these are thought to have died in an extinction event approximately 4 500 years ago, but fragments are still widespread within shelf sediments (Tamborrino, et al., 2019). Dead coral fragments were not recorded during 2022 EBS surveys within Block 2913B.

Deep-water corals were not observed during EBS surveys within Block 2913B, with the observed homogenous, ‘Sandy Mud’/ ‘Muddy’ sediments likely restricting the establishment of these cold-coral communities.

6.5.1.3 Demersal Fish

Demersal fish are those species that live and feed on or near the seabed. As many as 110 species of bony and cartilaginous fish have been identified in the demersal communities on the continental shelf off southern Namibia (Roel, 1987). Changes in fish communities occur both latitudinally (Shine K. , 2006; Shine K. H., 2008; Yemane, 2015) and with increasing depth (Roel, 1987; Smale, Roel, Badenhorst, & Field, 1993; MacPherson & Gordoa, 1992; Bianchi, Hamukuaya, & Alvheim, 2001; Atkinson L. J., 2009), with the most substantial change in species composition occurring in the shelf break region between depths of 300 m and 400 m (Roel, 1987; Atkinson, 2009).

The shelf community (<350 m) is dominated by the Cape hake (*Merluccius capensis*), and includes jacobever (*Helicolenus dactylopterus*), Izak catshark (*Holohaelurus regain*), soupfin shark (*Galeorhinus galeus*) and whitespotted houndshark (*Mustelus palumbes*). The more diverse deeper water community is dominated by the deepwater hake (*M. paradoxus*), monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*), bronze whiptail (*Lucigadus ori*) and hairy conger (*Bassanago albescens*) as well as cephalopod species (such as squid and cuttlefishes) and squalid shark species. There is some degree of species overlap between the depth zones.

Roel (1987) showed seasonal variations in the distribution ranges shelf communities, with species such as the pelagic goby (*Sufflogobius bibarbatus*), and West Coast sole (*Austroglossus microlepis*) occurring in shallow water during summer only. The deep-sea community was found to be homogenous both spatially and temporally. In a more recent study, however, Atkinson (2009) identified two long-term community shifts in demersal fish communities; the first (early to mid-1990s) being associated with an overall increase in density of many species, whilst many species decreased in density during the second shift (mid-2000s). These community shifts correspond temporally with regime shifts detected in environmental forcing variables (Sea Surface Temperatures and upwelling anomalies) (Howard, Jarre, Clark, & Molo, 2007) and with the eastward shifts observed in small pelagic



fish species and rock lobster populations (Coetzee, Van der lingen , & Hutchings, 2008; Cockroft, Schoeman, Pitcher, Bailey, & Van Zyl, 2000).

The diversity and distribution of demersal cartilaginous fishes on the southern African west coast was discussed by Compagno, et al. (1991). The species that may occur on the continental shelf inshore of the Venus field area, and their approximate depth range, are listed in Table 6-3, with several of these species potentially encountered during vessel transit and nearshore transshipment operations.

Information on demersal and cartilaginous fish species beyond the shelf break is lacking. Typical upper and mid slope fishes (200 to 2 000 m) include rattails (Macrouridae), greeneyes (*Chlorophthalmus* species), notacanthids, halosaurs, chimaeras, skates, bythitids such as *Cataetys* spp. and morids (deep-sea cods) (Smith & Heemstra, 2003) lower slope fishes include rattails, bythitids, liparidae (snail fishes) and notacanthids (*Polyacanthonotus* species and halosaurs) (Iwamoto & Anderson, 1994; Jones, 2014).

Fish species, such as eel-shaped fishes (Halosauridae sp.), rat-tails (Macrouridae sp.), tripod fishes (Ipnopidae sp.), cusk-eels (Ophidiidae sp.) and larvacean houses (Appendicularia sp.), were recorded by video transects during the Block 2913B EBS survey (BSL, 2023a).

Table 6-3: Demersal cartilaginous species found on the continental slope along the southern African west coast and their IUCN conservation status.

Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
Frilled shark	<i>Chlamydoselachus anguineus</i>	200-1 000	LC
Six gill cowshark	<i>Hexanchus griseus</i>	150-600	NT
Gulper shark	<i>Centrophorus granulosus</i>	480	EN
Leafscale gulper shark	<i>Centrophorus squamosus</i>	370-800	EN
Bramble shark	<i>Echinorhinus brucus</i>	55-285	EN
Black dogfish	<i>Centroscyllium fabricii</i>	>700	LC
Portuguese shark	<i>Centroscymnus coelolepis</i>	>700	NT
Longnose velvet dogfish	<i>Centroscymnus crepidater</i>	400-700	NT
Birdbeak dogfish	<i>Deania calcea</i>	400-800	NT
Arrowhead dogfish	<i>Deania profundorum</i>	200-500	NT
Longsnout dogfish	<i>Deania quadrispinosa</i>	200-650	VU
Sculpted lanternshark	<i>Etmopterus sculptus</i>	450-900	LC
Brown lanternshark	<i>Etmopterus compagnoi</i>	450-925	LC
Southern Lanternshark	<i>Etmopterus granulosus</i>	>700	LC
Smooth lanternshark	<i>Etmopterus pusillus</i>	400-500	LC
Spiny dogfish	<i>Squalus acanthias</i>	100-400	VU
Shortnose Spurdog	<i>Squalus megalops</i>	75-460	LC
Shortspine Spurdog	<i>Squalus mitsukurii</i>	150-600	EN
Warren's Sixgil Sawshark	<i>Pliotrema warreni</i>	60-500	LC
Goblin shark	<i>Mitsukurina owstoni</i>	270-960	LC
Smalleye catshark	<i>Apristurus microps</i>	700-1 000	LC
Saldanha catshark	<i>Apristurus saldanha</i>	450-765	LC



Common Name	Scientific name	Depth Range (m)	IUCN Conservation Status
“grey/black wonder” catsharks	<i>Apristurus</i> spp.	670-1 005	NA
Tiger catshark	<i>Halaelurus natalensis</i>	50-100	VU
Izak catshark	<i>Holohalaelurus regani</i>	100-500	LC
Yellowspotted catshark	<i>Scyliorhinus capensis</i>	150-500	NT
Soupfin shark/Tope	<i>Galeorhinus galeus</i>	<10-300	CR
Common smoothhound/ Houndshark	<i>Mustelus mustelus</i>	<100	EN
Whitespot smoothhoundshark	<i>Mustelus palumbes</i>	>350	LC
Lesser guitarfish	<i>Acroteriobatus annulatus</i>	>100	VU
Great Torpedo Ray	<i>Torpedo nobiliana</i>	120-450	LC
African softnose skate	<i>Bathyraja smithii</i>	400-1 020	LC
Smoothnose pygmy skate	<i>Cruriraja durbanensis</i>	>1 000	DD
Roughnose/triangular legskate	<i>Cruriraja parcomaculata</i>	150-620	LC
South African dwarf skate	<i>Neoraja stehmanni</i>	290-1 025	LC
Thorny skate	<i>Raja radiata</i>	50-600	VU
Bigmouth skate	<i>Raja robertsi</i>	>1 000	LC
Slime skate	<i>Dipturus pullopunctatus</i>	15-460	LC
Roughbelly skate	<i>Raja springeri</i>	85-500	LC
Yellowspot skate	<i>Raja wallacei</i>	70-500	VU
Roughskin skate	<i>Dipturus trachydermus</i>	1 000-1 350	EN
Biscuit skate	<i>Raja straeleni</i>	25-500	NT
Munchkin skate	<i>Rajella caudaspinosa</i>	300-520	LC
Bigthorn skate	<i>Raja confundens</i>	100-800	LC
Ghost skate	<i>Rajella dissimilis</i>	420-1 005	LC
Leopard skate	<i>Rajella leopardus</i>	300-1 000	LC
Smoothback skate	<i>Rajella ravidula</i>	500-1 000	LC
Spearnose skate	<i>Rostroraja alba</i>	75-260	EN
St Joseph	<i>Callorhynchus capensis</i>	30-380	LC
Cape chimaera	<i>Chimaera notafricana</i>	680-1 000	LC
Brown chimaera	<i>Chimaera carophila</i>	420-850	LC
Atlantic Longnose Chimaera/ Broadnose Chimaera	<i>Rhinochimaera atlantica</i>	650-960	LC

Notes: DD = Data Deficient, LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NA = Not Assessed.

Source: Compagno et al. (1991) and International Union for the Conservation of Nature (IUCN)

6.5.2 Seamount Communities

Seamounts, including banks, knolls, and protruding underwater features interact with the surrounding water currents. There are several seamounts located outside of the Block 2913B, the closest being Tripp Seamount, 85 km east. These formations can cause upwelling of cool, nutrient-rich water amidst nutrient-poor surface water, resulting in higher productivity (Clark, O’Shea, Tracey, & Glasby, 1999). This phenomenon shapes the



distribution and occurrence of organisms in and around seamounts, causing diverse and abundant bottom-associated communities.

Seamounts serve as vital habitats for deep-sea commercial fish stocks such as orange roughy, oreos, alfonsino, and Patagonian toothfish, aggregating for spawning or feeding (Koslow, 1996). They also attract a variety of predators like turtles, tunas, billfish, pelagic sharks, cetaceans, and seabirds, creating mid-ocean focal points for pelagic species (Hui, 1985; Haney, Hauray, Mullineaux, & Fey, 1995). Seamounts thus serve as feeding grounds, spawning and nursery grounds and possibly navigational markers for many species (SPRFMA, 2007; Derville, Torres, Zerbini, Oremus, & Carrigue, 2020).

Seamounts, characterized by enhanced currents, steep slopes, and volcanic rocky substrata, support suspension feeders such as deep- and cold-water corals, barnacles, bryozoans, molluscs, and sponges, enriching benthic communities (Rogers A. , 1994; Rogers A. , 2004). There are also associated mobile benthic fauna including echinoderms (sea urchins and sea cucumbers) and crustaceans (crabs and lobsters) (reviewed by Rogers 1994). Corals create refugia, adding structural complexity and fostering high biological diversity as discussed in Section 6.5.1.2.

Compared to the surrounding deep-sea environment, seamounts typically form biological hotspots with a distinct, abundant, and diverse fauna, with many species likely unidentified. Consequently, associated fauna is usually highly unique and may be restricted to a single geographic region, a seamount chain or even a single seamount location (Rogers, Clark, & Gjerde, 2008). As a result of conservative life histories (i.e., very slow growing, slow to mature, high longevity, low levels of recruitment, endemic species) and sensitivity to changes in environmental conditions, such biological communities are often identified as Vulnerable Marine Ecosystems (VMEs). They are recognised as being particularly sensitive to anthropogenic disturbance (primarily deep-water trawl fisheries and mining), and once damaged are very slow to recover, or may never recover (FAO, 2008).

6.5.3 Pelagic (Water Column) Communities

In contrast to demersal and benthic biota that are associated with the seabed, pelagic species live and feed in the open water column. The pelagic communities are typically divided into plankton and fish, and their main predators: marine mammals (seals, dolphins, and whales), seabirds and turtles. These are discussed separately below.

6.5.3.1 Plankton

Plankton is associated with the upwelling characteristic of the region and is therefore particularly abundant in the shelf waters off Namibia, within 100 km of the coast. Plankton range from single-celled bacteria to jellyfish of 2 m diameter, and include bacterio-plankton, phytoplankton, zooplankton, and ichthyoplankton (Figure 6-13) (see also Sections 6.4.6 and 6.4.8).

Off the Namibian coastline, phytoplankton are the principal primary producers with mean annual productivity at 2 g C/m²/day (Barnard, 1998). Diatoms dominate as they are adapted to the turbulent sea conditions. Diatom blooms occur after upwelling events, whereas dinoflagellate blooms more commonly occur during quiescent periods, since they can grow rapidly at low nutrient concentrations. In the surf zone, diatoms and dinoflagellates are nearly equally important members of the phytoplankton, and some silicoflagellates are also present.

Zooplankton abundance reaches a maximum further offshore than the phytoplankton maximum along the Namibian coastline. Samples collected over a full seasonal cycle (February to December) along a 18 to 167 km transect offshore Walvis Bay showed that the mesozooplankton (<2 mm body width) community included egg, larval, juvenile and adult stages of copepods, cladocerans, euphausiids, decapods, chaetognaths, hydromedusae



and salps, as well as protozoans and meroplankton larvae (Hansen, Cloete, & Verheye, 2005). Copepods were the dominant group making up 70–85% of the zooplankton. The hydrography, phytoplankton, and zooplankton demonstrate close coupling, with zooplankton biomass tracking upwelling intensity and phytoplankton biomass. Following upwelling peaks, there is a lag time of 3-8 weeks when copepods respond to the environmental conditions and increase in abundance (Hansen, Cloete, & Verheye, 2005). Consistently higher biomass of zooplankton occurs offshore to the west and north-west of Walvis Bay (Barnard, 1998).

Vertical trawl and water sampling conducted in Block 2913B recorded 8 phylum (principal taxonomic category), with Arthropoda found to be the dominant group, followed by Chaetognathes, Ophiuroid larvae and Cnidaria. Copepods were dominant amongst the Arthropoda, representing the majority of species recorded (BSL, 2019a; BSL, 2023a).



Figure 6-13: Phytoplankton (left) and zooplankton (right) associated with upwelling cells.

Source: hymagazine.com and mysciencebox.org

Ichthyoplankton constitutes the fish eggs and larvae. As the preferred spawning grounds of numerous commercially exploited fish species are located off central and northern Namibia (Figure 6-14), their eggs and larvae form an important contribution to the ichthyoplankton in the region.

The Lüderitz Upwelling Cell - Orange River Cone (LUCORC) area, south of the Lüderitz upwelling cell between approximately 28°S- 31°S, is an environmental barrier to the transport of ichthyoplankton from the southern to the northern Benguela upwelling (Hutchings, et al., 2002; Lett, Veitch, Van Der Lingen, & Hutchings, 2007). Areas of intense upwelling are considered unfavourable spawning habitats due to intense offshore advection and low phytoplankton levels. Despite good nutrient supply, phytoplankton levels are reduced in these regions due to high turbulence and deep mixing (Lett, Veitch, Van Der Lingen, & Hutchings, 2007). Pelagic fish species, such as anchovy, redeye round herring, horse mackerel and shallow-water hake, spawn on either side of the LUCORC area, but not within it (Figure 6-14) (Lett, Veitch, Van Der Lingen, & Hutchings, 2007). Notably, only a single fish larvae was recorded during EBS surveys of Block 2913B (BSL, 2019a).

Orange roughy fish aggregate and spawn at several discrete locations along the continental slope (Figure 6-14). The species has a short, intense spawning period of about a month from July to August (Boyer & Hampton, 2001). Spawning is thought to occur near Tripp seamount, 85 km east of in Block 2913B, and in the fishery's Quota Management Area, "Johnnies", over 75 km northeast of Block 2913B. Eggs are fertilised in the water column, and then drift upwards to a depth of approximately 200 m and remain planktonic until they lose buoyancy and hatch close to the bottom after approximately 10 days (Branch 2001). During the spawning period orange roughy eggs could drift into the pelagic waters of Block 2913B, however egg distribution is extremely patchy, decreasing over 10-15 km to just 0.1% of the



density in spawning centres (Branch, 2001). The orange roughy fishery has been closed since 2007 due to overexploitation.

EBS findings (Section 6.2) indicate that the abundance of phytoplankton, zooplankton and ichthyoplankton in Block 2913B is low. This is expected as the block is removed from coastal upwelling processes, spawning and ichthyoplankton drift.

The abundance of phytoplankton, zooplankton and ichthyoplankton in nearshore areas is currently unknown, yet expected to be greater than the offshore development area, with the relative abundance dependant on the proximity to coastal upwelling and spawning processes and ichthyoplankton drift.



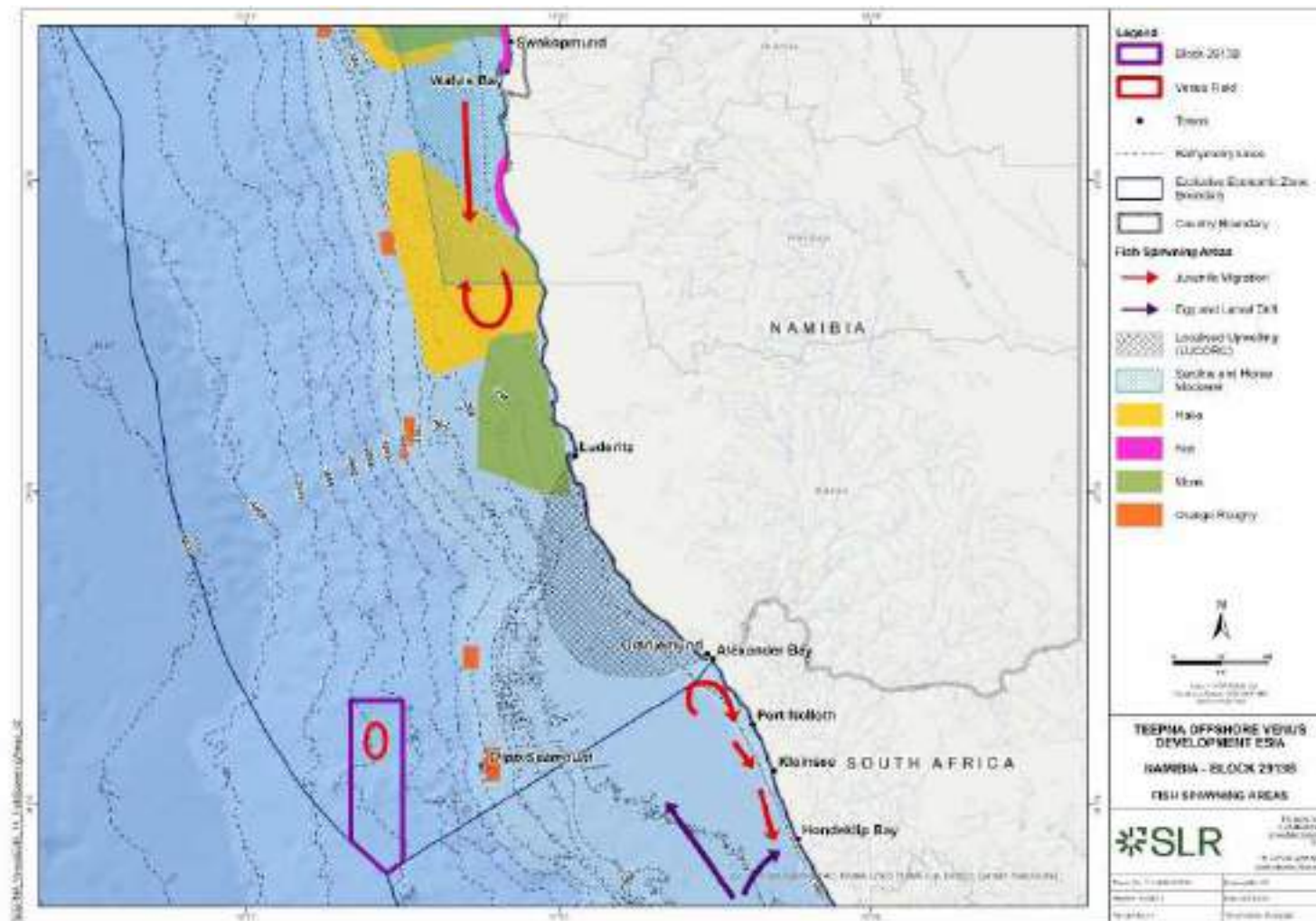


Figure 6-14: Block 2913B (purple polygon) and Venus development field (red circle) in relation to major spawning areas in the Benguela region.

Source: Adapted from Cruikshank (1990); Hampton (1992) and MFMR (2021).



6.5.3.2 Cephalopods

Fourteen species of cephalopods have been recorded in the southern Benguela, the majority of which are sepioids/cuttlefish (Lipinski, 1992; Augustyn, Lipinski, & Roeleveld, 1995). Most of the cephalopod resource is distributed on the mid-shelf to depths of 500 m, with a higher biomass in summer months. Cuttlefish are largely epi-benthic and occur on mud and fine sediments in association with their major prey item; mantis shrimps (Augustyn, Lipinski, & Roeleveld, 1995). They form an important food item for demersal fish.

The colossal squid (*Mesonychoteuthis hamiltoni*) and the giant squid (*Architeuthis* sp) are rare deep-dwelling species, with the colossal squid distributed across the entire circum-Antarctic Southern Ocean, and the giant squid usually found near continental and island slopes worldwide. Growing to more than 10 m in length, they are the principal prey of the sperm whale, and are also taken by beaked whales, pilot whales, elephant seals and sleeper sharks. Very little is known of their vertical distribution, but data from trawled specimens and sperm whale diving behaviour suggest they may span a depth range of 300-1 000 m. They lack gas-filled swim bladders and maintain neutral buoyancy through an ammonium chloride solution occurring throughout their bodies. Occasionally, carcasses of giant squids have washed up on South African and Namibian beaches, with 60 specimens known.

While both species could occur in the pelagic waters within Block 2913B, the likelihood of encounter in the project area is low.

6.5.3.3 Pelagic Fish

Small pelagic species include the sardine/pilchard (*Sardinops sagax ocellatus*) (Figure 6-15, left), anchovy (*Engraulis capensis*), chub mackerel (*Scomber japonicus*), horse mackerel (*Trachurus capensis*) (Figure 6-15, right) and round herring (*Etrumeus whiteheadi*). These species typically occur in mixed shoals of various sizes (Crawford, Shannon, & Pollock, 1987) and generally occur within the 200 m contour, although they may often be found very close inshore, just beyond the surf zone. Snoek (*Thyrsites atun*) and chub mackerel (*Scomber japonicas*), both rated as 'Least Concern' during the South African national assessment (Sink, et al., 2019) migrate along the southern African west coast following the shoals of sardine and anchovy. Their appearance along the Namibian coast is highly seasonal. Snoek are voracious predators occurring throughout the water column, feeding on both demersal and pelagic invertebrates and fish. The abundance and seasonal migrations of chub mackerel are thought to be related to the availability of their shoaling prey species (Payne & Crawford, 1989).



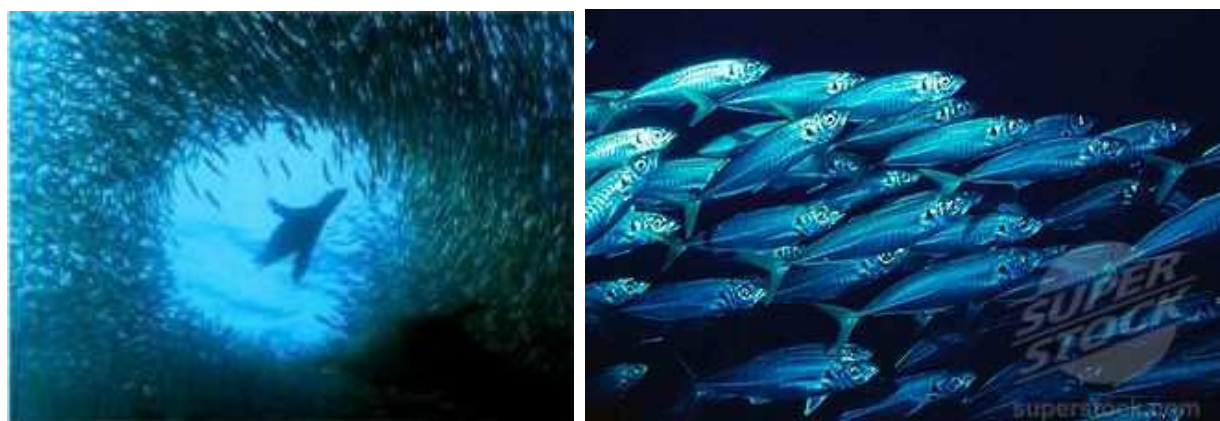


Figure 6-15: Cape fur seal preying on a shoal of sardine (left). School of horse mackerel (right).

Source: www.underwatervideo.co.za; www.delivery.superstock.com

The pelagic fish most likely to be encountered on the shelf, beyond the shelf break and in the offshore waters of Block 2913B are the large migratory species, including various tunas, billfish and sharks, many of which are considered Threatened by the IUCN, primarily due to overfishing (Table 6-4).

Tuna and swordfish are targeted by high seas fishing fleets and illegal overfishing has severely damaged the stocks of many of these species. Off the southern African west coast, fishers typically follow the movement of longfin tuna from the southern Benguela waters northwards into southern and central Namibia (see Section 6.7.5.2 for further details). This movement occurs from mid to late summer (January to March) at which time aggregations may occur around or near oceanic features, in particular seamounts. Other species movements (e.g., yellowfin and bigeye tuna), which occur spatially and temporally throughout the southeast Atlantic have not been clearly defined, although their availability to the fisheries is believed to increase from later summer into winter (March through to July) (Lehodeya, et al., 2006; Lan, et al., 2011). Similarly, pelagic sharks, are either caught as bycatch in the pelagic tuna longline fisheries, or are specifically targeted for their fins, which are removed, and the remainder of the body discarded.

Notably, Marine Mammal Observations (MMO) performed *en-route* from Walvis Bay to Block 2913B, between 11 and 16 September 2022, recorded a sunfish (*Mola mola*; IUCN Vulnerable) on two occasions, as well as an unidentified shark (BSL, 2022).

Table 6-4: Some of the more important large migratory pelagic fish likely to occur in the offshore regions of Namibian waters and their Global IUCN Conservation Status.

Common Name	Species	IUCN Conservation Status
Tunas		
Southern Bluefin Tuna*	<i>Thunnus maccoyii</i>	Endangered
Bigeye Tuna	<i>Thunnus obesus</i>	Vulnerable
Longfin Tuna/Albacore	<i>Thunnus alalunga</i>	Least concern
Yellowfin Tuna	<i>Thunnus albacares</i>	Least concern
Frigate Tuna	<i>Auxis thazard</i>	Least concern
Eastern Little Tuna	<i>Euthynnus affinis</i>	Least concern
Skipjack Tuna	<i>Katsuwonus pelamis</i>	Least concern
Billfish		
Black Marlin	<i>Istiompax indica</i>	Data deficient



Common Name	Species	IUCN Conservation Status
Blue Marlin	<i>Makaira nigricans</i>	Vulnerable
Striped Marlin	<i>Kajikia audax</i>	Least Concern
Sailfish	<i>Istiophorus platypterus</i>	Vulnerable
Swordfish	<i>Xiphias gladius</i>	Near Threatened
Pelagic Sharks		
Oceanic Whitetip Shark	<i>Carcharhinus longimanus</i>	Critically Endangered
Dusky Shark	<i>Carcharhinus obscurus</i>	Endangered
Great White Shark	<i>Carcharodon carcharias</i>	Vulnerable
Shortfin Mako	<i>Isurus oxyrinchus</i>	Endangered
Longfin Mako	<i>Isurus paucus</i>	Endangered
Whale Shark	<i>Rhincodon typus</i>	Endangered
Blue Shark	<i>Prionace glauca</i>	Near Threatened

*Until recently Southern Bluefin Tuna was globally assessed as 'Critically Endangered' by the IUCN. Although globally the stock remains at a low state, it is not considered overfished as there have been improvements since previous stock assessments. Consequently, the list of species changing IUCN Red List Status for 2020-2021 now list Southern Bluefin Tuna is globally 'Endangered'.

Notably, changes in the Benguela upwelling region have resulted in two contrasting pelagic ecosystems, one dominated by small pelagic fish (southern Benguela, south of the Lüderitz upwelling cell) and one dominated at the mid-trophic level by jellyfish (northern Benguela, north of the Lüderitz upwelling cell). Overfishing of planktivorous filter feeding pelagic fish stocks, and their subsequent decline, is argued to be linked to major jellyfish outbreaks ("jellyfish explosions"), resulting in a shift of the northern Benguela ecosystem to an alternative, jellyfish comminated state (Bakun & Weeks, 2006; Lynam, 2006; Richardson, Bakun, Hays, & Gibbons, 2009; Utne-Palm, et al., 2010; Jensen, Branch, & Hilborn; Roux, et al., 2013).

6.5.3.4 Turtles

Five turtle species occur in Namibian waters, namely Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Hawksbill (*Eretmochelys imbricata*), Olive Ridley (*Lepidochelys olivacea*) and Leatherback (*Dermochelys coriacea*) (Bianchi, et al., 1999). Observations of turtles in the area have been reported but are rare.

Leatherbacks (Figure 6-16 left) are the only species that frequently inhabit deeper, offshore waters and are considered pelagic species, while the other species are primarily found in continental shelf and coastal waters. **However, the MMO reports for adjacent Block 2814B, northeast of Block 2913B, as well as within Block 2913B have reported loggerhead turtle** (Figure 6-16 right) sightings during seismic operations. Additionally, recent telemetry data recorded by the South African Two Oceans Aquarium, shows a green turtle and loggerhead turtle recently released on the Cape Peninsula remaining in West Coast waters before heading northwards into Namibian waters, suggesting that occurrence in both offshore and coastal Namibian waters does arise⁴³(Figure 6-17).

⁴³ <https://www.aquarium.co.za/foundation/news/tracking-our-turtles-the-first-update-of-2024>





Figure 6-16: Leatherback (left) and loggerhead turtles (right) occur in Namibian waters.

Source: Ketos Ecology 2009; BSL (2022b)

The Benguela ecosystem is increasingly being recognized as a potentially important feeding area for leatherback turtles from several globally significant nesting populations in the south Atlantic (Gabon, Brazil) and southeast Indian Ocean (South Africa) (Lambardi, Lutjeharm, Menacci, Hays, & Luschi, 2008; Elwen & Leeney, 2011). While hunting they may dive to over 600 m and remain submerged for up to 54 minutes (Hays, et al., 2004). The Southwest Indian Ocean Leatherback subpopulation have been satellite tracked swimming around the west coast of South Africa and remaining in the warmer waters west of the Benguela ecosystem (Figure 6-18) (Lambardi, Lutjeharm, Menacci, Hays, & Luschi, 2008; Harris, et al., 2018).



Figure 6-17: Movements of two green (orange and green lines) and loggerhead (purple and red lines) turtles recorded by telemetry (2024).

Source: aquarium.evlink21.net/public/messages/view-online/sUxLeTchHn1pvYc9/f4ow0OckcO3B4rJT/VFS8EqhUDNyVyLW1

From mid-January to mid-March leatherback hatchlings emerge from their nests along the KwaZulu Natal coastline on the east coast of South Africa. Those which successfully escape predation, enter the sea and either actively swim to reach the Agulhas Current or are carried through coastal rip currents ~10 km offshore (Hughes, 1974). While hatchlings can swim to influence their dispersal trajectories, they are not powerful swimmers. As such hatchlings will primarily drift in a south-west direction, influenced by the Agulhas



Current migration corridor is thus expected to be very active with migrating sea turtles between January and April (Harris, et al., 2018), some of which may be distributed along the West Coast through mass transport of Agulhas Current water into the southeast Atlantic. Recent simulations estimate that Leatherback and Loggerhead turtles take between 200 and 365 days to reach the West Coast from iSimangaliso MPA, located on the east coast of South Africa (Le Gouvello, Hart-Davis, Backeberg, & Nel, 2020) (Figure 6-19).

Overall Leatherback abundance in the project area is unknown but expected to be low, with seasons of increased adult and neonate turtle's numbers anticipated.

Although they tend to avoid nearshore areas, they may be encountered off Lüderitz and south of Swakopmund and Walvis Bay between October and April when prevailing north wind conditions result in elevated seawater temperatures (Figure 6-18). Entanglement and drowning of leatherback turtles in mariculture rafts in Lüderitz Lagoon have been reported (J. Kemper pers. obs.). Additionally, significant numbers of leatherback turtles have washed up on central Namibian shores recently, likely after mistakenly ingesting plastic pollution.

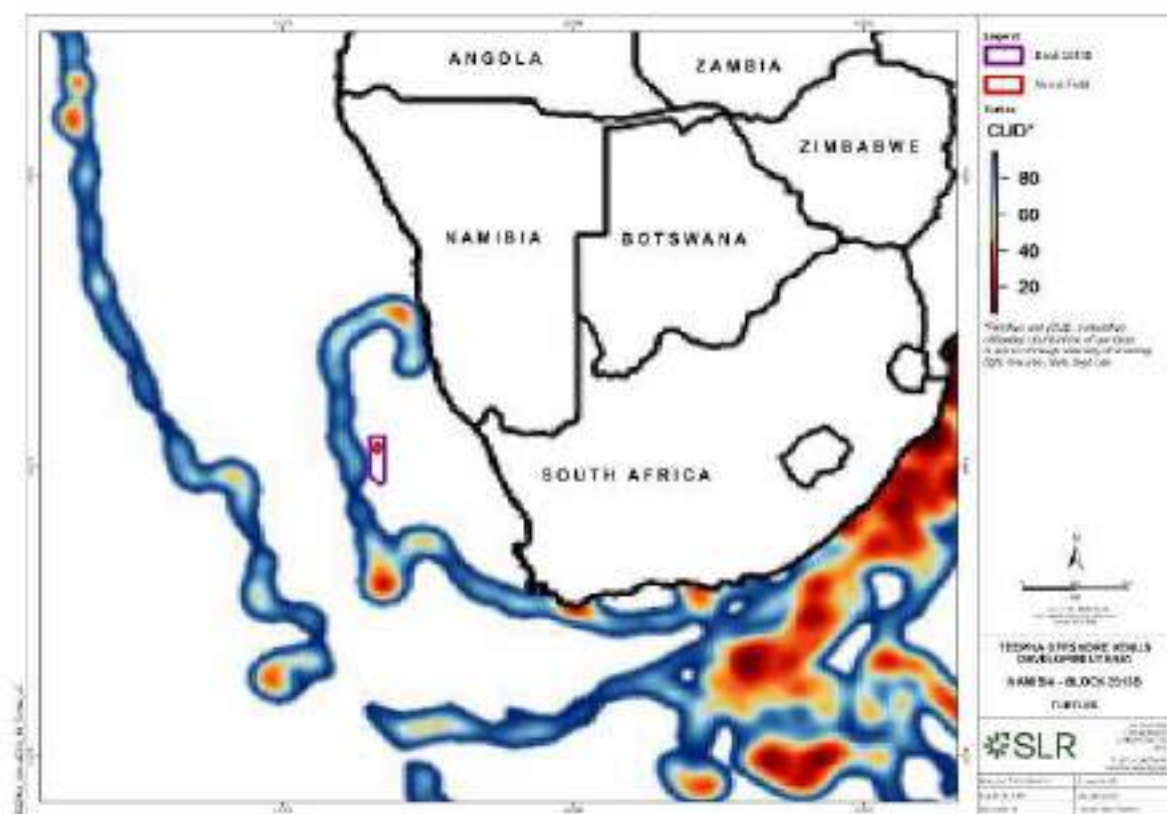


Figure 6-18: Block 2913B (purple polygon) and Venus development field (red circle) in relation to migration corridors of leatherback turtles in the south-western Indian Ocean.

Note: Relative use (CUD, cumulative utilization distribution) of corridors is shown through intensity of shading: light, low use; dark, high use.

Source: Harris et al. (2018)



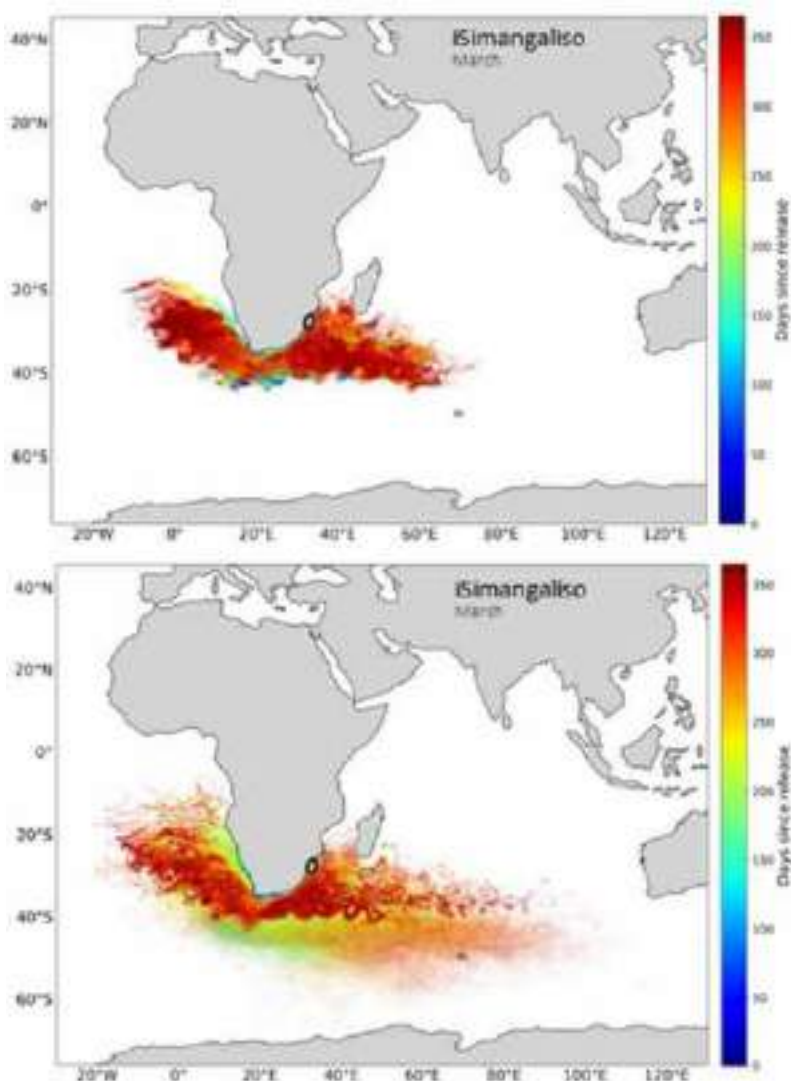


Figure 6-19: Dispersal maps showing trajectories of 5000 virtual, hatchling particles released from the respective nesting sites (iSimangaliso Wetland Park, East Coast of South Africa; white circles) in March 2018 for loggerheads (top) and leatherbacks (bottom).

Note: Colours (blue to red) indicate the number of days since release.
Adapted from Le Gouvello et al. (2020)

Leatherback Turtles are listed as 'Vulnerable' worldwide by the IUCN and are 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). Loggerhead and Olive Ridley turtles are globally listed as 'Vulnerable' whereas Hawksbill are globally listed as 'Critically Endangered', and Green turtles as 'Endangered'. Although not a signatory of CMS, Namibia has endorsed and signed a CMS International Memorandum of Understanding specific to the conservation of marine turtles. Namibia is thus committed to conserve these species at an international level.



The most recent conservation status, which assessed the species on a scale of Regional Management Units (RMU)⁴⁴, is provided in Table 6-5. Leatherback and loggerhead turtles, the two species most likely to be encountered offshore Namibia, are rated as 'Critically Endangered' and 'Near Threatened', respectively in the Southwest Indian RMU, while Green have not been formally rated. Notably, Hawksbill and Olive Ridley RMUs do not extend past the east coast of South Africa (Wallace, et al., 2023)

Overall, although the Venus field is 240 km offshore from the nearest coast and the relative abundance of turtles within its offshore waters is expected to be low, encounters in coastal waters *en route* between the operational area, logistics base, and transshipment locations may occur.

Table 6-5: Global and regional conservation status of the turtles occurring off the southern African coastline.

Listing	Leatherback	Loggerhead	Green	Hawksbill	Olive Ridley
IUCN Red List:					
Species (date)	VU (2013)	VU (2017)	EN (2004)	CR (2008)	VU (2008)
Population (RMU)	CR (2017)	NT (2017)	*		
Sub-Regional / South African National:					
NEMBA TOPS (2007)	CR	CR	EN	CR	EN
Hughes & Nel (2014)	EN	VU	NT	NT	DD

NT – Near Threatened, VU – Vulnerable, EN – Endangered, CR – Critically Endangered, DD – Data Deficient, * - Not yet assessed.

NEMBA TOPS: South African National Environmental Management: Biodiversity Act – List of Threatened or Protected Species (TOPS)

Note: Sub-regional and South African national assessments are included for reference. The listed turtle species have not been nationally assessed within Namibia.

6.5.3.5 Seabirds

The Namibian coastline sustains large populations of breeding and foraging seabird and shorebird species, which require suitable foraging and breeding habitats for their survival. In total, 12 species of seabirds are known to breed along the southern Namibian coast (Table 6-6). Most seabirds breeding in Namibia are restricted to areas where they are safe from land predators, although some species are able to breed on the mainland coast, either cryptically on the open ground (e.g. Damara Tern) or in inaccessible places. In general, most breed on the coastal islands off the southern Namibian coast, or to the north on the man-made guano platforms in Walvis Bay, Swakopmund and Cape Cross, well inshore of Block 2913B. The southern Namibian islands and guano platforms therefore provide a vital habitat to most species of seabirds that breed in Namibia. However, the number of successfully breeding birds at the particular breeding sites varies with local food abundance (Figure 6-20).

⁴⁴ Regional Management Units (RMUs) organise marine turtles that might be on independent evolutionary trajectories within regional entities into units of protection above the level of nesting populations, but below the level of species.



Table 6-6: Namibian breeding seabird species with their Namibian and global IUCN classification.

Species	Namibian	Global IUCN
*African Penguin <i>Spheniscus demersus</i>	Endangered	Critically Endangered
*Bank Cormorant <i>Phalacrocorax neglectus</i>	Endangered	Endangered
*Cape Cormorant <i>Phalacrocorax capensis</i>	Endangered	Endangered
*Cape Gannet <i>Morus capensis</i>	Critically Endangered	Endangered
*Crowned Cormorant <i>Microcarbo coronatus</i>	Near Threatened	Least Concern
*African Black Oystercatcher <i>Haematopus moquini</i>	Near Threatened	Least Concern
White-breasted cormorant <i>Phalacrocorax lucidus</i>	Least Concern	Least Concern
Kelp Gull <i>Larus dominicanus</i>	Least Concern	Least Concern
*Hartlaub's Gull <i>Larus Hartlaubii</i>	Vulnerable	Least Concern
Caspian Tern <i>Hydroprogne caspia</i>	Vulnerable	Least Concern
*Greater Crested (Swift) Tern <i>Thalasseus bergii</i>	Least Concern	Least Concern
*Damara Tern <i>Sternula balaenarum</i>	Near Threatened	Least Concern

* denotes the species is endemic to southern Africa.

Differences between Namibia and global classifications are the result of local population size, and the extent and duration of declines locally.

Species recorded by Marine Mammal Observers (MMOs) *en route* to and within Block 2913B are indicated in bold (BSL, 2019b; BSL, 2019c).

Source: Kemper et al. 2007; Simmons et al. 2015; IUCN

Most of the seabird species breeding in Namibia feed relatively close inshore (10-30 km), although exceptions occur (Ludynia, Kemper, & Roux, 2012), particularly when birds are forced to alter their dispersal patterns in response to environmental change (Sherley, et al., 2017). Cape Gannets (Figure 6-21, left), are known to forage up to 140 km offshore (Dundee, 2006; Ludynia K. , 2007) (Figure 6-22). **The closest Cape Gannet (IUCN; 'Endangered') colony to the Venus field is at Possession Island (~30 km south of Lüderitz) some 320 km to the north-east. Despite the distance offshore, 18 observations of Cape Gannets were recorded within Block 2913B during the 2022 EBS. Encounters may also occur further inshore during transshipment operations in the vicinity and/or along support vessel passages.**



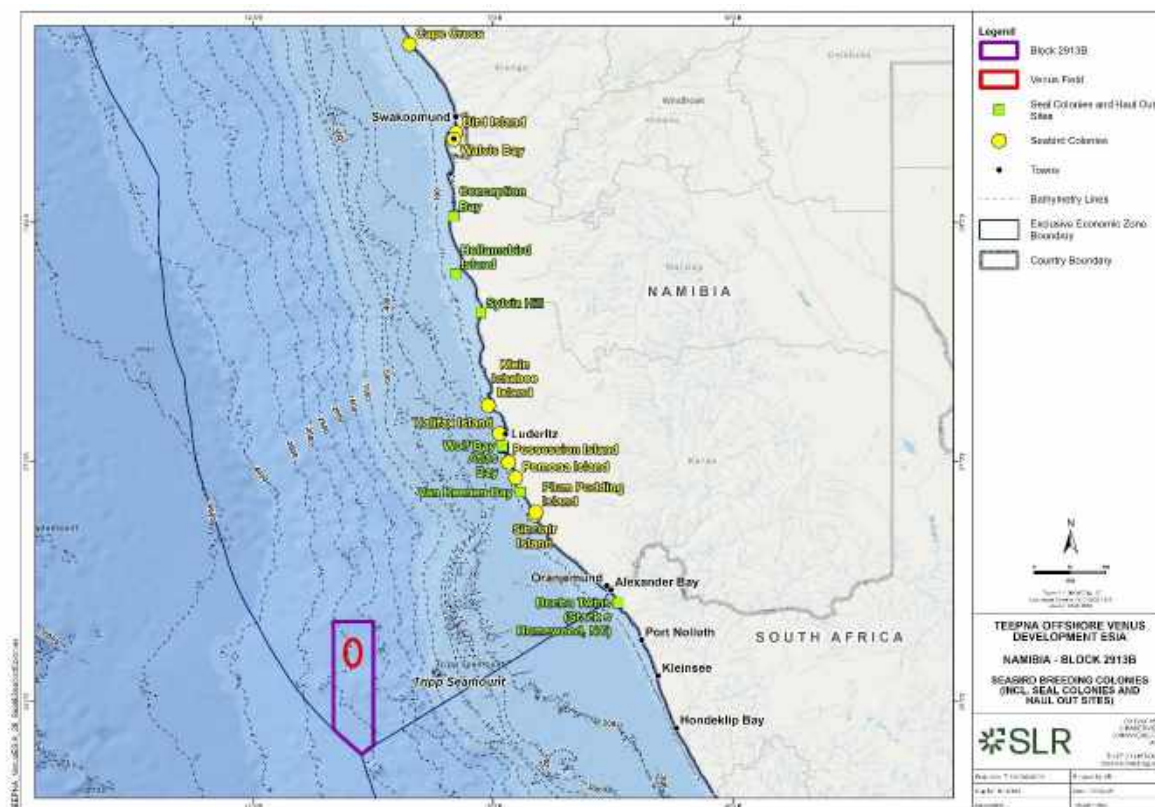


Figure 6-20: Block 2913B in relation to seabird breeding colonies and Cape Fur seal colonies and haul out sites.

African Penguins (Figure 6-21, right) have also been recorded as far as 60 km offshore (Ludynia, Kemper, & Roux, 2012). The closest African Penguin colonies are at Plumpudding, Sinclair, and Possession Islands, which lie some 280 km, 285 km and 320 km to the north-east of the Venus field, respectively. Encounters with this species within Block 2913B is, therefore, unlikely; however, may occur during possible coastal operations (transshipment) in the vicinity and/or along support vessel passages.



Figure 6-21: Cape Gannets *Morus capensis* (left) and African Penguins *Spheniscus demersus* (right) breed primarily on the offshore islands.

Source: J. Kemper, Klaus Jost

Among the non-breeding species present off Namibia's southern coast there are at least nine species of albatrosses, petrels and giant-petrels recorded (Boyer & Boyer, 2015). Numbers foraging in Namibian waters are poorly known, although some tracking data are available for example for the Block-browed Albatross (Figure 6-23). Forty-nine species of



pelagic seabirds have been recorded in the broader project area of influence, of which 14 are resident (Table 6-7). Highest pelagic seabird densities occur offshore of the shelf-break in winter. **Pelagic seabirds that have been encountered *en route* to or within Licence Block 2913B are recorded in Table 6-7.** Notably, during the 2022 EBS surveys, there were 224 sightings of the 'Vulnerable' white-chinned petrel, as well as 42 and 17 sightings of the 'Endangered' Atlantic yellow-nosed albatross and black-browed albatross, respectively, within Block 2913B (BSL, 2023a).

Although the Venus field is located more than 240 km offshore from the nearest coast and is likely to host only pelagic seabirds, support, and tanker vessels (DPST and CT), as well as possible helicopter flights, may encounter more coastal seabirds when *en route* between the operational area and the ports, transshipment and airport locations.

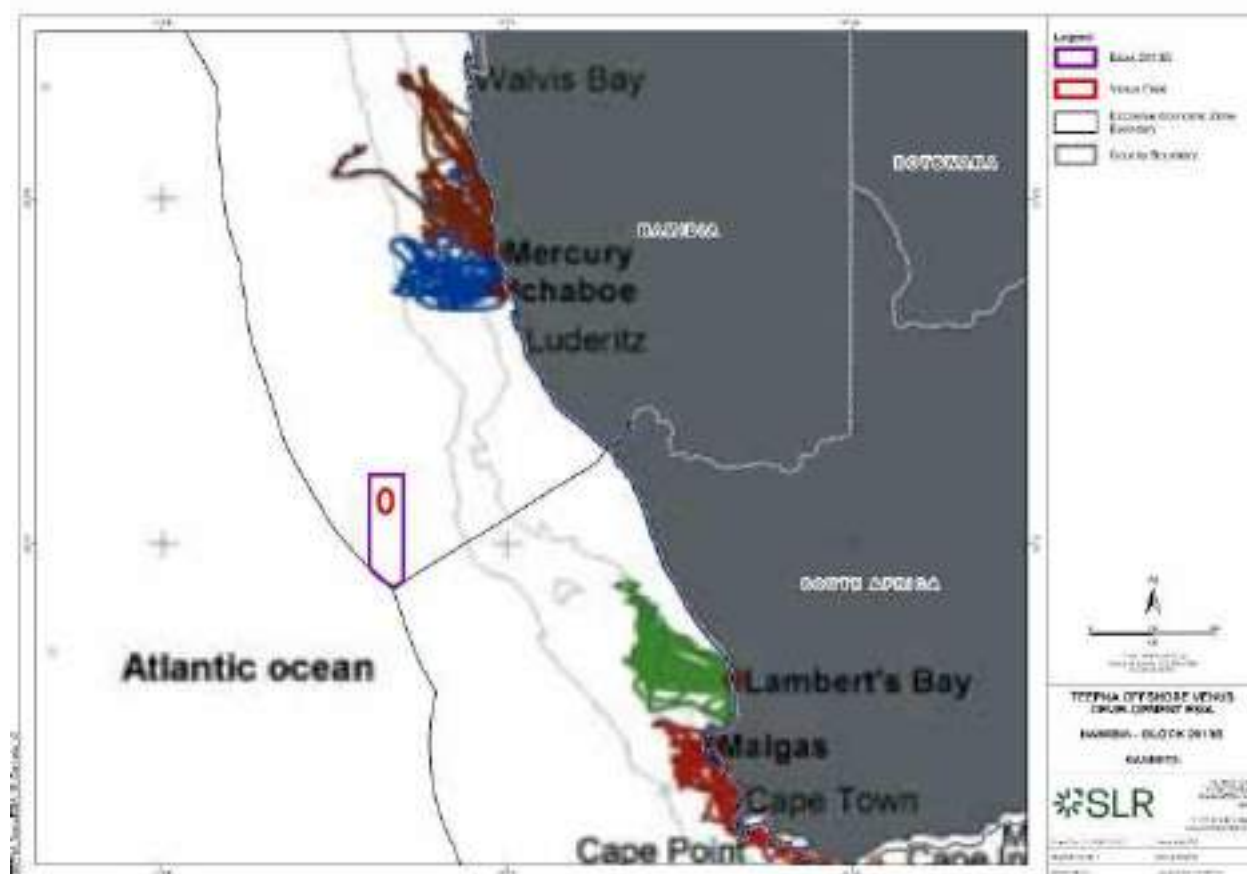


Figure 6-22: Block 2913B (purple polygon) and Venus development field (red circle) in relation to GPS tracks recorded for 93 Cape Gannets foraging off four breeding colonies on southern African west coast.

Source: Grémillet et al. (2008)



Table 6-7: Other bird species that occur in Namibia, with their Namibian and global IUCN classification.

Species	Namibian Regional Assessment	IUCN Global Assessment
Tristan Albatross <i>Diomedea dabbenena</i>	Critically Endangered	Critically Endangered
Atlantic Yellow-nosed Albatross <i>Thalassarche chlororhynchos</i> *	Endangered	Endangered
Black-browed Albatross <i>Thalassarche melanophris</i>	Endangered	Least Concern
Wandering Albatross <i>Diomedea exulans</i> *	Vulnerable	Vulnerable
Shy Albatross <i>Thalassarche cauta</i> *	Near Threatened	Near Threatened
White-capped Albatross <i>Thalassarche sneadi</i>	Near Threatened	Near Threatened
Spectacled Petrel <i>Procellaria conspicillata</i> *	Vulnerable	Vulnerable
Northern Giant-Petrel <i>Macronectes halli</i>	Near Threatened	Least Concern
Southern Giant-Petrel <i>Macronectes giganteu</i> *s	Not listed	Least Concern
Cape (Pintado) Petrel <i>Daption capense</i> *	Not listed	Least Concern
Kerguelen Petrel <i>Aphrodroma brevirostris</i>	Not listed	Least Concern
Great-winged Petrel <i>Pterodroma macroptera</i> *	Not listed	Least Concern
Soft-plumaged Petrel <i>Pterodroma mollis</i> *	Not listed	Least Concern
White-chinned Petrel <i>Procellaria aequinoctialis</i> *	Vulnerable	Vulnerable
Leach's Storm-Petrel <i>Oceanodroma leucorhoa</i>	Not listed	Vulnerable
Wilson's Storm-Petrel <i>Oceanites oceanicus</i>	Not listed	Least Concern
European Storm-Petrel <i>Hydrobates pelagicus</i>	Not listed	Least Concern
Sabine's Gull <i>Xema sabini</i>	Not listed	Least Concern
Arctic Tern <i>Sterna paradisaea</i>	Not listed	Least Concern
Red Phalarope <i>Phalaropus fulicarius</i>	Not listed	Least Concern
Brown (Sub-Antarctic) Skua <i>Catharacta antarctica</i> *	Not listed	Least Concern
Pomarine Jaeger (Skua) <i>Stercorarius pomarinus</i>	Not listed	Least Concern
Antarctic Prion <i>Pachyptila desolata</i>	Not listed	Least Concern
Long-Tailed Jaeger (Skua) <i>Stercorarius longicaudus</i>	Not listed	Least Concern
Sooty Shearwater <i>Ardenna grisea</i>	Near Threatened	Near Threatened
Cory's Shearwater <i>Calonectris borealis</i> *	Not listed	Least Concern
Scopoli's Shearwater <i>Calonectris diomedea</i>	Not listed	Least Concern
Manx Shearwater <i>Puffinus puffinus</i>	Not listed	Least Concern
Great Shearwater <i>Ardenna gravis</i>	Not listed	Least Concern

Differences between Namibia and global classifications are the result of local population size, and the extent and duration of declines locally.

Species recorded by Marine Mammal Observers (MMOs) *en route* to Block 2913B are indicated in bold bold (BSL, 2019b; BSL, 2019c; BSL, 2022a).

Birds recorded within Block 2913B are shown with * (BSL, 2022a).

Species Assessment: from Kemper et al. 2007; Simmons et al. 2015; IUCN 2023.



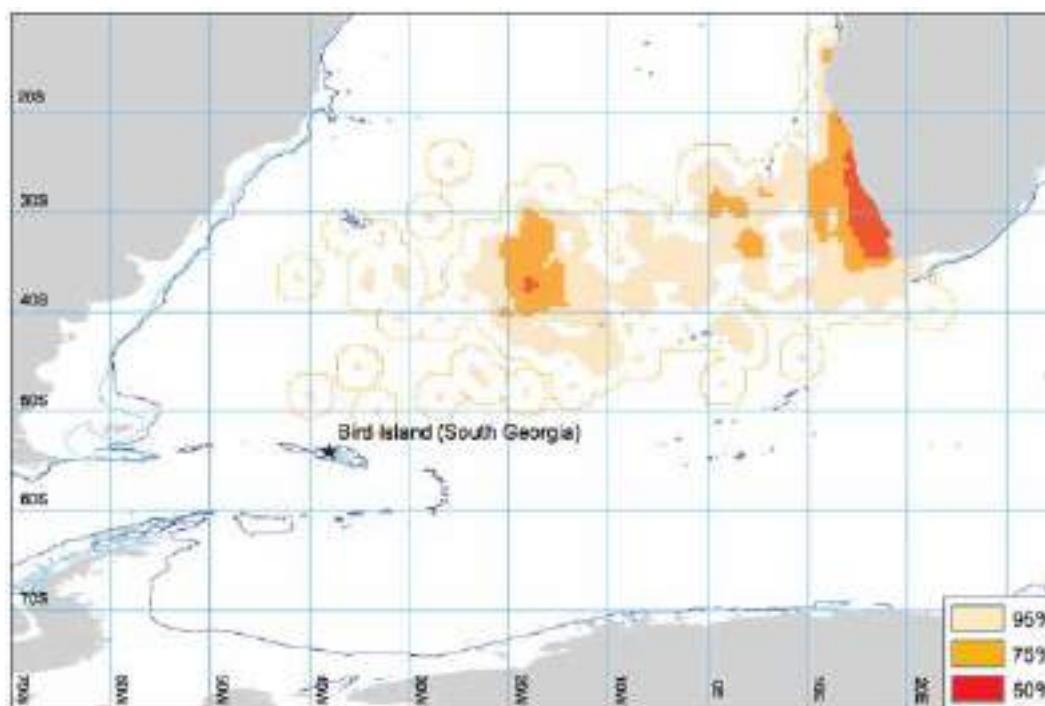


Figure 6-23: Utilisation distribution of incubating Black-browed Albatross from Bird Island, South Georgia.

Source: Birdlife International (2004)

Note: The percentage utilization, i.e., the time spent by tracked individuals within an area over the study period, is illustrated with dark red corresponding to 50%, orange to 75%, and cream to 95%.

6.5.3.6 Marine Mammals - Cetaceans

The cetacean fauna of Namibia comprises **33 species of whales and dolphins** known (historic sightings or strandings) or likely (habitat projections based on known species parameters) to occur here (Table 6-8). Namibian waters host resident species such as the endemic Heaviside's dolphin, bottlenose and dusky dolphins, but also species that migrate between Antarctic feeding grounds and warmer low latitude breeding grounds, as well as species with a circum-global distribution.

The Namibian shelf and deeper waters have been poorly studied with most available information in deeper waters (>200 m) arising from historic whaling records. However, recent data from MMOs and passive acoustic monitoring is improving knowledge. Current information on the distribution, population sizes and trends of most cetacean species, especially smaller cetaceans, occurring in Namibian waters is lacking.

The warmer waters offshore of the Namibian coast may host some species associated with the more tropical and temperate parts of the Atlantic such as rough toothed dolphins, striped dolphins, pan-tropical spotted dolphins and short finned pilot whales.

The distribution of cetaceans in Namibian waters can largely be split into those associated with the continental shelf and those that occur in deep, oceanic water. Importantly, species from both environments may be found in the **shelf edge area (200-1 000 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. The most common species within the broader project area of influence (in terms of likely encounter rate not total population sizes) are likely to be the humpback whale (Mysticete) and pilot whale (Odontocete / Delphinid).



Cetaceans comprise two basic taxonomic groups, the mysticetes (filter feeding whales with baleen) and the odontocetes (predatory whales and dolphins with teeth)⁴⁵. Due to large differences in their size, sociality, communication abilities, ranging behaviour and principally, acoustic behaviour, these two groups are considered separately.

A review of the distribution and seasonality of the key cetacean species likely to be found within the broader project area is provided below, based on information previously provided by the Sea Search - Namibian Dolphin Project (NDP) and data sourced from: Findlay et al. (1992), Best (2007), Weir (2011), Dr J-P Roux, (MFMR pers comm) and sightings from fisheries observers and MMOs working in the area, (de Rock, et al., 2019). Table 6-8 lists the cetaceans likely to be found within the project area of influence. Table 6-9 shows the likely seasonality of key species.

The NDP holds the most up-to-date data of cetacean occurrence and distribution since whaling times, with the records including a total database of over 7 000 records with more than 1 000 sightings made by MMOs on seismic or mining vessels and fisheries observers operating in shelf or pelagic waters. From MMO sightings (Figure 6-24) it is evident that many species do occur near and/or within Block 2913B, particularly sei whales, fin whales, Bryde's whales, humpback whales and various dolphin species but it is also important to highlight that the extent of available data is dependent on the location of previous hydrocarbon exploration and appraisal activities as well as environmental surveys that utilised MMOs.

The South African red list of cetacean fauna was updated in 2016, with global reviews underway. These listings provide the most up to date assessments as the Namibian listings have not been updated recently. Of the 33 species listed:

- Blue whale is considered 'Critically Endangered' for both lists;
- Fin whale and Sei whale are considered 'Endangered' for both lists;
- Sperm whale, Bryde's whale (inshore) and the Humpback B2 subpopulation⁴⁶ are considered 'Vulnerable' but 'Least Concern' and Not Assessed by IUCN; and
- 11 species are listed as Data Deficient or Not Assessed underlining how little is known about cetaceans, their distributions and population trends in southern Africa.

⁴⁵ The term 'whale' is used to describe cetaceans larger than approximately 4 m in length in both these groups and is taxonomically meaningless (e.g. the killer whale and pilot whale are members of the Odontocetes and the family Delphinidae and are thus dolphins, not whales).

⁴⁶ The humpback population in the southern hemisphere is comprised of different breeding subpopulations. B2 is the subpopulation that breeds on the south-west coast of Africa (Rosenbaum *et al.* 2009).





Table 6-8: Cetaceans occurrence off the southern Namibian Coast, their seasonality, likely encounter frequency in Block 2913B and South African (Child et al. 2016) and Global IUCN conservation status.

Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Delphinids (Odontocetes)							
Dusky dolphin	<i>Lagenorhynchus obscurus</i>	HF	Yes (0- 800 m)	No	Year round	Least Concern	Least Concern
Heaviside's dolphin	<i>Cephalorhynchus heavisidii</i>	VHF	Yes (0-200 m)	No	Year round	Least Concern	Near Threatened
Common bottlenose dolphin	<i>Tursiops truncatus</i>	HF	Yes	Yes	Year round	Least Concern	Least Concern
Common dolphin	<i>Delphinus delphis</i>	HF	Yes	Yes	Year round	Least Concern	Least Concern
Southern right whale dolphin	<i>Lissodelphis peronii</i>	HF	Yes	Yes	Year round	Least Concern	Least Concern
Striped dolphin	<i>Stenella coeruleoalba</i>	HF	No	Yes	Year round	Least Concern	Least Concern
Pantropical spotted dolphin	<i>Stenella attenuata</i>	HF	Edge	Yes	Year round	Least Concern	Least Concern
Long-finned pilot whale	<i>Globicephala melas</i>	HF	Edge	Yes	Year round	Least Concern	Least Concern
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	HF	Edge	Yes	Year round	Least Concern	Least Concern
Rough-toothed dolphin	<i>Steno bredanensis</i>	HF	No	Yes	Year round	Not Assessed	Least Concern
Killer whale	<i>Orcinus orca</i>	HF	Occasional	Yes	Year round	Least Concern	Data deficient
False killer whale	<i>Pseudorca crassidens</i>	HF	Occasional	Yes	Year round	Least Concern	Near Threatened
Pygmy killer whale	<i>Feresa attenuata</i>	HF	No	Yes	Year round	Least Concern	Least Concern
Risso's dolphin	<i>Grampus griseus</i>	HF	Yes (edge)	Yes	Year round	Data Deficient	Least Concern
Sperm whales (Odontocetes)							
Pygmy sperm whale	<i>Kogia breviceps</i>	VHF	Edge	Yes	Year round	Data Deficient	Least Concern
Dwarf sperm whale	<i>Kogia sima</i>	VHF	Edge	Yes	Year round	Data Deficient	Least Concern
Sperm whale *	<i>Physeter macrocephalus</i>	HF	Edge	Yes	Year round	Vulnerable	Vulnerable



Common Name	Species	Hearing Frequency	Shelf (<200 m)	Offshore (>200 m)	Seasonality	RSA Regional Assessment	IUCN Global Assessment
Beaked whales (Odontocetes)							
Cuvier's	<i>Ziphius cavirostris</i>	HF	No	Yes	Year round	Data Deficient	Least Concern
Arnoux's	<i>Berardius arnuxii</i>	HF	No	Yes	Year round	Data Deficient	Least Concern
Southern bottlenose	<i>Hyperoodon planifrons</i>	HF	No	Yes	Year round	Least Concern	Least Concern
Layard's	<i>Mesoplodon layardii</i>	HF	No	Yes	Year round	Data Deficient	Least Concern
True's	<i>Mesoplodon mirus</i>	HF	No	Yes	Year round	Data Deficient	Least Concern
Gray's	<i>Mesoplodon grayi</i>	HF	No	Yes	Year round	Data Deficient	Least Concern
Blainville's	<i>Mesoplodon densirostris</i>	HF	No	Yes	Year round	Data Deficient	Least Concern
Baleen whales (Mysticete)							
Antarctic Minke	<i>Balaenoptera bonaerensis</i>	LF	Yes	Yes	>Winter	Least Concern	Near Threatened
Dwarf minke	<i>B. acutorostrata</i>	LF	Yes	Yes	Year round	Least Concern	Least Concern
Fin whale	<i>B. physalus</i>	LF	Yes	Yes	MJJ & ON	Endangered	Vulnerable
Blue whale (Antarctic)	<i>B. musculus ssp. intermedia</i>	LF	No	Yes	Winter peak	Critically Endangered	Critically Endangered
Sei whale	<i>B. borealis</i>	LF	Yes	Yes	MJ & ASO	Endangered	Endangered
Bryde's (inshore)	<i>B. edeni (subsp)</i>	LF	Yes	Edge	Year round	Vulnerable	Least Concern
Bryde's (offshore)	<i>B. edeni</i>	LF	Edge	Yes	Summer (JFM)	Data Deficient	Least Concern
Pygmy right	<i>Caperea marginata</i>	LF	Yes	?	Year round	Least Concern	Least Concern
Humpback	<i>Megaptera novaeangliae</i>	LF	Yes	Yes	Year round (SONDJF)	Least Concern	Least Concern
Humpback B2 subpopulation *	<i>Megaptera novaeangliae</i>	LF	Yes	Yes	Spring/Summer peak (ONDJF)	Vulnerable	Not Assessed
Southern right	<i>Eubalaena australis</i>	LF	Yes	No	Year round (ONDJFMA)	Least Concern	Least Concern

Species recorded by Marine Mammal Observers (MMOs) *en route* to Block 2913B are indicated in bold (BSL, 2019b; BSL, 2019c; BSL, 2022a; BSL, 2022b). Species recorded within Block 2913B during EBS survey indicated with * (BSL, 2022a). LF= Low Frequency; HF = High Frequency; VHF = Very High Frequency.



Mysticete (Baleen) whales

The majority of mysticete whales fall into the family Balaenidae. Those occurring in the study area are listed in Table 6-8 and Table 6-9. Most of these species occur in pelagic waters with only the occasional visit to shelf waters (<500 m). All these species show some degree of migration either to, or through the latitudes of Block 2913B when *en route* between higher latitude (Antarctic or Sub Antarctic) feeding grounds and lower latitude breeding grounds. Depending on the ultimate location of these feeding and breeding grounds, seasonality in Namibian waters can be either unimodal, usually in winter months, or bimodal (e.g., May-July and October-November) reflecting a northward and southward migration through the area (see Table 6-9). Northward and southward migrations may take place at different distances from the coast due to whales following geographic or oceanographic features, thereby influencing the seasonality of occurrence at different locations.

Due to the complexities of the migration patterns, each species is discussed in further detail below.

Table 6-9: Seasonality of baleen whales in the broader project area of influence based on data from multiple sources, predominantly commercial catches and data from stranding events.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bryde's (inshore)	L	L	L	L	L	L	L	L	L	L	L	L
Bryde's (offshore)	H	H	H	L	L	L	L	L	L	L	L	L
Sei	L	L	L	L	H	H	L	H	H	H	L	L
Fin	M	M	M	H	H	H	M	H	H	H	M	M
Blue	L	L	L	L	L	H	H	H	L	M	L	L
Minke (Antarctic & Dwarf)	M	M	M	H	H	H	M	H	H	H	M	M
Humpback B2	M	M	L	L	L	H	H	M	M	L	M	H
Southern right	H	M	L	L	L	H	H	H	M	M	H	H
Pygmy right	H	H	H	M	L	L	L	L	L	L	M	M

Values of high (H), Medium (M) and Low (L) are relative within each row (species) and not comparable between species.

Source: Best 2007; NDP unpublished data and other sources

Bryde's whales

Two genetically and morphologically distinct populations of Bryde's whales live off the west coast of southern Africa (Best P. , 2001; Penry, 2010).

The "offshore population" occurs beyond the shelf (>200 m depth) off west Africa and migrates between wintering grounds off equatorial west Africa (Gabon) and summering grounds off western South Africa. Its seasonality on the west coast is thus opposite to the majority of the balaenopterids with abundance likely to be highest in the project area of influence from January to March. Several strandings of adult offshore Bryde's whales have occurred in central Namibia including in January 2012 and November 2017 near Walvis Bay.

The "inshore population" of Bryde's whales is unique amongst baleen whales in the region by being non-migratory. The published range of the population is the continental shelf and Agulhas Bank of South Africa ranging from Durban in the east to at least St Helena Bay off the west coast with possible movements further north into the Benguela current especially in



the winter months (Best P. , 2007). A live stranding of a calf of this population (population assigned genetically – G Penry pers. comm.) in Walvis Bay, Namibia confirms the current occurrence of this population in Namibian waters. An additional live sighting in the Namibian Islands Marine Protected Area (NIMPA) and a third stranding of a Bryde's whale adult in April 2013 have not been assigned to population but supports regular, year-round occurrence of both populations of the species in the central Benguela ecosystem.

Sightings of Bryde's whales have been made within Block 2913B (BSL, 2019b; BSL, 2019c). Encounters in the project area of influence are thus possible.

Sei whales

There is very little information on sei whales in Namibian waters and most information on the species from the southern African sub-region originates from whaling data from 1958-1963. Sei whales spend time at high latitudes (40-50°S) during summer months and migrate north through South African waters (where they were historically hunted in relatively high numbers) to unknown breeding grounds further north (Best P. , 2007). As whaling catches were confirmed off both Congo and Angola, it is likely that they migrate through Namibian waters. Due to their migration pattern, densities in the project area of influence are likely to show a bimodal peak with numbers predicted to be highest in May to June and August to October. All whales were historically caught in waters deeper than 200 m with most catches recorded from waters deeper than 1 000 m (Best & Lockyer, 2002). There is no current information on the abundance or distribution of this species in the region, but a sighting of a mother and calf in March 2012 (NDP unpublished data) and a stranding in Walvis Bay in July 2013 (NDP unpublished data), as well as a MMO recording of an individual in September 2022 (BSL, 2022a), confirms their contemporary and probably year-round occurrence on the Namibian continental shelf and beyond. **Encounters in the project area of influence are thus possible.**

Fin whales

Fin whales were historically caught off the west coast of South Africa and Namibia. A bimodal peak in the catch data from South African shore-based stations suggests animals were migrating further north to breed (during May-June) before returning to Antarctic feeding grounds (during August-October). However, the location of the breeding ground (if any) and how far north it is remains unknown (Best P. , 2007). Some juvenile animals may feed year-round in deeper waters off the shelf (Best P. , 2007). Four strandings have occurred between Walvis Bay and the Kunene River in the last decade during January, April (2) and October (NDP unpubl. data). Groups of 5-8 animals have been seen on multiple occasions on the coast either side of Lüderitz in April, May of 2014 and January 2015 (NDP unpubl. data) confirming their contemporary occurrence in Namibian waters and potential use of the upwelling areas for feeding. To date, most sightings or strandings have occurred in late summer (April-May), supporting evidence from whaling data that this is a peak time of occurrence in southern Namibia. **Sightings of fin whales were recorded en route to and within Block 2913B in 2018 and 2019 (BSL, 2019b; BSL, 2019c). Encounters in the project area of influence are thus possible.**

Blue whales

Antarctic blue whales were historically caught in high numbers during commercial whaling activities, with a single peak in catch rates during July in Walvis Bay and Namibe, suggesting that in the eastern South Atlantic these latitudes are close to the northern migration limit for the species (Best P. , 2007). Evidence of blue whale presence off Namibia is rapidly increasing. Acoustic detections of blue whales in the Antarctic peak between December and January (Thomisch, et al., 2016) and in northern Namibia between May and July (Thomisch K. , 2017) supporting observed timing from whaling records. Several sightings of blue whales (2014-2015) have occurred during seismic surveys off the southern part of Namibia in water >1 000 m deep confirming their current existence in the area and occurrence in Autumn



months. **Encounters in the project area of influence are thus possible, with a single individual observed within Block 2913B in September 2022 (BSL, 2022).**

Minke whales

Two forms of minke whale occur in the Benguela, the Antarctic minke whale and the dwarf minke whale (Best 2007; NDP unpubl. data).

Antarctic minke whales range from the pack ice of Antarctica to tropical waters and are usually seen more than ~50 km offshore. Although adults of the species do migrate from the Southern Ocean (summer) to tropical/temperate waters (winter) where they are thought to breed, some animals, especially juveniles, are known to stay in tropical/temperate waters year-round. Regular sightings of semi-resident Antarctic minke whales in Lüderitz Bay, especially in summer months (December - March) and a stranding of a single animal in Walvis Bay (in February 2014) confirm the contemporary occurrence of the species in Namibia (NDP unpubl. data). Data from passive acoustic monitoring over a two-year period off the Walvis Ridge shows acoustic presence in June to August and November to December (Thomisch, et al., 2016), supporting observations from whaling records.

The dwarf minke whale has a more temperate distribution than the Antarctic minke and do not range further south than 60-65°S. Dwarf minke whales have a similar migration pattern to Antarctic minkes with at least some animals migrating to the Southern Ocean in summer months. Around southern Africa, dwarf minke whales occur closer to shore than Antarctic minkes and have been seen <2 km from shore on several occasions around South Africa.

Both species are generally solitary, and densities are likely to be low in the project area of influence, but encounters may occur.

Humpback whales

The majority of humpback whales passing through the Benguela are migrating to breeding grounds off tropical West Africa, between Angola and the Gulf of Guinea (Rosenbaum, et al., 2009; Barendse, et al., 2010). A synthesis of available humpback whale data from Namibia (Elwen, et al., 2014) shows that in coastal waters, the northward migration stream is larger than the southward peak supporting earlier observations from whale catches (Best & Allison, 2010). This supports previous suggestions that animals migrating north strike the coast at varying places, mostly north of St Helena Bay (South Africa), resulting in increased whale density on shelf waters northwards towards Angola, but there is no clear migration 'corridor'. On the southward migration, there is evidence from satellite tagged animals and the smaller secondary peak in numbers in Walvis Bay, that many humpback whales follow the Walvis Ridge offshore then head directly to high latitude feeding grounds, while others follow a more coastal route (including the majority of mother-calf pairs), possibly lingering in the feeding grounds off west South Africa in summer (Elwen, Gridley, Roux, Best, & Smale, 2013; Rosenbaum, Maxwell, Kershaw, & Mate, 2014). Although migrating through the Benguela, there is no existing evidence of a clear 'corridor' and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration (Barendse, et al., 2010; Best & Allison, 2010; Elwen, et al., 2014). Regular sightings of humpback whales in spring and summer months in Namibia, especially in the Lüderitz area, suggest that summer feeding is occurring in Namibian waters as well, or that the foraging range extends into southern Namibia. Abundance estimates in 2005 suggest that there were >9 000 individuals in the west African breeding population, with the population increasing by approximately 5% per annum (IWC, 2012).

In the first half of 2017 (when numbers are expected to be at their lowest) more than 10 humpback whales were reported stranded along the Namibian and west South African coasts. A similar event was recorded in late 2021 / early 2022 when numerous strandings of young humpbacks were reported along the Western Cape Coast (South Africa) and in Namibia (Simon Elwen, Sea Search, pers. comm.). The cause of these deaths is not known, but similar events have been recorded off Brazil (2010) and the US Atlantic coast (2016 and



2022). The 2010 event was linked to possible infectious disease or malnutrition (Siciliano, et al., 2013). The West African population may be undergoing similar stresses or responding to changes in their ecosystem (see for example Kershaw, et al., (2021)). It is not yet understood what may be driving these ecosystem changes and what the long-term effects to populations could potentially be.

Humpback whales are thus likely to be the most frequently encountered baleen whale in Block 2913B, being the most identified cetacean both *en route* to and within Block 2913B (BSL, 2022). This species ranges from coastal waters to well beyond the continental shelf. They have a year-round presence with numbers peaking in June and July (northern migration) and to a lesser degree in September to October (southern migration). Regular encounters occur until February associated with subsequent feeding in the Benguela ecosystem.

Southern right whales

The southern African population of southern right whales historically extended from southern Mozambique (Maputo Bay) to southern Angola (Baia dos Tigres) and is considered to be a single population within this range (Roux, Brady, & Best, 2015). The most recent abundance estimate for this population is available for 2017 which estimated the population at ~6 100 individuals including all age and sex classes, which is increasing at ~6.5% per annum (Brandao, Vermeulen, Ross-Gillepsie, Findlay, & Butterworth, 2017). When the population numbers crashed in 1920, the range contracted down to just the south coast of South Africa, but as the population recovers, it is repopulating its historic grounds including Angola (Whitt, Warde, Blair, Deslarzes, & Chaineau, 2023), Namibia (Roux, Best, & Stander, 2001; Roux, Brady, & Best, 2015; de Rock, et al., 2019) and Mozambique (Banks, et al., 2011).

Southern right whales are one of the most abundant whales in the Benguela region, seen regularly in Namibian coastal waters (<3 km from shore), especially in the southern half of the Namibian coastline (Roux, Best, & Stander, 2001; Roux, Brady, & Best, 2011). Southern right whales have been recorded in Namibian waters in all months of the year (J-P Roux pers. Comm.) but with numbers peaking in winter (June - August). A secondary peak in summer (November - January) also occurs, probably associated with animals feeding off the west coast of South Africa performing exploratory trips into southern Namibia (NDP unpubl. data). **Notably, all available records have been very close to shore with only a few out to 100 m depth. As such encounters within Block 2913B are unlikely, however encounters may occur within inshore, coastal waters during transshipment and/or supporting vessel transfers, with a single individual recorded in 330 m deep waters *en route* from Walvis Bay to Block 2913B (BSL, 2022a).**

Pygmy right whales

The pygmy right whale is the smallest of the baleen whales reaching only 6 m total length as an adult (Best P. , 2007). The species is typically associated with cool temperate waters between 30°S and 55°S, with records from Namibia, south of Walvis Bay, providing the northern most records for the species (Leeney, Post, Hazevoet, & Elwen, 2013).

Odontocete (toothed) whales

Odontocetes are a varied group of cetaceans including the dolphins, beaked whales and sperm whales. Species occurring within the broader project area of influence 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 1.6 m long (Heaviside's dolphin) to 17 m (bull sperm whale).

Sperm whales

Most of the information about sperm whales in the southern African subregion stems from data collected during commercial whaling activities, i.e., pre 1985 (Best P. , 2007). Sperm whales are the largest of the toothed whales and have a complex, structured social system



with adult males behaving differently to younger males and female groups. They occur in deep ocean waters, usually greater than 1 000 m depth, although they occasionally come into waters 500-200 m deep on the shelf (Best P. , 2007). They are relatively abundant globally (Whitehead, 2002) although no estimates are available for the southern African subregion. Seasonality of catches off west Southern Africa suggests that medium and large sized males are more abundant in winter months, while female groups are more abundant in autumn (March-April), although animals occur year-round (Best P. , 2007). Sperm whales were one of the most frequently seen cetacean species from offshore seismic survey vessels operating between Angola and the Gulf of Guinea. All sightings were recorded in waters deeper than 780 m, and numbers peaked during April to June (Weir C. , 2011). Multiple sightings of sperm whales have also been recorded by MMOs from vessels operating around Tripp Sea Mount in the last decade (NDP Unpublished data; de Rock, et al., 2019). Sperm whales feed at great depths during dives in excess of 30 minutes making them difficult to detect visually. The regular echolocation clicks made by the species when diving, however, make them relatively easy to detect acoustically using Passive Acoustic Monitoring (PAM). **Sperm whales in the project area of influence are likely to be encountered in deeper waters (>500 m), predominantly in the winter months (April - October). This has been confirmed by sightings of sperm whales enroute to Block 2913B in April 2019 and September 2022** (BSL, 2019b; BSL, 2019c; BSL, 2022a).

Dwarf and pygmy sperm whales

The genus *Kogia* contains two recognised species, the dwarf and pygmy sperm whales, both of which occur worldwide in pelagic and shelf edge waters, with few sighting records of live animals in their natural habitat (McAlpine, 2018). Both species are deep water specialists living primarily off the shelf. There is preliminary evidence of species level genetic differentiation between dwarf sperm whale populations in the Indian and Atlantic Oceans (Chivers, Leduc, Robertson, Barros, & Dizon, 2004). Due to their small body size, cryptic behaviour and small school sizes, these whales are difficult to observe at sea, and morphological similarities make field identification to species level problematic. However, their narrow-band high frequency echolocation clicks make them detectable and identifiable (at least to the genus) using passive acoustic monitoring equipment. The majority of what is known about *Kogiid* whales in the southern African subregion results from studies of stranded specimens (Ross, 1979; Findlay, Best, Ross, & Cockroft, 1992; Elwen, Gridley, Roux, Best, & Smale, 2013; Moura, et al., 2016). There are >30 records of pygmy sperm whales collected along the Namibian coastline with a peak in strandings in June and August. A single account of a dwarf sperm whale recorded in Walvis Bay in 2010, demonstrates that this species also occurs in Namibian waters (Elwen, et al., 2014). Dwarf sperm whales are associated with warmer tropical and warm-temperate waters, being recorded from both the Benguela and Agulhas ecosystem (Best P. , 2007) in waters deeper than ~1 000 m. *Kogia* species **are likely to occur in the project area of influence at low levels**; seasonality is unknown.

Killer whales

Killer whales have a circum-global distribution and are found in all oceans from the equator to the ice edge (Best P. , 2007). They occur year-round in low densities off western South Africa (Best, Meyer, & Lockyer, 2010) , Namibia (Elwen & Leeney, 2011) and in the Eastern Tropical Atlantic (Weir, Collins, Carvalho, & Rosenbaum, 2010). Killer whales are found in all depths from the coast to deep open ocean environments and may **thus be encountered in the project area of influence at low levels**.

False killer whales

False killer whales are recognised as a single species globally, although clear differences in morphological and genetic characteristics between different study sites show that there is substantial difference between populations and a revision of the species taxonomy may be needed (Best P. , 2007). The species has a tropical to temperate distribution and most



sightings off southern Africa have occurred in water deeper than 1 000 m, but with a few close to shore as well (Findlay, Best, Ross, & Cockroft, 1992)(NDP Unpubl. data). False killer whales usually occur in groups ranging in size from 1-100 animals (mean 20.2) (Best P. , 2007) and are thus easily seen in most weather conditions. However, the strong bonds and matrilineal social structure of this species makes it vulnerable to mass stranding (8 instances of 4 or more animals stranding together have occurred in the western Cape, South Africa, all between St Helena Bay and Cape Agulhas (Kirkman, Meyer, & Thornton, 2010). There is no information on population numbers of conservation status and no evidence of seasonality in the region (Best P. , 2007). **Encounters within the project area of influence may occur.**

Long- and short-finned pilot whales

Long- and short-finned pilot whales display a preference for temperate waters and are usually associated with the continental shelf or adjacent deep waters (Mate, Best, Lagerquist, & Winsor, 2011; Findlay, Best, Ross, & Cockroft, 1992; Weir C. , 2011; Seakamela, et al., 2022). They are regularly seen associated with the shelf edge by MMOs, fisheries observers and researchers operating in Namibian waters (NDP unpubl. data; de Rock, et al., 2019) The distinction between long finned and short finned pilot whales is difficult to make at sea. Short finned pilot whales are regarded as a more tropical species (Best P. , 2007) and most sightings within the Benguela Ecosystem are thought to be long-finned pilot whales, however, due to the low latitude and offshore nature of the project, **it is likely that both could be encountered within the project area of influence. This was confirmed by the sighting of two short-finned pilot whales enroute to Block 2913B in late 2018** (BSL, 2019b). There are many confirmed sightings of pilot whales along the shelf edge of South Africa and Namibia including within the Venus development area since 2010 (de Rock, et al., 2019; Sea Search unpublished data). Observed group sizes range from 8-100 individuals (Seakamela, et al., 2022).

Dusky dolphins

Dusky dolphins are frequently encountered in water less than 500 m deep. The species is very boat friendly and will often approach to bow-ride. This species is resident year-round throughout the Benguela ecosystem (Findlay, Best, Ross, & Cockroft, 1992). Although no information is available on the size of the population, they are regularly encountered in near shore waters off South Africa and Lüderitz, although encounters nearshore are rare along the central Namibian coast (Walvis Bay area), with most records coming from beyond 5 nautical miles from the coast (Elwen, Thornton, & Reeb, 2010)(NDP unpubl. data). In a recent survey of the Namibian Islands Marine Protected Area (between latitudes of 24°29' S and 27°57' S and depths of 30-200 m) dusky dolphin were the most detected cetacean species with group sizes ranging from 1 to 70 individuals (NDP unpubl. data), although group sizes up to 800 have been reported in southern African waters (Findlay, Best, Ross, & Cockroft, 1992). Sightings of dusky dolphins have been made during trips to Block 2913B (BSL, 2019c), as such **encounters within the larger project area of influence and vessel passages may occur. However, due to the offshore location of Block 2913B, encounters within the License Block are unlikely.**

Heaviside's dolphins

Heaviside dolphins are relatively abundant in both the southern and northern Benguela ecosystems with 10 000 animals estimated to live in the 400 km of coast between Cape Town and Lamberts Bay (South Africa) (Elwen S. , Thornton, Reeb, & Best, 2009a) and several hundred animals living in the areas around Walvis Bay and Lüderitz. Heaviside's dolphins are resident year-round. This species occupies waters from the coast to at least 200 m depth (Elwen, et al., 2006; Best P. , Whales and Dolphins of the Southern African Subregion, 2007) and may show a diurnal onshore-offshore movement pattern feeding offshore at night, although this varies throughout the range (Elwen, Snyman, & Leeney, 2009b).



Since this species occur primarily inshore, encounters within Block 2913B are unlikely. However, sightings have been recorded during various EBS trips to Block 2913B (BSL, 2019b; BSL, 2019c; BSL, 2022a). As such, encounters within inshore transshipment and/or vessel transfer operations may occur.

Common dolphins

Common dolphins are known to occur offshore in Namibian waters (Findlay, Best, Ross, & Cockcroft, 1992). Two forms of common dolphins occur around southern Africa, a long-beaked and short-beaked form (Findlay, Best, Ross, & Cockcroft, 1992; Best P. , 2007), although they are currently considered part of a single global species (Cunha et al. 2015). The long-beaked common dolphin lives on the continental shelf of South Africa rarely being observed north of St Helena Bay on the west coast or in waters more 500 m deep (Best P. , 2007), although more recent sightings, including those from MMOs, suggest sightings regularly out to 1 000 m or more (SLR data, Sea Search data). A stranding in Lüderitz (May 2012, NDP unpublished data) and MMO reports have confirmed their occurrence in the region. Although group sizes can be large, averaging 267 ($\pm$ SD 287) for the southern African region (Findlay, Best, Ross, & Cockcroft, 1992), average sizes of 37 ($\pm$ SD 31) have been reported for the Namibian region (NDP unpublished data). They are more frequently seen in the warmer waters offshore and to the north of the country, and all sightings to date have been in water deeper than 500 m. There is no evidence of seasonality. Far less is known about the short-beaked form, which is challenging to differentiate at sea from the long-beaked form. Group sizes are also typically large. It is likely that common dolphins encountered deeper than 2 000 m are of the short-beaked form. **Encounters in the project of influence area may occur.**

Common bottlenose dolphins

Common bottlenose dolphins are widely distributed in tropical and temperate waters throughout the world, but frequently occur in small (10s to low 100s) isolated coastal populations. Within Namibian waters two populations of bottlenose dolphins occur. A small population of less than 100 individuals inhabits the very near shore coastal waters (mostly <15 m deep) of the central Namibian coastline from approximately Lüderitz in the south to at least Cape Cross in the north (Elwen, Findlay, Kiszka, & Weir, 2011). This group is considered to be of conservational concern, but **its nearshore habitat (<15 m deep) makes it unlikely to be impacted by the proposed project activities, nevertheless encounters with nearshore transshipment operations may occur.** An offshore 'form' of common bottlenose dolphins occurs around the coast of southern Africa including Namibia and Angola (Best P. , 2007) with sightings restricted to the continental shelf edge and deeper. Offshore bottlenose dolphins frequently form mixed species groups, often with pilot whales or Risso's dolphins.

Southern right whale dolphins

The cold waters of the Benguela region provide a northwards extension of the normally sub-Antarctic habitat of southern right whale dolphins (Best, 2007). Most records in the region originate in a relatively restricted region between 26°S and 30°S roughly between Lüderitz and Tripp Seamount in water 100-2 000 m deep (Rose & Payne 1991; Best, 2007; NDP Unpublished data). There was a live stranding of two individuals in Lüderitz Bay in December 2013. They are often seen in mixed species groups with other dolphins such as dusky dolphins. It is possible that the Namibian sightings represent a regionally unique and resident population (Findlay, Best, Ross, & Cockcroft, 1992). **Encounters in the project area of influence are, therefore, possible .**

Beaked whales

There are almost no data available on the abundance, distribution, or seasonality of the smaller odontocetes (with dolphins) known to occur in oceanic waters (greater than 200 m) off the Namibian continental shelf (see Table 6-8). Beaked whales are all considered to be



true deep-water species, usually recorded in waters in excess of 1 000-2 000 m (see various species accounts in Best 2007) and **thus may be encountered in the Venus development area.**

Other Delphinids

Several other species of dolphins that might occur in the deeper waters of broader project area at low levels include the pygmy killer whale, Risso's dolphin, rough toothed dolphin, pantropical spotted dolphin and striped dolphin (Findlay et al., 1992; Best, 2007). Although nothing is known about the population size or density of these species in the broader project area, **it is likely that encounters would be rare.**

6.5.3.7 Marine Mammals - Seals

The Cape fur seal (*Arctocephalus pusillus pusillus*), considered as of Least Concern (IUCN), is the only species of seal resident along the west coast of Africa, occurring at numerous breeding and non-breeding sites on the mainland and on nearshore islands and reefs (see Figure 6-25). Vagrant records from four other species of seal more usually associated with the sub-Antarctic environment have also been recorded: southern elephant seal (*Mirounga leonina*), sub- Antarctic fur seal (*Arctocephalus tropicalis*), crabeater (*Lobodon carcinophagus*) and leopard seals (*Hydrurga leptonyx*) (David, 1989).

The Namibian southern colonies (Spencer Bay to Baker's Bay) historically contributed approximately 62% to the overall seal population in Namibia. However, since the distributional shift of the seal population northwards in response to environmental changes and altered prey distributions, the southern colonies comprise just less than a third of the total Namibian seal population (J-P Roux pers comm.). Population estimates fluctuate widely between years in terms of pup production, particularly since the mid-1990s (MFMR unpubl. Data; Kirkman et al. 2007). **The colonies closest to Block 2913B are at van Reenen Bay and Baker's Bay approximately 280 km inshore to the north-east of Block 2913B, in the Tsau//Khaeb (Sperrgebiet) National Park.** These southern Namibian colonies have important conservation value since they are largely undisturbed at present, as public access to the southern Namibian coast is restricted.

Northern Namibia colonies and haul out sites at Atlas Bay, Wolf Bay and Long Island, are **located over 300 km north-east of the Licence Block 2913B (Figure 6-20). Nearshore transshipment operations may take place within the vicinity of these Namibian colonies, dependant on the final transshipment selected location.**

Further colonies occur at Kleinsee (incorporating Robeiland), at Buchu Twins near Alexander Bay, and Strandfontein Point (south of Hondeklipbaai) in South Africa. The colony at Kleinsee has the highest seal population and produces the highest seal pup numbers on the South African coast (Wickens, 1994). The colony at Buchu Twins, formerly a non-breeding colony, has also attained breeding status (M. Meyer, SFRI, pers. comm.). **These colonies are over 350 km inshore and south-east of Block 2913B. Nearshore transshipment operations will take place offshore Namibia, as such these operations will not take place within the vicinity of these colonies.**

The Cape fur seal population in the Benguela is regularly monitored by the South African and Namibian governments (e.g. Kirkman et al. 2012). Surveys of the full species range are periodically undertaken providing data on seal pup production (which can be translated to adult population size), thereby allowing for the generation of data on the population dynamics of this species. The population is considered to be healthy and stable in size although there has been a northward shift in the distribution of the breeding population (Kirkman, et al., 2007; Skern-Mauritzen, et al., 2009; Kirkman, et al., 2012).

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles (~220 km) offshore (Shaughnessy, 1979), with bulls ranging further out to sea than females. Their diet varies with season and availability and includes pelagic



species such as horse mackerel, pilchard, and hake, as well as squid and cuttlefish. Although Cape fur seals are primarily epipelagic foragers, some degree of geographic and temporal variation in resource and habitat use have been demonstrated (Botha, et al., 2023). Benthic feeding to depths of up to 454 m has been recorded in females from the Kleinzee colony, with individual modal dive durations of 0.2 – 5.6 minutes (Kirkman, et al., 2015; Kirkman, et al., 2019). Botha et al. (2020) reported diel foraging patterns in females from the Kleinzee and False Bay colonies, with dive depth and benthic foraging increasing during daylight hours likely reflecting the vertical movements of prey species. The foraging area of tracked seals from Namibian colonies and the South African West Coast colonies was provided in Skern-Mauritzen et al. (2009) and Harris et al. (2022) respectively. **Inshore transshipment and vessel transfer passages may fall within the foraging ranges of these species, with several Cape fur seals recorded during transit from Walvis Bay to Block 2913B, but also within the Block in waters ranging from 2 600 to 3 000 m deep** (BSL, 2022).

The timing of the annual breeding cycle is very regular, occurring between November and January. Breeding success is highly dependent on the local abundance of food, territorial bulls and lactating females being most vulnerable to local fluctuations as they feed in the vicinity of the colonies prior to and after the pupping season (Oosthuizen, 1991).

There is a controlled annual quota, determined by government policy, for the harvesting of Cape fur seals on the Namibian coastline. The Total Allowable Catch (TAC) for 2020 and 2021 stands at 60 000 pups and 8 000 bulls, distributed among seven licence holders at Cape Cross and a further three in Lüderitz. The annual quotas are seldom filled with concessionaires typically only harvesting 50% of the bulls and 30% of the pups. The seals are exploited mainly for their pelts (pups), blubber and genitalia (bulls). The pups are clubbed, and the adults shot. These harvesting practices have raised concern among environmental and animal welfare organisations (Molloy & Reinikainen, 2003; Kirkman & Lavigne, 2010).

In South Africa, an unprecedented mortality event was recorded between September and December 2021 at colonies around the West Coast Peninsula and north to Lambert's Bay and Elands Bay. Primarily pups and juveniles were affected. Post-mortem investigations revealed that seals died in a poor condition with reduced blubber reserves, and protein energy malnutrition was detected for aborted fetuses, for juveniles and subadults. Although no unusual environmental conditions were identified that may have triggered the die-off, or caused it indirectly (e.g., HABs), 2021 was a year of below average recruitment of anchovy and sardine, the main food source for seals. While a lack of food, as a result of possibly climate change and/or overfishing, has been predicted to be the cause of this mass mortality, the underlying causes of the mortality event remain uncertain (Seakamela, et al., 2022). In Namibia, similar mortality events typically related to prey shortage occur periodically, the most recent being a large-scale abortion event in 2020, especially at the colonies in central Namibia (J.-P. Roux, pers.comm.).



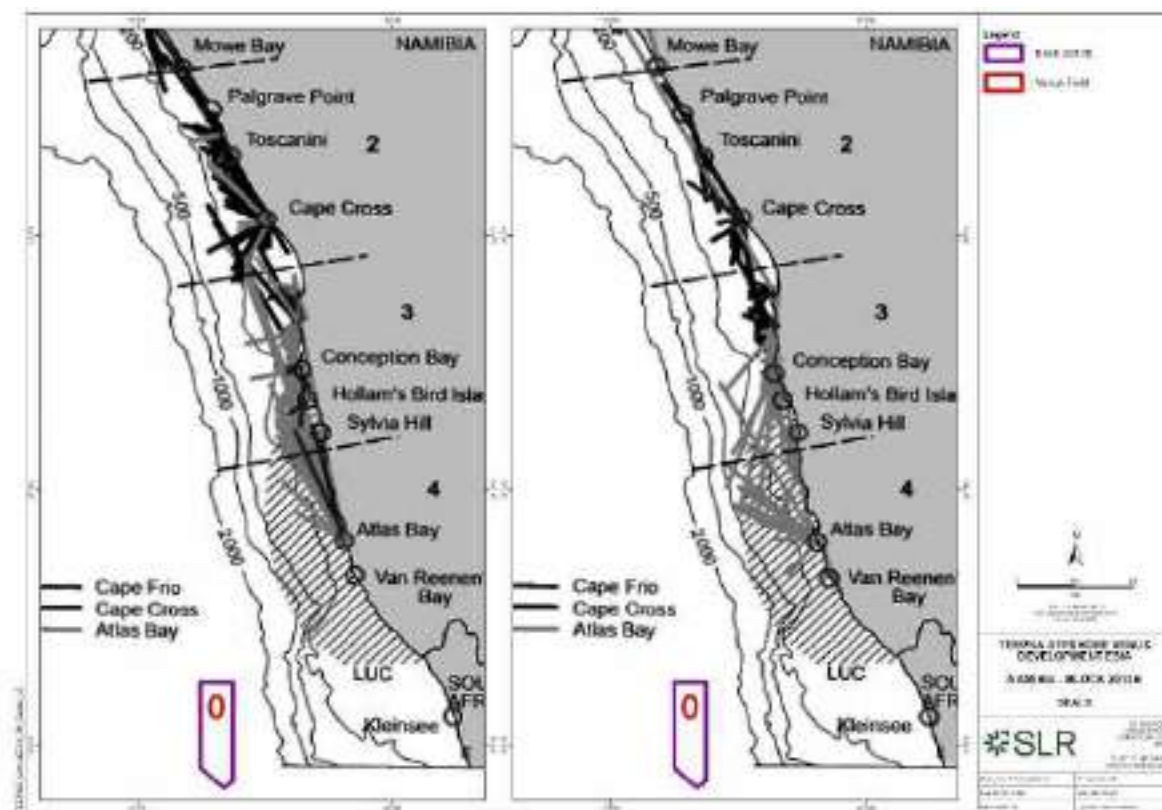


Figure 6-25: Block 2913B (purple polygon) and Venus development field (red circle) in relation to foraging trips of females (left) and males (right) of Cape fur seals at the Cape Frio, Cape Cross and Atlas Bay colonies.

Source: Skern-Mauritzen et al. (2009)

Trips are depicted as straight lines between the start location and the location where the seals spent most time during a trip.

6.5.4 Ecological Network Conceptual Model

Figure 6-26 provides a simplified conceptual model for the nearshore and offshore receiving environment in the southern Benguela system illustrating key variables, processes, linkages, relationships, dependencies and feed-back-loops.

The southern Benguela region's upwelling of nutrients is a critical driver of seasonal phytoplankton production, forming the foundation of a diverse food web that includes zooplankton, pelagic fish, cephalopods, marine mammals, and benthic species. This high productivity in surface waters creates a cyclical process of plankton growth, mortality, and nutrient replenishment through microbial decomposition. Millions of tonnes of organic material naturally enter the seabed each year, supporting benthic communities and contributing to the region's rich organic content. However, organic detritus that isn't consumed can lead to oxygen depletion and the formation of hydrogen sulphide due to anaerobic bacteria.



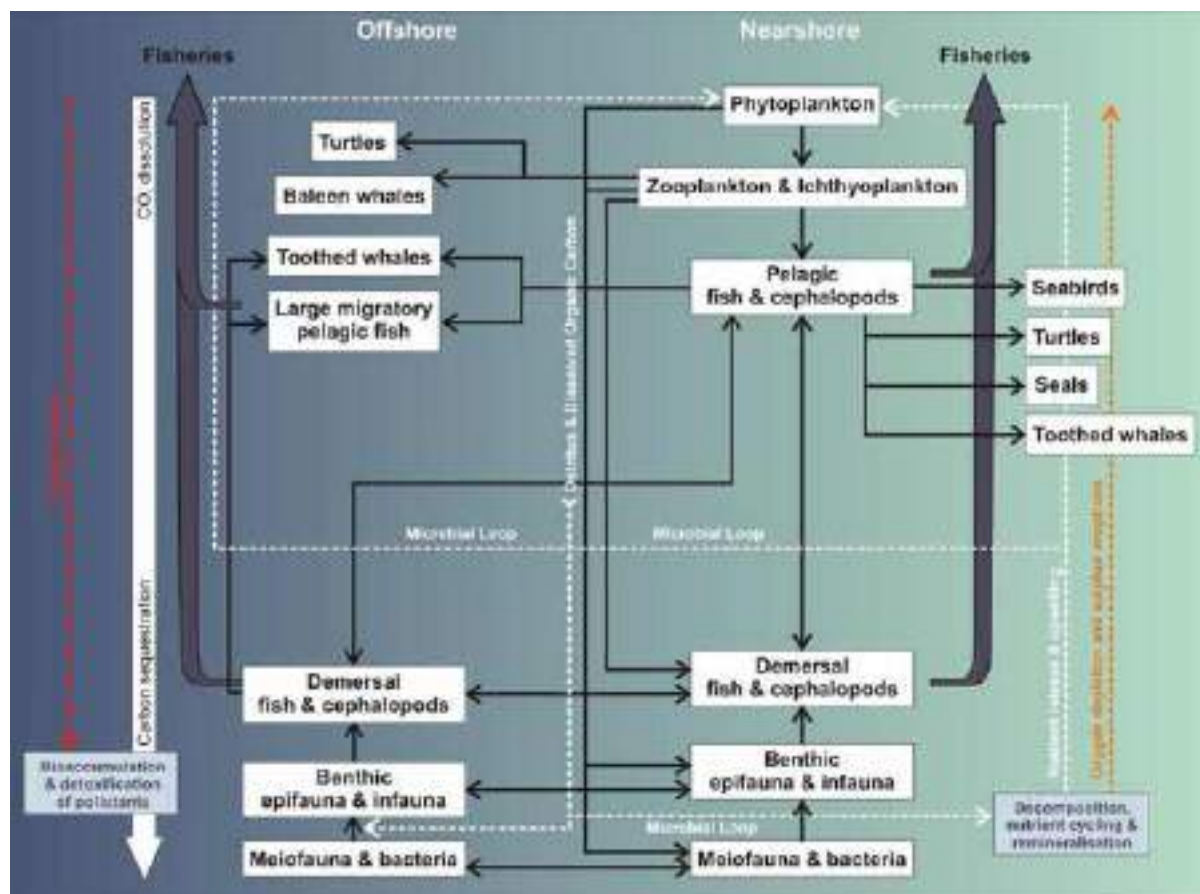


Figure 6-26: Simplified Network Diagram Indicating the Interaction Between the Key Ecosystem Components off the southern Benguela system.

Source: Pisces (2022)

In offshore environments, particularly around seamounts, similar processes enhance local primary and secondary production, creating hotspots for higher-order consumers. Cold-water corals and other structures associated with seamounts increase habitat complexity and biodiversity, supporting detritivore-based food webs that attract scavengers and predators. These seamounts are vital habitats for commercial deep-water fish stocks, reinforcing the ecosystem's productivity and health. The functions of these marine ecosystems include supporting fisheries, sequestering carbon, and detoxifying waste, all of which are influenced by natural variations and human activities such as hydrocarbon exploration.

Anthropogenic disturbances can disrupt marine ecosystems at both population and ecosystem-wide levels. For instance, changes in marine mammal behaviour due to human activities could alter nutrient flows in feeding areas, impacting overall ecosystem health. Similarly, significant disturbances to plankton populations can have cascading effects on the entire food web, threatening the viability of fish and marine mammal populations that rely on healthy plankton communities for sustenance. Effective management strategies must account for these potential impacts and emphasize the importance of stable predator populations in maintaining ecosystem balance.

To assess these complex interactions, researchers have developed numerical models, including the Population Consequences of Acoustic Disturbance (PCAD) framework, which evaluates how behavioural changes in individuals affect population dynamics. These frameworks are usually complex and under continual development but have been successfully used to assess the population consequences and ecosystem effects of



disturbance in real-life conditions both for marine mammals (Villegas-Amtmann, Schwartz, Sumich, & Costa, 2015; Villegas-Amtmann, Schwarz, Gailey, Sychenko, & Costa, 2017; Costa, et al., 2016; Ellison, Racca, Clark, Streever, & al., 2016; McHuron, Schwarz, Costa, & Mangel, 2018; Pirota, Booth, Costa, & al., 2018; Dunlop, Braithwaite, Mortensen, & Harris, 2021), fish (Slabbekoorn & Halfwerk, 2009; Hawkins, Roberts, & Cheesman, 2014; Slabbekoorn, et al., 2019) and invertebrates (Hubert, et al., 2018). The PCAD/ PCoD (Potential Consequence of Decision) models use and synthesise data from behavioural monitoring programmes, ecological studies on animal movement, bio-energetics, prey availability and mitigation effectiveness to assess the population-level effects of multiple disturbances over time (Bröker, 2019).

An ecosystem-based management approach is necessary to address the cumulative impacts of human activities and preserve ecosystem services. Within complex marine ecosystems, the integrated ecosystem assessment framework, which incorporates ecosystem risk assessments, provides a method for evaluating the cumulative impacts of multiple pressures on multiple ecosystem components (Levin, Fogarty, Murawski, & Fluharty, 2009; Holsman, et al., 2017; Spooner, et al., 2021). However, quantifying reference points for effective management remains challenging, particularly in data-limited regions like southern Africa. (Slabbekoorn, et al., 2019).



Summary of key biological characteristics in the study area

The Venus development area is located in a deep-water environment that exhibits much lower diversity and abundance of species than the inner shelf areas that benefit from nutrient-rich upwelled waters and the resultant higher productivity, where support vessels transit and transshipment operations will occur.

The benthic habitat at depths beyond 500 m have been assigned a threat status of 'Least Threatened' as they comprise large areas in the Namibian EEZ and experience limited impacts. However, the continental shelf is considered 'Endangered' due to habitat degradation from trawling.

Environmental surveys undertaken within the Licence Block, as well as in comparable environments and depth ranges, show that benthic infauna are generally impoverished, which is typical for deep water sediments. The macrofaunal communities recorded were dominated by polychaetes, with lower abundances of molluscs and crustaceans. Bioturbation, in the form of burrows, was present within all biotopes indicating the presence of infaunal taxa.

Information about demersal fish communities at depths beyond 500 m is limited, but fishes that typically occur on the upper and mid slopes, and into the abyss, include rattails, bythitids, liparidids (snail fishes) and notacanthids (*Polyacanthonotus* species) and halosaurs. Fish species such as eel-shaped fishes (*Halosauridae* sp.), rat-tails (*Macrouridae* sp.), tripod fishes (*Ipnopidae* sp.), cusk-eels (*Ophidiidae* sp.) and larvacean houses (*Appendicularia* sp.) were recorded within Block 2913B during environmental surveys

Key observations regarding pelagic fauna are as follows:

- Important biological processes such as primary production, fish spawning and migratory routes occur inshore (outside) of Block 2913B, however may overlap with nearshore transshipment operations
- The distribution of small pelagic fish, which include many commercially important species such as sardine and anchovy, are located inshore (outside) of the Venus development area, yet may be encountered by nearshore transshipment operations.
- Large migratory pelagic fish species, such as tunas, billfish and sharks, occur seasonally throughout the southern oceans; they may thus be encountered in the project area of influence.
- Turtle occurrence in the project area of influence is also possible but abundances are similarly expected to be low.
- Foraging and breeding areas of most resident breeding seabirds and Cape fur seals are located inshore (outside) of the Licence Block, yet may overlap with inshore transshipment locations and vessel transfer passages.
- Cetacean species most likely to be encountered in the project area of influence are long-finned pilot, sperm, southern right and humpback whales, and common dolphins.

6.6 Conservation and Sensitive Areas

Numerous categories of conservation and sensitive areas exist along and offshore the Namibian coastline, which are discussed below.

6.6.1 National Parks

Inshore of the project area of influence, the entire coastline of Namibia is part of a continuum of protected areas that stretch along, a distance of about 1 570 km, from Southern Angola into Namaqualand in South Africa (Figure 6-28).

From north to south these comprise the Skeleton Coast National Park, the Dorob National Park, the Namib-Naukluft National Park and the Tsau//Khaeb (Sperrgebiet) National Park.



In the south across the Orange River, it borders on the Richtersveld in South Africa, which comprises a protected area of about 1 600 km² within a multiple-use buffer zone of about 3 984 km². This whole area forms the Ai-Ais/Richtersveld Transfrontier Conservation Area under a formal co-operative agreement between the governments of Namibia and South Africa.

6.6.2 Ramsar Sites

A Ramsar site is wetland designated to be of international importance under the Ramsar Convention, also known as "The Convention on Wetlands", an intergovernmental environmental treaty established by UNESCO in 1971. Namibia has a total of five Ramsar sites, three of which are located along the coast. The Ramsar sites potentially in the project's Area of Influence are listed in Table 6-10. **Block 2913B lies offshore of these coastal sites, however nearshore transshipment locations may fall within the vicinity of these coastal sites.**

Table 6-10: List of coastal Ramsar sites inshore of Block 2913B.

Name	Size (ha)	Description
Walvis Bay Wetlands	10 550	Ramsar site no. 742. A tidal lagoon consisting of adjacent intertidal areas, Pelican Point, mudflats exposed at low tide, and sandbars serving as roosting sites. The site supports varying numbers of wetland birds (37 000 to 79 000 individuals); some species such as flamingos occur in impressive numbers. Eleven endangered bird species are regularly observed. Human activities consist of recreation and salt production. Residential development exists along the lagoon, and natural siltation may eventually lead to the infilling.
Sandwich Harbour	13 825	Ramsar site no. 743. Two distinct wetlands and associated mudflats. One is aquifer-fed and supports typical emergent vegetation but is slowly disappearing due to natural causes. The second, under tidal influence, consists of mudflats and raised shingle bars. One of Namibia's most important coastal wetlands, supporting eight endangered species among the large numbers of wading birds. Several archaeological sites dating back 1 000 years exist within the site. The site is used for scientific research, with surrounding areas used for tourism, recreation, and angling.
Orange River Mouth	2 000	Ramsar site no. 526. Transboundary area of extensive saltmarshes, freshwater lagoons and marshes, sand banks, and reedbeds shared by South Africa and Namibia. Important for resident birds and for staging locally migrant waterbirds. Following the collapse of the saltmarsh component of the estuary, the site was placed on the Montreux Record in 1995.

6.6.3 Important Bird and Biodiversity Areas

The confirmed Important Bird and Biodiversity Areas (IBAs) located along the Namibian coastline, as designated by BirdLife International in Namibia (Figure 6-27), include, north to south:

- 30-kilometre Beach: Walvis-Swakopmud;



- Cape Cross Lagoon;
- Mile 4 saltworks;
- Walvis Bay
- Namib-Naukuluft Park;
- Sandwich Harbour;
- Sperrgebiet; Mercury Island;
- Ichaboe Island;
- Lüderitz Bay Islands; and
- Possession Island;

Various marine IBAs have also been proposed in Namibian territorial waters, with a candidate trans-boundary marine IBA suggested off the Orange River mouth (Figure 6-27). The proposed Atlantic Southeast 21 marine IBA specifically targets the protection of Atlantic Yellow-nosed Albatross, Black-browed Albatross and White-chinned Petrels. **Block 2913B lies west of this proposed marine IBA. Block 2913B lies well offshore of the confirmed and proposed IBAs. However, inshore transshipment and vessel transfer passages may fall within these proposed IBAs (Figure 6-27).**

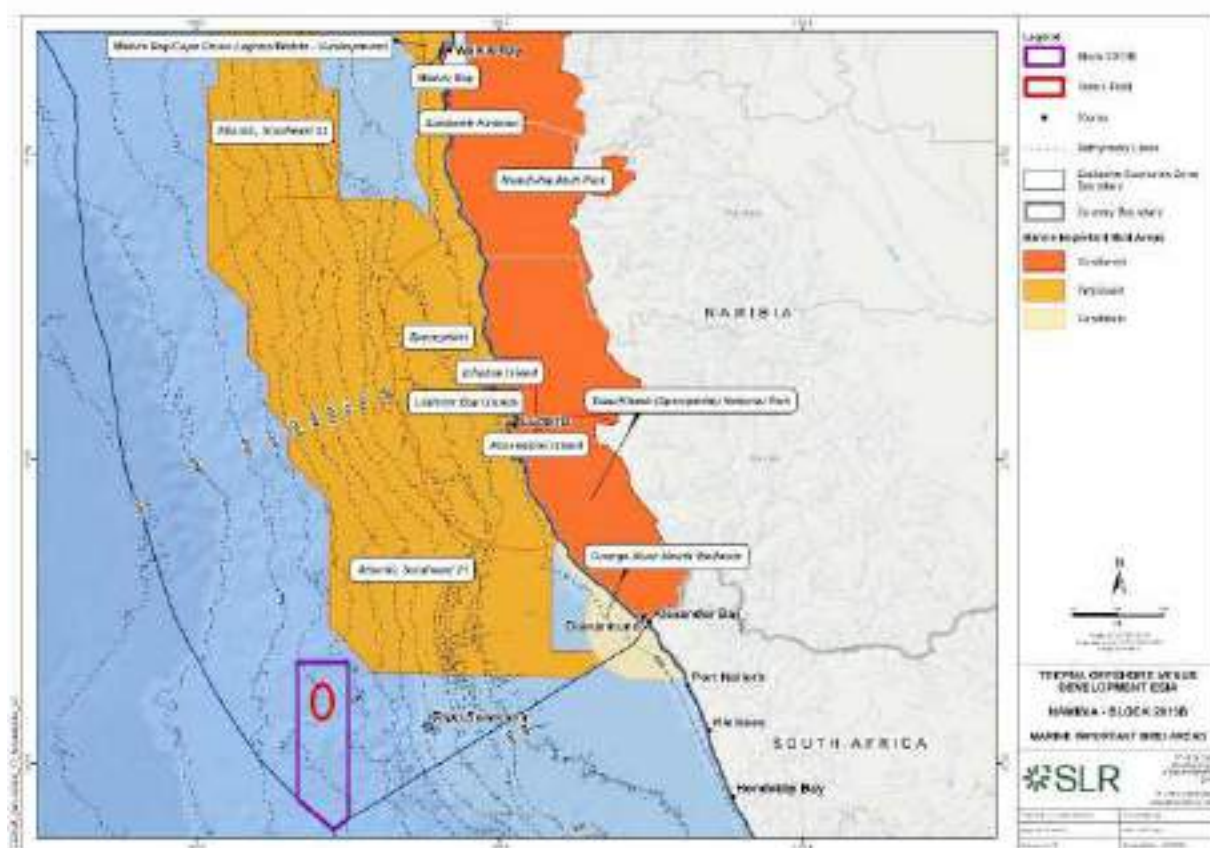


Figure 6-27: Confirmed, proposed and candidate IBAs along the coast of Namibia.

Source: <https://maps.birdlife.org/marineIBAs/>

6.6.4 Marine Protected Areas

The actual Namibian MPA was launched on 2 July 2009 under the Namibian Marine Resources Act (No. 29 of 1992 and No. 27 of 2000), with the purpose of protecting sensitive ecosystems and breeding and foraging areas for seabirds and marine mammals, as well as protecting important spawning and nursery grounds for fish and other marine resources (such as rock lobster). The MPA comprises a coastal strip extending from Hollamsbird Island (24°38' S) in the north, to Chameis Bay (27°57' S) in the south, spanning approximately three



degrees of latitude and an average width of 30 km from the coast, including 16 specified offshore islands, islets and rocks (Currie et al. 2009). The Namibian Islands' Marine Protected Area (NIMPA) spans an area of 9 555 km², and includes the **Lüderitz Bay and Ichaboe Island Rock-Lobster** (a 478 km² coastal sanctuary stretching between Chameis Bay and Prince of Wales Bay).

The offshore islands, whose combined surface area amounts to only 2.35 km² have been given priority conservation and highest protection status (Figure 6-28; Currie et al. 2009). The area has been zoned into four degrees of incremental protection. These are detailed in Currie et al. (2009). The closest point with **NIMPA is 225 km to the north-east of Block 2913B.**

The Orange Shelf Edge MPA is 64 km east of Block 2913B at its closest point, in South African waters. This offshore MPA covers depths of between 250 m and 1 500 m and was proclaimed in 2019. The area has not been trawled therefore provides a good reference for a healthy benthic environment. Several other MPAs lie off the West Coast of South Africa.

Block 2913B does not overlap with any MPAs, but a possible transshipment area north or south Lüderitz may be within the NIMPA.



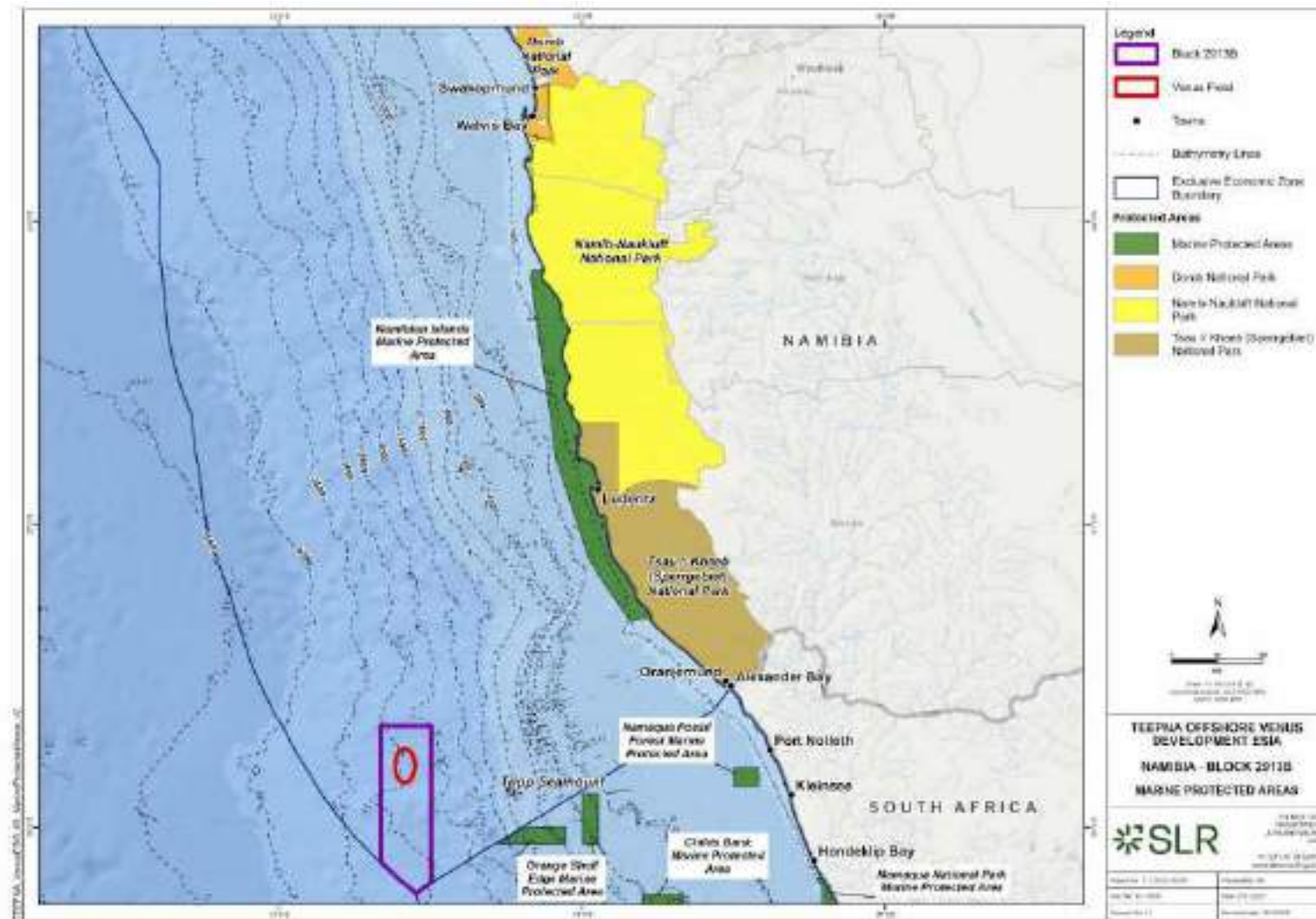


Figure 6-28: Block 2913B (purple polygon) in relation to National Parks and Marine Protected Areas in Namibia and South Africa.



6.6.5 Sensitive Areas

6.6.5.1 Benthic and pelagic ecosystems threat and protection level

The benthic and coastal ecosystem types of Namibia were mapped as part of the Benguela Current Commission's Spatial Biodiversity Assessment (BCC-SBA) (Holness, et al., 2014) to develop assessments of the ecosystem threat status and ecosystem protection level. Submarine canyons were also mapped as biodiversity features, although descriptions of their geographical situations were not sufficiently accurate for inclusion in the benthic habitat map⁴⁷ (Figure 6-29). The benthic and coastal ecosystems were subsequently assigned an ecosystem threat status based on their level of protection and ecological condition (Figure 6-29).

Benthic ecosystem types along the shelf edge in southern Namibia (500 m depth contour) were classified as 'Endangered' by the BCC-SBA, largely due to the degraded habitat found in this area caused by trawling. The upper and lower shelf were considered 'Least Threatened'. **The benthic habitat/ecosystem type within Block 2913B is classified as 'Least Threatened'** (Holness et al. 2014, Table 6-2, Figure 6-29). Similarly, pelagic ecosystems south of Walvis Bay have all been assigned a threat status of 'Least Threatened' (Figure 6-30), with the **pelagic ecosystems within Block 2913B classified at 'Least Threatened'** (Holness, et al., 2014). **Transshipment operations likely to take place within nearshore waters, thus falling within benthic and ecosystem types considered as 'Least Threatened'.**

Despite the development of the offshore Ecologically or Biologically Significant Marine Areas (EBSAs, see Section 6.6.5.2) a number of 'Vulnerable' ecosystem types in the broader project area are currently considered 'not well protected' or 'poorly protected' and further effort is needed to improve protection of these threatened ecosystem types (Holness, et al., 2014) (Figure 6-32). Ideally, all highly threatened ('Critically Endangered' and 'Endangered') ecosystem types should be well protected. Currently, however, most of the upper and lower slope and abyss of the Namib biozone receives no protection at all, with the 'Endangered' and 'Critically Endangered' Namaqua Shelf Edge and Lüderitz Shelf edge being 'poorly protected' and 'moderately protected', respectively.

Block 2913B lies within an area receiving no ecosystem protection (Figure 6-29 and Figure 6-30), but support vessel will transit through vulnerable benthic ecosystems and transshipment operation could be in the vicinity.

⁴⁷ Possible marine canyons identified by the international Deep Ocean project mapped them as lines. The lines were buffered by 5 km to ensure that both the canyon and its associated adjacent ecosystems were included.



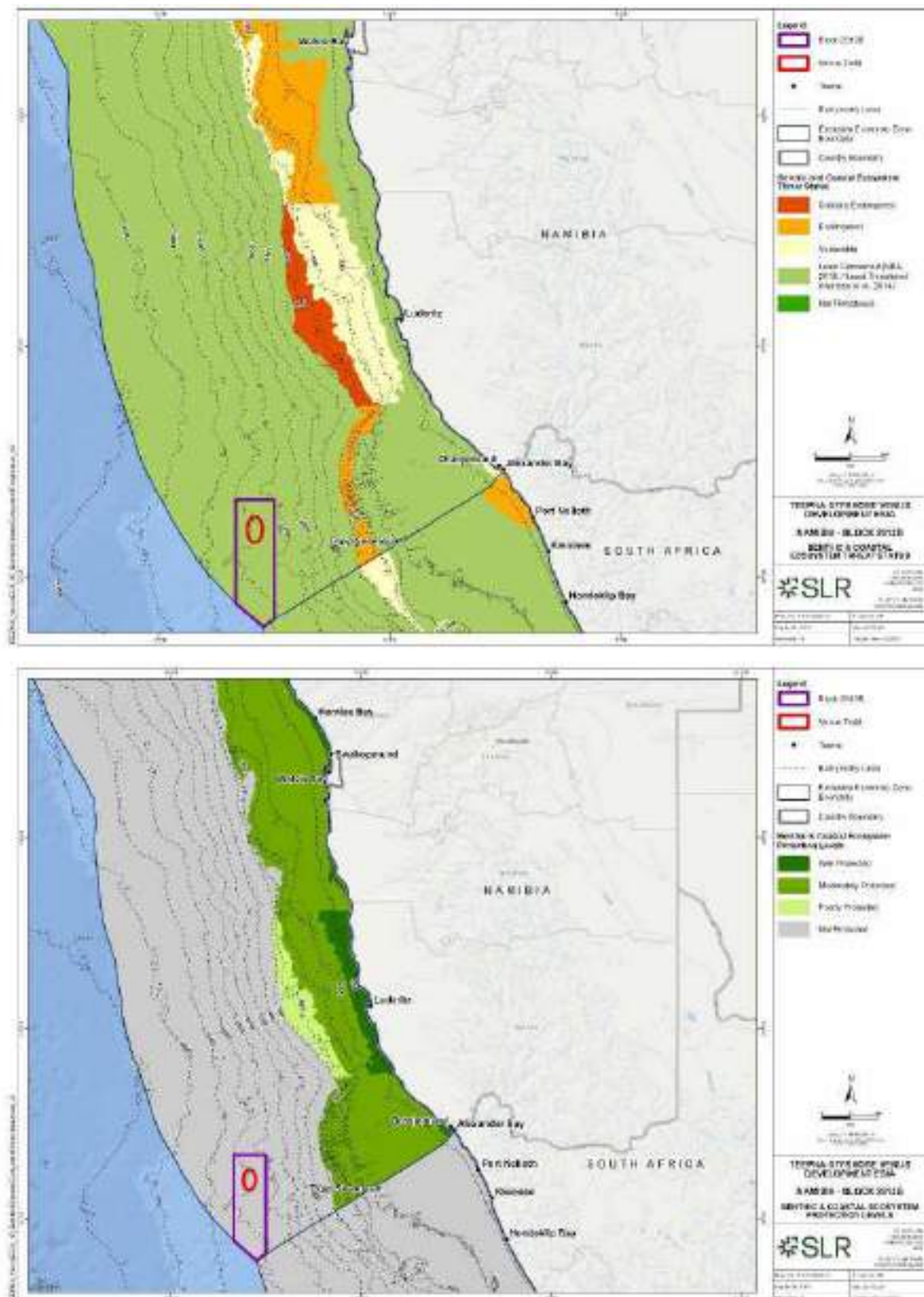


Figure 6-29: Block 2913B (purple polygon) and Venus development field (red circle) in relation to threat status (top) and protection levels (bottom) of benthic and coastal ecosystems.

Source: Adapted from Holness et al. (2014) and Sink et al. (2019).



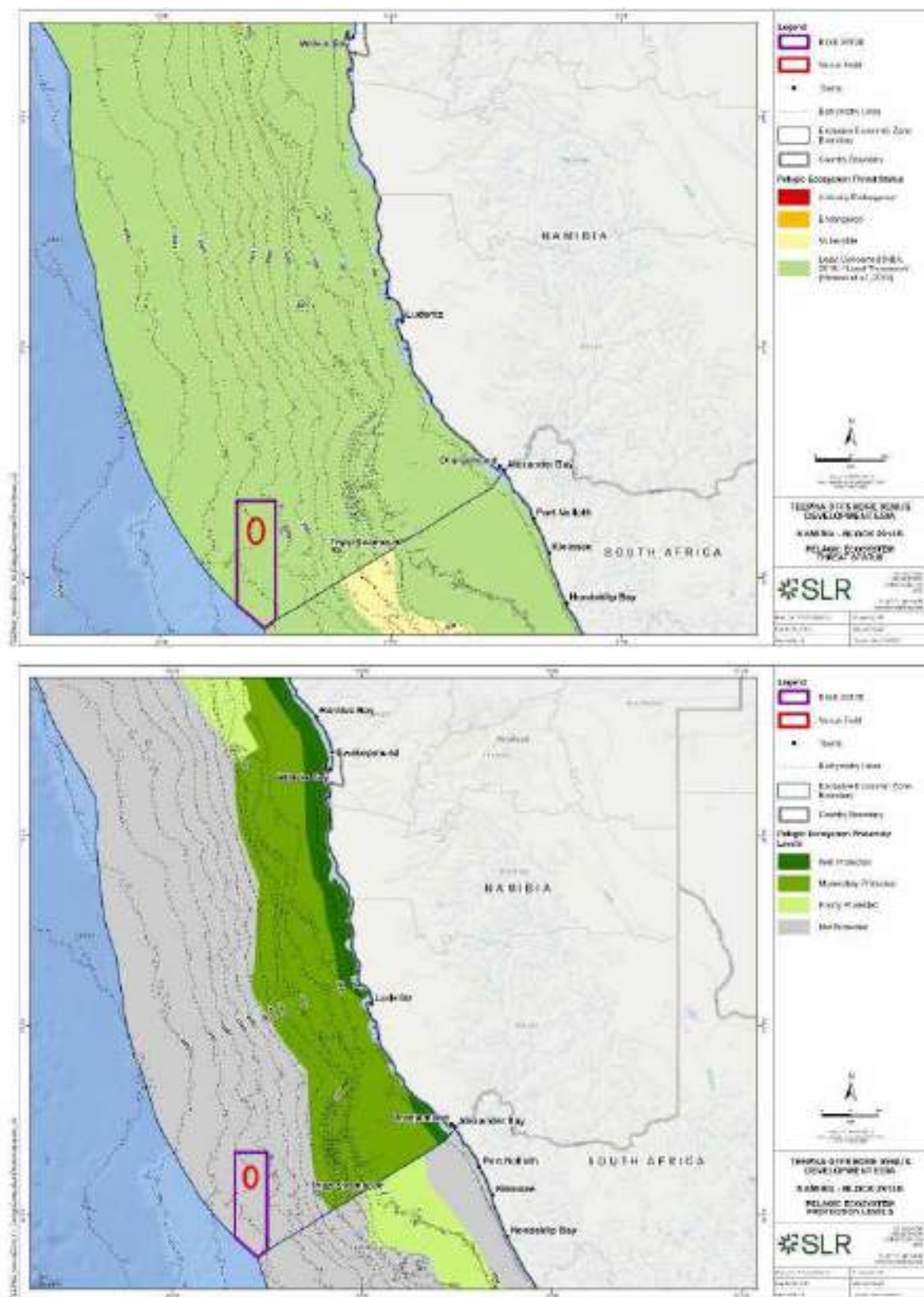


Figure 6-30: Block 2913B (purple polygon) and Venus development field (red circle) in relation to threat status (top) and protection levels (bottom) of pelagic ecosystems.

Source: Adapted from Holness et al. (2014)



6.6.5.2 Ecologically or Biologically Significant Marine Areas

In the spatial marine biodiversity assessment undertaken for Namibia (Holness, et al., 2014), several offshore and coastal areas were identified as being of high priority for place-based conservation measures. To this end, EBSAs spanning the coastline between Angola and South Africa were proposed and successfully submitted for international recognition to the Convention of Biological Diversity (CBD) in March 2020. The principal objective of the EBSAs is identification of features of higher ecological value that may require enhanced conservation and management measures. The EBSAs are delineated to minimise conflict and avoid negative impacts with industries. In line with Namibia's National Development Plan 5, the EBSAs will be used to inform and enhance Marine Spatial Planning in the country's EEZ..

No specific management actions have been formulated for the EBSAs at this stage and they carry no legal status. Any future decisions in relation to management of the areas and possible restrictions of human activities are within the mandate of the responsible authorities. However, two biodiversity zones have recently been defined within each EBSA as part of the marine spatial planning process⁴⁸ (Figure 6-31). Although the proposed zonation of the EBSAs is still under discussion, the management objective in the **zones marked for 'Conservation'** is "*strict place-based biodiversity protection aimed at securing key biodiversity features in a natural or semi-natural state, or as near to this state as possible*". The management objective in the **zones marked for 'Impact Management'** is "*management of impacts on key biodiversity features in a mixed-use area to keep key biodiversity features in at least a functional state*" (Institution for Coastal and Marine Research , 2023).

In the list of sea-use activities provided for Conservation and Impact Management EBSAs, the marine spatial planning zone for petroleum activities recommends that petroleum extraction is either conditionally permissible (Consent⁴⁹) or prohibited⁵⁰ within 'Conservation Zones', depending on the EBSA in which the 'Conservation Zone' falls. **Petroleum extraction (i.e., development) activities are conditionally permissible across all 'Impact Management' zones, regardless of the EBSA in which it falls.** These spatial planning zones have been carried across to the draft Central MSP (see Section 6.6.5.3).

Of the eight identified EBSAs:

- Two fall solely within Namibian national jurisdiction, Namib Flyway and Namibian Islands;
- One is shared with Angola, Namibe; and
- Two are shared with South Africa, Orange Shelf Edge and Orange Cone.

The Benguela Upwelling System transboundary EBSA extends along the entire southern African West Coast from Cape Point (South Africa) to the Kunene River (Angola) and includes a portion of the high seas beyond the Angolan EEZ. The following bullets summarise the EBSAs possibly overlapping the Venus development project activities, as adapted from the MARISMA EBSA Workstream (2020 and 2023):

- The **Namib Flyway** is a highly productive coastal area in central Namibia that attracts large numbers of seabirds, shorebirds, waterbirds, marine mammals, sea

⁴⁸ <https://cmr.mandela.ac.za/EBSA-Portal/Namibia/Namibian-EBSA-Status-Assessment-Management>

⁴⁹ Consent activities are defined as "An activity which can continue in this zone subject to specific regulation and control. Careful controls are likely to be put in place to avoid unacceptable impacts on biodiversity features, or to avoid intensification or expansion of impact footprints of uses that are already occurring and where there are no realistic prospects of excluding these activities."

⁵⁰ Prohibited activities are defined as "An activity which is not allowed or should not be allowed because it is incompatible with maintaining the biodiversity objectives of the zone".



turtles, and other fauna, many of which are threatened species. The main coastal features in the EBSA provide important stopover, breeding, and/or foraging sites for resident and migratory species include two sheltered bays (Sandwich Harbour and Walvis Bay), The upwelling cell off Lüderitz raises productivity northwards due to longshore drift and predominant onshore winds. Primary production of the Benguela Current is highest in the central regions of Namibia, near the EBSA, driven by delayed blooming. **While Block 2913B is located well offshore of this EBSA, support vessel transit and transshipment operations may overlap with this EBSA.**

- The **Namibian Islands** are located offshore of the central Namibian coastline and within the intensive Lüderitz upwelling cell. These islands and their surrounding waters are significant for life history stages of threatened seabird species as they serve as crucial seabird breeding sites within the existing Namibian Islands Marine Protected Area (NIMPA). The surrounding waters are also key foraging grounds for both seabirds and for 'Critically Endangered' leatherback turtles that nest along the north-eastern coast of South Africa. **While Block 2913B is located well offshore of this EBSA, support vessel transit and transshipment operations may overlap with this EBSA.**
- The **Orange Seamount and Canyon Complex** occur at the western continental margin of southern Africa, spanning the border between South Africa and Namibia. On the Namibian side, it includes Tripp Seamount and a shelf-indenting canyon. The EBSA comprises shelf and shelf-edge habitat with hard and unconsolidated substrates, including at least eleven offshore benthic habitat types of which four habitat types are 'Threatened', one is 'Critically Endangered' and one 'Endangered'. The Orange Seamount and Canyon Complex EBSA is one of few places where these threatened habitat types are in relatively natural/pristine condition. The local habitat heterogeneity is also thought to contribute to the Orange Shelf Edge being a persistent hotspot of species richness for demersal fish species. Although focussed primarily on the conservation of benthic biodiversity and threatened benthic habitats, the EBSA also considers the pelagic habitat, which is characterized by medium productivity, cold to moderate Atlantic temperatures (Sea Surface Temperature (SST) mean = 18.3°C) and moderate chlorophyll levels related to the eastern limit of the Benguela upwelling on the outer shelf. **The eastern border of Block 2913B has a 0.01% surface overlap with the Conservation Zone of this EBSA. The proposed Venus development area is, however, over 15 km northwest of the EBSA (Figure 6-31).** Notably within the Namibian EEZ do not prohibit petroleum extraction (development), which is considered a 'Consent' activity requiring a detailed assessment before approval (e.g an ESIA).
- The **Orange Cone** is a transboundary EBSA that spans the mouth of the Orange River. The estuary is biodiversity-rich but modified, and the coastal area includes many 'Critically Endangered', 'Endangered', and 'Vulnerable' habitat types (with the area being particularly important for the 'Critically Endangered' Namaqua Sandy Inshore, Namaqua Inshore Reef and Hard Grounds and Namaqua Intermediate and Reflective Sandy Beach habitat types). The marine environment experiences slow, but variable currents and weaker winds, making it potentially favourable for reproduction of pelagic species. An ecological dependence for of river outflow for fish recruitment on the inshore Orange Cone is also likely. The Orange River Mouth is a transboundary Ramsar site and falls within the Tsau//Khaeb (Sperrgebiet) National Park. It is also under consideration as a protected area by South Africa and is an Important Bird and Biodiversity Area. This area is thus highly relevant in terms of: 'Uniqueness or rarity', 'Importance for threatened, endangered or declining species and/or habitats' and 'Special importance for life history stages of species'. **While Block 2913B does not overlap with this EBSA, support vessel transit and transshipment operations may occur within this EBSA.**



- The **Benguela Upwelling System** is a transboundary EBSA and is globally unique as the only cold-water upwelling system to be bounded in the north and south by warm-water current systems and is characterized by very high primary production ($>1\,000\text{ mg C.m}^{-2}\text{.day}^{-1}$). It includes important spawning and nursery areas for fish as well as foraging areas for threatened vertebrates, such as sea- and shorebirds, turtles, sharks, and marine mammals. Another key characteristic feature is the diatomaceous mud-belt in the Northern Benguela, offshore the northern Namibian coast in waters ranging from 50 to 200 m deep, which supports regionally unique low-oxygen benthic communities that depend on sulphide oxidising bacteria. **Block 2913B lies west of this EBSA, yet nearshore transshipment operations may fall within this EBSA.**

At the same latitude, within South African waters, are the following EBSAs:

- The **Namaqua Fossil Forest** EBSA, (~285 km east of Block 2913B), is a small seabed outcrop composed of fossilized yellowwood trees at 136-140 m depth, approximately 30 km offshore on the west coast of South Africa. A portion of the EBSA comprised the Namaqua Fossil Forest MPA. The fossilized tree trunks form outcrops of laterally extensive slabs of rock have been colonised by fragile, habitat-forming scleractinian corals and a newly described habitat-forming sponge species. The EBSA thus encompasses a unique feature with substantial structural complexity that is highly vulnerable to benthic impacts.
- The **Childs Bank and Shelf Edge** EBSA, (~180 km southeast of Block 2913B) is a unique submarine bank feature rising from 400 m to 180 m on the western continental margin on South Africa. This area includes five benthic habitat types, including the bank itself, the outer shelf and the shelf edge, supporting hard and unconsolidated habitat types. Childs Bank and associated habitats are known to support structurally complex cold-water corals, hydrocorals, gorgonians and glass sponges; species that are particularly fragile, sensitive and vulnerable to disturbance, and recover slowly.



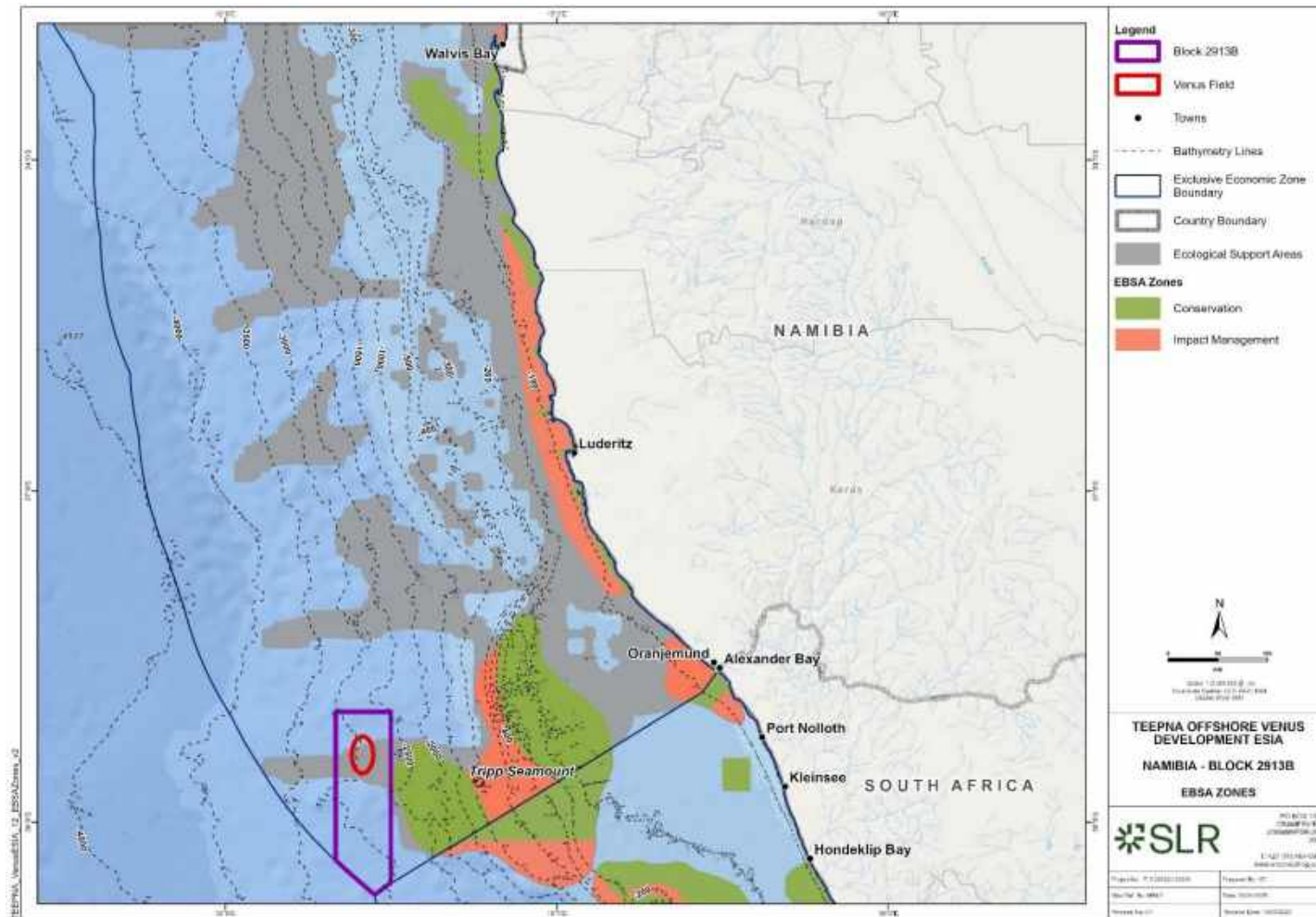


Figure 6-31: Block 2913B (purple polygon) and Venus development field (red circle) in relation to Ecologically and Biologically Significant Areas (EBSAs) and the Ecological Support Areas (ESAs).

Source: Adapted from MFMR (2021) and MARISMA (2020).



6.6.5.3 Ecological Support Areas and Marine Spatial Planning

In addition to EBSAs, Ecological Support Areas (ESAs) have been identified more recently. Although these areas do not meet the EBSA criteria they reflect secondary priority conservation areas with special attributes that support a healthy and functioning marine ecosystem (Figure 6-31). **Block 2913B partially overlaps with an ESA extending the Orange Seamount and Canyon Complex EBSA.**

In addition, nearshore transshipment operations may overlap with ESAs extending the Namib Islands and Namib Flyway EBSAs.

Namibia also recently embarked on a MSP process implemented as a development planning approach to organize the use of the country's marine territory in such way that comprehensive, integrated, and complementary planning and management across sectors and for all ocean uses is enabled. MSP in Namibia is highly precautionary and forward-looking given the relatively low intensity of current uses of this marine territory, has a strong ecosystem-based perspective due to the pristine environment, is driven by a social equity and distributive justice agenda, and features a strong collaborative process governance (Finke F. , et al., 2020a; Finke G. , Gee, Kreiner, Amunyela, & Braby, 2020b). Although at this stage MSP lacks legislation and has only weak links to broader ocean governance, the MSP process has resulted in a clear framework for the development of the first marine plan (MFMR 2019), as it was linked to a systematic conservation planning process from the outset.

The objectives and principles for MSP, as well as the steps each planning process is expected to follow, is set out in the National MSP Framework (MFMR 2019). The Framework provides high-level direction to ensure consistent and coherent plan development, implementation and review across Namibia's marine space and its three proposed planning areas: a northern, central and southern area. It also describes the background to MSP and its overarching objectives in Namibia and identifies relevant institutional structures, roles and responsibilities (MFMR 2022).

The first MSP for Namibia is being developed for the central area, followed by the northern and the southern areas. The draft central Namibian MSP, which extends from Hottentots Bay in the south to Cape Cross in the north, outlines several 'zones', which define desired uses or combinations of use for specific marine areas, as well as the proposed regulations pertaining to each zone. Zonation is based on the eight main marine sectors, namely defence, environmental protection, fisheries, mining, mariculture, tourism, transport and infrastructure. Zones and their regulations are based on the following types of use:

- Primary use: This is an activity that is given priority in a particular zone. Other activities are only allowed in the zone if they do not impede the primary use and if an ECC (if required) is granted.
- Consent use: This is an activity that is compatible with the primary use of the zone and which can be approved in a primary use zone under specified conditions, based on and in line with the Environmental Management Act, 2007.
- Prohibited use: This is an activity that is not allowed in the zone as it would impede the primary use.

Notably, the regulations of each proposed zone do not replace existing sector regulations for specific uses (e.g. marine protected areas, fisheries and port regulations).

The MSPs in each of the three planning areas will translate the National Framework for MSP into integrated and strategic sustainable development plans that guide users, developers and regulators in their decision-making, setting out which activities should take place where, when and under what conditions. Any future licensing decisions would need to be in line with the provisions set out in the respective plans. To date (April 2025) there is no legally



binding framework in place, with the respective MSPs currently under development and/or review.

6.6.5.4 Important Marine Mammal Areas

Important Marine Mammal Areas (IMMAs) were introduced by the IUCN Marine Mammal Protected Areas Task Force in 2016 to support marine mammal and marine biodiversity conservation. Complementing other marine spatial assessment tools including the EBSAs and IMMAs are identified on the basis of four main scientific criteria, namely species or population vulnerability, distribution and abundance, key life cycle activities and special attributes. Designed to capture critical aspects of marine mammal biology, ecology and population structure, they are devised through a biocentric expert process that is independent of any political and socio-economic pressure or concern. IMMAs are not prescriptive but comprise an advisory, expert-based classification of areas that merit monitoring and place-based protection for marine mammals and broader biodiversity.

The majority of the west coast of Africa has not yet been assessed with respect to its relevance as an IMMA. IMMAs in southern Africa, are all restricted to the South African coast and include:

Southern Coastal and Shelf Waters of South Africa IMMA (166 700 km²);

Cape Coastal Waters IMMA (6 359 km²); and

South East African Coastal Migration Corridor IMMA (47 060 km²).

All identified IMMAs for southern Africa lie well to the south of Block 2913B and any nearshore transshipment location.

Summary of key conservation and sensitive areas in the study area.

The Venus development area does not overlap with any MPAs, IBAs, IMMAs or Ramsar sites, however vessel transit and transshipment operations may overlap and / or be within the vicinity.

The benthic habitat along 500 m depth contour in southern Namibia are considered 'Endangered', due to the degraded condition caused by trawling. Inshore and offshore of this, the benthic habitat is considered 'Least Threatened'. The benthic and pelagic ecosystem types within the Licence Block have been assigned a threat status of 'Least Concern', with the project area receiving no protection.

Block 2913B is partially overlaps along the eastern boundary with the Orange Seamount and Canyon Complex transboundary EBSA. In addition, transshipment and vessel transit activities may take place within the Benguela EBSA.

MPAs, EBSAs as well as proposed MSP zonations include regulations and proposed sea-use guidelines, respectively, to be taken into consideration during the ESIA assessment.

6.7 Socio-Economic Environment

6.7.1 Geographic and Administrative Overview

Namibia is divided into 14 Regions, with each Region being administered by a Regional Council under the management of a Chief Regional Officer. Each Region is led by a Governor who is the political head of the region, represents the President and central government and oversees the exercise of any executive function of the government in the region.



Regional Councils in Namibia play a crucial role in the governance and development of the country's regions. Their responsibilities include development planning, acting as a link between local communities and central government, implementing decentralisation policies to bring government closer to the people, overseeing local authorities in their regions and delivering essential services such as education, healthcare, and infrastructure development, tailored to the specific needs of their regions.

At local level, a hierarchy of urban areas serves each region. Municipal Councils manage the larger urban areas, which are designated as municipalities while Town Councils manage proclaimed towns and Village Councils lead proclaimed villages. Settlement areas are smaller developing urban concentrations and these are managed by the regional councils.

Relative to the locality of the offshore Block 2913B, the most direct relationships between the Venus field and the country will be with the //Kharas and Erongo Regions. Despite a portion of the Hardap Region also covering part of the coastline, the entire coastline and approximately 125 km inland is covered by the Namib Naukluft Park and the Namib Sand Sea, which is largely uninhabited. There are also no towns or settlements in the Hardap portion of the coastline and the impacts on the Hardap Region is likely to be mostly indirect and related to the national impact of the project.

The Figure 6-32 provides the terrestrial and offshore context of Block 2913B within which the Venus field is located. The most important observations are that the entire Namibian Coastline is covered by National Parks with only the Oranjemund, Lüderitz and Walvis Bay/Swakopmund enclaves linking the hinterland with the coast and constituting the main coastal towns in the country. It is where the vast majority of coastal inhabitants live and subsist and from where the fishing, logistics, mining, and exploration oil and gas sectors are served.

The Namibian southern and central coastline is sparsely populated and dominated by the uninhabited Namib-Naukluft National Park, Tsau //Khaeb (Sperrgebiet) National Park and the Namibian Islands' Marine Protected Area.

Established in 1936, **Oranjemund** was run by Namdeb (formerly Consolidated Diamond Mines) until 2017, and access was restricted to employees and their relatives. However, Oranjemund was proclaimed a town in 2011 and opened to the public in 2017. Today, Oranjemund is still dominated by the diamond mining industry, but efforts are being made to diversify its economy and create a sustainable future beyond mining.

Located in the !Nami-Nûs Constituency in the //Kharas Region, **Lüderitz** is the southern-most port town in Namibia. It mainly supports the fishing and mining sectors, as well as oil and gas exploration activities with little other industrial development. Much of the town is comprised of residential neighbourhoods, made up of both formal housing concentrated around the port and informal or low-income settlements on the outskirts of the town.

Located in the Walvis Bay Urban Constituency in the Erongo Region, **Walvis Bay** is the third largest town in Namibia (after Windhoek and Rundu). The Walvis Bay port is Namibia's largest commercial port and handles container imports, exports and transshipments and bulk commodities. It is a base for many of Oil and Gas operations for offshore exploration activities in Namibia. Industrial development is located within and along the port boundaries and extends into the desert. The fisheries industry accounts for a significant portion of the local economy. Walvis Bay's residential suburbs are structured around the harbour, with formalised (middle to high income) suburbs closer to the harbour and seafront to the south while lower-income neighbourhoods are located north and east of the port, spreading across the main road into the desert.



Source: Geo Business Solutions (2025)

6.7.1.1 The //Kharas Region

The //Kharas Region is bordered by the Hardap Region to the north and South Africa to the south, as indicated in Figure 6-33. The region is divided into seven constituencies: !Nami#Nûs, Berseba, Oranjemund, Karasburg East, Karasburg West, Keetmanshoop Urban, and Keetmanshoop Rural.

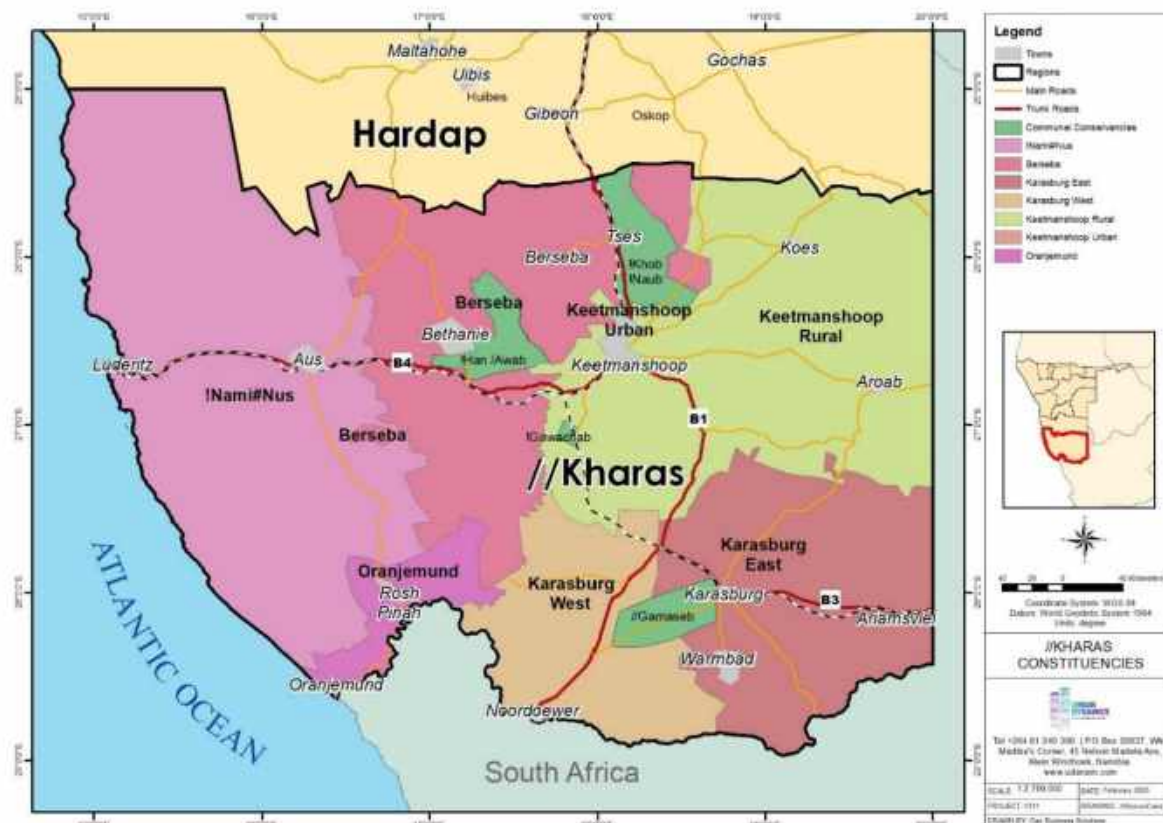


Figure 6-33: The //Kharas Region and its Constituencies and Towns.

Source: Geo Business Solutions (2025)

At the heart of this region lies Keetmanshoop, the largest settlement and administrative centre, which hosts the //Kharas Regional Council. Municipalities and town councils include Karasburg, Oranjemund, and Lüderitz, while proclaimed settlement areas, such as Aus, Warmbad, Grünau, Ariamsvlei, Aussenkehr and Noordoewer, complete the region's urban landscape.

According to the latest Namibia Household Income and Expenditure Survey (2015/16) (NHIES) the average national annual household consumption was N\$ 119 065. In comparison, the average annual household consumption for the //Kharas Region stood at N\$ 116 857, which is slightly below the national average. The highest average household consumption was in Khomas, followed by Hardap, Erongo, Oshana and //Kharas in fifth position.

Key economic drivers include the Lüderitz harbour, diamond mining in Oranjemund, mining at Rosh Pinah, grape farming in Aussenkehr, small stock and game farming across the region, and a wide variety of tourist ventures, especially the Fish River Canyon and the lodges established around it. These sectors form the backbone of the region's economy.

Within the !Nami#Nûs Constituency, the town of Lüderitz, with its strategic location and significant population concentration, serves as the focal point for the constituency's economic and social activities. The Tsau //Kheib (Sperrgebiet) National Park and the Namib



Naukluft Park restrictions confine settlement and activities to Lüderitz, with the exception of the settlement of Aus, thereby concentrating the population and economic activity within Lüderitz. In 2023, 93.7% of the population of the !Nami#Nûs constituency lived and worked in Lüderitz (Namibia Statistics Agency, 2024). Lüderitz therefore functions as the primary hub for transport, fisheries, trade, services, and infrastructure in the constituency, underscoring its vital role in the regional economy.

6.7.1.2 The Erongo Region

The Erongo Region comprises seven constituencies: Swakopmund, Walvis Bay Urban, Walvis Bay Rural, Arandis, Daures, Karibib, and Omaruru as indicated in Figure 6-34. The region's municipalities and town councils include Swakopmund, Walvis Bay, Arandis, Omaruru, Hentiesbaai, Karibib, and Usakos, alongside settlement areas like Uis, Okombahe, and Otjimbingwe. Swakopmund, a major administrative centre, hosts the Erongo Regional Council.

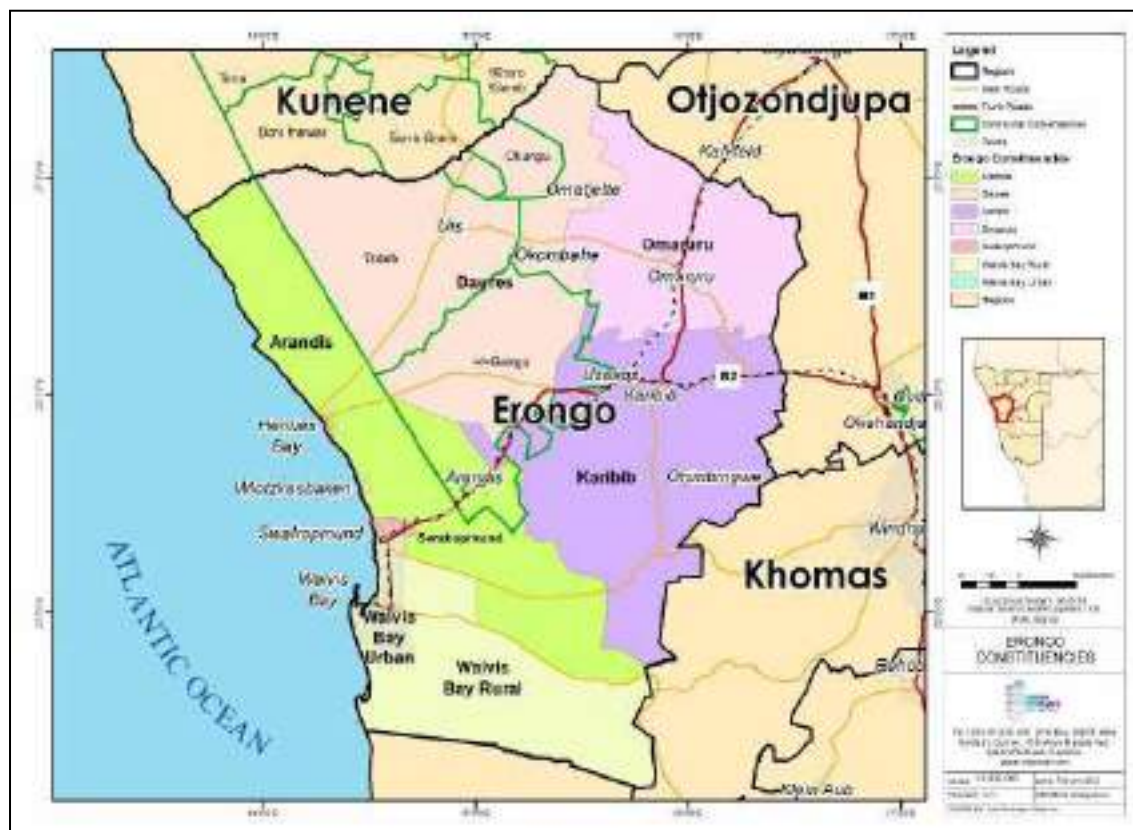


Figure 6-34: The Erongo Region and Its constituencies and Towns

Source: Geo Business Solutions (2025)

The Port of Walvis Bay plays a strategic role in the country, facilitating both national and international import and export operations. Swakopmund boosts the region's economy with its vibrant tourism sector, attracting visitors to its beaches, cultural sites, and adventure activities. Swakopmund, Arandis, Usakos, and Karibib are important mining towns, contributing significantly through their mineral extraction and processing industries, while Omaruru stands out as a vital agricultural town.

In terms of the well-being of the population, the Erongo Region had the third highest average household consumption of all regions at N\$ 128 617 in 2015/16 (Namibia Statistics Agency, 2017).



While the average household consumption often masks the incidence of poverty, there is a good correlation and the 2015/16 NHIES indicates that, in the Erongo Region, between 2.3 – 11.4% of households are regarded as severely poor meaning that their total consumption expenditures are insufficient to meet their daily calorific requirement.

6.7.2 Socio-Economic Characteristics of the Study Area

6.7.2.1 Demographics

According to the 2023 Population and Housing Census, Namibia's population numbered just over 3 million, increasing from 1.4 million in 1991 (an increase of 114.4% over 32 years). Between 2011 and 2023 Namibia recorded an annual population growth rate of 3% (Namibia Statistical Agency, 2024).

The population for the **//Kharas Region** was reported as 109 893 people in 2023. The **!Nami#Nûs Constituency** accounts for 15.7% of the population within the region, while the 2023 population for the town of Lüderitz in the **//Kharas Region** stood at 16 125 in 2023 (Namibia Statistical Agency, 2024). The town of Lüderitz is the biggest settlement in the **!Nami#Nûs Constituency** with 93.7% of the population within the constituency residing within Lüderitz. The population of the Region grew at a rate of 2.9% between 2011 and 2023, up from a low 1.1% between 2001 and 2011. With a declining fertility rate, this indicates increased migration into the region over the past intercensal period.

The population in the **Erongo Region** is more than double the size of the **//Karas Region** at 240 206 people in 2023. Walvis Bay (rural and urban) accounted for 42.8% of the region's population with 102 704 residents. The population of the Erongo Region grew at a rate of 3.9% between 2011 and 2023, up from 3.4% during the 2001 to 2011 intercensal period. Fertility in this region is also on the decline and the rate of population growth also indicates substantial migration into the region (Namibia Statistical Agency, 2024).

More than half of the population (56%) was of economically active age (15 – 59 years), while more than one third (37%) was younger than 15 years old, with a relatively small proportion of 7% of the population 60 years and older (Namibia Statistical Agency, 2024).

Figure 6-35 shows the age composition of Namibia, the **//Kharas Region** and the **Erongo Region**. Albeit similar at first glance, the proportion of the population in the productive age groups is higher in the two regions (64.5%) than in the national distribution (56.1%).



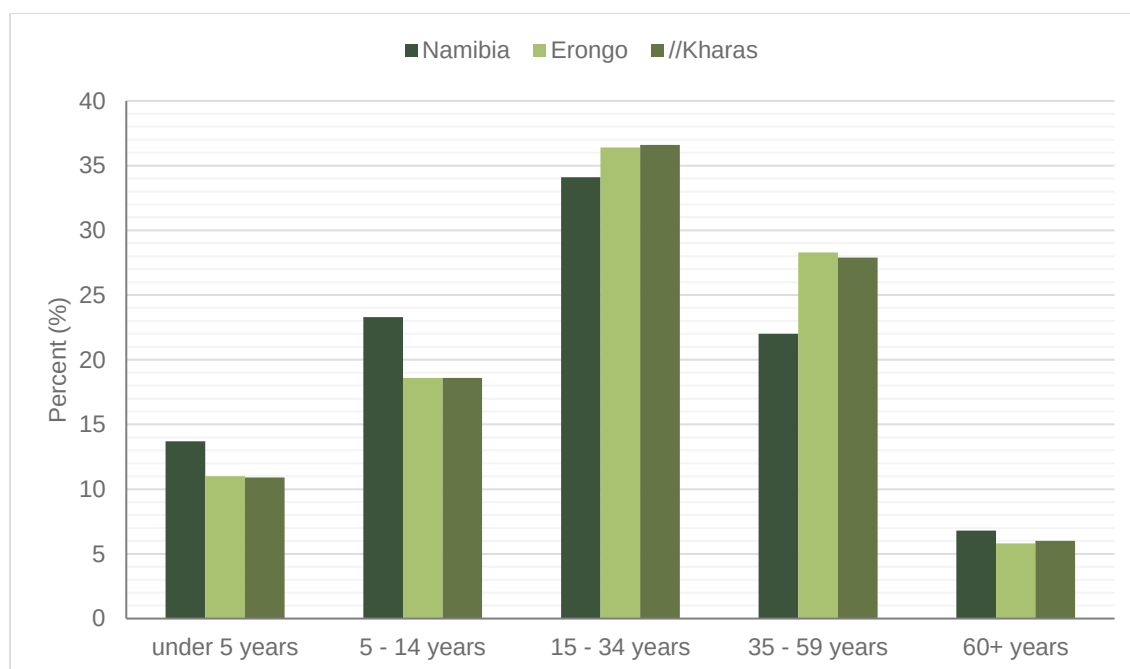


Figure 6-35: Age Composition for Namibia and the //Kharas and Erongo Regions

Source: Namibia Statistical Agency (2024)

6.7.2.2 Housing and Living Conditions

According to the 2023 Population and Housing Census, 60.1% of households in the Erongo Region and 57.4% in the //Kharas Region reside in formal dwellings. These include detached houses, semi-detached houses, flats, apartments, cluster houses, and Townhouses.

Figure 6-36 shows the type of dwelling occupied by household for the country and the two regions. A much larger percentage of households in the //Kharas and Erongo Regions reside in formal housing than is the case in Namibia as a whole. However, 37.4% of households in the Erongo Region reside in informal dwellings while 29% of households in the //Kharas Region and 28.7% nationally do the same. This is an indication that adequate housing is a challenge and this can be further exacerbated by further influx of people.



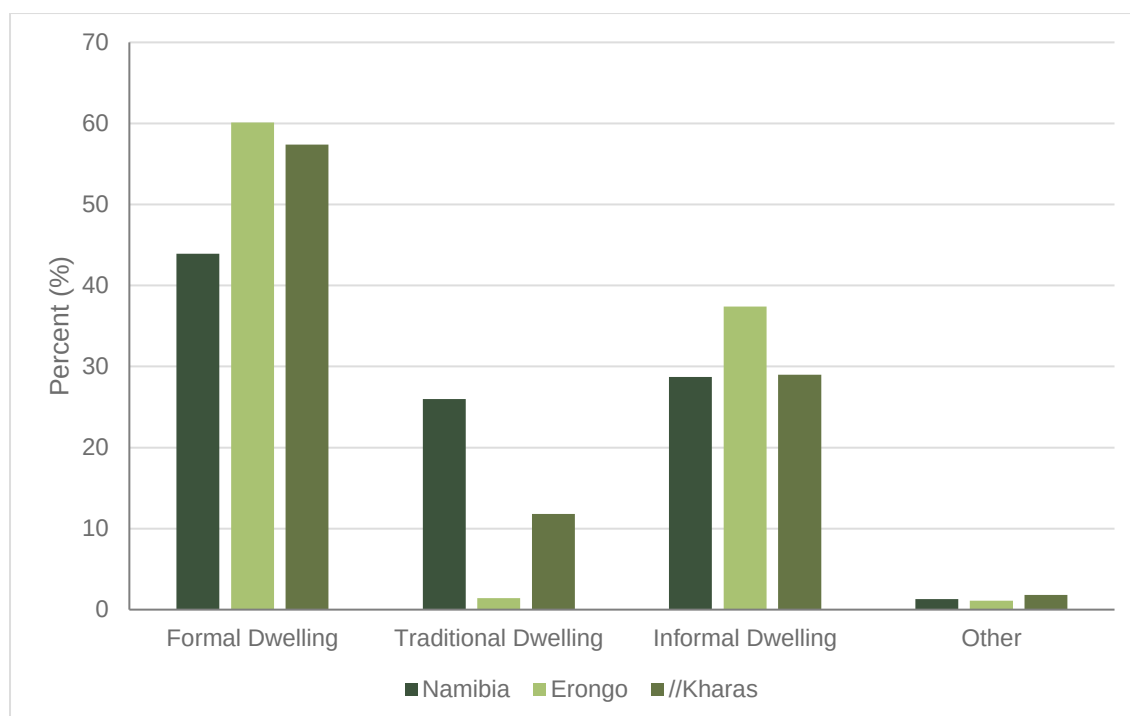


Figure 6-36: Type of Dwelling by Area

Source: 2023 Namibian Population and Housing Census

Since the regional statistics of the 2023 Population and Housing Census have not been released yet (as of 31/03/2025), the 2011 Population and Housing Census Data as well as Namibian Household Income and Expenditure Survey Report (NHIES, 2015/2016) was used to provide an idea of housing typologies in the key constituencies in the //Kharas and Erongo Regions.

This distribution is similar at the !Nami#nūs and Walvis Bay Urban Constituency levels, where 'detached house' is the most common housing type and 'improvised housing' is the second most common. The high level of 'improvised housing' is likely the result of people migrating to the urban centres of Lüderitz and Walvis Bay and taking up residence on the urban fringe in informal housing.

A breakdown of the different dwelling types at a regional and constituency level is provided in Table 6-11. It is important to note that, in 2011, the !Nami#nūs Constituency and, therefore, Lüderitz had a substantially higher percentage of improvised housing than the other regions.

Table 6-11: Housing Type by Constituency.

Type of Housing	Percentage of Households			
	//Karas Region (2015/2016)	!Nami#nūs Const (2011)	Erongo Region (2015/2016)	WB (Urban) Const. (2011)
Detached house	62.4%	40.4%	39.4%	43.3%
Semi-Detached House	2.8%	9.4%	9.0%	9.9%
Apartment/Flat	5.6%	7.7%	9.2%	10.4%
Guest Flat	1.6%	0.9%	2.7%	1.6%
Part Commercial/Industrial	0.8%	0.5%	0.0%	0.3%
Mobile Home	0.6%	0.4%	0.0%	0.2%



Type of Housing	Percentage of Households			
	//Karas Region (2015/2016)	!Nami#nūs Const (2011)	Erongo Region (2015/2016)	WB (Urban) Const. (2011)
Single Quarters	2.1%	6.2%	4.9%	2.5%
Traditional Dwelling	6.1%	0.1%	1.8%	0.3%
Improvised Housing Unit (Shack)	18.0%	34.4%	33.0%	31.5%
Total	100%	100%	100%	100%

Source: Namibian Statistics Agency, 2011, 2015/2016

6.7.2.3 Education

According to the Ministry of Education's Education Management Information System 2023 report, the **//Kharas Region** had eleven secondary schools, nine combined schools, and thirty-seven (37) primary schools. Seven of these schools are situated within the !Nami#Nūs Constituency (Ministry of Education, 2023).

Figure 6-37 demonstrates a steady increase in the number of learners in the region, from 22 388 in 2018 to 24 964 in 2023. The number of children per school increased from about 392 learners per school in 2018 to about 430 learners per school in 2023. This is slightly higher than the national average of 390 learners per school in 2023. The learner to teacher ratio in //Kharas increased from 22.9 in 2018 to 24.6 in 2023.

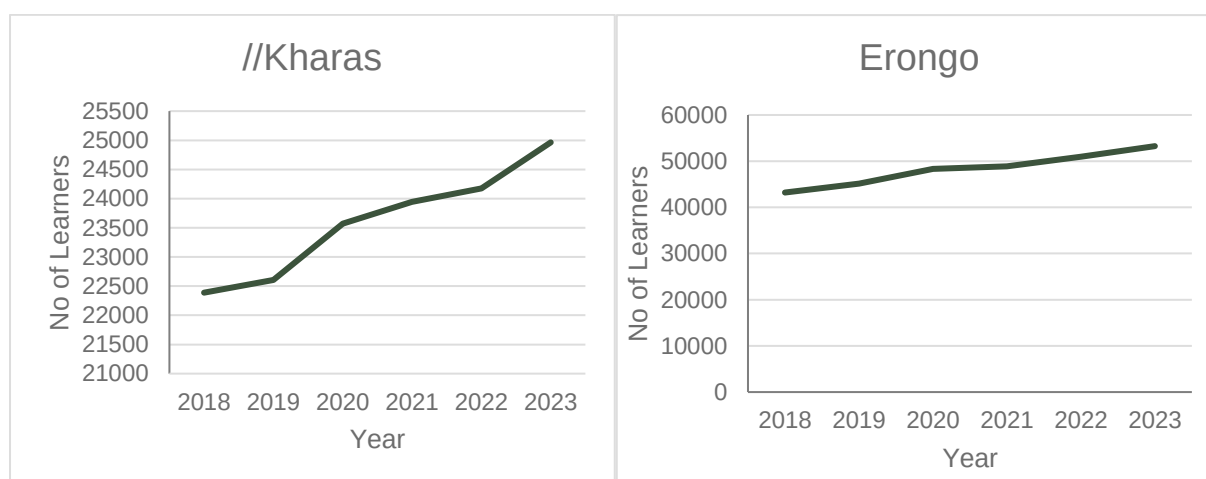


Figure 6-37: Growth in Number of Learners by Region.

Source: Ministry of Education (2023)

A similar trend is found in the **Erongo Region**. According to the Educational Management Information System (EMIS) 2023 report, the Erongo Region had 18 secondary schools, 17 combined schools and 49 primary schools in 2023. Twenty of these schools are situated within Walvis Bay.

Figure 6-37 also indicates how the number of learners in Erongo grew; from 43 213 in 2018 to 53 258 in 2023. The number of children per school in Erongo increased from about 576 learners per school in 2018 to about 619 learners per school in 2023. This is substantially higher than the national average of 390 learners per school in 2023. The learner to teacher ratio in Erongo increased from 24.8 in 2018 to 26.8 in 2023 (Ministry of Education, 2018).

Literacy

Figure 6-38 indicates the literacy rates in Namibia by region according to the 2023 Population and Housing Census. The Khomas Region has the highest literacy rate in



Namibia (95.8%) followed closely by the //Kharas Region at 95.6% and the Erongo Region with 95.4%.

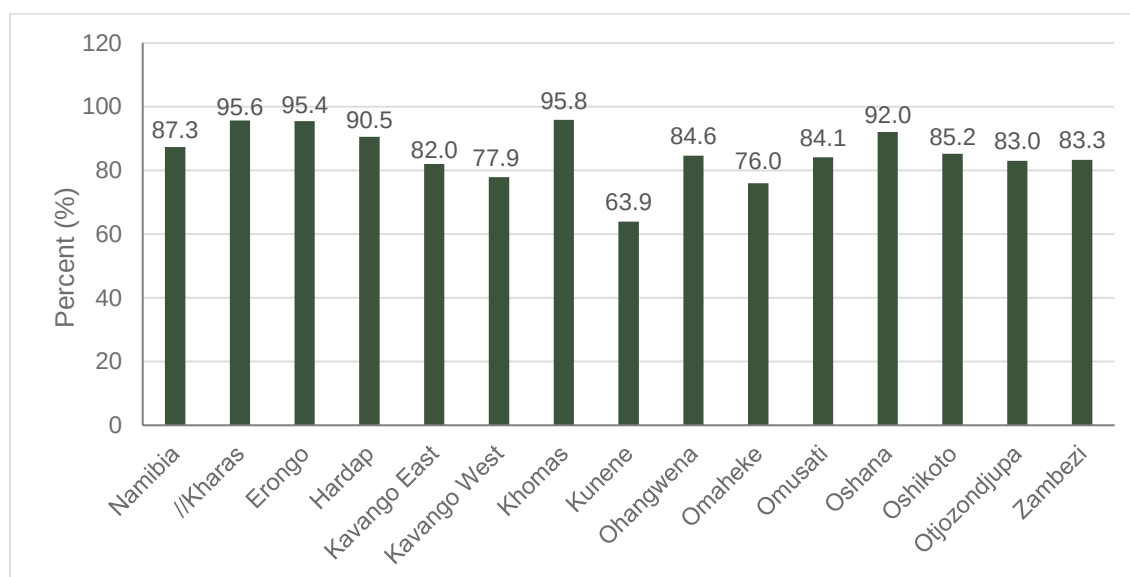


Figure 6-38: Literacy Rate by Region.

Source: 2023 Namibian Population and Housing Census

At the time of the 2011 Census, 54% of the //Kharas population and 44% of the Erongo population had completed primary school as their highest level of education, while a small portion of the population in both regions reported having tertiary education (3.8% and 6.7%, respectively).

Overall, the Erongo Region exhibits slightly better access to education with a higher proportion of the population over the age of 15 having completed secondary school and tertiary education. This is indicative of the more urbanised nature of the Erongo Region compared to //Karas, with centres such as Walvis Bay offering better access to facilities and services including education.

Figure 6-39 below illustrates the different levels of education within the //Kharas Region and Erongo Region (Namibia Statistics Agency, 2014(a)) ⁵¹.

⁵¹ Note that the regionally disaggregated data was not available at the time of writing and the report will be updated as soon as this data are released.



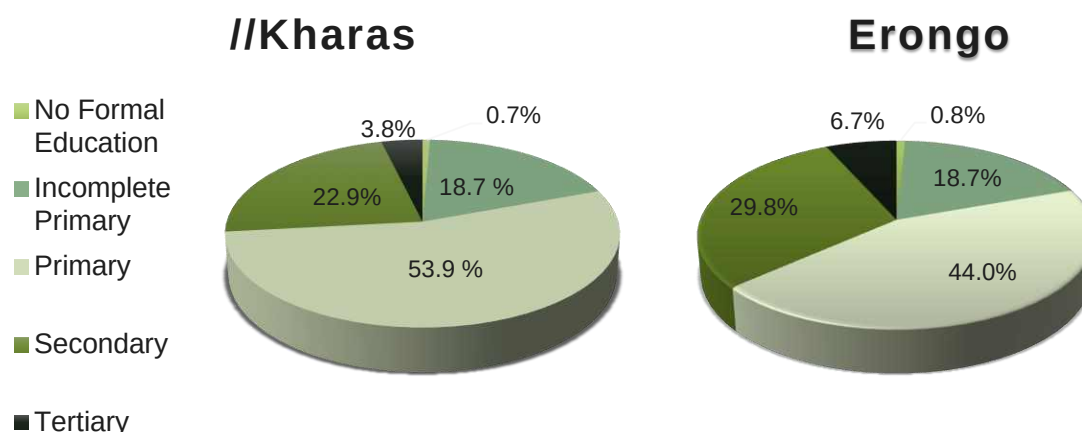


Figure 6-39: Highest level of education population over the age of 15.

Source: Namibian Statistics Agency (2014a)

6.7.2.4 Economy

Namibia's rich mineral base and small population of about 3 million gives it a World Bank classification of an upper-middle-income country. Political stability and social policies, such as public spending on pensions and welfare grants since Independence in 1990, have reduced poverty.

However, socio-economic inequalities inherited from the past apartheid system remain extremely high and structural constraints to growth have hampered job creation. Economic advantage remains in the hands of a relatively small segment of the population and the large disparities of income have led to a dual economy - a highly developed modern sector co-existing with an informal subsistence-oriented one. The duality of the labour market, combined with slow job creation and low primary-sector productivity, results in very high unemployment⁵².

Poverty levels and the cost of living are high and thus the quality of life for many are not in unison with the country's macro-economic indicators. The economy grew between 2010 and 2015 by an average of 5.3% per annum, but since 2016, it has not come out of recession. COVID-19 negatively impacted commodity export markets, tourism and local consumption patterns and service industries and these resulted in a further 8.5% contraction of the economy in 2020 (IPPR, 2021).

According to the 2023 Annual National Accounts, the Country's GDP grew at a rate of 1.1% in 2018 whereafter it contracted by 0.8% in 2019 and by 8.1% in 2020 (Figure 6-52). Thereafter, the GDP grew again by 3.6% in 2021, 5.3% in 2022 and 4.2% in 2023.

⁵² Namibia Overview: Development news, research, data | World Bank accessed on 4/10/2022



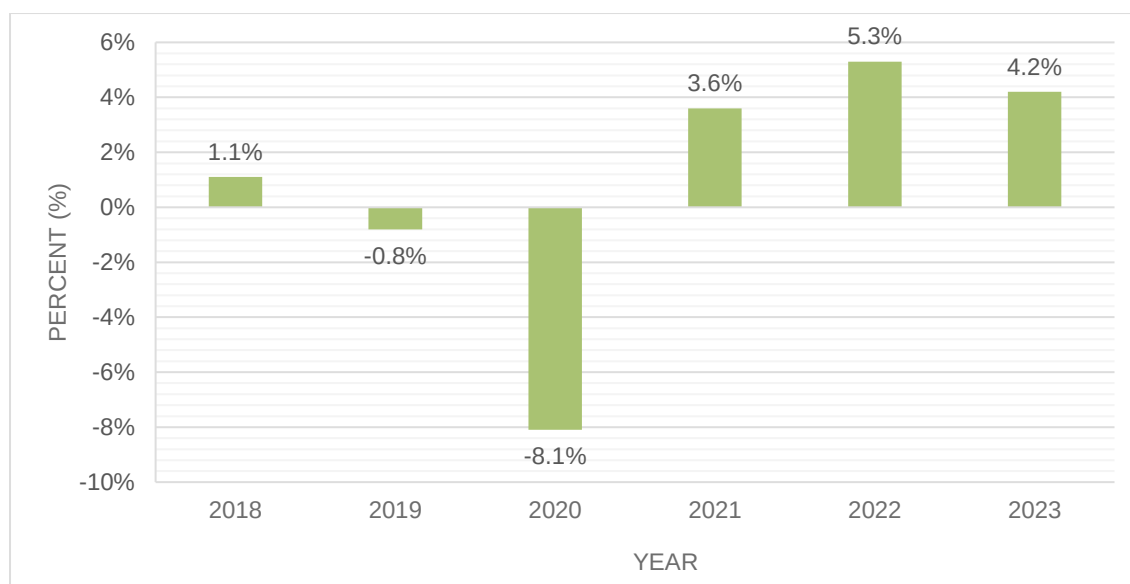


Figure 6-40: Namibian GDP Growth 2018 – 2023.

Source: Namibia Statistics Agency (2024a)

The size of the Namibian economy expanded from N\$ 171 570 billion in 2017 to N\$227 831 billion in 2023.

Tertiary industries have always been the most significant contributor to Namibia's GDP in recent years, contributing 53.4%, in 2023. These industries include the public sector, retail and wholesale, transport and services sectors.

Secondary industries contributed 18% to GDP and include manufacturing such as meat and other food processing, beverages, mineral processing, electricity generation and construction.

The primary industries, such as mining and agriculture, contributed 22.2% to GDP (Figure 6-41) (Namibia Statistics Agency, 2024(a)).

It is, however, important to take note of the trends in the extent to which the various types of industries contribute to GDP. From the data in Figure 6-42, it is clear that the primary industry contribution to GDP is on the increase while the contribution of secondary and tertiary industries is on the decrease. From 2015 to 2023, the primary sector contribution to GDP increased from 15.53% to 22.2% while the secondary sector contribution declined from 18.68% to 15.6% and the tertiary sector from 57.94% to 53.4%.



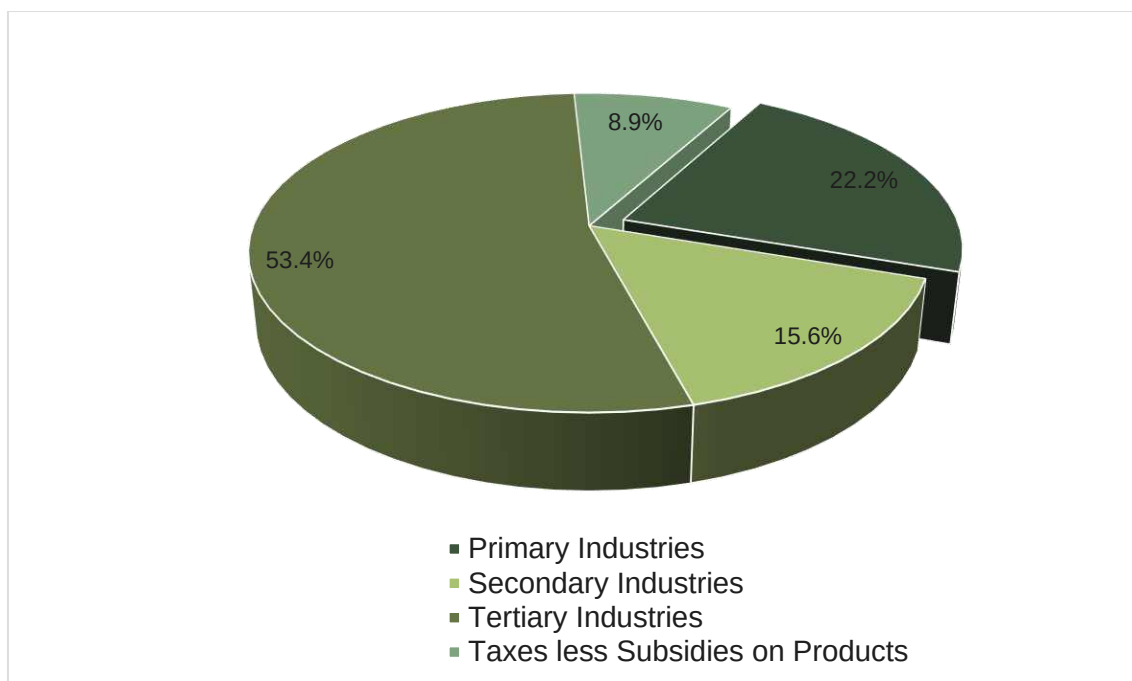


Figure 6-41: Industry Contribution to GDP.

Source: Namibia Statistics Agency (2024a)

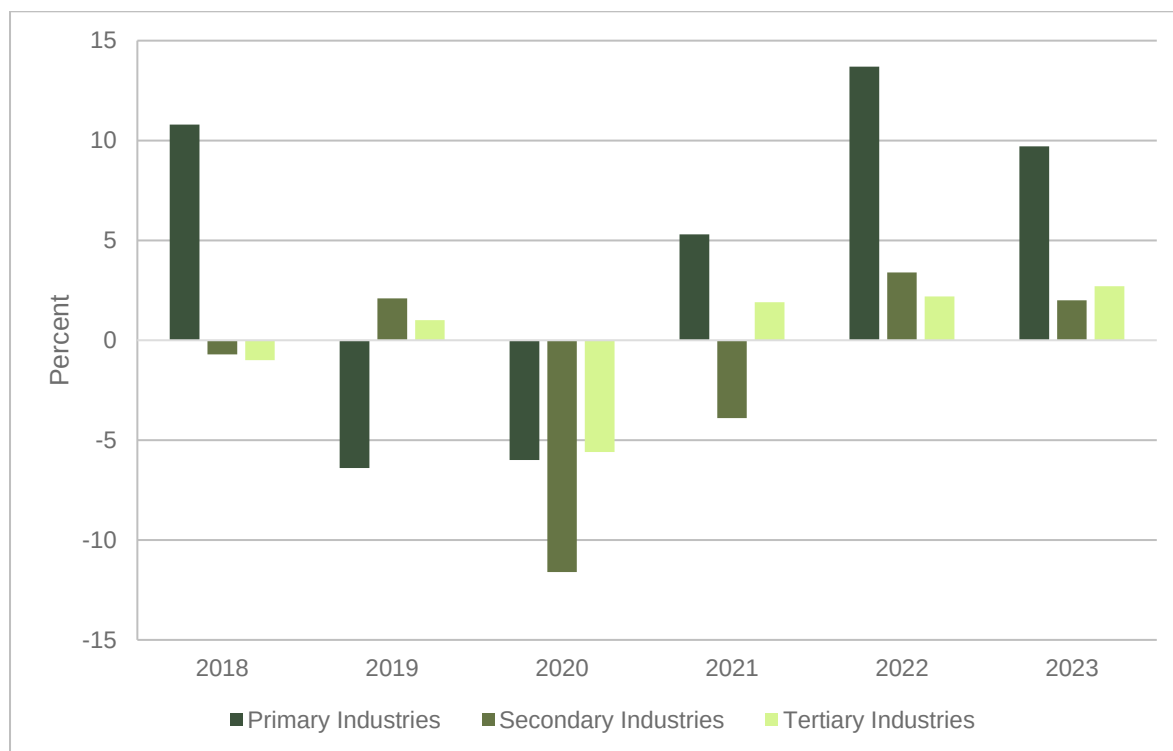


Figure 6-42: Growth Rates of Industries.

Source: Namibia Statistics Agency (2024a)

The country has good mineral resources, some fish stocks, widespread livestock production, an increasingly urban population and high school attendance of both girls and boys up to Grade 11. However, the Government is under more pressure than ever before to improve



the lives of Namibians. There is widespread rural and urban poverty, low educational attainment, shortage of technical skills, a major housing back-log and deepening unemployment.

Economy of Lüderitz

The Port of Lüderitz serves the local fishing industry, the local diamond industry, the mines in the southern Namibia and north-western South Africa with imports and exports of mining commodities and handling general cargo for those regions. In 2023/24, the port handled over 375 000 tonnes of dry bulk cargo, and 230 00 tonnes of break bulk during that year with between 1 640 and 2 115 vessel visits each year ((NAMPORT, 2025)). The port is hampered by being only 8.75 metres deep so that it cannot accommodate average sized, economic bulk carriers that are used to transport bulk ore and other cargoes; it also has no direct rail connection into the harbour. Nevertheless, Namport and other service providers contribute to the local economy with marine engineering, shipping and logistics, freight storage, vessels, boat builders and repairs, employing several hundred people. Namdeb and two other small diamond companies operate out of Lüderitz.

The main employment sector in Lüderitz is the local commercial and subsistence fishing industry, which provides more than 80% of the employment (Lüderitz Town Council), even though the industry has been in steady decline as the larger vessels relocated to Walvis Bay. The lack of economic diversity has been identified as a key risk due to variations in fish stock and much of the national fishing fleet moving to the deeper harbour at Walvis Bay. There is, therefore, an increased focus towards tourism development and the logistics industry (Lüderitz Town Council, 2020). In addition, the town supports a range of secondary / service businesses including supermarkets, commercial banks, insurance, and hospitality amongst others.

Tourism to the town is recovering from the Covid-19 pandemic, as Lüderitz offers various attractions such as the Kolmanskop deserted diamond town, quaint old German architecture, a port for smaller passenger liners, the annual Crayfish Festival, the annual Lüderitz Speed Sailing Challenge and other events. It is one of the four entry points into the access restricted Tsau //Khaeb (Sperrgebiet) National Park, a protected area of high biodiversity. Tourism will always be a challenge as Lüderitz is far from Namibia's other main southern attractions of the Fish River Canyon and Sossusvlei.

Economy of Walvis Bay

The economy of the Erongo Region and the Walvis Bay Urban Constituency is more developed and diversified when compared to Lüderitz. The region is largely dependent on the primary sector: mining (notably uranium), commercial and small-scale fishing, and agriculture (mostly livestock farming).

The economy of Walvis Bay revolves around the Port of Walvis Bay which is Namibia's largest commercial port and received between 1 800 and 2 500 vessel calls each year and handled about 5 million tonnes of cargo, prior to the Covid-19 pandemic. The Namibia Ports Authority (Namport) handles container imports, exports and transshipments, as well as bulk and breakbulk volumes of various commodities. The port serves a wide range of industries such as mining, petroleum, salt, and fishing. Namport is a major employer in the region, employing most of its 841 staff in Walvis Bay (NAMPORT, 2019; NAMPORT, 2025). The expanded container harbour at the port was in response to growth in port related activity serving the SADC region. Unfortunately, the growth has not been sustained, partly due to the impact of Covid-19 on world trade and perhaps over-ambitious targets.

Walvis Bay supports a diverse economy including industrial development largely centred around the Namibian Export Processing Zone and secondary / service sector businesses (finance, retail, accommodation and food). The fishing industry is however considered a



critical economic sector (Walvis Bay Municipality, 2020) and provides an estimate 8 000 local jobs.

The fishing sector is critical for both the economies of Walvis Bay and Lüderitz and warrants more consideration. The Food and Agriculture Organisation (FAO) recognises that Namibia has one of the most productive fishing grounds in the world, with 20 fish species that are commercially exploited (Food and Agriculture Organisation, 2020). Most catches are landed at either Walvis Bay or Lüderitz; however, because of its strategic location in the middle of the fishing grounds, most of the landings and processing plants are in Walvis Bay (Food and Agriculture Organisation, 2020). Both Walvis Bay and Lüderitz support businesses in both primary commercial fishing as well secondary fish processing.

During the 2020/21 financial year, a total of 207 vessels were licenced to operate in the Namibian Exclusive Economic Zone (Ministry of Fisheries and Marine Resources, 2021) with the majority based at Walvis Bay.

6.7.2.5 Employment and Occupations

The working age population in Namibia is defined as all people aged 15 years and older. Out of the population of 3 022 401, the working age population stood at 1 876 122 in 2023.

Figure 6-43 provides an indication of the proportion of the working age population that makes up the Namibian Labour Force in 2023 (Namibia Statistics Agency, 2024)⁵³.

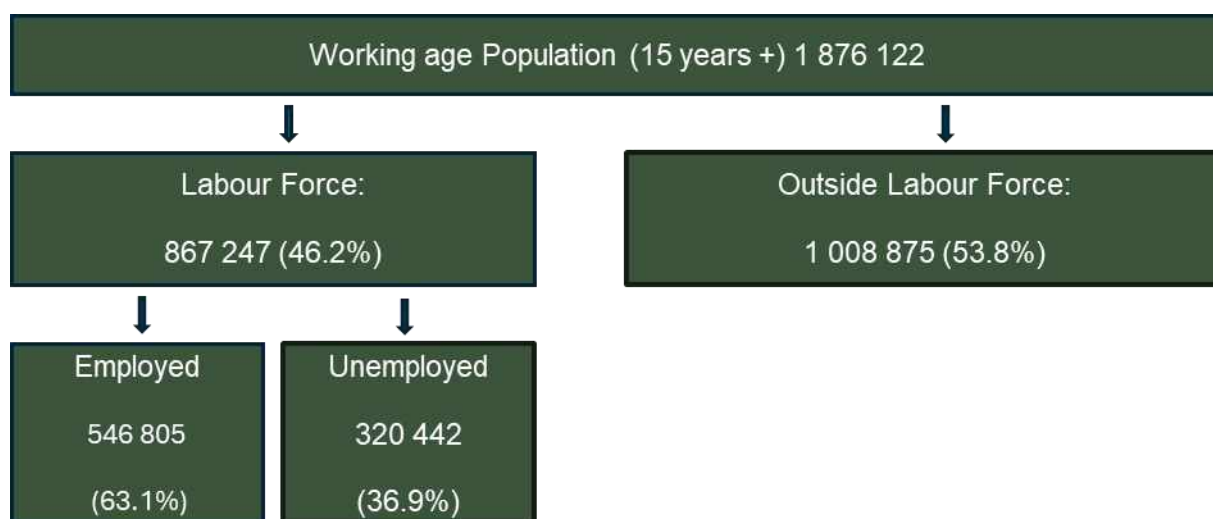


Figure 6-43: Namibian Labour Force.

Source: Namibia Statistics Agency (2024b)

The Erongo Region had the second most people aged between 15 and 65 years that are active in the labour force. In 2023 the labour force for Erongo stood at 106 518 persons, with a labour force participation rate of 64.4% (69.1% among males and 59.4% among females), compared to the national average of 46.2%.

The //Kharas Region's participation rate was 63.3% (68.4% for males and 58% for females) (Namibia Statistics Agency, 2024).

In 2023, 70.4% of the labour force in the //Kharas Region and 68% in Erongo Region were employed. In the !Nami#nūs and Walvis Bay Urban Constituencies the employment rates were 75.2% and 60.2%, respectively.

⁵³ Those outside the labour force are defined as those that do not want employment and those that are not actively seeking employment.



There is, however, a clear gender divide in terms of employment, as unemployment rates for women are 8.1% and 5.2% higher when compared to men in the //Kharas and Erongo Regions respectively.

Table 6-12 provides some labour force indicators by region and constituency.

Table 6-12: Unemployment and Youth Unemployment

Region	Population (15 years and above)		Youth (15 – 34 years)	
	Unemployment Rate (UR)	Combined UR and PLF	Youth Unemployment Rate	Combined UR and PLF
//Kharas	29.7	40.1	37.9	48.6
!Nami#nūs	24.8	32.7	34.2	43.1
Erongo	32.0	41.9	40.7	50.6
Walvis Bay Urban	29.8	38.3	40.1	49.5
Walvis Bay Rural	34.6	42.6	44.9	53.1

Note: The potential labour force (PLF) refers to people who are available for work but are not actively looking for work.

Source: (Namibia Statistics Agency, 2024)

The data indicates that in terms of the broad definition of unemployment (which includes both the unemployed that actively seeks work and those that don't) unemployment in the is lower than in the //Kharas region as a whole and very similar to Walvis Bay. Of great concern should be the very high levels of youth unemployment that is very close to 50% in most areas, except for !Nami#nūs where it is 43.1%. Walvis Bay Rural has the highest combined youth UR and PLF of 53.1%.

6.7.2.6 Poverty and Inequality

Namibia is defined as an upper middle-income country and had a Human Development Index (HDI) of 0.610 in 2022, which places it in the medium human development level at 142nd place out of 193 monitored countries and territories.

When the HDI is adjusted for inequality (IHDI) the score reduces to 0.402, indicative of relatively high inequality in Namibia (UNDP, 2021 as cited in (SLR, 2024b).

While the IHDI has improved since Namibia's independence in 1990, the rate of decline in inequality is slowing (Namibian Statistics Office, 2012 as cited in (SLR, 2024b)). In part, the endemic inequality is attributed to the exclusion of many households from the modern economy and associated benefits, despite the economy growing substantially since Namibia's independence in 1990 (Namibian Statistics Office, 2012 as cited in in (SLR, 2024b)). This is apparent between administrative regions, as well as between urban and rural areas.

Due to stronger GDP growth in 2022 and 2023, poverty is estimated to have decreased but remains high at 17.8% based on the \$2.15 per day international poverty line (IPL; 2017 PPP) (World Bank Group, 2024).

Between 2009/10 and 2015/16, income inequality as measured by the Gini-coefficient declined from 0.59 to 0.57, however in 2022 inequality was reported to have increased with a reported Gini coefficient of 0.61 (African Development Bank Group, 2024). A similar trend was evident with poverty levels during the same period (2009/10 to 2015/16) with the incidence of poverty decreasing from 19.5% to 17.4% and then increasing to 26.9% in 2022 (National Planning Commission, 2021) and (African Development Bank Group, 2024). This trend, i.e. increased inequality and poverty, is likely due to COVID-19.



Despite the economic recovery following COVID-19, the socio-economic situation has not improved materially. Vulnerable households including female-headed households, those with lower levels of education, larger families, children and the elderly, and labourers in subsistence farming, are particularly prone to poverty (World Bank Group, 2024).

Poverty mapping undertaken in 2011 (National Planning Commission, n.d.) shows that the Erongo Region has the second lowest rates of poverty (2.4% of the total population being below a predetermined poverty limit) while //Karas is higher at 6.7%. This compares positively against the national poverty rate of approximately 19.5% during the same period.

At the Constituency level, Walvis Bay Urban is ranked the fifth least deprived constituency in the country while Namiǁnūs is slightly more deprived but still ranked high at 10/107 constituencies (NPC, 2015 as cited in SLR 2024).

6.7.2.7 Health

Namibia recognises that health is a fundamental human right and is committed to achieving health for all Namibians. The main health and well-being issues for Namibia are child and maternal mortality, Human Immunodeficiency Virus (HIV), malaria- and Tuberculosis (TB)-related deaths, Non-Communicable Diseases (NCDs), and road accident deaths (The Namibia Ministry of Health and Social Services (MoHSS) and ICF International, 2014).

As specified in the United Nations General Assembly Special Session (UNGASS) on HIV and Acquired Immune Deficiency Syndrome (AIDS), young people in the 15-24 age range are an important group to monitor with regard to reductions in HIV incidence at the population level (UN General Assembly, 2001, as cited in (The Namibia Ministry of Health and Social Services (MoHSS) and ICF International, 2014) .

In 2013 testing of women and men aged between 15 and 24 revealed an HIV positive infection rate of 4.1% in the Erongo Region and 2.8% in the //Karas Region (The Namibia Ministry of Health and Social Services (MoHSS) and ICF International, 2014).

The HIV incidence per 1 000 people (all ages) has decreased from 3.31 in 2018 to 2.81 in 2020. The female and male incidence rates were 3.96 and 2.66 in 2018, respectively which declined to 3.70 and 2.25 in 2020 (National Planning Commission, 2021). The total number of HIV infections in the 15-49 age category was 7 190 in 2018 and reduced to 6 353 in 2020 (National Planning Commission, 2021).

TB cases declined from 524 in 2018 to 486 in 2019. Hepatitis B cases declined substantially from 191 in 2019 to 95 in 2020. Malaria incidence decreased significantly from 31.9% in 2018 to 2.8% in 2019 (National Planning Commission, 2021).

6.7.2.8 Access to Services

In Namibia approximately 47.1% of households use electricity for lighting, compared to 77.9% in the Erongo Region and 66.8% in the //Karas Region (Namibia Statistics Agency, 2024).

In the 2023 Census, safe water was defined as water from the following sources: piped water inside, outside, public pipe, well-protected, bottled water, and boreholes with tank covers. At national level, 91.4% of households have access to safe drinking water. Access to safe drinking water is similar in the Erongo and //Karas Regions (97.6% and 90% respectively).

The majority of households in the urban areas of the Erongo Region (85.5%) use flush toilets, compared to 91.6% in the //Karas region. However, better access to sanitation within the Erongo Region as a whole was also evident in that 9.7% of households reported no access while in the //Karas Region 23.8% of households reported no access to sanitation (Namibia Statistics Agency, 2024).



Since the 2023 Population and Housing Census Regional reports have not been released, the 2011 data is used to provide a sense of the situation in the and Walvis Bay Urban Constituencies. In 2011, some 77% of households in the !Nami#nūs (Lüderitz) and 99% of households in the Walvis Bay Urban Constituencies had access to electricity for lighting. The proportion of households using electricity on the Walvis Bay Urban Constituency is indicative of the urban setting while a greater reliance on candles in the !Nami#nūs Constituency is likely indicative of informal settlement on the urban periphery lacking services (Namibia Statistics Agency, 2014(a)).

In 2011, both the !Nami#nūs and the Walvis Bay Urban Constituencies provided good access to piped and treated water; however, the level of access to piped water varied by neighbourhood. Walvis Bay provided a higher level of services with 71.6% of households having piped water inside their property. Comparatively Lüderitz had poorer access, with 38.6% of households having access to piped water inside their property, while poorer households in surrounding informal or low-income settlements relied on water stands inside their property (31.7%) or communal standpipes (28.8%). Overall, however access to piped water within both constituencies was higher than in the Erongo Region and //Karas Region (Namibia Statistics Agency, 2014(a)).

Access to sanitation also differed between the two constituencies with access in Walvis Bay was substantively more developed, with almost 60% of households having access to private toilets and 40% to shared flush toilets connected to water-borne sewage. In contrast, only 38% of households in Lüderitz had access to private toilets, while 45% of households used shared flush toilets and 14% used buckets or had no toilet facility (Namibia Statistics Agency, 2014).

Most households in Lüderitz (77% of households) and Walvis Bay (95% of households) had their domestic waste regularly collected by the municipality. The level of service in Lüderitz was, however, lower and some households had only irregular collections (5.7% of households) or rely on roadside dumping (4% of households) and burning (11% of households).

Access to basic services at a regional and constituency level is provided in Table 6-13.

Table 6-13: Basic services profile by constituency.

Type of Basic Services	Percentage of Households			
	//Kharas Region (2015/2016)	!Nami#nūs Const. (2011)	Erongo Region (2015/2016)	WB (Urban) Const (2011)
Source of Energy for Cooking				
Electricity from Mains	48.2%	45.9%	80.7%	97.3%
Gas	30.0%	48.8%	8.1%	2.3%
Other	21.8%	5.3%	11.2%	0.4%
Source of Energy for Lighting				
Electricity from Mains	77.3%	76.7%	83.6%	99.4%
Candles	11.6%	16.0%	8.2%	0.4%
Other	11.1%	7.3%	8.2%	0.2%
Source of Domestic Water				
Piped Water	93%	99.1%	94%	99.6%
Piped Water Inside House	-	38.6%	-	71.6%
Piped Water Outside House	-	31.7%	-	27.9%
Public Pipe	-	28.8%	-	0.1%
Other	7%	0.9%	6%	0.4%



Type of Basic Services	Percentage of Households			
	//Kharas Region (2015/2016)	!Nami#nūs Const. (2011)	Erongo Region (2015/2016)	WB (Urban) Const (2011)
Type of Sanitation				
Flush toilet	73.2%	83.1%	86.5%	99.4%
Bucket Toilet	1.4%	4.0%	0.3%	0.0%
No Toilet Facility	18.1%	9.5%	9.8%	0.1%
Other (including pit toilet)	7.3%	3.4%	3.3%	0.5%
Waste Disposal				
Regularly Collected	-	77.4%	-	95.7%
Irregularly Collected	-	5.7%	-	4.0%
Burning	-	1.8%	-	0.0%
Roadside Dumping	-	4.2%	-	0.2%
Rubbish Pit	-	10.7%	-	0.1%

Source: Namibian Statistics Agency, 2011, 2015/2016

Both Lüderitz and Walvis Bay provide good access to public and private facilities and services (see Table 6-14). Walvis Bay is a much larger settlement with a proportionately larger range of services, including a wider choice of banking, retail, public and private health facilities. Accommodation, restaurants and take-aways are numerous, as well as tourism and recreational facilities, that suggest that tourism is an important sector for Walvis Bay and there is a substantial local market for recreational activities. Most of these services and facilities are found in the residential and business areas of Walvis Bay, as well as in industrial areas that surround the Port.

Lüderitz has fewer public and private facilities or services (see Table 6-14) due to its smaller population. These services are primarily used by residents of Lüderitz and the Port's visitors, although there is provision for domestic and international tourism though accommodation (notably hotels, bed and breakfasts, back-packers etc.), as well as the expanded waterfront.

Table 6-14: Profile of private and public services and facilities.

Type of Facility / Service	Number of Facilities / Services	
	Lüderitz Town	Walvis Bay Town
Accommodation & Food	24	32
Cemetery	2	2
Education	7	22
Finance	3	12
Government Ministries	5	11
Health	3	5
Tourism and Recreation	10	40
Retail	4	7

Source: OpenStreetMap and GRN ministerial data

6.7.3 Heritage

6.7.3.1 Marine Cultural and Heritage Resources

There are a number of shipwrecks located along the Namibian coastline. In Namibian waters, wrecks older than 50 years are declared national monuments. The majority of identified shipwrecks occur close to the coastline (Turner, 1988) and are not likely to be present in the Block. However, because most of the sites described on the shipwreck list



have been documented only through survivor accounts, archival descriptions and eyewitness reports, many remain uncharted and undiscovered. It is not, therefore, possible to provide accurate location data. **Although no wrecks are known to occur in Block 2913B based on available information and environmental studies undertaken within the block (Section 6.2), the possibility of identifying new shipwrecks remains, although of very low probability.**

6.7.3.2 Intangible Cultural Heritage

The current overview of intangible cultural heritage is based on the study undertaken for the Block 2912 exploration well drilling (SLR, 2023).

Intangible cultural heritage relates primarily to ritual and spiritual valuations and relations with the elements (wind, water, fire), ritual practices (ancestral veneration) and beliefs (natural-spiritual beliefs in the water sourcing / bearing deities). Intangible cultural heritages of Namibia are complex and influenced by ancient histories of the San peoples and their social-ecological relations with nature, the histories of the Ovahimba, Herero and Ovambo peoples, as well as those people coming into Namibia from Angola.

The small-scale fishers of Namibia come mostly from the coastal areas and have historically enjoyed either a leisure or livelihood relationship with the sea. However, increasingly, poverty in the northern region is leading to migration of peoples to the coast. This has resulted in what are known as Bicycle Fishermen in Swakopmund: men who fish for subsistence purposes in demarcated spots along the coast.

There are contestations between these groups, as well as tendency to cast identity as primordial (i.e., fixed, unchanging over time or to ignore cross-cultural connections and inter-marriages).

The deserts (Namib) are an important influence of concepts of time and space, human cultural engagement with the temporal and spatial aspects of cultural heritage practice and faunal/floral use for spiritual reasons.

Key intangible cultural heritage beliefs in Namibia can be summarised as follows:

- The ancestors reside in both water and wind but not in the sea.
- For the northern inhabitants of Ovambo and Ovaherero descent, the floodplains and rivers are sources of spiritual significance, since these may contain water spirits and specifically the water snake 'deity'. Hoff (cited in Low, 2007) identified |Xam descendants who believed in a giant, water-bringing snake thought to live mainly in the sky alongside the Water Bull but found very little evidence of this belief beyond Bushmanland. Hoff also observed that the Nama living around the Orange River had forgotten older ideas of a good and bad Water Snake and Water Bull in the sky, which symbolised the good and bad dimensions of rain, and only believed in a giant quasi-mythical and largely malign snake that lived in and near watercourses.
- Among the Damara and Haillom in the northern Namib, there is stronger belief / knowledge of the water snake and its associate, the crocodile. The beliefs suggest a deep social-ecological embedding and valuation of nature.
- For the San, the wind plays a critical role in shaping ritual practice (dance, drumming). Dance and drumming / music making are key to the expression of the self but also important for access to a trance/trans-dimensional state of being / alternative consciousness. San and Nama are known for their musical prowess. The music uses wind (flutes), guitar and harmonica (which involves inhalation/exhalation thereby invoking the power of the wind) to communicate with the community and ancestral world.
- There is an indication of some San cultural heritage with the ocean, but these have been largely severed by the process of forced removals from the coastal context under the colonial and apartheid regimes. San communities living inland (in places



such as Tsumeb and Tsintsabis) still remember some of these rituals but are not able to revive them, due to distance from the coast.

- While the indigenous groups make use of waterways such as springs and rivers (when these are evident), there is rare connection with the ocean or sea. For example, in interviews with Himba communities, many expressed the view that they had never been to the sea and some said that they imagined it to be like a 'big river'.
- There were no rituals identified in respect of European settler groupings living along the coast.

6.7.4 Human Rights Profile

Fundamental human rights are recognised in the Namibian Constitution of 1990, and Namibia is a signatory to a range of United Nations Human Rights Conventions (Table 6-15). The latest universal review undertaken by the United Nations in 2016 indicates that human rights are largely respected; however, the country still faces challenges with respect to addressing the root causes of poverty, hunger and to uplift the living conditions of the poor.

Table 6-15: Ratified Human Rights Treaties.

Treaty Description	Ratification Date
Convention against Torture and Other Cruel Inhuman or Degrading Treatment or Punishment	28 Nov 1994
Optional Protocol of the Convention against Torture	None
International Covenant on Civil and Political Rights	28 Nov 1994
Second Optional Protocol to the International Covenant on Civil and Political Rights	28 Nov 1994
Convention for the Protection of All Persons from Enforced Disappearance	None
Convention on the Elimination of All Forms of Discrimination against Women	23 Nov 1992
International Convention on the Elimination of All Forms of Racial Discrimination	11 Nov 1982
International Covenant on Economic, Social and Cultural Rights	28 Nov 1994
International Convention on the Protection of the Rights of All Migrant Workers and Their Families	None
Convention on the Rights of the Child	30 Sep 90
Optional Protocol to the Convention on the Rights of the Child (Armed Conflict)	16 Apr 02
Optional Protocol to the Convention on the Rights of the Child (Child Prostitution)	16 Apr 02
Convention on the Rights of Persons with Disabilities	04 Dec 07

6.7.5 Fisheries

Block 2913B is located off the coast of Namibia, within the Southern Benguela Current marine ecosystem. The Benguela Current is one of the most productive coastal upwelling systems in the world supporting highly productive commercial fisheries.

In Namibia, the management of fish stocks for commercial purposes is overseen by MFMR, which receives guidance from the National Marine Information and Research Centre (NatMIRC) in Swakopmund under the Ministry. Total Allowable Catches (TACs), or in some cases effort limits (TAEs) are set annually by the Minister based on scientific resource assessments. An advisory council then advises / recommends TACs/TAEs and management measures for approval by the Minister of Fisheries.



The Confederation of Namibian Fishing Industries represents commercial fisheries at the industry level on issues of common interest, while sector-specific associations, such as the Namibian Hake Association and the Pelagic Fishing Association of Namibia, represent specific fisheries and the species they exploit.

Namibia's commercial fisheries are listed in Table 6-16. The sectors currently operating off the coast of southern Namibia (south of 26°S), and within the area of influence of the project are described in Section 6.7.5.2. Stock distributions, spawning and recruitment of important species are described in more detail in the Section 6.7.5.1.

Supported by the high productivity of the Benguela upwelling ecosystem, abundant fish stocks have historically typified Namibian waters⁵⁴. The main targeted species and gear types are demersal (bottom), small pelagic (surface), large migratory pelagic fish, linefish and crustaceans.

The country has only two major fishing ports, Walvis Bay and Lüderitz, and in 2023 had 163 Namibian-registered commercial fishing vessels (FAO, 2024), dominated by demersal trawlers that fish for hake year-round except for a one month closed season in October. This is Namibia's most valuable fishery. The midwater trawlers that target the pelagic horse mackerel is the largest fishery by volume while the much smaller large pelagic tuna longline vessels are also active. Licensed foreign fishing vessels in Namibian waters are few – as fishing in Namibian waters is restricted to Namibians and national flagged vessels.

Namibia's mariculture industry is developing, focusing on species such as oysters (*Crassostrea gigas* and *Ostrea edulis*), black mussels (*Choromytilus meridionalis* and *Mytilus galloprovincialis*), abalone (*Haliotis midae*), and seaweed (*Gracilaria gracilis*). The industry employs various methods, including rafts, suspended long-lines, racks in ponds, and onshore flow-through tanks. Key mariculture operations are concentrated around, Lüderitz, Walvis Bay, Swakopmund, and more recently Oranjemund.

MFMR conducts regular research surveys to determine the biomass of demersal, midwater, and small pelagic species, covering the entire EEZ from the Angolan to South African maritime borders. All fisheries have a suite of management measures aimed at maintaining the ecosystem and resource sustainability, including a prohibition on bottom trawling shallower than 200 m, enforced by Namibian regulations.

Table 6-16: List of fisheries that operate within Namibian waters, targeted species and gear types.

Sector	Gear Type	Target Species
Large pelagic longline	Pelagic longline	Shark spp. Swordfish (<i>Xiphias gladius</i>) Bigeye tuna (<i>T. obesus</i>) Yellowfin tuna (<i>T. albacares</i>)
Small pelagic	Purse-seine	Sardine (<i>Sardinops sagax</i>) Cape horse mackerel (<i>Trachurus capensis</i>)
Mid-water trawl	Mid-water trawl	Cape horse mackerel
Demersal trawl	Demersal trawl	Shallow water hake (<i>Merluccius capensis</i>) Deep-water hake (<i>M. paradoxus</i>)

⁵⁴ Noting that in the International Commission for Southeast Atlantic Fisheries (ICSEAF) period these resources were over-exploited. The northern Benguela (Namibian waters), however, remains a highly productive upwelling system resulting in proportionately (to many other countries) abundant commercial fish resources.



Sector	Gear Type	Target Species
		Monkfish (<i>Lophius vomerinus</i>)
Demersal longline	Demersal longline	Shallow water hake Deep-water hake
Pole-line	Pole and line	Albacore tuna (<i>Thunnus alalunga</i>)
Line-fish	Hand line	Silver kob (<i>Argyrosomus inodorus</i>) Dusky kob (<i>A. coronus</i>) Snoek (<i>Thyrsites atun</i>)
Deep-water trawl	Demersal trawl	Orange roughy (<i>Hoplostethus atlanticus</i>) Alfonsino (<i>Beryx splendens</i>)
Rock Lobster	Demersal trap	Rock lobster (<i>Jasus lalandii</i>)
Deep-sea crab	Demersal longline trap	Red crab (<i>Chaceon maritae</i>)
Mariculture	Longlines, rafts	Pacific oysters (<i>Crassostrea gigas</i>) Black mussel (<i>Choromytilus meridionalis</i>) Abalone (<i>Haliotis midae</i>) Seaweed (<i>Gracilaria</i> sp. and <i>Ecklonia maxima</i>)

Table 6-17: Total Allowable Catches (tonnes) from 2009/10 to 2024/25 (MFMR, 2024).

Year	Sardine	Hake	Horse Mackerel	Crab	Rock Lobster	Monk
2009/10	17 000	149 000	230 000	2 700	350	8 500
2010/11	25 000	140 000	247 000	2 700	275	9 000
2011/12	25 000	180 000	310 000	2 850	350	13 000
2012/13	31 000	170 000	310 000	3 100	350	14 000
2013/14	25 000	140 000	350 000	3 100	350	10 000
2014/15	25 000	210 000	350 000	3 150	300	12 000
2015/16	15 000	140 000	335 000	3 446	250	10 000
2016/17	14 000	154 000	340 000	3 400	240	9 800
2017/18	0	154 000	340 000	3 400	230	9 600
2018/19	0	154 000	349 000	3 900	200	9 600
2020/21	0	154 000	349 000	3 900	180	9 600
2021/22	0	154 000	330 000	4 200	180	9 600
2022/23	0	154 000	290 000	4 200	180	9 000
2023/24	0	154 000	270 000	4 300	180	9 600
2024/25	0	140 000	234 000	3 900	180	9 600

Note: Deep-water trawl TAC is currently not applied for Alfonsino and Orange roughy. There is a moratorium on sardine. ICCAT issues a TAC for albacore of which Namibia's current apportionment is 4 320 t.

6.7.5.1 Stock Distribution, Spawning and Recruitment

Spawning is the process by which fish and other marine species produce and fertilize eggs to maintain populations (normally an annual seasonal process). Environmental conditions



such as water temperature, light levels, and ocean currents can have a critical influence on spawning success. Once spawning has occurred and eggs fertilized, their development as juveniles, then into sub adults and ultimately adults that combine with existing populations of the same species, is referred to as “recruitment”.

Various coastal oceanographic processes in the southern Benguela influence the recruitment process. This may include settlement and protection in nearshore waters that act as nursery areas for juveniles before migrating offshore into deeper waters.

Seasonal upwelling off Lüderitz provides critical nutrients for primary and secondary production and which supports early-stage development of many fish species. As the preferred **spawning grounds of numerous commercially exploited fish species are located off central and northern Namibia**, their eggs and larvae form an important contribution to the ichthyoplankton in the region. However, as noted in Section 6.5.3.1, the LUCORC area, south of the Lüderitz upwelling cell, is an environmental barrier to the transport of ichthyoplankton from the southern to the northern Benguela upwelling ecosystems (Hutchings, et al., 2002; Lett, Veitch, Van Der Lingen, & Hutchings, 2007)⁵⁵. **The location of Block 2913B and the Venus field is well offshore of the expected spawning areas of most fish. However, nearshore transshipment and vessel transit operations may overlap with spawning grounds off central Namibia.**

The stock distribution, spawning and recruitment of key target species are discussed below.

Sardine

The Namibian sardine (*Sardinops sagax*) stock is distributed inshore of the 200 m isobath, from the Lüderitz upwelling cell into southern Angola. There was a rapid decline in the sardine stock in the late 1960s, following intense exploitation, ecosystem change and variability, and poor recruitment (Crawford, Shannon, & Pollock, The Benguela ecosystem. 4. The major fish and invertebrate resources., 1987; Boyer D. , Boyer, Fossen, & Kreiner, 2001; Erasmus V. N., 2021). The status remains overexploited with a low biomass estimate and a significantly contracted distribution pattern compared to historical levels. It is reported that the stock has reduced by 99.5%, from an estimated 11 million tonnes in the 1960s to 50 000 tonnes in 2015 (Erasmus, et al., 2021). The fishery is currently closed following a moratorium that was implemented in 2018.

Following the collapse of the sardine stock, two main spawning areas have been described in the northern Benguela, one off central Namibia in the Walvis Bay region (22°S and 25°S) and another further north near Palgrave Point (19°S and 21°S) (King, 1977). The spawning season is thought to be between August and April, with peaks in September/October and March. Spawning peaks 30-80 km offshore with larvae occurring slightly further offshore and recruits appearing close inshore (Hutchings, et al., 2002). Recruitment varies considerably between years, with environmental variability and conditions playing an important role (Kirchner, Bartholomae, & Kreiner, 2009). During late summer the warm Angolan Current pushes southwards, which brings eggs and larvae into nursery grounds off central Namibia (Hutchings, et al., 2002).

Cape Horse Mackerel

In Namibia, Cape horse mackerel (*Trachurus capensis*) occur predominantly north of 25°S, with juveniles present in the inshore pelagic regions up to the 200 m isobath and adult horse mackerel extending into waters up to 500 m deep. Concentrations are dense between Cape Cross and the Kunene River. Biomass estimates in this region are mostly low in summer, increasing in winter and early spring. Horse mackerel shoal in large numbers with a distinct

⁵⁵ The border between the northern and southern Benguela ecosystems can be broadly located at the Namibia/South Africa maritime border and depends largely on the intensity of the Lüderitz



diurnal vertical migration pattern, staying near the seabed during the day and rising in the water column to feed on zooplankton at night.

Spawning occurs between Cape Frio (18°S) and Cape Cross (22°S), with the highest spawning intensity taking place 50-100 km from the shore (O'Toole, 1977). In these areas, horse mackerel spawn continuously from September to May, peaking from January and April (Klingelhoeffer, 1994).

Large Pelagics

Albacore tuna (*Thunnus alalunga*), yellowfin tuna (*T. albacares*), bigeye tuna (*T. obesus*), pelagic sharks and swordfish (*Xiphias gladius*) are large pelagic species with an extensive offshore distribution ranging along the entire South African and Namibian coastlines and broadly throughout the Atlantic Ocean. Albacore tunas are targeted by the pole and line fishery while bigeye tuna and yellowfin tuna dominate the landings of the longline fishery. The abundance of these species has a strong seasonal signal resulting in increased availability to the fisheries targeting them at different periods.

For the tuna-pole fishery, availability increases from early summer and peaks late summer to early autumn.

- Albacore tuna is a temperate species that prefers subtropical ocean waters between 16°C and 20°C but appears to be differentially distributed depending on their life-history stage. Spawning occurs in equatorial regions where water temperatures exceed 24°C (Manning, 1998). In Namibian waters aggregations of albacore tuna are known to occur in the vicinity of the Tripp Seamount (approximately 75 km south-west of the licence block) and the highest catches are recorded in this area.

For the pelagic longline sector targeting bigeye tuna, yellowfin tuna, and swordfish, the availability of these target species is highest from April to September. The longline tuna fishing season peaks two to three months later than the fishery for albacore tuna.

- Bigeye tuna spawn across the east central Atlantic, North of 5°N in the warmest season when surface temperatures are above 24°C, and in the Gulf of Guinea (Manning, 1998).
- Yellowfin tunas are distributed between 10°S and 40°S in the south Atlantic, and spawn in the central Atlantic off Brazil in the austral summer (Penney, Krohn, & Wilke, 1992). According to Crawford, et al., (1987), juvenile and immature yellowfin tuna occur throughout the year in the Benguela system. After reaching sexual maturity they migrate (in summer) from feeding grounds off the West Coast of southern Africa to the spawning grounds in the central Atlantic.
- The availability of longfin tuna increases during the summer upwelling season due to the increased biological activity and prey (sardine and anchovy) abundance.
- Swordfish spawn in warm tropical and subtropical waters and migrate to colder temperate waters during summer and autumn months.

It is important to note that weather conditions play an important role in operations within the tuna fisheries (tuna pole and longline).

Hake

Shallow-water hake (*Merluccius capensis*) and deep-water hake (*M. paradoxus*) are among the dominant demersal fish species in the Benguela Current ecosystem and form the most commercially important fisheries in Namibia.

These species display diurnal vertical migration, occurring in demersal waters in the daytime and moving to mid-water at night to feed. Each species shows different spawning patterns in terms of depth and timing, with food availability and environmental conditions thought to be to



important drivers for spawning. Hake are serial spawners, spawning throughout the year with peaks observed in October/November and March/April (Jansen, et al., 2015; Japp, et al., 2019).

Both species occur on the West Coast of South Africa and Namibia, however deep-water hake is more abundant south of the Lüderitz upwelling cell in the southern Benguela. Shallow-water hake mainly occur between depths of 100 m and 450 m while deep-water hake occur between depths of 300 m and 1 000 m.

Shallow-water hake spawn primarily over the continental shelf in South Africa and Namibian waters at depths less than 200 m. In Namibia, areas of localized spawning appear to be focused off central Namibia (25°S to 20°S), however the exact location varies between years. Spawning peaks during July to September along the shelf break off central Namibia (Jansen, et al., 2015)

It is hypothesised that deep-water hake spawn largely between the western Agulhas Bank and Elands Bay on the West Coast with the main nursery ground between Hondeklip Bay and the northern tip of the Orange Banks. Fish then migrate northwards into Namibia as they mature before returning south to spawn. Deep-water hake spawn at depths between 200 m and 650 m, and eggs are typically distributed between 340 m to 1 500 m (Stenevik, Verheye, Lipinski, Ostrowski, & Stromme, 2008). In contrast to shallow-water hake, several studies suggest that deep-water hake do not spawn in Namibian waters (Kainge, Kjesbu, Thorsen, & Salvanes, 2007; Stenevik, Verheye, Lipinski, Ostrowski, & Stromme, 2008; Strømme, Lipinski, & Kainge, 2015).

Monkfish

Monkfish (*Lophius vomerinus*) are found along the entire extent of the Namibian coast, with the fishery concentrated between 17°S and 29°S on the deeper continental shelf and upper slope between depths of 200 m to 500 m. Cape monkfish spawn throughout the year with a peak between July and September (Erasmus V. ..., 2021). Cape monkfish appear to spawn along the entire coastline, with evidence of hotspot spawning aggregations between 21°S and 25°S (Erasmus V. ..., 2021).

Deep-sea Red Crab

Deep-sea red crab stocks are distributed predominantly from 23°S northwards into Angolan waters, within a depth range of approximately 300 m to 1000 m. Highest densities occur along the northern range of its distribution, the Angolan border, to 18°S. Spawning takes place throughout the year (Le Roux, 1997) in the shallower waters of the continental slope with adult females generally occurring at shallower depths to that of males.

Orange Roughy

Orange roughy has a discontinuous pattern of distribution along the continental slope. Aggregations of fish occur within four known spawning grounds (within designated Quota Management Areas) within Namibian waters. The species has a short, intense spawning period of about a month from July to August (Boyer & Hampton, 2001) during which individuals aggregate. As a result of overexploitation of the stock(s), the fishery (which only existed for four years) has been closed since 2007; however, the stock is currently being assessed and the viability of re-opening the fishery is under consideration.

Namibian Cape Rock Lobster

Namibian Cape Rock lobster (*Jasus lalandii*) is found from 25°S to 28°S at depths shallower than 100 m. The depth distribution of adults varies seasonally in response to changes in dissolved oxygen levels in the water. Adults moult during spring (males) and late autumn/early winter (females), with egg hatching peaking in October/November. Fishing



activity is greatest over January and February with the number of active vessels declining towards the end of the fishing season in May.

6.7.5.2 Commercial Fishing Sectors

The large pelagic longline sector is the only Namibian commercial fishing sector which overlaps with Block 2913B.

Nearshore transshipment operations may overlap with the linefish and large pelagic longline sectors as well as small pelagic purse-seine fisheries, should this sector reopen. These sectors, as well as other important fisheries are described below.

Large Pelagic Longline

The Namibian pelagic longline sector primarily targets yellowfin tuna, bigeye tuna, swordfish and various pelagic shark species (Table 6-18).

There is provision for up to 26 fishing rights and 40 vessels. The fishery's target species are highly migratory, with populations spanning the EEZs of multiple countries and international waters. Consequently, they are managed as a "shared resource" among several nations through Regional Fisheries Management Organisations (RFMOs). Namibia is a member of, and therefore receives quotas from, the International Commission for the Conservation of Atlantic Tuna (ICCAT).

Catches of tuna species and shark species show interannual variation as shown in Figure 6-45 (ICCAT, 2023). Following independence, catches increased as Namibia systematically increased their fishing capacity. There was a peak in catches in 2005 (9 594 tonnes), however, annual average catch has approximated 4 200 tonnes since. The reported catches for 2020 (8 555 tonnes) and 2021 (13 216 tonnes) were far higher than this average, with tuna spp. contributing the most to the annual catch in 2021.

Table 6-18: Key target species of the large pelagic longline fishery.

Target and bycatch species	Reference image
Bigeye tuna (<i>Thunnus obesus</i>)	
Albacore tuna (<i>Thunnus alalunga</i>)	
Yellowfin tuna (<i>Thunnus albacares</i>)	
Swordfish (<i>Xiphias gladius</i>)	
Southern bluefin tuna (<i>Thunnus maccoyii</i>)	



Target and bycatch species	Reference image
Shortfin mako shark (<i>Isurus oxyrinchus</i>)	
Blue shark (<i>Prionace glauca</i>)	

Source: WWF-SASSI

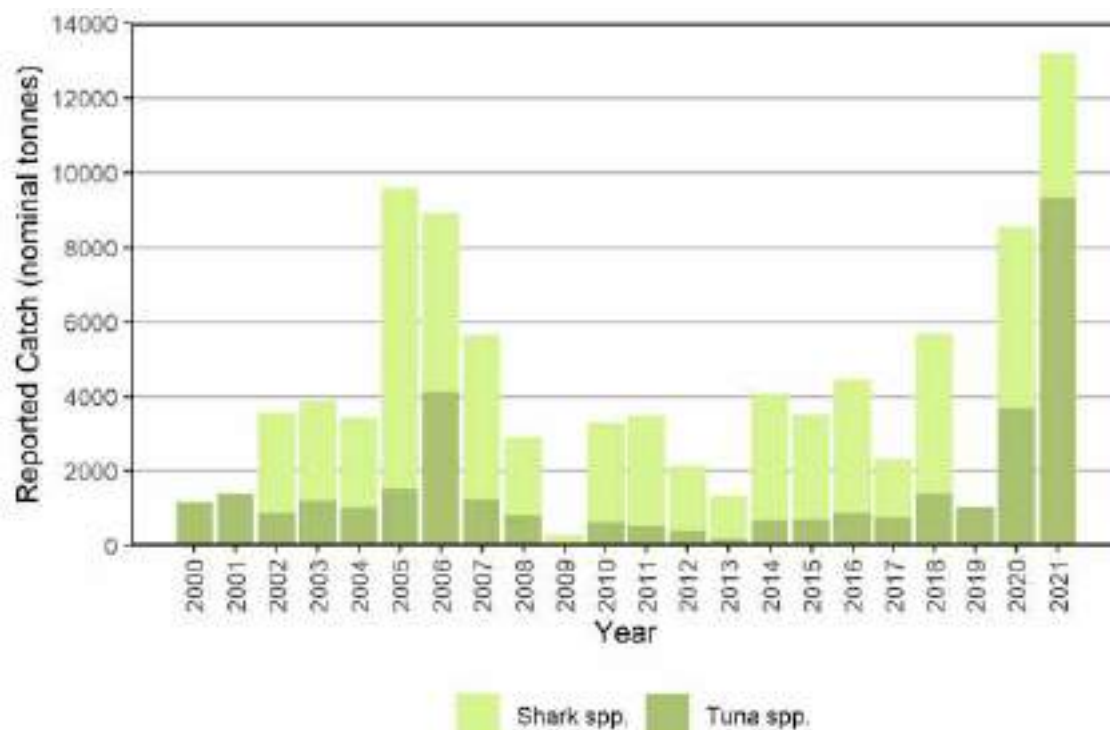


Figure 6-44: Annual longline catch (nominal tonnes) of large pelagic species between 2000 and 2021.

Source: ICCAT Statistical Bulletin (2023).

Longline vessels operate extensively around the entire coast along the shelf-break (approximately along the 500 m isobath) and into deeper waters (~2 000 m) where tuna, swordfish and sharks are targeted along thermoclines. **Effort occurs year-round with peaks from March to May and December to a lesser degree (Figure 6-44).** This seasonality is also seen in catch data.

Figure 6-46 shows the spatial distribution of annual average effort along the Namibian and South African West Coast over the period 2013 to 2023. **During this time large pelagic longline fishing effort was recorded within Block 2913B and the proposed Venus development field. On average less than 5 000 hooks were set within the Block per year, which is low in comparison to the number of hooks set along the continental shelf break and to the north of the Block.**

While overlap with nearshore transshipment operations may occur, it is expected to be limited, as the fishing sector primarily operates in waters deeper than 200 meters.

Pelagic longline vessels deploy a drifting mainline that can extend up to 100 km in length. This mainline is maintained near the surface or at a specified depth (up to 20 m) using buoys connected by buoy lines, spaced approximately 500 m apart (see Figure 6-47 and Figure



6-48). Hooks are attached to the mainline via 20 m long trace lines, clipped to the mainline at intervals of about 50 m. Each line can carry up to 3 500 hooks.

Various types of buoys are used in combination to keep the mainline near the surface and to locate it if the line is cut or breaks. Each end of the line is marked by a Dahn buoy and a radar reflector, ensuring its position can be identified for later retrieval by the fishing vessel.

A line may drift for up to 18 hours before being retrieved using a powered hauler at a speed of approximately 1 knot. During hauling, the vessel's manoeuvrability is significantly restricted, and in the event of an emergency, the line may be dropped for later retrieval.



Figure 6-45: Monthly average catch (bars) and effort (line) recorded by the large pelagic longline sector within Namibian waters (2004 – 2023).

Source: Data provided by MFMR 2023.



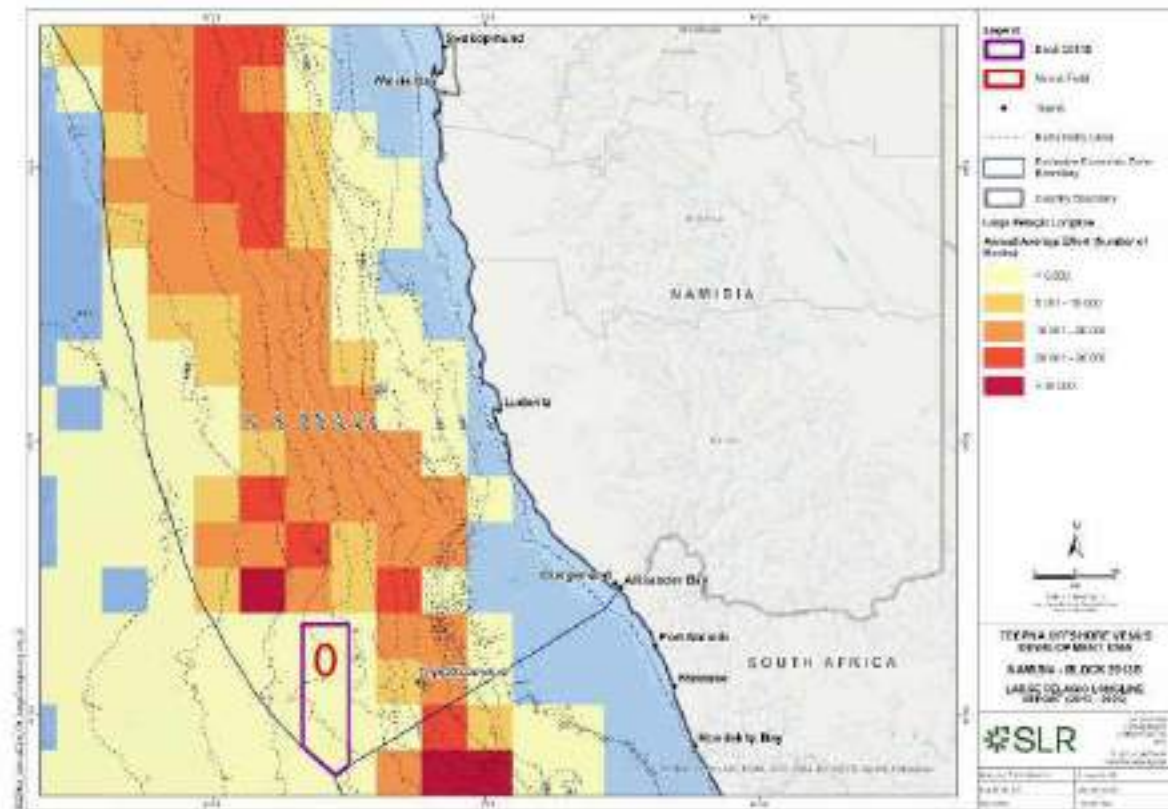


Figure 6-46: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the spatial distribution of annual average effort recorded by the large pelagic longline fisheries offshore Namibia (2014-2023).

Source: Namibian data provided by MFMR (2014-2023), South African data provided by DFFE (2013-2022).



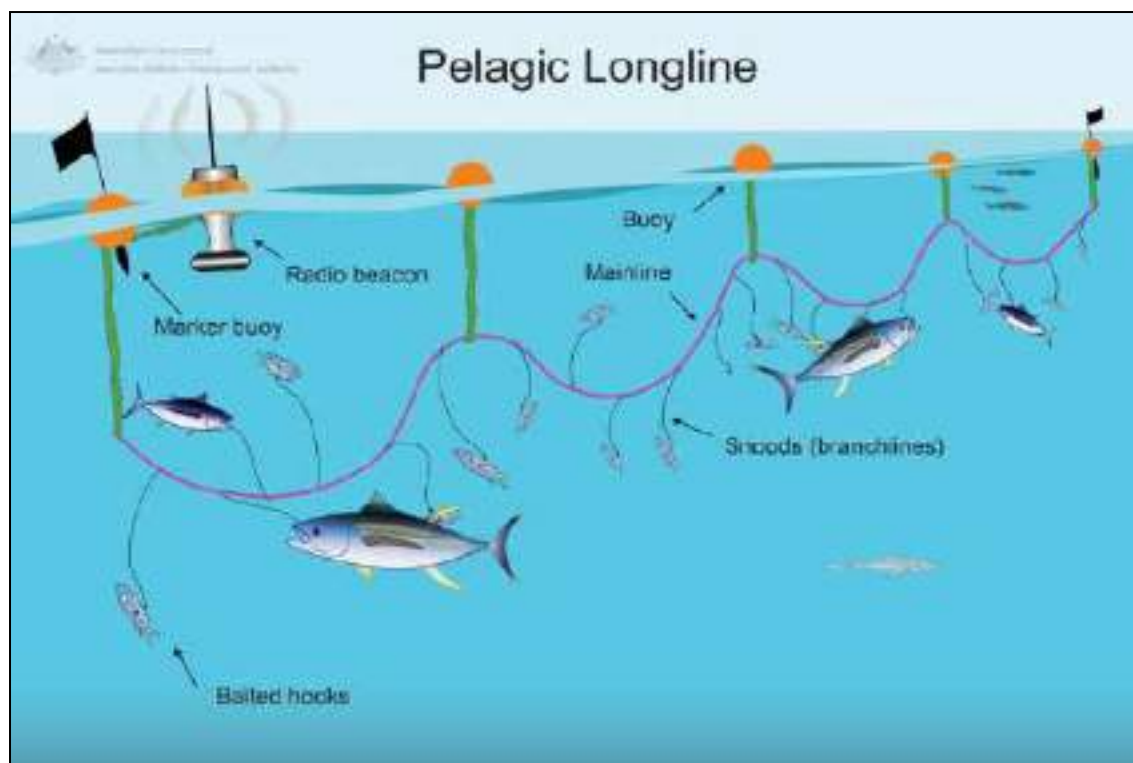


Figure 6-47: Schematic diagram of gear typically used by the pelagic longline fishery

Source: <http://www.afma.gov.au/portfolio-item/longlining>.



Figure 6-48: Photographs showing marker buoys (left), radio buoys (centre) and monofilament branch lines (right).

Source: CapMarine (2015)

Small Pelagic Purse-Seine

The pelagic purse-seine landings comprise Benguela sardine (also regionally referred to as pilchard), and small quantities of juvenile horse mackerel (Table 6-19). A moratorium was implemented on 01 January 2018 due to a significant population reduction. **This fishery remains closed at present.** Prior to the stock collapse, the stock distribution extended throughout the Benguela system, however a contracted distribution is currently apparent. Recent biomass surveys have shown small aggregations of the stock mostly located inshore of the 200 m isobath. Commercial fishing activity occurred primarily inshore of 200 m,



northwards of 25°S to the Angolan border with the main commercial fishing grounds situated at least 300 km northward of the licence area.

The fishery is currently closed, however there is not overlap of historical fishing activity within Block 2913B and the Venus development field (Figure 6-49). Should the fishery reopen, possible nearshore transshipment operations in the vicinity of Walvis Bay may overlap with fishing activity, based on historical fishing activity.

Table 6-19: Key target species of the small pelagic purse-seine fishery.

Target and bycatch species	Reference image
Sardine (<i>Sardinops sagax</i>)	
Horse mackerel (<i>Trachurus capensis</i>)	

Source: WWF-SASSI

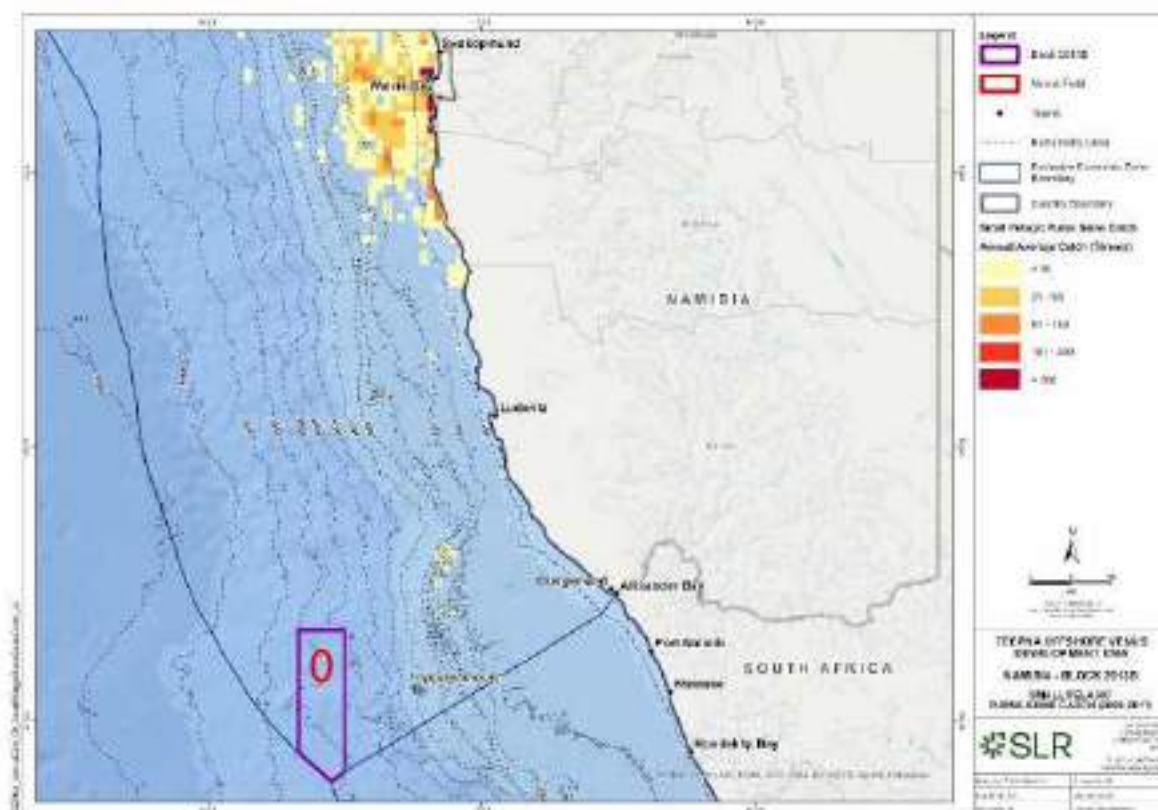


Figure 6-49: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the spatial distribution of the annual average catch recorded by the small pelagic purse-seine fishery in Namibia.

Source: Namibian data provided by MFMR (2000-2017).



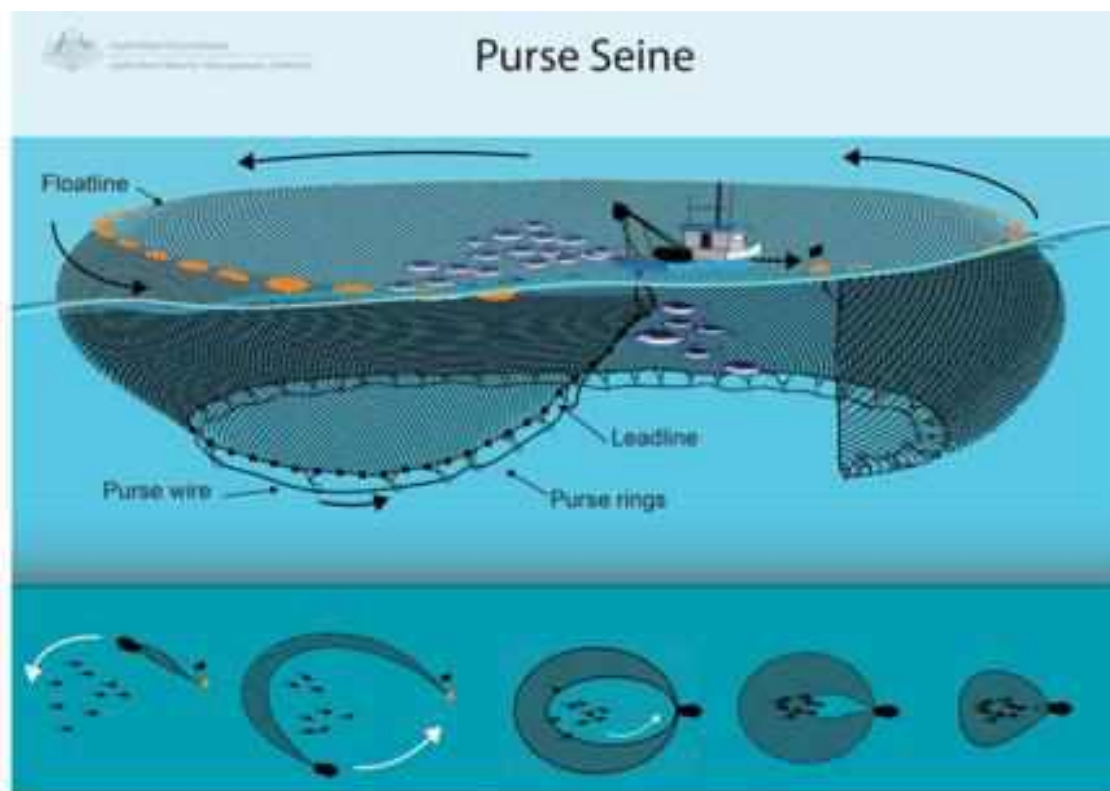


Figure 6-50: Schematic of typical purse-seine gear deployment in the "small" pelagic fishery.

Source: <http://www.afma.gov.au/portfolio-item/purse-seine>

Mid-water Trawl

The Namibian fishery for Cape horse mackerel (*Trachurus capensis*) is the largest contributor by volume and second highest contributor by value to the industry. The stock is currently caught by the mid-water trawl fishery (targeting adult horse mackerel) but was also previously caught by the small pelagic purse-seine fishery (targeting juvenile horse mackerel) (see Small Pelagic Purse-Seine above). The midwater fishery operates using large trawls within the water column to catch schools of adult horse mackerel.

The fishery operates year-round with relatively constant catch and effort values by month. The mid-water trawl fleet operates exclusively out of the port of Walvis Bay and fishing grounds extend north of 25°S to the border of Angola. Juvenile Cape horse mackerel move into deeper water when mature and are fished mostly between the 200 m and 500 m isobaths towards the shelf break.

The main commercial fishing grounds are situated approximately 300 km northward of Block 2913B, however incidental catches have been recorded to the east and north-east of the block (Figure 6-51). With fishing activities concentrated between the 200 m and 500 m isobaths, overlap with nearshore transshipment operations is considered unlikely⁵⁶.

Mid-water trawling gear configuration is similar to that of demersal trawlers, except the net is much larger and fishes only in midwater and off the seafloor. The towed gear may extend up to 1 km behind the vessel and comprises trawl warps, net and codend (see Figure 6-52).

⁵⁶ The potential overlap of nearshore transshipment operations with commercial fisheries will be confirmed in the ESIA phase, following the finalization of these transshipment locations.



Once deployed, the net is towed for several hours at speeds of approximately 5 to 7 knots predominantly parallel with the shelf break.

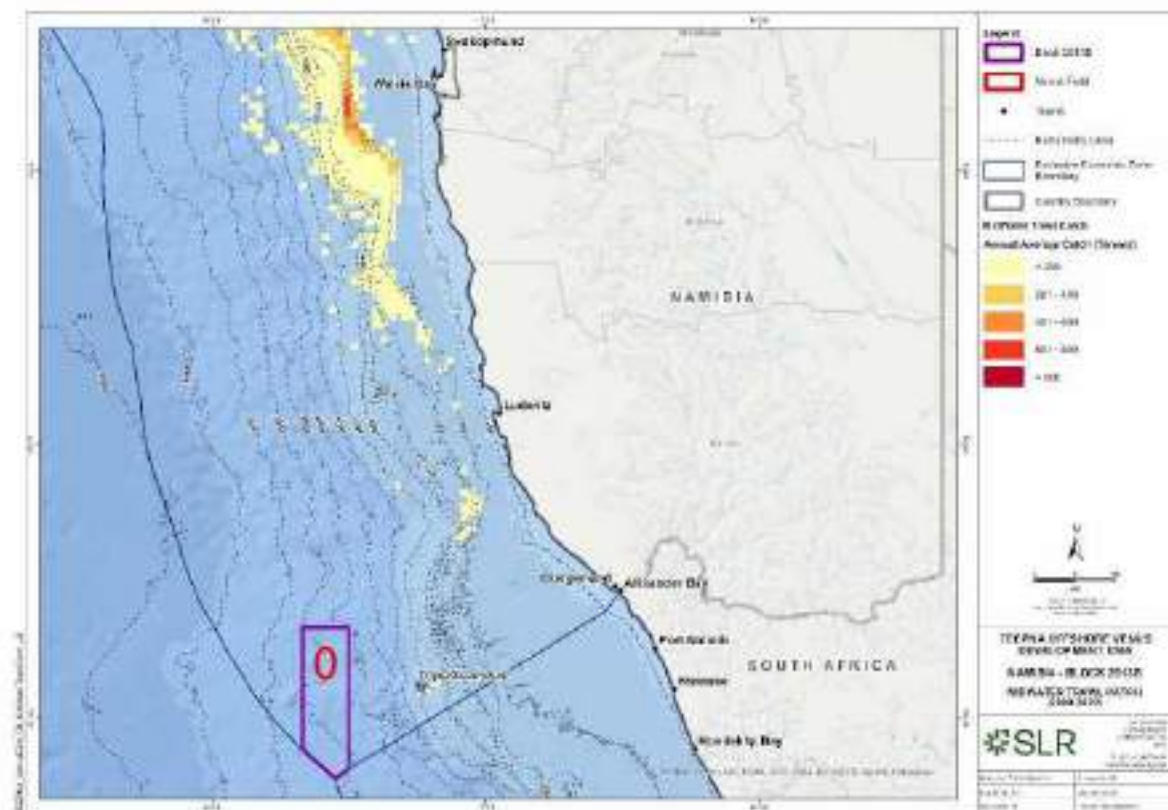


Figure 6-51: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the spatial distribution of annual average catch recorded by the mid-water trawl fishery offshore Namibia (2000 – 2022).

Source: Namibian data provided by MFMR (2000-2022).



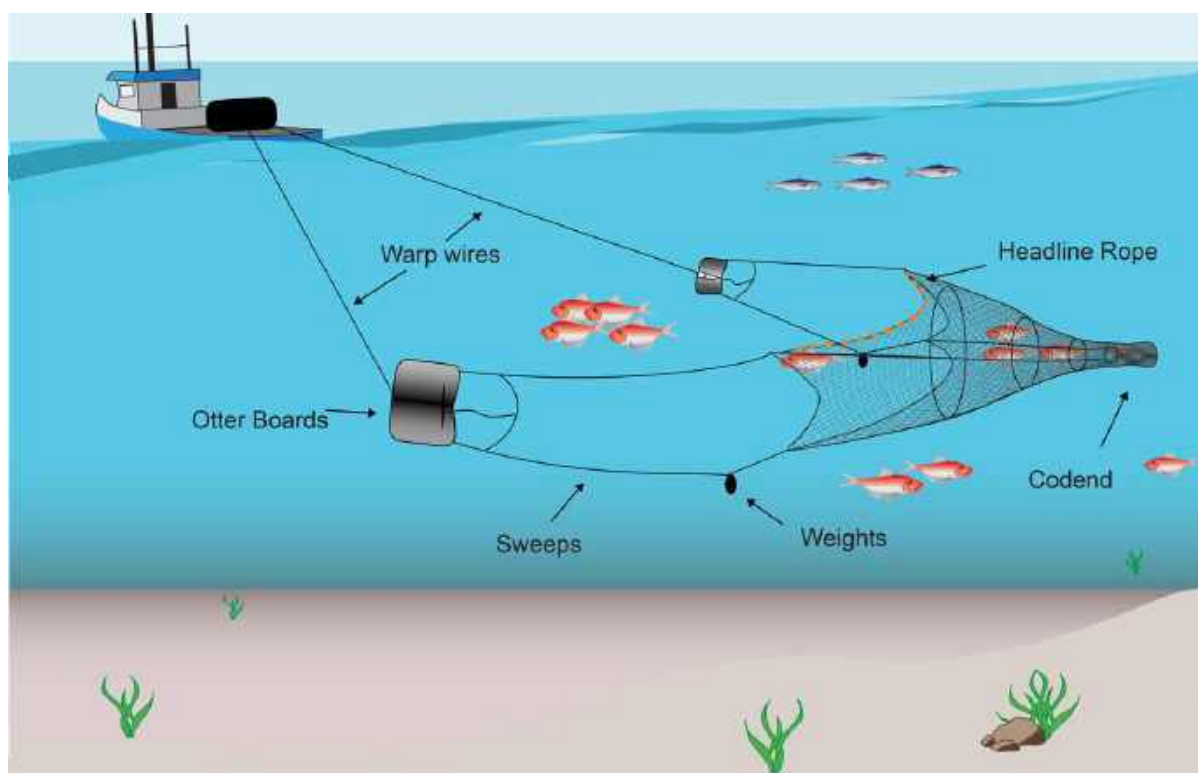


Figure 6-52: Typical configuration of mid-water trawl gear.

Source: www.afma.gov.au/fisheries-management/methods-and-gear/trawling

Demersal Trawl

The demersal trawl fishery in Namibia mainly targets shallow-water and deep-water hake (Table 6-20) and is managed as a single sector. At the peak of exploitation in the mid-1970s, catches of hake in Namibian waters reached almost 1 million tonnes, although some believe that this figure was underestimated. The directed hake trawl fishery is Namibia's most valuable fishery, with a current annual TAC of 140 000 tonnes (2024/25 season). The fleet of 71 demersal trawlers licensed to operate within the fishery primarily targets hake in waters >300m and as deep as 800 m in places. A smaller group of vessels is licensed to fish for monkfish and sole. These fisheries also have a small bycatch which includes kingklip (Table 6-20).

Table 6-20: Key target and bycatch (grey shading) species of the demersal trawl fishery.

Target and bycatch species	Reference image
Deepwater hake (<i>Merluccius paradoxus</i>)	
Shallow water hake (<i>Merluccius capensis</i>)	
West Coast sole (<i>Austroglossus microlepis</i>)	



Target and bycatch species	Reference image
Monkfish (<i>Lophius vomerinus</i>)	
Kingklip (<i>Genypterus capensis</i>)	

Source: WWF-SASSI

The deep-sea fleet is divided into wetfish and freezer vessels, with a prescribed 70:30 ratio. Freezer vessels process fish offshore, while wetfish vessels land fish at factories ashore for processing. Wetfish vessels are smaller, with an average length of 45 m, and can only remain in an area for about a week before returning to port, whereas freezer vessels can work in an area for up to a month at a time. Most trawlers operate from the port of Walvis Bay, with fewer vessels operating from Lüderitz.

Fishing effort is relatively constant throughout the year except for a closure for the month of October and lower levels of effort expended during November and December. Demersal trawling is prohibited in waters shallower than 200 m⁵⁷.

Fishing grounds extend along the entire coastline following the distribution of hake and monkfish along the continental shelf at a depth range of 200 m to approximately 850 m.

Figure 6-53 shows the spatial distribution of average effort in the vicinity of Block 2913B over the period 2010-2021, with **no catch and/or effort data reported by the Namibian demersal trawl fishery was recorded within the Venus development field, or the larger Block 2913B. Potential overlap of nearshore transshipment operations is considered unlikely, with fisheries effort concentrated along the shelf edge, in water depths of 200 m to 850 m deep, with no trawling shallower than 200 m.**

⁵⁷ Namibia has a designated area closed to most “offshore” fishing activities under 200 m water depth to protect potential spawning areas as well as areas of high juvenile abundance for most demersal species, including hake. Demersal trawling is prohibited in waters shallower than 200 m. Wetfish trawlers can only fish >300 m and freezer trawlers >350 m south of 25° S.



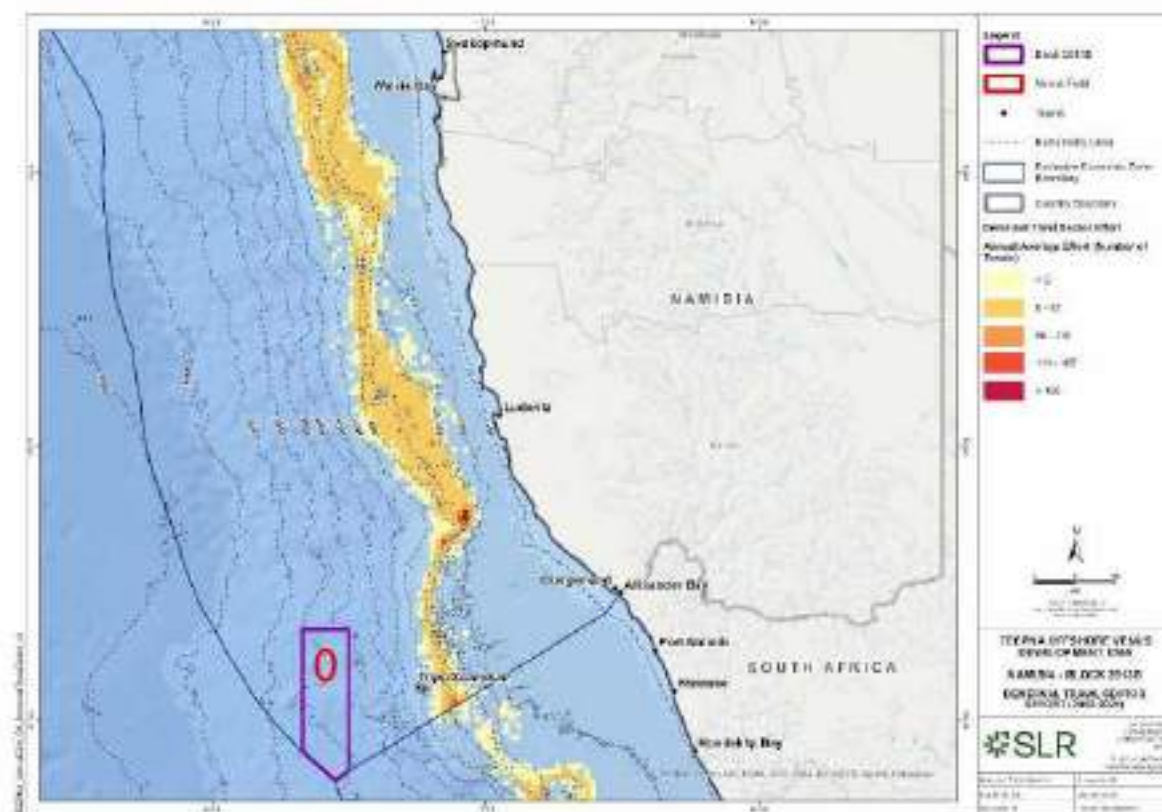


Figure 6-53: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the spatial distribution of annual average effort (no. of trawls) recorded by the demersal trawl fishery offshore Namibia (2012 - 2021).

Source: Namibian data provided by MFMR (2012-2021), South African data provided by DFFE (2012-2021).

Otter trawling is the primary method used in the Namibian demersal trawl fishery. This technique involves the use of trawl doors, or otter boards, which are dragged along the seafloor ahead of the net to maintain the horizontal net opening (see Figure 6-54). The trawling gear configuration is similar for both offshore and inshore vessels.



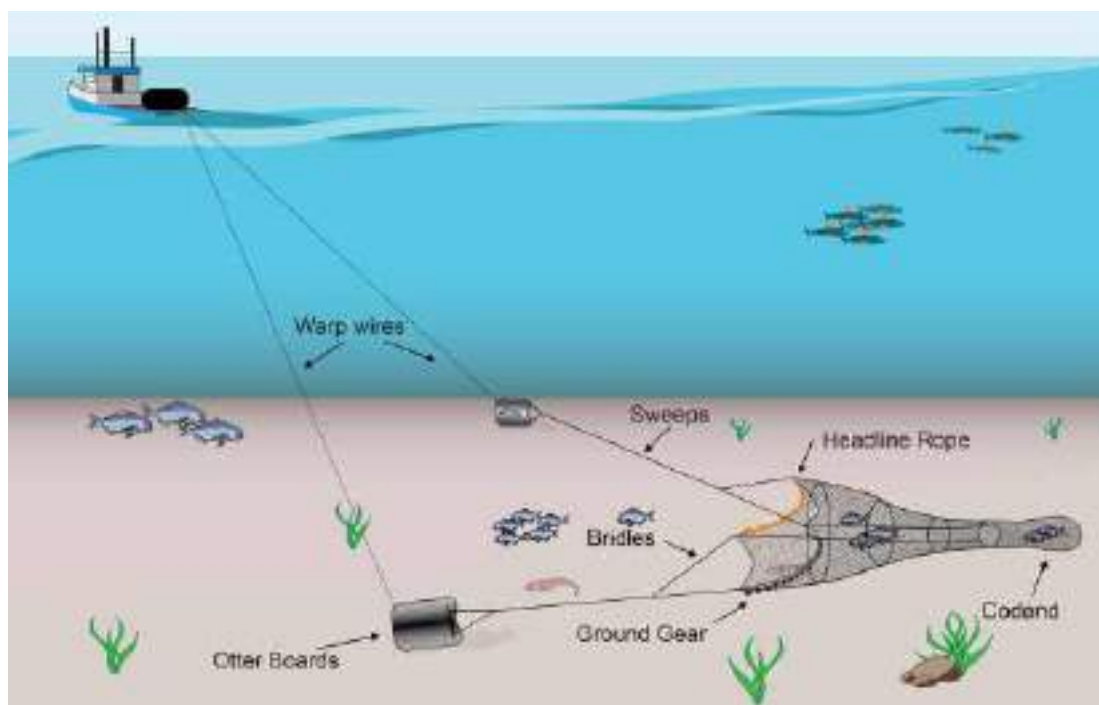


Figure 6-54: Trawl gear typically used by demersal trawlers targeting hake.

Source: <http://www.afma.gov.au/portfolio-item/trawling>

Demersal Longline

The demersal longline fishery targets bottom dwelling species, primarily Cape hakes (shallow-water and deep-water hakes), with kingklip caught as bycatch (Table 6-20). Longline vessels fish in similar areas as the hake-directed trawling fleet, in a broad area extending along the full length of the Namibian coastline at depths between 200 m to 650 m. Some 18 vessels operate within the sector. Those based in Lüderitz mostly work South of 26°S towards the South Africa border while those based in Walvis Bay operate between 23°S and 26°S and North of 23°S. The fishery effort is highest offshore of Walvis Bay.

Figure 6-55 shows the spatial distribution of average effort in the vicinity of Block 2913B over the period 2012-2023. **During this time (2010-2023), no catch and/or effort was recorded by the Namibian demersal longline fishery within the Venus development field or the larger Block 2913B. Similar to the demersal trawl fishery, effort is concentrated along the shelf edge (200 m – 650 m) with overlap with nearshore transshipment operations considered unlikely.**

Lines are typically 10 to 20 km long, carrying 6 900 to 15 600 baited hooks at regular intervals (1 to 1.5 m) (Figure 6-56). Gear is set at night at speeds of five to nine knots and left to soak for up to eight hours before retrieval. A line hauler is used to retrieve gear at approximately one knot, taking six to ten hours to complete.



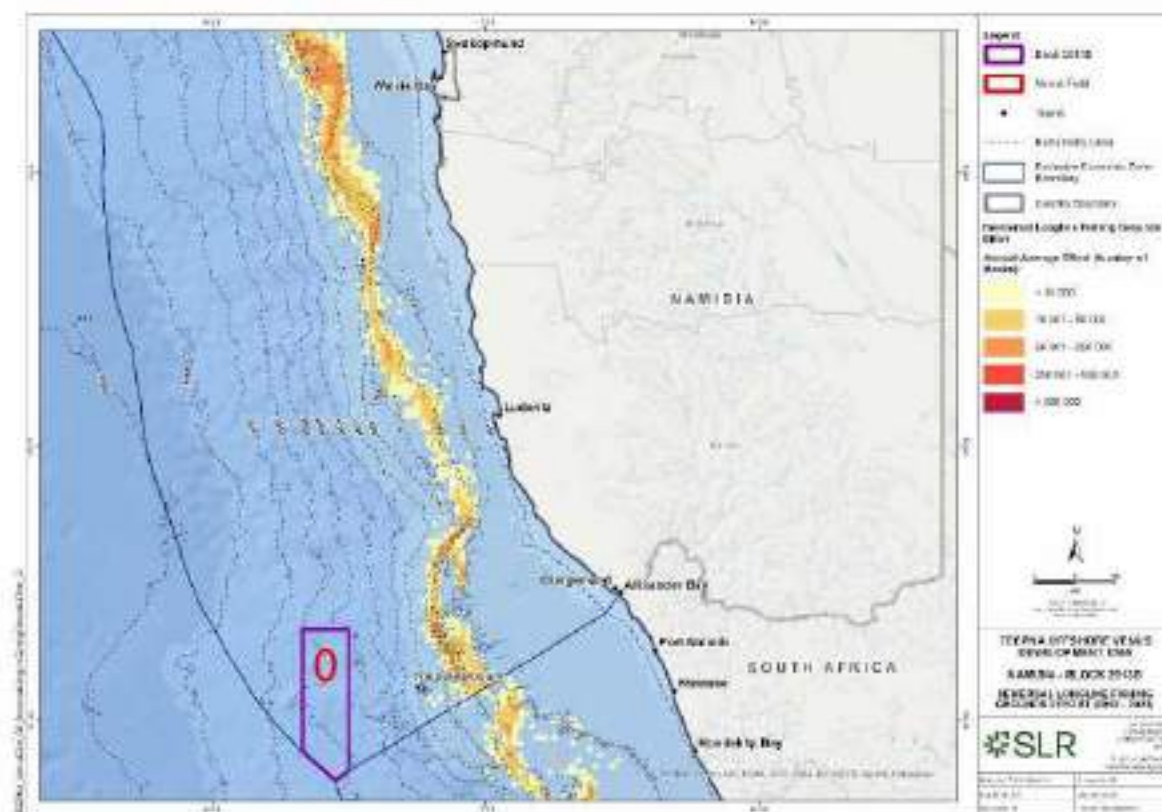


Figure 6-55: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the spatial distribution of annual average effort recorded by the demersal longline fishery offshore Namibia (2014-2023).

Source: Namibian data provided by MFMR (2014-2023), South African data provided by DFFE (2018-2020).

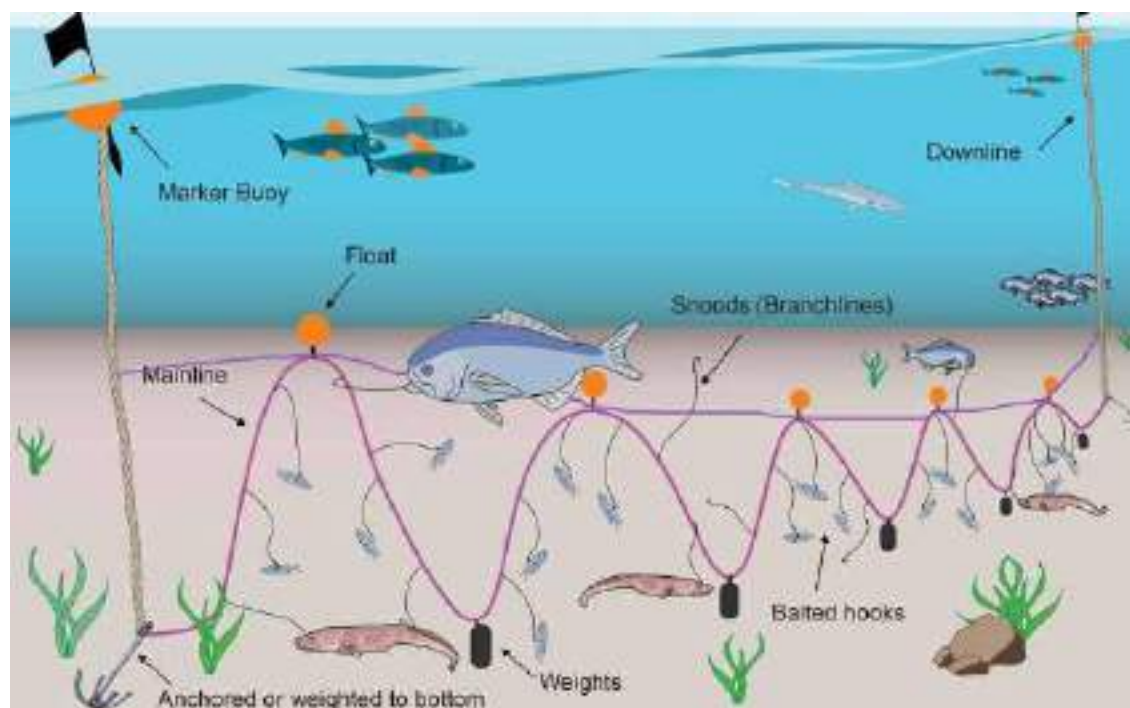


Figure 6-56: Typical configuration of demersal (bottom-set) hake longline gear.

Source: adapted from <http://www.afma.gov.au/portfolio-item/longlining>



Pole-line

The tuna pole fishery predominantly targets juvenile and sub-adult Albacore tuna, also known as southern Atlantic longfin tuna. Other species caught include yellowfin tuna, bigeye tuna and skipjack tuna. Historically, South African pole and line vessels were allowed to operate in Namibian waters under arrangements with Namibian right holders each year. However, recently the activity has been restricted only to Namibian-registered vessels.

The fishery is seasonal with vessel activity mostly between December and May and peak catches in March and April. Effort fluctuates according to the availability of fish in the area, but once a shoal of tuna is located a number of vessels will move into the area and target a single shoal which may remain in the area for days at a time. As such the fishery is dependent on window periods of favourable conditions relating to catch availability (Table 6-21). Commercial landings of large pelagic species are variable and Namibian catches reported by the pole sector (also referred to as “baitboat”) are shown in Figure 6-57.

Namibia's allocation of the global TAC for longfin (albacore) tuna and swordfish is allocated by the International Commission for Conservation of Atlantic Tunas (ICCAT), of which Namibia is a member (4 320 t of albacore in 2024/25). The Tuna-Pole fishery catches albacore using long poles that have lines with hooks attached to them. Bait is thrown directly into the sea to create feeding frenzy. The poles are manually lowered into the water and raised to retrieve the catch.

Table 6-21: Key target and bycatch (grey shading) species of the tuna pole fishery.

Target and bycatch species	Reference image
Albacore tuna (<i>Thunnus alalunga</i>)	
Bigeye tuna (<i>Thunnus obesus</i>)	
Yellowfin tuna (<i>Thunnus albacares</i>)	
Skipjack tuna (<i>Katsuwonus pelamis</i>)	

Source: WWF-SASSI



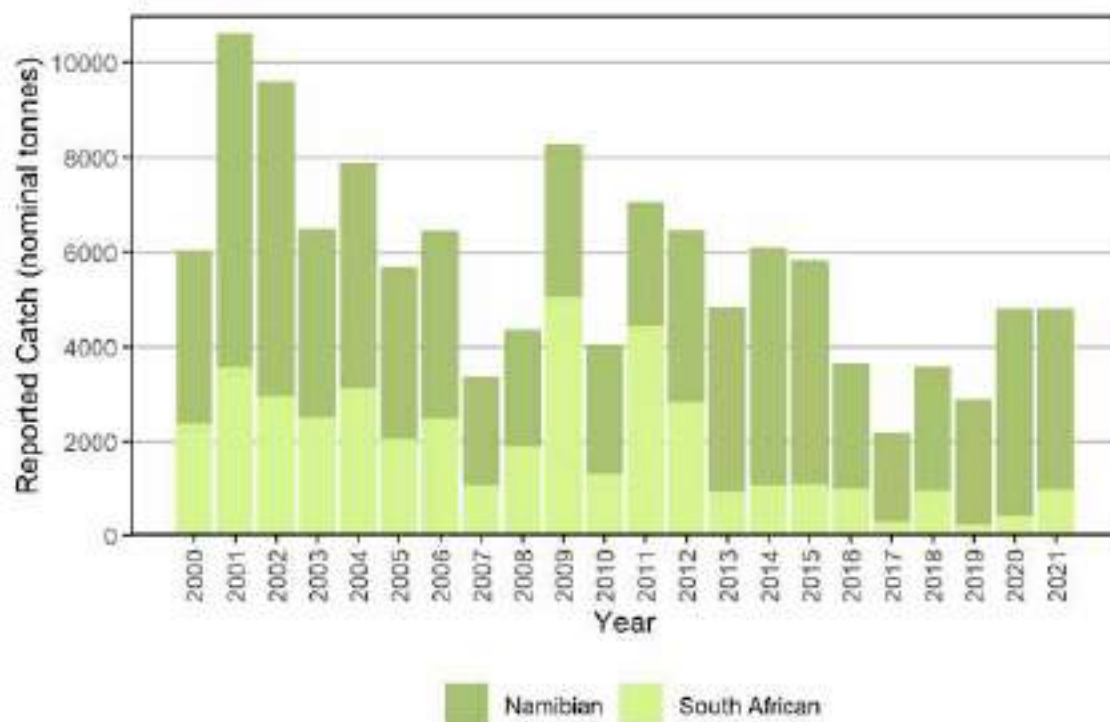


Figure 6-57: Total nominal pole-line catch (tonnes) within Namibian waters reported to ICCAT from 2000 to 2021 (Namibian and South African flagged vessels).

Source: ICCAT Statistical Bulletin (2023).

Aggregations of albacore tuna occur in specific areas, in particular Tripp Seamount which is situated just north of the South Africa/ Namibia maritime border. Catches in this area are variable from year to year, although boats will frequent the area knowing that albacore aggregate around the seamount after migrating through South African waters. The movement of albacore between South Africa and Namibia is not clear although it is believed that the fish move northwards following bathymetric features and generally stay beyond the 200 m depth contour.

Figure 6-58 shows the spatial distribution of average catch in the vicinity of Block 2913B over the period 2013-2022. **There is no spatial overlap of fishing activity with the block. The highest catch is over Tripp seamount, 85 km east of Block 2913B. Potential overlap of nearshore transshipment operations is considered unlikely, with fisheries effort concentrated along the shelf edge, in water depths of 200 m or deeper.**



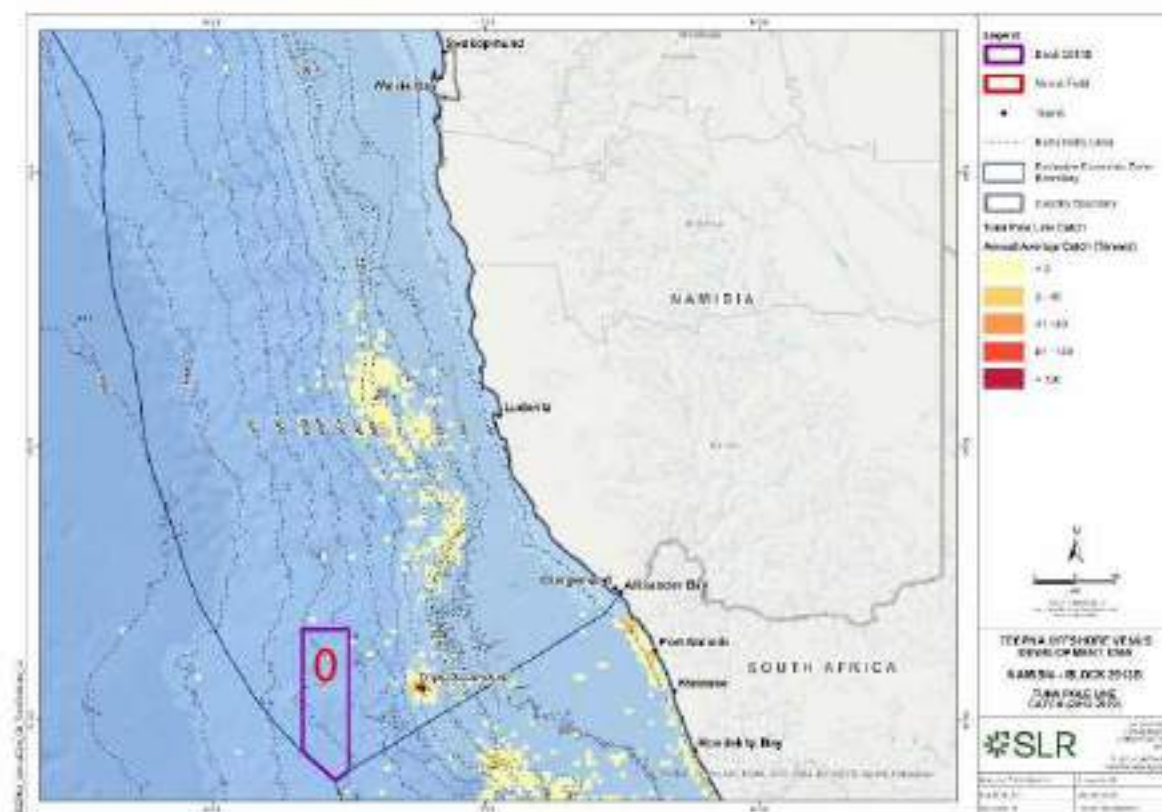


Figure 6-58: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the spatial distribution of the annual average catch recorded by the pole-line fishery offshore Namibia (2013-2022).

Source: Namibian data provided from MFMR (2013-2022), South African data provided from DFFE (2013-2022).

While vessels are at sea, most of the time is spent searching for schools of tuna using sonars echo-sounders and troll lines, with actual fishing events occurring over relatively short periods. Pole fishing gear consists of a bamboo pole with nylon leader attached that ends in a hook (and sometimes artificial bait) (Figure 6-59). Rod and reel gear is used to target yellowfin tuna.

During pole fishing, bait is thrown into the water to attract albacore tuna. In some cases, bigger boats may carry live bait. In addition, high-pressure nozzles spray water overboard around the vessel which help create a feeding frenzy and keeps the school around the vessel. The crew work in pairs to efficiently bring caught tuna on board using the poles and shorter hooked sticks, known as 'gaffs'. Rod and reel methods are akin to those employed by recreational anglers; a chum line is created and up to 8 baited lines are cast.



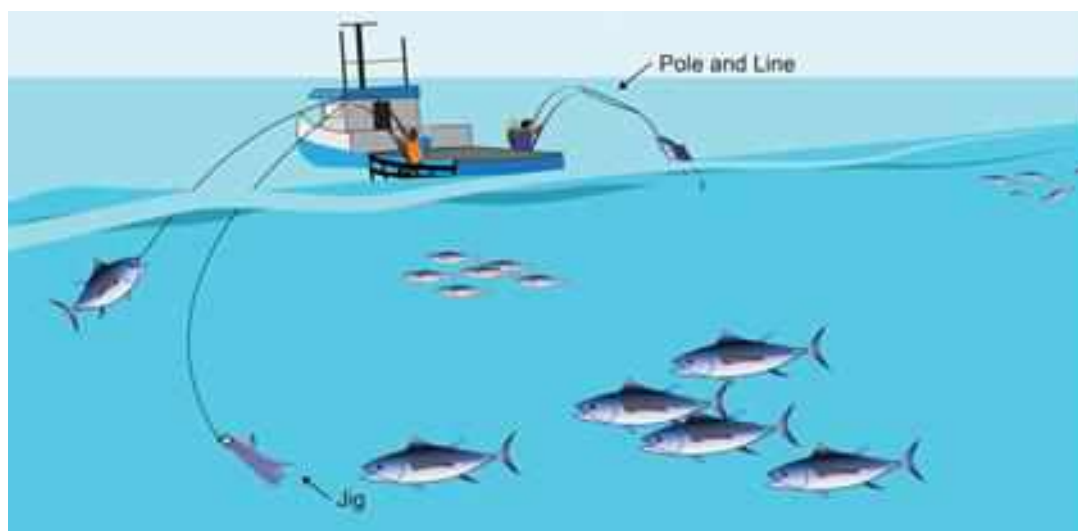


Figure 6-59: Typical tuna pole and line operations.

Source: <http://www.afma.gov.au/portfolio-item/minor-lines>

Linefish

The traditional line fishery primarily targets snoek with bycatch of yellowtail, silver kob, dusky kob, and sharks, which are sold on the local market. **Snoek availability to the fishery is seasonal. Catches peak in late summer where after the fish migrate south into South African waters. The other species caught, such as kob and shark occurs year-round, but in relatively small amounts.**

Operationally the fishery is limited in extent to Walvis Bay, Swakopmund and Henties Bay, and due to the small size of vessels, does not operate much further than 12 nm offshore (i.e., 22 km). There is also a small component of the fishery operating out of Lüderitz in the South.

The sector operates inshore of the 200 m depth contour with incidental reports of fishing in deeper waters. There is no spatial overlap of fishing activity with the block. The closest fishing activity takes place from Lüderitz, at least 300 km north-east of Block 2913B and off Oranjemund at least 300 km east of the block, however there are incidental catch records 20 km inshore of the Licence Block (Figure 6-60).

Nearshore transshipment operations, as well as vessel transit, may overlap with the linefish fishing sectors' activities, particularly if occurring from Lüderitz northwards.



Table 6-22: Key target and bycatch species of the linefish fishery.

Target and bycatch species	Reference image
Snoek (<i>Thyrstites atun</i>)	
Yellowtail (<i>Seriola lalandi</i>)	
Silver kob (<i>Argyrosomus inodorus</i>)	
Dusky kob (<i>Argyrosomus coronus</i>)	

Source: WWF-SASSI

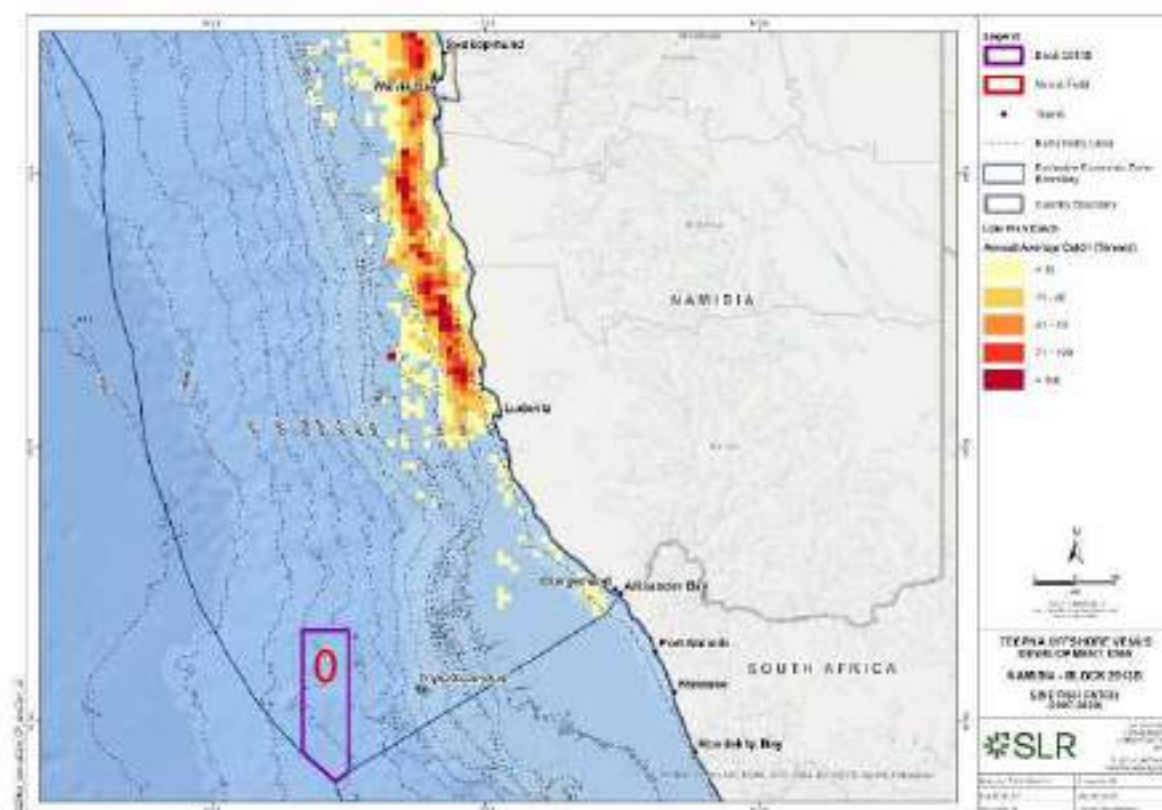


Figure 6-60: Block 2913B (purple polygon) and Venus development field (red circle) in relation to the spatial distribution of the annual average catch recorded by the linefish fishery offshore Namibia (2007-2020).

Source: Namibian data provided by MFMR (2007-2020).

Deep-Water Trawl

The deep-water trawl fishery is a small but lucrative fishing sector directed at the outer Namibian shelf from 400 m to 1 500 m water depth targeting orange roughy (*Hoplostethus*



atlanticus) and alfonso (Beryx splendens). Both species are extremely long-lived and form dense aggregations, leading to high catch rates. General aggregations of the stock occur between June and August. Fishable aggregations are usually found on hard grounds on features such as seamounts, drop-off features or canyons (Branch, 2001). Off Namibia, orange roughy has a restricted spawning period of less than a month in late July, when spawning takes place in dense aggregations close to the bottom in small areas typically between 10 and 100 km² in extent (Boyer & Hampton, 2001).

The fishery is split into four Quota Management Areas (QMAs) referred to as “Hotspot”, “Rix”, “Frankies” and “Johnies” and TACs are set for each specific QMA (see Figure 6-61).

Block 2913B and nearshore transshipment locations do not overlap with any of these QMAs.

In 2009, a three-year moratorium on orange roughy was enforced in Namibia and the deep-water fishery has not yet been re-opened.

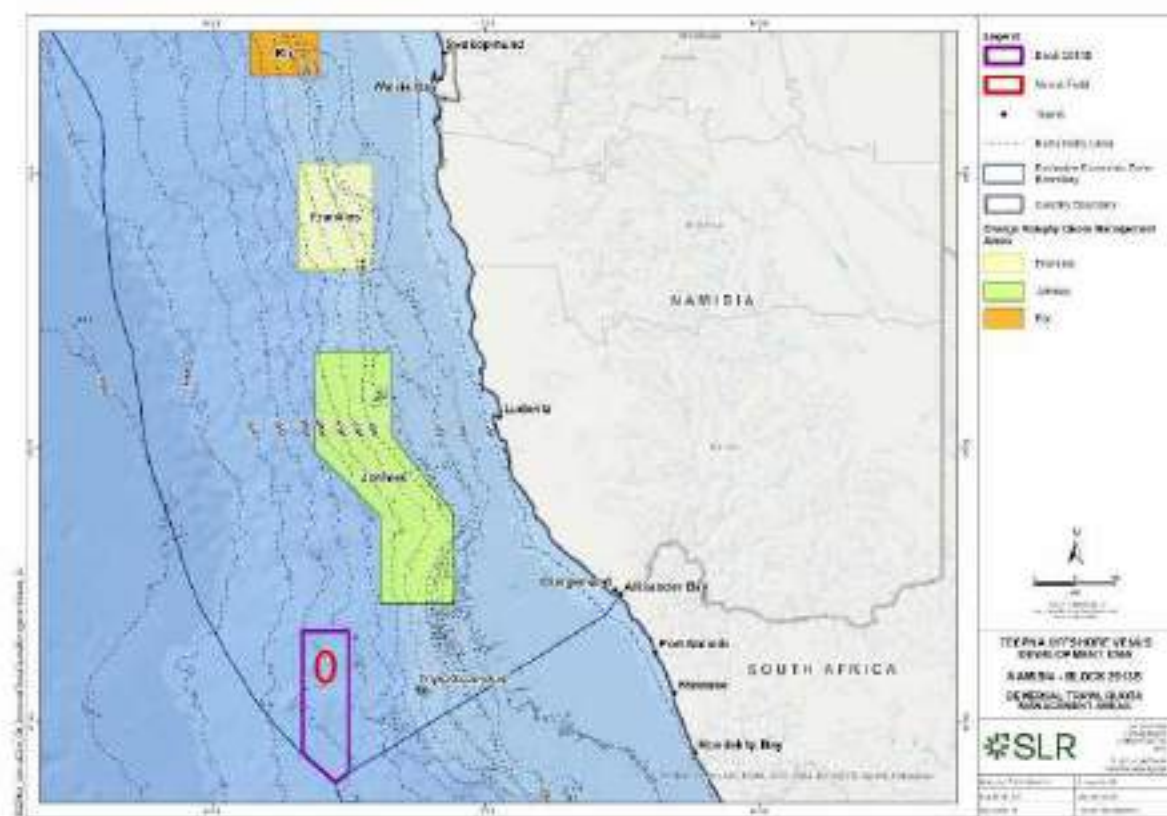


Figure 6-61: Deep-water trawl QMAs in relation to Block 2913B.

Source: CapMarine

Rock Lobster

The small but valuable fishery of rock lobster (*Jasus lalandii*) is based exclusively in the port of Lüderitz. The catch season is a six-month period with a closed period extending from 1 May to 31 October and highest activity levels are experienced over January and February. A total of 18 vessels participated in the 2021-22 rock lobster fishing season.

The sector operates in water depths of between 10 and 80 m. Within Namibian waters, the lobster stock is commercially exploited between the Orange River border in the south to Easter Cliffs/Sylvia Hill north of Mercury Island (approximately 25°S). The fishery is spatially managed through the demarcation of catch grounds by management area. **There is no**



spatial overlap between Block 2913B and fishing grounds, however nearshore transshipment operations and vessel transit may overlap with these fishing grounds.

Deep-Sea Crab

The Namibian deep-sea crab fishery is based on two species of crab namely spider crab (*Lithodes ferox*) and red crab (*Chaceon maritae*).

The distribution of red crab extends from ~5°S to just South of Walvis Bay and the commercial fishery operates in grounds extending northwards of 23°S and into Angolan waters. There is a minimum operational depth of 400 m set for the fishery, which sets traps at depths of up to 1 200 m. The fishery is small, with only two vessels currently operating from the port of Walvis Bay. Vessels are active year-round but with relatively low fishing effort from November to February.

Fishing grounds are located over 700 km to the north of Block 2913B and there is therefore no spatial overlap. Overlap with transshipment and vessel transit operations is deemed highly unlikely, with fishing activities taking place north of Walvis Bay (Figure 6-62).

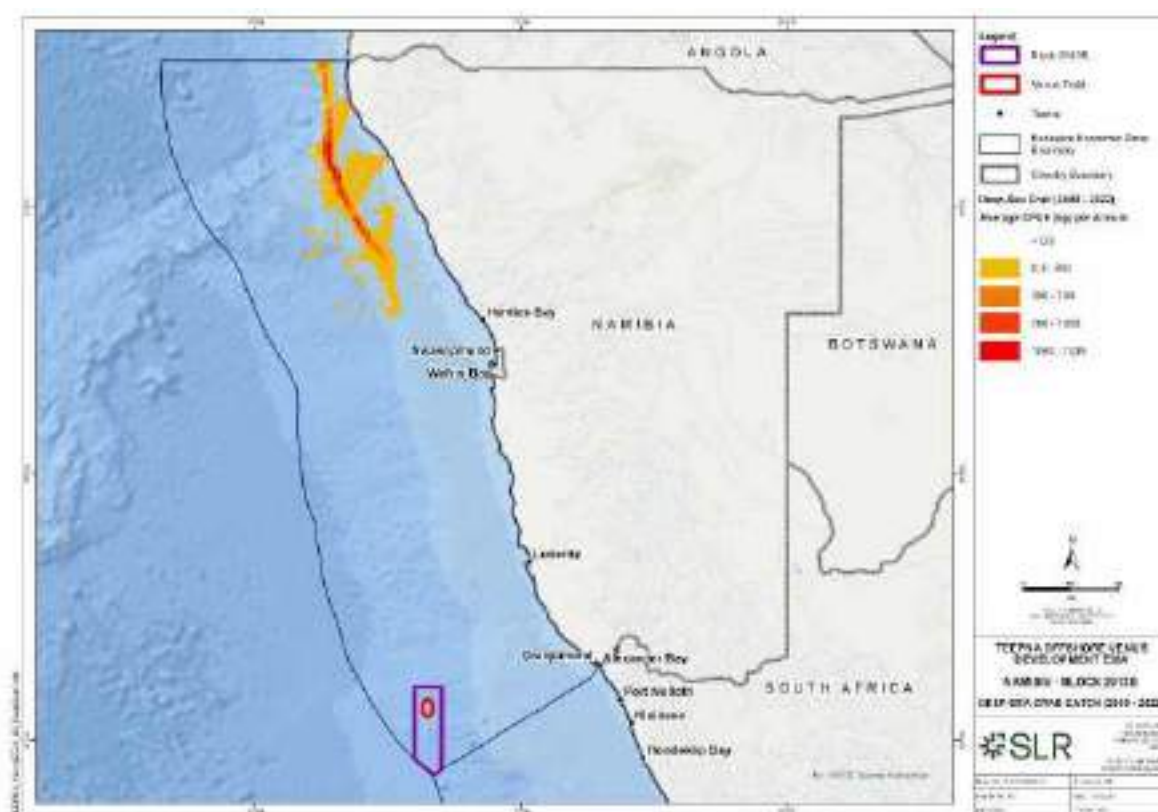


Figure 6-62: Block 2913B in relation to the spatial distribution of annual average catch recorded by the deep-sea crab fishery offshore Namibia (2000-2022).

Note: Average annual CPUE (kg/pot) over the period 2000 to 2022 is displayed on a 5 x 5 minute grid.

6.7.5.3 Small-Scale Fisheries

Historically, Small-Scale Fisheries (SSF) were not formally recognized by law in Namibia. The Inland Fisheries Resources Act, 2003 recognized “subsistence fisheries” as those activities where fishers regularly catch fish using traditional gear for personal and household consumption, occasionally selling or bartering excess catch locally. “Recreational fisheries”



were defined as those conducted primarily for sport, with a secondary objective of catching fish for domestic consumption, but not for sale.

Recent fisheries surveys indicate that inland and coastal fishing communities dependent on fisheries display characteristics of SSF. Recognizing this, the Namibian government, in collaboration with the Food and Agriculture Organization (FAO), developed the National Plan of Action for Small-Scale Fishers (NPOA-SSF) for 2022 to 2026. This plan aims to formally recognize the SSF sector and its stakeholders while addressing the challenges faced by this sector. Namibia's SSF sector is defined as "small-scale fishers who are women, men, and sometimes children, using various fishing methods (e.g., small fishing vessels) on a daily or regular basis. They catch fish as a source of income, for their own consumption or livelihoods for most of the year, and sell or barter surplus within weight or number limits (note: MFMF is in the process of determining catch and limit sizes for formalization at the policy and regulatory levels)" (MFMF; FAO, 2022).

Namibia's SSF sector consists of two sub-sectors: inland SSF and coastal (or marine) SSF. Due to the lack of recognition and management legislation, there is limited data on catches by SSF communities. Coastal SSF is largely limited to the areas offshore of Walvis Bay, Henties Bay, Swakopmund, and Lüderitz, with restricted fishing zones in the Namib-Naukluft National Park, the Sperrgebiet National Park, and the NIMPA.

Namibian SSF, often referred to as artisanal fisheries, primarily operate nearshore, utilizing traditional fishing methods to harvest a variety of marine species. These methods include ski-boats, nets, and hook and line, with vessel sizes being less than 25 tons. Various marine resources are harvested, including shellfish collected in Walvis Bay, Swakopmund, and Lüderitz; line fish caught through line fisheries operating out of Henties Bay and Lüderitz (including snoek, Kabeljou, Galjoen, and elf or shad); and mullet and rock lobster fisheries in Lüderitz (MFMF; FAO, 2022).

The Venus development area does not overlap with these nearshore and coastal fisheries, however, overlap between nearshore transshipment operations and nearshore fishing activities may occur, dependant on the final transshipment location.

6.7.5.4 Mariculture Development

Namibia's mariculture industry is developing, focusing on species such as oysters (*Crassostrea gigas* and *Ostrea edulis*), black mussels (*Choromytilus meridionalis* and *Mytilus galloprovincialis*), abalone (*Haliotis midae*), and seaweed (*Gracilaria gracilis*).

The industry employs various methods, including rafts, suspended long-lines, racks in ponds, and onshore flow-through tanks. Key mariculture operations are concentrated around, Lüderitz, Walvis Bay, Swakopmund, and more recently Oranjemund.

In Oranjemund, abandoned diamond mine pits are repurposed for culturing Pacific oysters, while Lüderitz hosts mariculture plots allocated by NamPort, focusing on oysters and experimental farming of mussels and rock lobsters.

Walvis Bay primarily produces Pacific oysters and mussels using long-line methods. Swakopmund features onshore holding ponds for cultivating Pacific and European flat oysters. These coastal towns are of particular importance for Namibia's mariculture industry due to their existing infrastructure and the shelter provided by their bays (SLR, 2020; Mutra & Kibria, 2017).

As outlined in Vision 2030 and the Third National Development Plan, the Namibian government has been actively promoting the development of aquaculture and mariculture. However, despite global expansion, mariculture in Namibia remains relatively limited, with a declining trend in annual productivity observed from 2008 to 2019 (Erasmus, Hamutenya, Numwa, & Petrus, 2023).



The Venus field does not overlap with any of these inshore mariculture activities (Figure 6-63). However, nearshore transshipment operations and support vessels travelling to either Lüderitz or Walvis Bay, may come in close proximity to mariculture activities. No interference is expected.

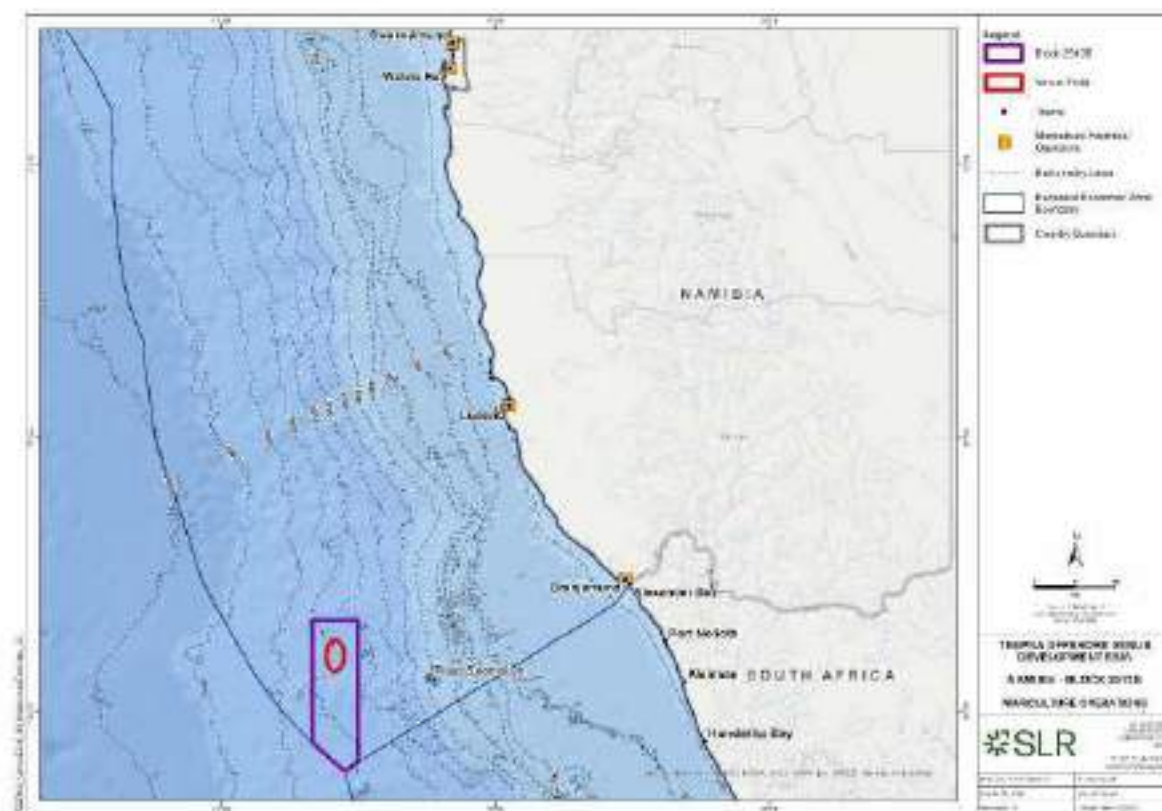


Figure 6-63: Namibian mariculture development areas

6.7.5.5 Fisheries Research

MFMR conducts regular research (biomass) surveys for demersal, mid-water and small pelagic species. These surveys typically follow fixed transects, are spaced 20-25 nm apart, and are designed to statistically optimize the number of stations. In some years the Benguela Current Commission may conduct “transboundary” surveys.

Swept-area biomass surveys for hake are conducted annually to obtain an index of abundance, determine the geographical distribution and collect biological information of the stock. These surveys are normally carried out over the period of one month during January and February and cover the entire continental shelf from the Angolan to the South African maritime border. The method of abundance estimation from these surveys is based on depth stratification and trawls range in depth from 100 m to 600 m; **thus, overlap is not expected with Block 2913B and/or the larger area of operations. However, overlap with nearshore transshipment operations may occur** During trawling the vessel tows the net for a period of 30 minutes at a speed of approximately 3 knots.

Scientific acoustic surveys are carried out between February and March each year to estimate the biomass of small pelagic species (using the survey vessel F/V Welwitchia). The vessel surveys along pre-determined transects that run perpendicular to depth contours (east-west / west-east direction). These surveys cover the Namibian shelf from the coastline to the 500 m depth contour (and up to the 2 000 m contour northwards of 18°30' S), **thus, overlap with Block 2913B is unlikely, yet may occur with nearshore transshipment operations.**



6.7.6 Other Human Uses

6.7.6.1 Marine Traffic and Transport

There are various international shipping routes along the Namibian coastline. The majority of the international shipping traffic is located on the outer edge of the continental shelf. Traffic inshore of the continental shelf largely comprises fishing and mining vessels, especially off the coast of Oranjemund.

The two main ports in Namibia are:

- Walvis Bay Port is Namibia's largest commercial port and is a key port for regional and international shipping trade. It offers direct access to principal shipping routes and is a natural gateway for international trade. It has a sheltered deep-water harbour which benefits from a temperate climate. The port is operated by Namport and receives approximately 3 000 vessel calls each year and handles over 5.3 million tons of cargo.
- Lüderitz Port is historically Namibia's second largest port, functioning mainly as a fishing port. It has expanded in recent years to ship cargo from the mining industry and to support and service offshore petroleum exploration and diamond mining activities.

The Venus field lies within a medium to high intensity vessel route that passes around southern Africa (see Figure 6-64).

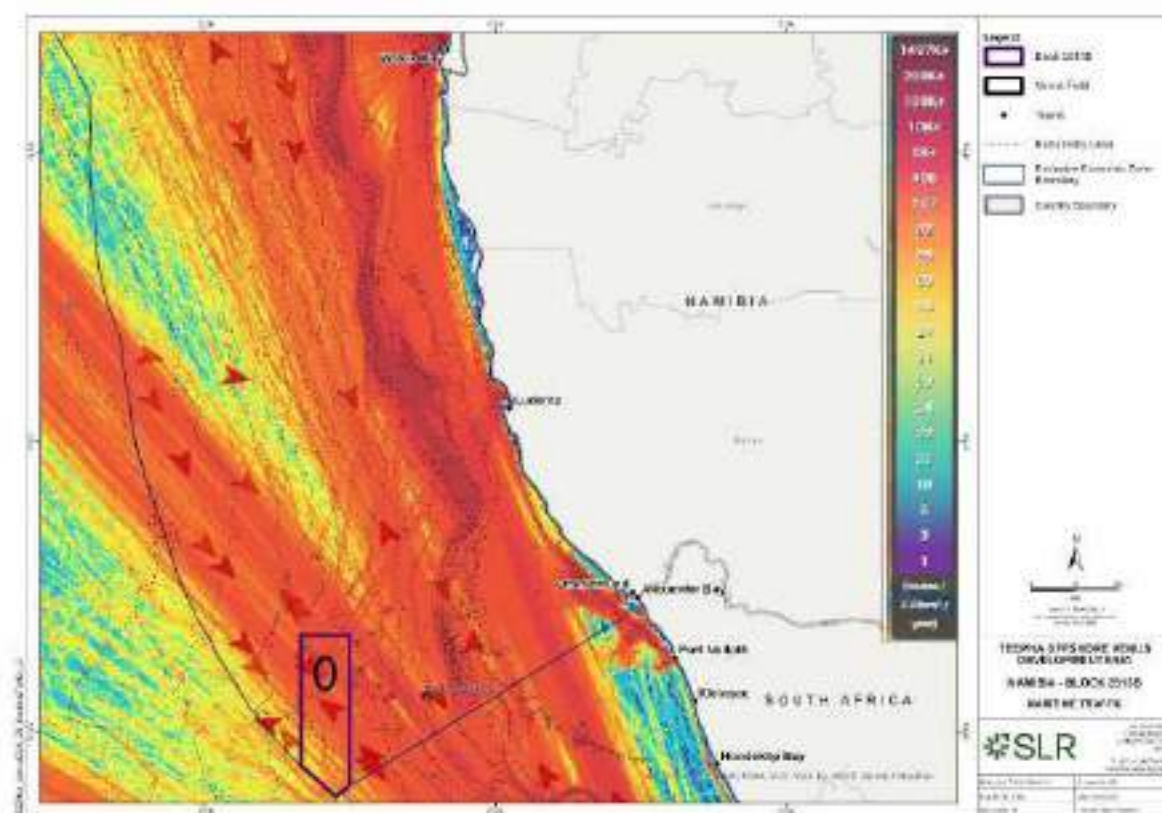


Figure 6-64: Block 2913B in relation to shipping density around southern Africa

Adapted from: <http://www.marinetraffic.com/> [accessed January 2025].



6.7.6.2 Oil and Gas Exploration and Production

Exploration aims to identify commercially viable reserves of hydrocarbons such as oil and gas. The first step in the search for hydrocarbons is to undertake geophysical surveys. These allow for the evaluation of the structure and composition of subsurface formations. Geophysical surveys include magnetometric, aerial photogrammetric, gravimetric, seismic, radiographic and stratigraphic surveys, all of which provide a more detailed understanding of the likelihood of the existence of commercially viable hydrocarbons. The certainty which can be achieved through surveys is limited and to prove the existence of commercially viable reserves, exploration and appraisal drilling is necessary (DTI, 2001).

The first Namibian oil and gas exploration wells were drilled in the 1960s, but it wasn't until 1974 that the presence of hydrocarbons was confirmed through the discovery of the Kudu Gas Field on the northern section of the Orange Basin, directly west of Oranjemund. By 1991, fewer than 10 hydrocarbon wells had been drilled in Namibia, with no commercially viable reserves having been discovered (Light & Shimutwiken, 1991). Following unsuccessful attempts to prove commercially viable reserves, interest in Namibian oil and gas waned.

In recent years there has been a resurgence in Namibian hydrocarbon exploration, with the government allocating exploration licences to a number of companies. Improvements in deep-water drilling technology have increased the viability of what were previously considered unviable reserves.

The collection of survey, seismic and aeromagnetic data has contributed to a substantial geological and geophysical database for the country and has revealed the existence of four offshore frontier basins of interest to explorers: the Orange, Lüderitz, Walvis and Namib basins. 2D seismic surveys have been undertaken offshore much of Namibia's coastline (see Figure 6-65), supplemented by more than 20 infill 3D surveys, including various seismic acquisition in the southern Namibian offshore between 2022 and 2024.

Drilling effort has also intensified, with much of the effort focussing on the Orange Basin in which Block 2913B is located. Between 2010 and 2014, 13 wells were drilled in Namibia, bringing the total number of offshore hydrocarbon wells drilled in Namibian waters by 2014 to 32 (Namcor, 2017a). Since 2018, more than 20 additional wells have been drilled in the Walvis and Lüderitz (Orange) basins.

Recent, current and anticipated exploration well drilling activities nearby the Venus field includes those in Blocks:

- 2813A (Galp - Mopane wells)
- 2813B (Harmattan / Chevron- Kapanan well)
- 2814A (BW Energy – Kudu wells)
- 2912 (TEEPNA - Nara and Olympe wells)
- 2913A (Shell - Cullinan, Jonkers, Lesedi and Graff wells)
- 2913B (TEEPNA – Mangetti, Venus, Tamboti and Marula wells)
- 2914B (Shell - La Rona well)
- 2914A (Rhino – Rhino well)

Table 6-23 lists key approvals for petroleum exploration in the Southern Benguela region (South African West Coast and southern Namibia) since 2007 and indicates whether those were undertaken.



Source: MIME (2024). (Resolution of the source document is limited).

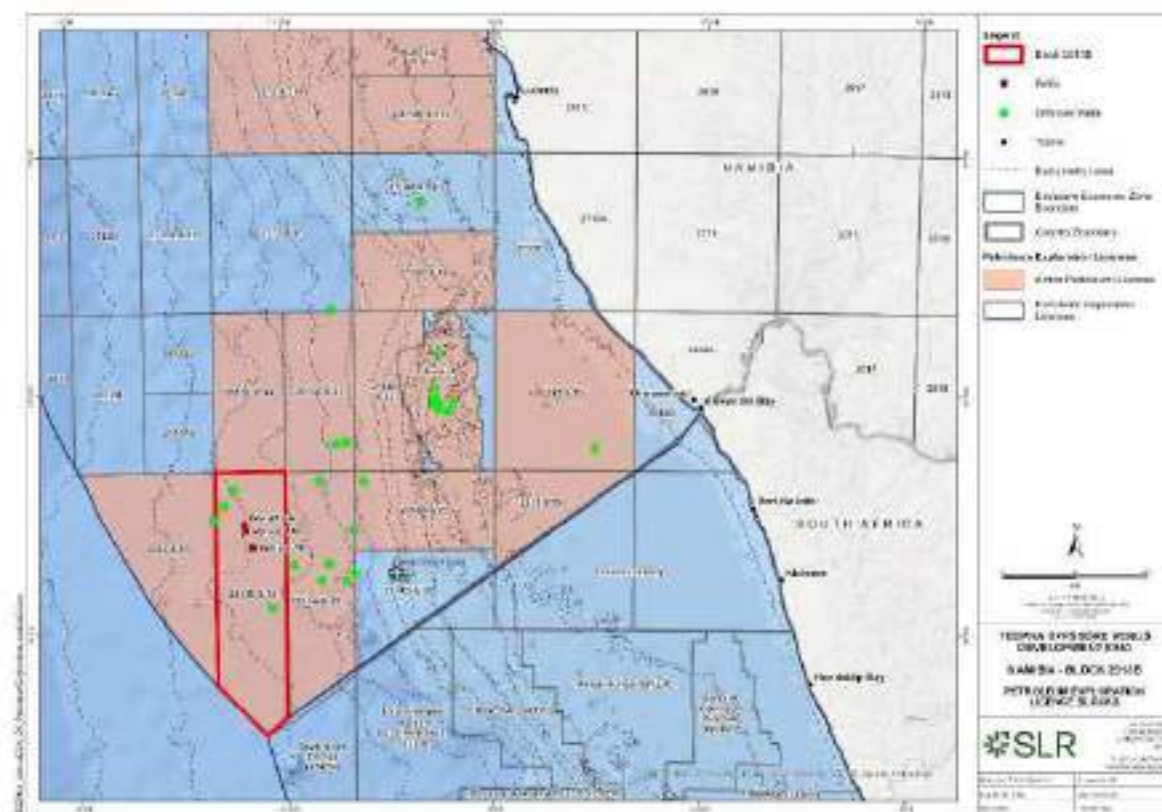


Figure 6-66: Block 2913B in relation to Petroleum Exploration and Production Licence Blocks.

Table 6-23: Overview of key Oil and Gas activities in the Southern Benguela region (southern Namibia) since 2007.

Application Year	Right holder / operator	Block	Activity	Activity completed
Southern Namibia Petroleum Exploration				
2024	BW Energy	Kudu	Exploration drilling	ESIA underway
2024	Rhino	Block 2914A	Exploration drilling	2025 ongoing
2024	Harmattan/Chevron	Block 2813B	Exploration drilling	2025 ongoing
2023	TEEPNA	Block 2913B	Exploration drilling	2025 ongoing
2023	TEEPNA	Block 2912	Exploration drilling	2023
2023	PGS	Blocks 2713, 2712A&B, 2812A&B, 2813A&B, 2814B, 2714A&B, 2614, 2613, 2612A&B	3D Seismic	2022-2023
2022	Searcher	Blocks 2614, 2613, 2612A&B, 2714A&B, 2713, 2712A&B, 2812B, 2813A, 2814A&B, 2912, 2913B, 2914A&B	2D and 3D Seismic	2023
2020	Tullow Namibia (Harmattan Energy)	Block 2813B (PEL90)	3D Seismic	2023
2020	TEEPNA	Block 2912, 2913B (PEL91; PEL56)	3D Seismic	Periodically since 2022
2020	TGS Namibia	Blocks 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2913B in the Orange Basin	3D Seismic	Yes



Application Year	Right holder / operator	Block	Activity	Activity completed
2019	Galp Namibia	PEL82	Exploration drilling	No
2019	Galp Namibia	PEL83	Exploration drilling	Yes
2019	TEEPNA	Block 2913B (PEL56)	Exploration drilling	Periodically since 2022
2018	Shell Namibia	PEL39	3D Seismic	Ongoing
2017	Shell Namibia	PEL39	Exploration drilling	Yes
2016	Spectrum	Southern Namibia regional	2D Seismic	2019
2014	Shell Namibia	2913A; 2914B	3D Seismic	2015
2013	Spectrum Namibia	Orange Basin multiclient	2D Seismic	2014
2011	Signet	Block 2914B (now part of PEL39)	2D and 3D Seismic; production facility	Unknown
2011	PGS	Block 2815	3D Seismic	3D: 2011 (HRT)

6.7.6.3 Mineral Prospecting and Mining

Diamond Prospecting and Mining

Marine diamonds are mined along the Southern African West Coast from the Olifants River mouth northwards to Walvis Bay. Diamonds are mined either in:

- Shallow waters (less than 30 m depths) by shore-based divers or small vessel-based divers who employ suction pipes to deliver gravel to land for sorting;
- Midwater (30 - 70 m depth) region, where remote operated tools are used; or
- Deep waters (more than 75 m), where custom mining equipment (undersea crawlers and large rotating drills) and high-pressure airlift suction is used.

Marine diamond mining is currently limited to the southern half of the Namibian offshore. Diamond Mining Licence (ML) Areas are shown in Figure 6-67. Current diamond mining activities are minimal to non-existent, with the only active operations being in ML-47 (Atlantic 1) held by Debmarine Namibia. Deep-water diamond mining operations in the Atlantic 1 Mining Licence Area are typically conducted to depths of 150 m.

The Venus field lies far offshore and does not overlap with any diamond mining activities. Nearshore transshipment operations may overlap with these activities.

Phosphate Prospecting and Mining

Phosphate deposits off Namibia were delineated during regional studies in the 1970's but have remained undeveloped to date. The deposits occur as unconsolidated seafloor sediments, which can be efficiently mined by applying currently available dredging technology. Preliminary reconnaissance sampling by Bonaparte Diamond Mines NL during 2007 demonstrated potential for enrichment to commercial grades (up to 35% P₂O₅) (MRA, 2008).

In 2011, the MIME granted mining licences to two companies Namibian Marine Phosphate (NMP) and LL Namibia Phosphates for licence areas located south-west of Walvis Bay⁵⁸. Strong opposition to the granting of these rights resulted in the Namibian government establishing a moratorium on offshore phosphate mining. A condition of the moratorium was that an independent and comprehensive EIA must be conducted. In 2016, NMP was awarded an ECC to mine offshore phosphates. Legal action against the issuing of the certificate was taken resulting in the High Court setting aside the ECC on concerns relating

⁵⁸ https://cer.org.za/wp-content/uploads/2016/06/CER_Factsheet3_web.pdf



to the local fishing industry (specifically monk fish) and the environment (Perks, 2016). However, in May 2018 NMP received a further High Court judgment winning back its Environmental Clearance Certificate for its marine phosphate EIA. Further legal action has since been ongoing regarding the validity of the mining licence (Russell, 2018).

The Venus field lies far offshore and does not overlap with any proposed phosphate mining activities. Nearshore transshipment operations may however overlap with proposed mining activities, dependant on the final transshipment locations as well as outcomes of the ongoing legal action.

6.7.6.4 Recreational Use

Traditional recreational coastal pursuits are less popular in this region than in many other coastal areas because of the cold water and generally cool, foggy climate. Coastal recreation may be either consumptive or non-consumptive. Due to access restrictions along the coastline between Lüderitz and Oranjemund (part of the Namdeb mining area) no recreational activities occur within this area.

Closer inshore, the ports of Lüderitz and Walvis Bay are fully operational and already supports existing commercial vessels. Thus, certified recreational and pleasure crafts have and continue to operate around the port and alongside existing commercial vessels.

Consumptive recreational uses involve collection of material from the sea for personal use. Recreational anglers (Brouwer, Mann, Lamberth, & Sauer, 1997) and divers target line-fish from either a boat or the shore, with shore-based divers also targeting West Coast rock lobsters. Rock lobsters are also exploited recreationally from boats with the use of hoop nets. Consumptive recreational use is carried out more regularly near coastal settlements (e.g. Henties Bay), although is of a limited nature off the coast of Namibia, largely due to access restrictions imposed by diamond mining concessions.

International and domestic tourism, a *non-consumptive recreational use*, is a major contributor (14.5%) to Namibia's GDP, creating approximately 18% of all employment (directly or indirectly). Offshore recreational and tourist activities which take place in the areas around Walvis Bay and Lüderitz include recreational boating, boat tours (including whale watching) and recreational angling. **The Venus field is located far offshore with overlap with nearshore recreational activities unlikely, while recreational activities may overlap with transshipment operations occurring closer to shore.**

6.7.6.5 Undersea Cables

A number of submarine telecommunications cable systems across the Atlantic and the Indian Ocean, five of which pass through Namibian waters, namely the African Coast to Europe (ACE), the West Africa Cable System (WACS), Equiano, 2Africa and South Atlantic Telecommunications cable No.3 / West African Submarine Cable / South Africa Far East (SAT3/WASC/SAFE) (see Figure 6-67). Both the ACE and WACS have cable landings and connections at Swakopmund. **The Venus field lies between the WACS-SAT 3 and Equiano submarine cables.** The exact positioning of WACS-SAT3 cable (closest to Venus field) in relation to proposed Venus development subsea layout was recorded during a geophysical acquisition campaign performed on Block 2913B in 2024, and confirmed that the current Venus development subsea layout is not impacting any subsea telecommunication cables.





6.7.6.6 Guano Harvesting

The Venus field lies far offshore from those activities, with nearshore transshipment operations likely taking place in waters deeper and further offshore than the guano platforms.

The Venus field overlaps directly with the large pelagic longline sector. Nearshore transshipment operations may overlap with linefish and large pelagic longline fisheries as well as small pelagic purse seine fisheries (should these reopen). Namibia promotes mariculture, particularly in Lüderitz's nutrient-rich waters, with allocated plots for various seafood cultivation. The block overlaps the main traffic route that passes around southern Africa. The coastal region south of Lüderitz is a restricted diamond mining area, which limits public access. Current diamond mining operations exist to depths of 150 m, and as such there is no overlap with the Venus field. The Venus field development does not overlap with submarine cables.

7.0 Environmental and Socio-Economic Screening of Key Impacts

This chapter provides a high-level screening of the interaction between the proposed activities and the receiving environment, as well as an activity-specific Aspects and Impacts Register to ensure that all environmental and social aspects of the proposed development project and the associated impacts are identified. Key potential impacts were identified by the ESIA project team on this basis and reviewed by I&APs during the DSR comment period. No additional issues were identified by I&APs during this DSR comment period. Specialists will, however, be required to confirm these, as well as identify any others, and assess the significance thereof.

This chapter also presents those impacts considered to be insignificant and the rationale for which they were screened out during the Scoping Phase (and will thus not be assessed in detail) (see Section 7.3).

7.1 Environmental and Socio-Economic Interaction Matrix

Potential impacts have been identified by examining the possible interactions of all proposed activities and associated aspects (described in Chapter 5.0) with the broad physical characteristics of the area of influence (described in Chapter 6.0), through which potential impacts on biological and social receptors (or features) in the area of influence could arise. The identified possible interactions are shown in the environmental and social interaction matrix in Table 7-1. Shaded cells indicate where proposed activities may interact with a certain physical characteristic and, in turn or directly with, biological or socio-economic receptors. Interactions are broadly grouped into minor interactions and potentially significant interactions (which need to be confirmed by specialist assessments).

During normal operations, the biological receptors that may be most affected by proposed activities include benthic communities, fish and marine mammals (although other receptors are also considered). Socio-economic receptors (or activities or resources) that may be most affected by proposed activities include fishing, income / livelihoods, maritime shipping, cultural heritage, and public health and safety. Contribution to climate change is also considered.

Potential interactions with receptors in the event of **unplanned events**, associated with potential activity risks such as vessel collisions, minor hydrocarbon spills, loss of equipment, well blow-out, were also considered to ensure a comprehensive assessment. These unplanned events are unlikely to occur, and measures are in place to actively prevent them in line with Industry Best Practice.

7.2 Aspects and Impacts Register

The activity-specific Aspects and Impacts Register identifies potential impacts⁵⁹ for each proposed activity and associated aspect⁶⁰ based on the interactions identified in Table 7-1. This systematic approach allowed for the planning of the scope of the specialist studies.

⁵⁹ An “impact” is any change to the environment, whether adverse or beneficial, wholly or partially resulting from the organisation’s activities, products or services.

⁶⁰ An “aspect” is the element of an organisation’s activities, products or services that can interact with the environment.



Table 7-1: Environmental and Social Interaction Matrix

See legend at the end of the table.

	Aspects associated with activities that can cause impacts	Physical characteristics potentially affected, which may affect sensitive receptors						Potentially affected sensitive receptors in the receiving environment																
								Biological receptors / resources								Socio-economic receptors / resources								
		Seabed characteristics	Water quality and turbidity	Underwater noise	Underwater light	Air emissions	Atmospheric noise	Atmospheric light	Benthic communities	Plankton	Fish	Seabirds	Turtles	Marine mammals	Nearshore habitats and communities	Protected /designated sensitive areas	Fishing	Commercial shipping	Livelihoods / Income	Maritime / cultural heritage	Visual / sense of place	Services availability	Public health and safety	Climate change effects
1. Normal Operations																								
Drilling and installation																								
Establishment of onshore logistics bases and mobilisation of staff	Procurement of facilities and services																							
	Employment of staff																							
Operation of drilling units and support / supply / installation vessels at Venus field	Presence and implementation of safety zones																							
	Underwater noise from manoeuvring and positioning																							
	Air emissions from drilling units and support / supply / installation vessels																							
	Lighting from drilling units and support / supply / installation vessels																							
	Discharges to sea from drilling units and support / supply / installation vessels																							
	Waste generation for disposal onshore																							
Well drilling and installation of well infrastructure	Underwater noise from drilling																							
	Seabed disturbance																							
	Discharge of drill cuttings, mud and residual cement																							
Vertical seismic profiling	Underwater noise from VSP operations																							



	Aspects associated with activities that can cause impacts	Physical characteristics potentially affected, which may affect sensitive receptors							Potentially affected sensitive receptors in the receiving environment														
									Biological receptors / resources								Socio-economic receptors / resources						
		Seabed characteristics	Water quality and turbidity	Underwater noise	Underwater light	Air emissions	Atmospheric noise	Atmospheric light	Benthic communities	Plankton	Fish	Seabirds	Turtles	Marine mammals	Nearshore habitats and communities	Protected /designated sensitive areas	Fishing	Commercial shipping	Livelihoods / Income	Maritime / cultural heritage	Visual / sense of place	Services availability	Public health and safety
Well flow testing	Non-routine flaring of hydrocarbons																						
Transit of helicopters	Atmospheric and underwater noise from helicopters																						
	Air emissions from helicopters																						
Transit of vessels	Underwater noise from vessels																						
	Air emissions from vessels																						
	Lighting from vessels																						
	Increased vessel traffic																						
Installation and commissioning of FPSO	Disturbance of seabed during installation of anchors																						
	Discharge at sea surface of various substances during commissioning																						
	Presence and implementation of safety zone																						
	Anti-fouling paint used on the FPSO hull																						
Installation and commissioning of subsea infrastructure at Venus field	Seabed disturbance																						
	Discharge near seabed of various substances used for cleaning and testing																						
	Presence and implementation of safety zone																						
	Disturbance of seabed during installation of anchor																						



	Aspects associated with activities that can cause impacts	Physical characteristics potentially affected, which may affect sensitive receptors							Potentially affected sensitive receptors in the receiving environment															
									Biological receptors / resources								Socio-economic receptors / resources							
		Seabed characteristics	Water quality and turbidity	Underwater noise	Underwater light	Air emissions	Atmospheric noise	Atmospheric light	Benthic communities	Plankton	Fish	Seabirds	Turtles	Marine mammals	Nearshore habitats and communities	Protected /designated sensitive areas	Fishing	Commercial shipping	Livelihoods / Income	Maritime / cultural heritage	Visual / sense of place	Services availability	Public health and safety	Climate change effects
Installation and commissioning of transshipment buoy in nearshore area	Presence and implementation of safety zone																							
Production and Operation																								
Operation of Venus field	Procurement of goods and services																							
	Employment of staff																							
	Contribution to State income																							
Operation of support vessels, FPSO and DPST at Venus field	Presence and implementation of safety zones																							
	Underwater noise from manoeuvring and positioning																							
	Presence of mooring chains																							
	Air emissions from DPST, FPSO and vessels																							
	Lighting from DPST, FPSO and vessels																							
	Discharges to sea from DPST, FPSO and vessels																							
	Abstraction of sea water																							
	Non-routine flaring of gas																							
	Waste generation for disposal onshore																							
Presence of subsea infrastructure at Venus field	Presence and implementation of safety zones																							
	Infrastructure on seabed																							
	Presence of radioactive materials in Xmas trees																							



	Aspects associated with activities that can cause impacts	Physical characteristics potentially affected, which may affect sensitive receptors							Potentially affected sensitive receptors in the receiving environment														
									Biological receptors / resources							Socio-economic receptors / resources							
		Seabed characteristics	Water quality and turbidity	Underwater noise	Underwater light	Air emissions	Atmospheric noise	Atmospheric light	Benthic communities	Plankton	Fish	Seabirds	Turtles	Marine mammals	Nearshore habitats and communities	Protected /designated sensitive areas	Fishing	Commercial shipping	Livelihoods / Income	Maritime / cultural heritage	Visual / sense of place	Services availability	Public health and safety
Transit of helicopters	Atmospheric and underwater noise from helicopters																						
	Air emissions from helicopters																						
Transit of vessels	Underwater noise from vessels																						
	Air emissions from vessels																						
	Lighting from vessels																						
	Increased vessel traffic																						
Nearshore transshipment	Presence of vessels and implementation of safety zones																						
	Presence of mooring buoy																						
	Underwater noise from manoeuvring and positioning																						
	Air emissions from DPST, tugs and conventional tanker																						
	Lighting from DPST, tugs and conventional tanker																						
	Discharges to sea from DPST, tugs and conventional tanker																						



	Aspects associated with activities that can cause impacts	Physical characteristics potentially affected, which may affect sensitive receptors							Potentially affected sensitive receptors in the receiving environment															
									Biological receptors / resources								Socio-economic receptors / resources							
		Seabed characteristics	Water quality and turbidity	Underwater noise	Underwater light	Air emissions	Atmospheric noise	Atmospheric light	Benthic communities	Plankton	Fish	Seabirds	Turtles	Marine mammals	Nearshore habitats and communities	Protected /designated sensitive areas	Fishing	Commercial shipping	Livelihoods /Income	Maritime / cultural heritage	Visual / sense of place	Services availability	Public health and safety	Climate change effects
Decommissioning																								
Shutdown of onshore logistics base and demobilisation of staff	Retrenchment of staff																							
	End of procurement																							
Operation of vessels involved in decommissioning at Venus field	Presence and implementation of safety zones																							
	Underwater noise from manoeuvring and positioning																							
	Air emissions from support / supply / decommissioning vessels																							
	Lighting from support / supply / decommissioning vessels																							
	Discharges to sea from support / supply / decommissioning vessels																							
	Waste generation for disposal onshore																							
	Transit of helicopters	Atmospheric and underwater noise from helicopters																						
	Air emissions from helicopters																							
Transit of vessels	Underwater noise from vessels																							
	Air emissions from vessels																							
	Lighting from vessels																							
	Increased vessel traffic																							
	Seabed disturbance during removal																							



	Aspects associated with activities that can cause impacts	Physical characteristics potentially affected, which may affect sensitive receptors							Potentially affected sensitive receptors in the receiving environment															
									Biological receptors / resources								Socio-economic receptors / resources							
		Seabed characteristics	Water quality and turbidity	Underwater noise	Underwater light	Air emissions	Atmospheric noise	Atmospheric light	Benthic communities	Plankton	Fish	Seabirds	Turtles	Marine mammals	Nearshore habitats and communities	Protected /designated sensitive areas	Fishing	Commercial shipping	Livelihoods / Income	Maritime / cultural heritage	Visual / sense of place	Services availability	Public health and safety	Climate change effects
Decommissioning of FPSO and subsea infrastructure including wells	Infrastructure left on seabed																							
	Discharge of residual plugging cement to seabed																							
	Hazardous waste generation																							
2. Unplanned Events																								
Operation and transit of drilling units, support / supply vessels	Marine diesel spill																							
	Loss of equipment at sea																							
Well drilling and installation of well infrastructure	Loss of well control / Blow-out																							
Well plugging and abandonment	Hydrocarbon leak from plugged well																							
Operation of the subsea infrastructure	Gas injection line rupture																							
Transshipment of hydrocarbons	Hydrocarbon spill																							
Legend																								
	No significant interaction		Interaction of aspects with key physical characteristics in the area of influence					Potential minor interactions screened out as described in Section 7.3					Potentially significant negative interaction to be assessed in the ESIA					Potentially significant positive interaction to be assessed in the ESIA						



Table 7-2: Aspects and Impacts Register

Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
1. Normal Operations			
Drilling and installation			
Establishment of onshore logistics bases and mobilisation of staff	Procurement of facilities and services	Income from local procurement and spending	Socio-economic
		State income from taxes and levies	Socio-economic
		Availability of services (e.g. port services, accommodation, transportation)	Minor – Screened out
	Employment of staff	Income and skills training for workers	Socio-economic
		Shortage of skills and labour	Socio-economic
Operation of drilling units and support / supply / installation vessels at Venus field	Presence and Implementation of safety zones	Displacement of fishing vessels and disruption of industry	Fisheries/Socio-economic
		Displacement of shipping vessels and disruption of industry	Socio-economic
	Underwater noise from manoeuvring and positioning	Behavioural disturbance of marine fauna	Marine ecology
		Physical and/or physiological injury to marine fauna	Marine ecology
		Changes in catch availability due to behavioural change in fish	Fisheries
	Air emissions from drilling units and support / supply / installation vessels	Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Lighting from drilling units and support / supply / installation vessels	Behavioural disturbance of marine fauna	Marine ecology
	Discharges to sea from drilling units and support / supply / installation vessels	Ecological effects from pollutants in water column from routine discharges ⁶¹	Minor – Screened out
		Deterioration of cultural heritage links to the sea due to potential pollution	Cultural heritage
		Alteration of ecological composition due to introduction of invasive aliens from ballast water discharge	Minor – Screened out
	Waste generation for disposal onshore	Availability of services	Minor – Screened out
Well drilling and installation of well infrastructure	Underwater noise from drilling	Behavioural disturbance of marine fauna	Marine ecology
		Physical and/or physiological injury to marine fauna	Marine ecology

⁶¹ Routine discharges refer to those common to most vessels, including grey and black water, waste food, bilge water, deck drainage and brine generated from onboard desalination



Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
	Seabed disturbance	Changes in catch availability due to behavioural change in fish	Fisheries
		Smothering and disturbance of benthic fauna	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Disturbance of archaeological material	Minor – Screened out
	Discharge of drill cuttings, mud and residual cement	Smothering and disturbance of benthic fauna	Marine ecology
		Ecological effects from pollutants in water column	Marine ecology
		Ecological effects from release of radioactive materials	Minor – Screened out
		Deterioration of cultural heritage links to the sea	Cultural heritage
Vertical seismic profiling	Underwater noise from VSP operations	Changes in catch availability due to behavioural change in fish	Fisheries
		Behavioural disturbance of marine fauna	Marine ecology
		Physical and/or physiological injury to marine fauna	Marine ecology
Well flow testing	Non-routine flaring of hydrocarbons	Changes in catch availability due to behavioural change in fish	Fisheries
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
		Ecological effects due to hydrocarbon 'drop out'	Marine ecology
Transit of helicopters	Atmospheric and underwater noise from helicopters	Behavioural disturbance of marine fauna due to flare lighting	Marine ecology
		Behavioural disturbance of marine fauna	Marine ecology
	Air emissions from helicopters	Sense of place/disturbance of coastal towns near helicopter base	Minor - Screened out
		Health effects from atmospheric pollution	Minor – Screened out
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
Transit of vessels	Underwater noise from vessels	Behavioural disturbance of marine fauna	Minor – Screened out
		Physical and/or physiological injury to marine fauna	Minor – Screened out
		Changes in catch availability due to behavioural change in fish	Minor – Screened out
	Air emissions from vessels	Health effects from atmospheric pollution	Minor – Screened out
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Lighting from vessels	Behavioural disturbance of marine fauna	Minor – Screened out
	Increased vessel traffic	Physical injury or mortality of marine fauna as a result of vessel collisions	Marine ecology
		Disruption to shipping industry	Socio-economic
		Disruption to fishing industry	Minor – Screened out
Installation and commissioning of FPSO	Disturbance of seabed during installation of anchors	Behavioural disturbance of marine fauna	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Disturbance of archaeological material	Minor – Screened out



Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
	Discharge at sea surface of various substances during commissioning	Ecological effects from pollutants in water column	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
	Presence and implementation of safety zones	Displacement of fishing vessels	Fisheries/Socio-economic
		Displacement of shipping vessels	Socio-economic
	Anti-fouling paint used on the FPSO hull	Ecological effects from pollutants in water column	Marine ecology
Installation and commissioning of subsea infrastructure at Venus field	Seabed disturbance	Smothering and disturbance of benthic fauna	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Disturbance of archaeological material	Minor – Screened out
	Discharge near seabed of various substances used for cleaning and testing	Ecological effects from pollutants in water column	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
	Presence and implementation of safety zones	Displacement of fishing vessels and disruption of industry	Fisheries/Socio-economic
Displacement of shipping vessels and disruption of industry		Socio-economic	
Installation and commissioning of transshipment buoy in nearshore area	Disturbance of seabed during installation of anchor	Smothering and disturbance of benthic fauna	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Disturbance of archaeological material	Minor – Screened out
	Presence and implementation of safety zones	Displacement of fishing vessels	Fisheries/Socio-economic
		Displacement of shipping vessels	Socio-economic
Production and Operation			
Operation of Venus field	Procurement of goods and services	Income from local procurement and spending	Socio-economic
		State income from taxes and levies	Socio-economic
		Availability of services	Minor – Screened out
	Employment of staff	Income and skills training for workers	Socio-economic
		Shortage of skills and labour	Socio-economic
		Crew presence in local communities during rotation	Socio-economic
	Contribution to state income	Increased Gross Domestic Product (GDP)	Socio-economic
Operation of support vessels, FPSO and DPST at Venus field	Presence and implementation of safety zones	Displacement of fishing vessels and disruption of industry	Fisheries/Socio-economic
		Displacement of shipping vessels and disruption of industry	Socio-economic
		Behavioural disturbance of marine fauna	Marine ecology
		Physical and/or physiological injury to marine fauna	Marine ecology



Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
	Underwater noise from manoeuvring and positioning	Changes in catch availability due to behavioural change in fish	Fisheries
	Presence of mooring chains	Physical injury of marine fauna (entanglement)	Marine ecology
	Air emissions from DPST, FPSO and vessels	Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Lighting from DPST, FPSO and vessels	Behavioural disturbance of marine fauna	Marine ecology
	Discharges to sea from DPST, FPSO and vessels	Ecological effects from pollutants in water column from routine discharges	Minor – Screened out
		Ecological effects from discharge of produced water	Marine ecology
		Deterioration of cultural heritage links to the sea due to potential pollution	Cultural heritage
		Alteration of ecological composition due to introduction of invasive aliens from ballast water discharge	Minor – Screened out
	Abstraction of sea water	Physical and/or physiological injury to marine fauna	Marine ecology
	Non-routine flaring of gas	Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
Presence of subsea infrastructure at Venus field	Waste generation for disposal onshore	Availability of services	Minor – Screened out
		Management of hazardous waste	Waste Management
	Presence and implementation of safety zones	Displacement of fishing vessels and disruption of industry	Fisheries/Socio-economic
		Displacement of shipping vessels and disruption of industry	Socio-economic
	Infrastructure on seabed	Modification of benthic habitat through additional hard substrate	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
Transit of helicopters	Presence of radioactive materials in Xmas trees	Ecological effects from pollutants in water column	Minor – Screened out
	Atmospheric and underwater noise from helicopters	Behavioural disturbance of marine fauna	Marine ecology
		Sense of place/disturbance of coastal towns near helicopter base	Minor - Screened out
Transit of vessels	Air emissions from helicopters	Health effects from atmospheric pollution	Minor – Screened out
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Underwater noise from vessels	Behavioural disturbance of marine fauna	Minor – Screened out
		Physical and/or physiological injury to marine fauna	Minor – Screened out
		Changes in catch availability due to behavioural change in fish	Minor – Screened out
	Air emissions from vessels	Health effects from atmospheric pollution	Minor – Screened out



Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Lighting from vessels	Behavioural disturbance of marine fauna	Minor – Screened out
	Increased vessel traffic	Physical injury or mortality of marine fauna due to vessel collisions	Marine ecology
		Disruption to shipping industry	Socio-economic
		Disruption to fishing industry	Minor – Screened out
Nearshore transshipment	Presence of vessels and Implementation of safety zones	Displacement of fishing vessels and disruption of industry	Fisheries/Socio-economic
		Displacement of shipping vessels and disruption of industry	Socio-economic
		Alteration of sense of place of coastal areas	Socio-economic
	Presence of mooring buoy	Modification of benthic habitat through additional hard substrate	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Physical injury of marine fauna (entanglement)	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Alteration of sense of place of coastal areas	Socio-economic
	Underwater noise from manoeuvring and positioning	Behavioural disturbance of marine fauna	Marine ecology
		Physical and/or physiological injury to marine fauna	Marine ecology
		Changes in catch availability due to behavioural change in fish	Fisheries
	Air emissions from DPST, tugs and conventional tanker	Health effects from atmospheric pollution	Air quality
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Lighting from DPST, tugs and conventional tanker	Behavioural disturbance of marine fauna	Marine ecology
	Discharges to sea from DPST, tugs and conventional tanker	Ecological effects from pollutants in water column from routine discharges	Minor – Screened out
		Deterioration of cultural heritage links to the sea due to potential pollution	Cultural heritage
		Human health effects from pollutants in water column due to discharges	Minor – Screened out
		Alteration of ecological composition due to introduction of invasive aliens from ballast water discharge	Minor – Screened out
Decommissioning			
Shutdown of onshore logistics base and demobilisation of staff	Retrenchment of staff	Job losses for workers	Socio-economic
	End of procurement	Loss of income from local procurement and spending	Socio-economic
		Loss of state income from taxes and levies	Socio-economic
		Displacement of fishing vessels and disruption of industry	Fisheries/ Socio-economic



Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
Operation of vessels involved in decommissioning at the Venus field	Presence and implementation of safety zones	Displacement of shipping vessels and disruption of industry	Socio-economic
	Underwater noise from manoeuvring and positioning	Behavioural disturbance of marine fauna	Marine ecology
		Physical and/or physiological injury to marine fauna	Marine ecology
		Changes in catch availability due to behavioural change in fish	Fisheries
	Air emissions from support / supply / decommissioning vessels	Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Lighting from support / supply / decommissioning vessels	Behavioural disturbance of marine fauna	Marine ecology
	Discharges to sea from support / supply / decommissioning vessels	Ecological effects from pollutants in water column from routine discharges	Minor – Screened out
		Deterioration of cultural heritage links to the sea due to potential pollution	Cultural heritage
		Alteration of ecological composition due to introduction of invasive aliens from ballast water discharge	Minor – Screened out
	Waste generation for disposal onshore	Availability of services (port services)	Minor – Screened out
Transit of helicopters	Atmospheric and underwater noise from helicopters	Behavioural disturbance of marine fauna	Marine ecology
		Sense of place/disturbance of coastal towns near helicopter base	Minor - Screened out
	Air emissions from helicopters	Health effects from atmospheric pollution	Minor – Screened out
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
Transit of vessels	Underwater noise from vessels	Behavioural disturbance of marine fauna	Minor – Screened out
		Physical and/or physiological injury to marine fauna	Minor – Screened out
		Changes in catch availability due to behavioural change in fish	Minor – Screened out
	Air emissions from vessels	Health effects from atmospheric pollution	Minor – Screened out
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
	Lighting from vessels	Behavioural disturbance of marine fauna	Minor – Screened out
	Increased vessel traffic	Physical injury or mortality of marine fauna due to vessel collision	Marine ecology
		Disruption to shipping industry	Socio-economic
		Disruption to fishing industry	Minor – Screened out



Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
Decommissioning of FPSO and subsea infrastructure including wells	Seabed disturbance during removal	Smothering and disturbance of benthic fauna	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Disturbance of archaeological material	Minor – Screened out
	Infrastructure left on seabed (including plugged wells)	Modification of benthic habitat through additional hard substrate	Marine ecology
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Displacement of fishing vessels	Fisheries
	Hazardous waste generation	Availability of services	Waste Management
2. Unplanned Events			
Operation and transit of drilling units, support / supply vessels	Marine diesel spill	Ecological effects from pollutants in water column	Marine ecology
		Displacement of fishing vessels and target species from polluted areas	Fisheries/Socio-economic
		Deterioration of cultural heritage links to the sea	Cultural Heritage
	Loss of equipment	Entanglement of fishing gear	Minor – Screened out
		Loss of income from any disruption of fisheries	Minor – Screened out
		Seafloor disturbance / damage to infrastructure on the seafloor	Minor – Screened out
		Deterioration of cultural heritage links to the sea	Minor – Screened out
Well drilling and installation of well infrastructure	Loss of well control / blow-out	Ecological effects from pollutants in water column	Marine ecology
		Displacement of fishing vessels and target species from polluted areas	Fisheries/Socio-economic
		Displacement of shipping vessels from polluted areas	Socio-economic
		Ecological effects from pollutants on the shore	Marine ecology
		Reduction of income from coastal livelihoods and recreation	Socio-economic
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Alteration of sense of place	Socio-economic
		Health impacts from atmospheric pollution	Air quality
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
Well plugging and abandonment	Hydrocarbon leak from plugged well	Ecological effects from pollutants in water column	Minor – Screened out
		Displacement of fishing vessels and target species from polluted areas	Minor – Screened out
		Displacement of shipping vessels from polluted areas	Minor – Screened out
		Ecological effects from pollutants on the shore	Minor – Screened out
		Reduction of income from coastal livelihoods and recreation	Minor – Screened out
		Deterioration of cultural heritage links to the sea	Minor – Screened out



Proposed Activities	Aspects associated with activities that can cause impacts	Potential impact	Proposed Specialist Study
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Minor – Screened out
Operation of the subsea infrastructure	Gas injection line rupture	Ecological effects from pollutants in water column	Marine ecology
		Displacement of target species from polluted areas	Fisheries/Socio-economic
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change
Transshipment of hydrocarbons	Hydrocarbon spill	Ecological effects from pollutants in water column	Marine ecology
		Displacement of fishing vessels and target species from polluted areas	Fisheries/Socio-economic
		Displacement of shipping vessels from polluted areas	Socio-economic
		Ecological effects from pollutants on the shore	Marine ecology
		Reduction of income from coastal livelihoods and recreation	Socio-economic
		Deterioration of cultural heritage links to the sea	Cultural heritage
		Alteration of sense of place	Socio-economic
		Health impacts from atmospheric pollution	Air quality
		Contribution to GHG emissions and increased carbon concentration in atmosphere	Climate change



7.3 Minor Screened Out Impacts

A number of potential impacts identified during the screening described in Sections 7.1 and 7.2 are deemed to be minor and not significant in the larger context of the proposed activities. This includes impacts that are commonplace in the marine environment, where existing legal requirements impose adequate management requirements, and/or where impacts are of a negligible intensity in relation to receiving environment before implantation of mitigation. These impacts have thus been screened out as discussed below and will not be formally assessed in the ESIA.

7.3.1 Availability of Services Supplying the Proposed Activities

The JV operator is not proposing to construct onshore facilities as part of this project. The plan is to use existing facilities and supply services (commercially available or imported).

Namibia has existing ports and facilities (including Walvis Bay and Lüderitz) and operators which service the oil and gas industry, including a range of offshore exploration and appraisal activities. Port Authorities are also in the process of expanding various Port infrastructure, which is subject to separate and dedicated permitting processes.

As offshore activities and associated demand for services increase, it is expected that more service providers will enter the market (and must obtain ECCs and other permits for their activities if required). Providers of non-specialised goods or services (e.g., accommodation or land-based transportation) may be able to expand faster than providers of fixed facilities (e.g., berthing space) or specialised goods and services (e.g., drilling muds and aerial transportation). However, there is no indication of supply shortages materially affecting offshore activities to date, or that the volume of existing goods and services cannot be expanded to meet increased market demand over time. While procurement will need careful planning and preparation, and may be a limiting factor, the associated economic stimulation will be reflected in the socio-economic impact assessment (see Section 8.1.2.4).

It is understood that none of the required logistics / support operations or goods are of such a nature, frequency, duration or volume that they would place undue pressure on local infrastructure or resources, and that they would consequently not materially affect supply to other current users. This is therefore not assessed as a negative impact of the project in this ESIA.

Solid wastes generated during the installation, operations and decommissioning activities will be transported to shore for further treatment and/or disposal at a licenced waste management facility approved by the operator. A waste management study will be conducted as part of this ESIA (see Section 8.1.2.9).

7.3.2 Ecological Effects due to Routine Discharges to Sea from vessels

Routine discharges considered in this section include grey and black water, waste food, bilge water, deck drainage and brine generated from onboard desalination⁶². The discharge of such substances can in principle have a number of impacts, including physiological effects on marine fauna from pollutants contained in the discharge, and attracting marine fauna and associated predator species to the vessel.

Such discharges are common to all ocean-going vessels and are regulated by national law and international conventions, such as MARPOL (see Section 2.4). Discharge volumes are directly proportional to the size of the vessel and crew.

⁶² The ecological impacts of production-related effluents from the FPSO, such as produced water, will be modelled and assessed.



The concentration of vessels, and associated crew, will be relatively high at the Venus field during certain construction periods extending over a number of months. However, the development area is located 300 km from the coast at its closest point in the open ocean, and discharges are expected to disperse rapidly to undetectable concentrations and are unlikely to have a material impact on water quality at the Venus field, provided that standard discharge mitigation is implemented.

Drilling units, supply and installation vessels and FPSOs are highly specialised vessels that are expected to fully implement standard international discharge management measures.

The following management measures must be implemented and will be included in the ESMP:

- Compile and implement a Waste and Discharge Management Plan that complies with MARPOL standards.
- Monitor and audit appropriate implementation of the Waste and Discharge Management Plan and MARPOL standards.

7.3.3 Introduction of Invasive Aliens due to Ballast Water Discharge

Ballast water is routinely used by offshore vessels to maintain safe operations. In this process, ballast water may be pumped into or out of the ballast water tanks of the vessel during a journey. Ballast water taken onboard will contain small marine organisms, some of which can survive the ballast water tanks. The discharge of ballast water in areas that are different from those where it was taken onboard can thus result in the release of marine organisms that are alien to the region where they are released. If these organisms are able to survive and proliferate in the new environment where they are released, they could then compete with native species and change the composition of the native ecosystem.

Such discharges are common to ocean-going vessels and are regulated by international conventions, such as the International Convention for the Control and Management of Ships' Ballast Water and Sediments (see Sections 2.4). The Convention requires that all ships using ballast water exchange will do so at least 50 nm ($\pm$ 93 km) from the nearest land and wherever possible 200 nm ($\pm$ 370 km) from the nearest land in waters at least 200 m deep when arriving from a different marine region, to minimise the chances of fauna carried in the ballast water surviving.

For the proposed installation, production and decommissioning activities, ballast water from different regions will likely be discharged once off (upon arrival in the project region) by the drilling units, FPSO, DPST and supply and installation vessels. These vessels are expected to remain in the broader project region for the duration of their engagement on the project. Commercial tankers are expected to arrive from ecologically different regions every time and would thus discharge ballast water with potentially alien organisms more frequently.

The development area of interest is located 300 km offshore, which is offshore of the minimum discharge distance requirement of the Convention. The area is, however, closer to the coast than the preferred discharge distance, and ballast water should be exchanged, where possible *en route* to the development area.

The nearshore transshipment area, which is the destination of commercial tankers, is located closer to the coast and hence more sensitive and vulnerable to potential alien invasives than the offshore Venus field. However, commercial tankers will approach the nearshore transshipment area from offshore and – as other vessels calling at Namibian ports – must effect ballast water exchange offshore.

Although a number of vessels will be engaged in the commissioning and production phases, the overall number of such additional vessels and, notably, new arrivals is relatively low compared to overall shipping traffic off the Namibian coast. Ballast water discharge from



project vessels is not considered to pose a materially higher risk than that from a multitude of other vessels traversing Namibian waters daily on the major commercial shipping routes and/or calling at Namibian ports. Drilling units and FPSOs are highly specialised international vessels that are expected to fully implement standard international discharge management measures.

The following management measures must be implemented and will be included in the ESMP:

- Compile and implement a Ballast Water Management Plan that complies with the International Convention for the Control and Management of Ships' Ballast Water and Sediments standards.
- Aim to exchange ballast water *en route* to the development area, in line with the preferred 200 nm distance from the coast.

7.3.4 Disturbance of Archaeological Material

No wrecks are known to occur or have been identified within Block 2913B during EBS, exploration and appraisal activities. Nevertheless, the possibility of identifying new shipwrecks or maritime debris remains, although of very low probability given the Block's offshore location.

In line with good practice, it is anticipated that prior to spudding the wells, an ROV will be used to finalise the well position based on the presence of any seafloor obstacles that may be observed. During such a survey any visible wrecks would more than likely be detected and, if detected, would be avoided as the drilling area should be free of obstacles to ensure optimal operations. The likelihood of finding and disturbing a shipwreck in this deep-water offshore environment is very small considering the vast size of the Namibian offshore area.

Should a wreck or ship remains be discovered, this would contribute to archaeological knowledge.

The following management measures must be implemented and will be included in the ESMP:

- Adjust the well location to avoid any marine underwater cultural heritage (shipwrecks) identified in pre-drilling environmental baseline survey or pre-spudding survey.
- If any historic shipwreck objects are found during the pre-spudding seafloor survey or after drilling commencement, which could potentially be impacted by the activity, work in the directly affected area should cease (if identified after drilling commencement) until the Namibian Heritage Council has been notified and the operator has complied with any additional mitigation as specified by the Authority, including any recommended buffer.

7.3.5 Release of Radioactive Material

The target resources are not expected to be naturally radioactive. Thus, drill cuttings are not expected to be radioactive.

If any radioactive materials are utilised in well drilling or testing tools, they would be of minimal volumes, contained and managed in line with the relevant legislation and guidelines for the management of radioactive sources. Contractors with the necessary accreditation and certification will handle radioactive sources and they will comply with necessary regulations for the transport, storage, and handling of radioactive devices. The testing does not generate radioactive wastes.

Any radioactive materials potentially contained in subsea equipment would be sealed and not in contact with the environment. Generation of hazardous waste during the decommissioning phase (e.g. from the decommissioning of such equipment) will be assessed.



7.3.6 Sense of Place/Disturbance of Coastal Towns near Helicopter Base

Sense of place impacts from the project could arise at coastal towns near the helicopter base due to increased aircraft traffic.

The increased use of helicopters to transport crew to and from the development area adds to an existing presence of such aircraft, and economic activity, at existing bases in Lüderitz or Oranjemund. The sense of place impacts are thus expected to be limited.

Helicopters transferring personnel for the project will adhere to the Civil Aviation Act, 2016 (No. 6 of 2016) and associated regulations.

7.3.7 Ecological, Human Health and Fishing Impacts from Vessels during Transit to and from Project Site

Vessels conducting various activities for this project (e.g. drilling, installation, transportation of supplies to and oil from the Venus field, transportation of produced crude oil) will arrive from other areas to the project site and leave the site after completing their tasks. During such transit to and from the project area the vessels emit noise (associated with propellers), air pollutants (associated with fuel burning), light (associated with deck and position lights) and routine discharges (discussed in Section 7.3.27.3.9).

Such emissions are common to all ocean-going vessels, including fishing boats, cargo ships and passenger / cruise ships and transient in relation to any one area.

The impacts associated with project vessels during transit to and from the site are not considered to pose a higher risk than those from a multitude of other vessels traversing Namibian waters daily on the major commercial shipping routes and fishing areas. Vessels implementing works for this project are generally specialised vessels from reputable contractors that are expected to fully implement international best practice to manage such effects.

7.3.8 Human Health Effects due to Air Emissions from Helicopters during Transit to and from Project Site

Helicopters will be used to transfer personnel from the shore to the project site on a regular basis, and in medical emergencies. During such transits, including take-off and landing at a coastal location, the helicopters will emit air pollutants (associated with burning of Jet-A1 (i.e. jet fuel)). Such emissions are common to all aircraft and transient in relation to any one area.

Air emissions associated with project helicopters are not considered to pose a higher risk than other aircraft operating in the region. Helicopters transferring personnel for the project will adhere to the Civil Aviation Act, 2016 (No. 6 of 2016) and associated regulations.

Emissions from helicopters will be included in the air emissions and greenhouse gas inventory compiled for the Air quality Impact Assessment and Climate Change Risk Assessments (see Sections 8.1.2.7 and 8.1.2.8), however the impact to human health is considered negligible.

7.3.9 Human Health Effects due to Discharges to Sea in Nearshore Area

Discharges considered in this section from a human health perspective include routine discharges and other effluents used during commissioning or equipment maintenance in the nearshore transshipment area. These effluents may contain pollutants and harmful substances which could pose health risks if humans would come into contact with them or ingest them. Most of these discharges are regulated by national law and international conventions, such as MARPOL (see Section 2.4), and dealt with in TotalEnergies company policies.



Discharges are expected to disperse rapidly to undetectable concentrations and are not expected to have health impacts on coastal receptors.

The following management measures must be implemented and will be included in the ESMP:

- Compile and implement a Waste and Discharge Management Plan that complies with MARPOL standards.
- Monitor and audit appropriate implementation of the Waste and Discharge Management Plan and MARPOL standards.

7.3.10 Accidental Loss of Equipment at Sea

It is conceivable that some equipment may be lost overboard during vessel manoeuvring and/or installation and production activities. This could result in potential disturbance and damage to seabed habitats and associated fauna where the equipment settles on the seabed, and/or injury or mortality to pelagic and neritic marine fauna due to collision with or entanglement in equipment drifting on the water surface or in the water column. Equipment on the seafloor could also provide a localised area of hard substrate for colonisation by benthic organisms.

Loss of equipment during transit is in principle common to all ocean-going vessels, and it is not expected that the risk of equipment loss is considerably higher, or more consequential, for the project-related vessels that will operate as part of this project.

During installation, project vessels will purposefully lower various types of equipment overboard for placement or activities on the seabed. The risk of accidental loss of equipment is in principle higher during such activities. However, most equipment used during the activities is highly specialised and costly, and crews are trained in the respective activities, and it is expected that every effort will be made to avoid equipment loss. The overall number of incidences and therefore effect of lost equipment is expected to be very limited in the context of the ocean environment, busy shipping traffic and other equipment that is purposefully placed on the seabed (this impact will be assessed).

The following management measures must be implemented and will be included in the ESMP:

- Ensure containers are sealed / covered during transport and loads are lifted using the correct lifting procedure and within the maximum lifting capacity of crane system.
- Minimise the lifting path between vessels.
- Ensure that procedures include measures to minimise risk of loss of survey equipment and mitigations should loss occur.
- Maintain an inventory of all equipment and undertake frequent checks to ensure items are stored and secured safely on board each vessel.
- Attempt to retrieve lost equipment.
- Notify the Directorate of Maritime Affairs (DMA) and SANHO of any hazards left on the seabed or floating in the water column, with the dates of abandonment/loss and locations and request that they send out a Notice to Mariners with this information.

7.3.11 Hydrocarbon leak from plugged well

Well plugging and abandonment are undertaken to ensure safe closure of offshore wells. Wells are sealed, plugged, tested for integrity and abandoned according to international best practices. The ultimate goal of these measures is to provide permanent containment of any



remaining formation fluids and to prevent migration from the reservoir to the seabed, i.e. isolate permeable and hydrocarbon bearing formations.

The principal technique applied to prevent cross flow between permeable formations is plugging of the well with cement, thus creating an impermeable barrier between two zones. The integrity of cement plugs can be tested by a number of methods. The cement plugs will be tag tested (to validate plug position) and weight tested, and if achievable then a positive pressure test (to validate seal) and/or a negative pressure test will be performed. Additionally, a flow check may be performed to ensure sealing by the plug.

The integrity of cement plugs will be validated either by physical tests (i.e. tag or weight test) or pressure tests according to the international standards and recommended best practice (API RP 65-3).

A leakage of hydrocarbons from an abandoned well could occur through a compromised well barrier either by degradation overtime or natural seepage, or both. However, given that the wells will be plugged and abandoned at the end the production, when hydrocarbons in the reservoir have largely been depleted, pressures and quantities in the reservoir would be low and therefore a leak from an abandoned production well is unlikely.



8.0 Terms of Reference for Detailed Assessment

An overview of the ESIA and public consultation process, highlighting each phase and corresponding activities, is provided in Sections 3.4 and 3.5, respectively. An outline of the planned specialist investigations is included in Section 8.1 below.

The specialist findings, mitigation, recommendations and other relevant information will be integrated into an ESIA Report and ESMP. The ESMP will provide recommendations on how to establish, operate, maintain and close the proposed activities throughout all relevant phases of the development of the offshore Venus field. The aim of the ESMP will be to ensure that the proposed activities are managed to avoid or reduce potential negative environmental impacts and enhance potential positive environmental impacts. The ESMP will detail the impact management objectives, outcomes and actions as required, the responsibility for implementation and the schedule and timeframe. Requirements for monitoring of environmental aspects, as well as compliance monitoring and reporting, will also be detailed.

Future public consultation that will be undertaken during the Impact Assessment Phase is summarised in Section 3.5.3.

8.1 Technical and Specialist Studies to be Undertaken

The terms of reference for the technical modelling and specialist studies are presented in Section 8.1.1 and 8.1.2 below. These terms of reference have been designed to address all the issues that have been identified during the Scoping Phase.

The technical modelling studies (including drilling and liquid effluent discharges, oil spill and underwater noise) will not assess any potential impacts as such, but rather provide supporting information for use in the other specialist studies, which will review and interpret data relevant to identifying and assessing environmental and social impacts that might occur as a result of the proposed development and production activities in their particular field of expertise.

The specialist studies will provide baseline information, identify and assess impacts (refer to Section 7.2) according to predefined impact assessment criteria (see Section 8.2). Specialists will apply the mitigation hierarchy by identifying and recommending actions in sequential order of priority by first seeking to avoid impacts and where avoidance is not possible suggest ways in which negative impacts could be mitigated and benefits could be enhanced.

The results of the technical modelling and specialist studies will be integrated into the Draft ESIA Report.

8.1.1 Technical Studies

8.1.1.1 Drilling Discharges Modelling

The specific terms of reference for the drilling discharges study are as follows:

- Provide a description of the metocean conditions, such as winds and ocean currents in Block 2913B, using the SAT-OCEAN hindcast dataset (2017-2024).
- Model the transport, dispersion and bottom deposition of drill cuttings and associated mud discharged during drilling operations over four seasons using the DREAM



(Dose-related Risk and Exposure Assessment Model)⁶³ and PARTRACK⁶⁴ model. Since the proposed development strategy may potentially involve the drilling of up to three wells simultaneously, two different strategies will be used to model the sediment and water column simulations (the modelling scenarios are described further in Table 8-1):

- o *Sediment simulation*: Since drilling discharges remain on the seabed for a longer period than in the water column, the seabed footprint from multiple releases may overlap and accumulate. Thus, the modelling will consider a well pair⁶⁵ which will then be replicated to account for the cumulative deposition of drilling material from discharge at multiple locations.
- o *Water column simulation*: Since drilling discharges in the water column are ephemeral, typically lasting only a few days, impacts from multiple releases may only overlap and accumulate if wells are drilled simultaneously in close proximity. Thus, in order to account for the total water column concentration, the modelling will consider the concurrent drilling of three well pairs in close proximity taking cognisance of the indicative drilling strategy and schedule.
- Modelling parameters should include aspects such as type and quantity of drilling fluids used and constituents, depth of discharge and volume of cuttings.
- Present results in relation to the drilling area and include the assumptions, modelling parameters and any limitations of the modelling exercise. Modelling outputs are presented in Table 8-1.

Further details on the relevant parameters and assumptions used in the drilling discharges modelling study will be provided in the Impact Assessment Phase.

Table 8-1: Proposed drilling discharge modelling scenarios.

No.	Scenario	Key assumptions / considerations
D1	<u>Drilling phase:</u> Sediment deposition footprint (<i>Venus field</i>)	• Model one well pair using a representative “worst-case” location taking cognisance of the following criteria: - o Distance from the coast; - o Water depth; - o Proximity of protected areas (including MPAs and EBSAs); and - o Metocean dataset. • Transpose modelling results of representative well pair for all 20 well pairs (20 OP and 20 GI wells) to determine the cumulative deposition footprint. • Perform simulations over four seasons, including: - o Season 1: December to February; - o Season 2: March to May; - o Season 3: June to August; and

⁶³ DREAM calculates the physical/chemical fates of the various compounds in the discharge in three dimensions plus time. The model includes processes like near-field mixing, dilution in the sea due to currents and turbulence, and biodegradation of organic compounds in the discharge. The model can include hundreds compounds simultaneously in the discharge and multiple release locations.

⁶⁴ PARTRACK is a model that simulates the release of drilling muds, cuttings, and chemicals from offshore drilling units. Given model inputs such as ambient currents and densities, chemical and physical properties of the effluent, and details of the release scenario, PARTRACK simulates the release and spreading of the effluent within a 3D ocean grid.

⁶⁵ As noted in Section 5.3.1.1, OP and GI wells will be sited in pairs, i.e. two wells be located close to each other. OP wellhead pairs will be located some ~4 km from each other, while GI wellheads pairs will be located some ~2 km from each other.



No.	Scenario	Key assumptions / considerations
		- Season 4: September to November. - The following thresholds will be applied: - The threshold level of hypoxia is 20% (i.e. 20% reduction in oxygen concentrations) (Predicted No-Effect Concentration (PNEC)); - The threshold of toxicity of chemicals is dependent on each component (cuttings, particulate matter and chemicals) (PNEC of each component); - The threshold of deposition thickness is 6.5 mm (PNEC); and - Considering that the local median grain-size is 10 μm, to have a significant risk (> 5%), the increase of the median grain-size must be above 115 μm. Modelling Outputs: - Sediment stressors associated significant risk⁶⁶ (above 5%) and Environmental Impact Factor (EIF⁶⁷). For the selected well pair, the results should be presented for the following stressors: - Burial of organisms (sediment thickness); - Change in sediment structure (grain-size change); - Oxygen depletion; and - Toxicity of all chemicals (total concentration). - For the integration of multiple wells (cumulative impact), only the results related to sediment thickness stressor can be presented and not the other stressors (e.g. oxygen depletion, etc.).
D2	<u>Drilling phase:</u> Water column plume (<i>Venus field</i>)	- Model three well pairs drilled concurrently in close proximity taking cognisance of the indicative drilling strategy and schedule (which will determine the representative “worst-case” location). Each well pair will be treated as one location, but for double the discharge duration and volume. - Perform simulations over four seasons (refer to scenario D1). - The threshold of toxicity of chemicals depends on each component (cuttings, particulate matter and chemicals) (PNEC of each component) Modelling Outputs: - Water column stressors (total concentration) associated significant risk (above 5%) and EIF for the three selected drill locations. The results are related to the following stressors: - Toxicity of all chemicals; and - Physical effects of suspended matter.

⁶⁶ In this study, risk is defined as an environmental assessment calculated by using the relationship between environmental exposure (Predicted Environmental Concentration - PEC) and sensitivity (Predicted No Effect Concentration - PNEC) to various stressors. Essentially, if a simulated stressor concentration (PEC) exceeds its environmental sensitivity threshold (PNEC), it represents a risk above 5%, indicating that more than 5% of the community (primarily the most sensitive species) may be impacted by the discharge. This study will thus refer to a risk above 5% as significant risk.

⁶⁷ In this study, EIF can be described as an integrated measure of the overall probability of damage caused by different stressors. It is an important result to identify how each stressor contributes to the risk. The EIF calculation is done by estimating the spatial extent over which the integrated risk exceeds 5% in terms of volume ($\times 10^5 \text{ m}^3$).



8.1.1.2 Liquid Effluent Discharges Modelling

The specific terms of reference for the liquid effluent discharges study are as follows:

- Provide a description of the metocean conditions, such as winds and ocean currents in Block 2913B, using the SAT-OCEAN hindcast dataset (2017-2024).
- Model both the discharge of produced water and flowline commissioning effluent over four seasons using the DREAM model:
 - o *Produced water:* Model a single representative “worst-case” scenario considering a release of produced water from the FPSO vessel.
 - o *Commissioning effluent:* Model a single representative “worst-case” scenario considering a release of commissioning effluent from one gas injection flowline.
- Present results in relation to the licence area and include the assumptions, modelling parameters and any limitations of the modelling exercise. Modelling outputs are presented in Table 8-2.

Further details on the relevant parameters and assumptions used in the liquid effluents discharges modelling study will be provided in the Impact Assessment Phase. Modelling scenarios that have been screened out are presented in Table 8-3.

Table 8-2: Proposed liquid effluent discharge modelling scenarios.

No.	Scenario	Key assumptions / considerations
E1	<u>Production phase:</u> Discharge of produced water in the water column (Venus field)	• Model the discharge of produced water from the FPSO vessel. • Release will be 15 m below sea surface, vertically downwards through a 14” pipe. • Perform simulations over four seasons, including: - o Season 1: December to February; - o Season 2: March to May; - o Season 3: June to August; and - o Season 4: September to November. • Different thresholds will be used for each component depending on the indicative produced water composition (i.e. each component has a specific PNEC). Modelling Outputs: • Dilution of the effluent on the water column (total concentration), associated significant risk (above 5%) and EIF.
E2	<u>Installation phase:</u> Discharge of commissioning effluent near to seabed (Venus field)	• Model a release volume related to the commissioning of a single gas injection pipe using a representative “worst-case” location taking into account proximity of sensitive areas (e.g. Tripp seamount); and • Perform simulations over four seasons (refer to scenario E1). • Different thresholds will be used for each component depending on the indicative produced water composition (i.e. each component has a specific PNEC). Modelling Outputs: • Dilution of the effluent on the water column (total concentration), associated significant risk (above 5%) and EIF.



Table 8-3: Effluent discharge modelling scenarios that have been screened out.

No.	Scenario	Description and rationale for exclusion
EE1	<u>Production phase:</u> Brine (<i>Venus field</i>)	- Seawater is desalinated on the FPSO, drilling unit and some support vessels for fresh water and other purposes. The waste stream from the desalination plant is brine (concentrated salt), which is produced in the reverse osmosis process. The brine stream contains high concentration of salts and other concentrated impurities that may be found in seawater. Water chemical agents will not be used in the treatment of seawater and therefore the brine is a natural salt in concentrated state. - No modelling required because the brine is a natural salt, although in concentrated state, produced in small volume (refer to project description in Chapter 5.0 for further detail), and released in the open ocean ± 240 km offshore from the nearest coast.
EE2	<u>All phases:</u> Sewage (<i>Venus field and nearshore</i>)	- Discharges of sewage (or black water) and grey water (i.e. wastewater from the kitchen, washing and laundry activities and non-oily water used for cleaning) will occur from all vessels intermittently throughout the project and will vary according to the number of persons on board. - Such discharges are common to all ocean-going vessels and are regulated by national law and international conventions, such as MARPOL. - No modelling required because small volume and treated to international standards prior to discharge.
EE3	<u>All phases:</u> Deck drainage (<i>Venus field and nearshore</i>)	- Vessel deck drainage consists of liquid waste resulting from rainfall, deck and equipment washing (using water and a water-based detergent). Contaminated or hazardous deck drainage is collected and directed into sump tanks on board for treatment prior to discharge to ensure MARPOL compliance. - Such discharges are common to all ocean-going vessels and are regulated by national law and international conventions, such as MARPOL Annex I (i.e. oil in water concentration less than 15 ppm prior to discharge overboard). There will be no discharge of free oil that could cause either a film, sheen or discolouration of the surface water or a sludge or emulsion to be deposited below the water's surface. - No modelling required because small volume and treated to international standards prior to discharge.
EE4	<u>Production phase:</u> Cooling water (<i>Venus field</i>)	- Seawater will be abstracted for cooling a separated closed loop of the FPSO and discharged at a higher temperature (~ 40 °C). Refer to project description in Chapter 5.0 for further detail. - Design is such that TEEPNA standard of maximum 3 °C differential within 100 m will be achieved. - No modelling required because the process is designed to achieve above-mentioned standards. Thus, zone of impact is known (i.e. 100 m from FPSO).
EE5	<u>Production phase:</u>	- FPSO slops include bilge water, drain water, spills, lab effluent, etc. - Volume is in the same order as produced water, but discharge is not regular.



No.	Scenario	Description and rationale for exclusion
	Slops / machinery space (bilge) drainage (Venus field)	- Slops discharges are regulated by national law and international conventions, such as MARPOL Annex I (i.e. oil in water concentration less than 15 ppm prior to discharge overboard). - No modelling required as small volume, discharge is not continuous and is treated to international standards prior to discharge (similar standards as produced water for oil content, which is being modelled).

8.1.1.3 Oil Spill Modelling

The specific terms of reference for the oil spill modelling study are as follows:

- Provide a description of the metocean conditions, such as winds and ocean currents in Block 2913B, using the SAT-OCEAN hindcast dataset (2017-2024).
- Model the trajectory and fate of the following spill scenarios at nearshore location(s) using the Oil Spill Contingency and Response (OSCAR)⁶⁸ modelling tool, if feasible using the SAT-OCEAN hindcast dataset, or assess qualitatively⁶⁹ (the modelling scenarios are described further in Table 8-4):
 - Spill during crude oil transshipment*: Model the trajectory and fate of a spill during oil transshipment from the DPST to commercial tanker
 - Loss of vessel fuel tank*: Model the trajectory and fate of a catastrophic instantaneous release of marine diesel from a tug.
- Model the trajectory and fate of the following spill scenarios in the Venus field using the OSCAR modelling tool (the modelling scenarios are described further in Table 8-4):
 - Well blow-out*: Model the trajectory and fate of a well blow-out of light oil (stochastic and deterministic) based on one spill location.
 - Loss of rig fuel tank*: Model the trajectory and fate of a catastrophic instantaneous release of marine diesel from a drilling unit tank.
- Present results in relation to the Venus field and coast, and include the assumptions, modelling parameters and any limitations of the modelling exercise. Modelling outputs are presented in Table 8-4.

Further details on the relevant parameters and assumptions used in the oil spill modelling study will be provided in the Impact Assessment Phase. Modelling scenarios that have been screened out are presented in Table 8-5.

Table 8-4: Proposed oil spill modelling scenarios.

No.	Scenario	Key assumptions / considerations
O1	Production phase: Spill during transshipment of oil from DPST to conventional tanker (<i>Nearshore</i>)	- If feasible using the SAT-OCEAN hindcast dataset, model a release of light oil at nearshore transshipment location(s). - Perform simulations over four seasons with and without spill response, including:

⁶⁸ OSCAR computes the fate and weathering of oil, in order to simulate the oil's drift, concentration and extent, on the sea surface and/or the shoreline. This tool offers the means to quantify potential environmental impacts caused by hydrocarbons spills and to identify the appropriate spill response strategy (dispersants, containment and mechanical recovery). OSCAR uses surface spreading, advection, entrainment, emulsification, and volatilization algorithms to determine the transport and fate of the oil on the surface.

⁶⁹ As the OSCAR model is a high-resolution model, and as such requires a suitable hydrodynamic model. As such the SAT-Ocean offshore hindcast dataset may not be suitable for use within 10 km from the coast. If not suitable, the nearshore spills will be qualitatively assessed.



No.	Scenario	Key assumptions / considerations
		- o Season 1: December to February; - o Season 2: March to May; - o Season 3: June to August; and - o Season 4: September to November. • The following thresholds will be applied: - o Surface: 5 µm thickness for crude oil and 0.3 µm thickness for diesel, considering oil at least in metallic appearance according to Bonn Agreement Oil Appearance Code (BAOAC). This is more conservative than the thickness that would impart a lethal dose to an intersecting wildlife individual (10 µm) according French-McCay (2009). This value was also chosen because it is the minimum thickness to remove it from the surface or use dispersant application. - o Water column: 58 ppb, following the OLF (the Norwegian Oil Industry Association) Guideline for risk assessment of effects on fish from acute oil pollution (2008) that indicate the value proposed by Neilson et al. (2005) for acute exposure to dispersed oil to various aquatic species. - o Shoreline oiling: 10 g/m². This is based on the literature reviews and analyses described in French-McCay et al. (2016) and French-McCay et al. (2018). Modelling Outputs: • Stochastic Simulation: - o Probability of oil on the sea surface. - o Probability of oil in the water column. - o Minimum Arrival Time at Surface. - o Minimum Arrival Time at Onshore. - o Maximum Mass Onshore. - o Mass Balance. • Deterministic Simulation: - o Results of oil on the surface. - o Vertical profiles of the total concentration. - o Mass Balance.
O2	<u>Production phase:</u> Loss of fuel from vessel tank (Nearshore)	• If feasible using the SAT-OCEAN hindcast dataset, model a release of marine diesel from a vessel at nearshore transshipment location(s) taking cognisance of the following: - o Distance from the coast and sensitive coastal receptors (e.g. islands, mariculture, etc.); - o Water depth; - o Proximity of protected areas (including MPAs and EBSAs); and - o Metocean dataset. • Perform simulations over four seasons (refer to Scenario O1) with and without spill response.



No.	Scenario	Key assumptions / considerations
		- The thresholds listed in Scenario O1 will be applied (surface thickness for diesel at 0.3 µm).. Modelling Outputs: - As per Scenario O1.
O3	<u>Production phase:</u> Loss of fuel from rig tank (<i>Venus field</i>)	- Model a catastrophic instantaneous release of marine diesel from a rig tank using a representative “worst-case” location taking cognisance of the following: - Distance from the coast and sensitive coastal receptors (e.g. islands, mariculture, etc.); - Water depth; - Proximity of protected areas (including MPAs and EBSAs); and - Metocean dataset. - Perform simulations over four seasons (refer to Scenario O1) with and without spill response. - The thresholds listed in Scenario O1 will be applied (surface thickness for diesel at 0.3 µm). Modelling Outputs: - As per Scenario O1.
O4	<u>Drilling phase:</u> Well blow-out (<i>Venus field</i>)	- Model a release of light oil using a representative “worst-case” location taking cognisance of the criteria listed in Scenario O3. - The duration of spill will be based on the estimated time taken to cap the well (as specified in the blow-out contingency plan). - Perform simulations over four seasons (refer to Scenario O1) with and without spill response. - The thresholds listed in Scenario O1 will be applied. Modelling Outputs: - As per Scenario O1.

Table 8-5: Oil spill modelling scenarios that have been screened out.

No.	Scenario	Description and rationale for exclusion
OE1	<u>Production phase:</u> Spill during crude oil transfer from FPSO to DPST (<i>Venus field</i>)	- This scenario can be covered by Scenario O3 (see Table 8-3), which is expected to provide for a larger spill volume from a rig tank spill. Assumption: Marine Gas Oil is similar to light oil from the reservoir. - This scenario deals with a spill from transfer hose in the Venus field. - There are various safeguards in place in terms of secure connection characteristics, 2nd barrier to stop flow (automatic redundancy), load position on vessel



No.	Scenario	Description and rationale for exclusion
		etc., which will reduce the probability and size of a spill during transfer.
OE2	<u>All phases:</u> Loss of fuel from vessel tank (<i>Venus field</i>)	This scenario deals with a fuel leak from a vessel tank. This scenario can be covered by Scenario O3 (see Table 8-3), which provides for a larger spill volume from a rig tank spill.
OE3	<u>Production phase:</u> Oil pipe leak (<i>Venus field</i>)	- This scenario deals with an oil leak from oil production line. - Pressure at seabed (~300 bar) exceeds upward pressure from well (~220 bar); thus, seawater would push in rather than the oil flowing out.
OE4	<u>Production phase:</u> Gas pipe leak (<i>Venus field</i>)	- This scenario deals with an oil leak from gas injector flowline. - Gas is pumped (injected) at pressure that exceeds water pressure (~620 bar at seabed and 593 bars at topsides); thus, rupture would mean gas in the pipeline would escape. - Loss could be inventory of line plus 15-30 minutes reaction time before shut down of compressor on FPSO. - The extent of the potentially impacted area by underwater gas blowout is much more limited to the vicinity of the leakage and is not comparable to the extent of the potentially impacted area by oil. The approach of assuming that the immediate vicinity of the leak would be impacted in the event of a gas leak is considered sufficient for assessment purposes.

8.1.1.4 Underwater Noise Modelling

The specific terms of reference for the underwater noise modelling study are as follows:

- Identify significant sources of underwater noise in relation to operation activities and quantify the typical noise characteristics of these sources (such as the source level, the frequency content and the temporal characteristics, etc.).
- Investigate the baseline underwater noise environment based on a review of available baseline noise data for the area of interest, or relevant metocean data (e.g., current, wind, etc.) when the noise measurement data are not available.
- Establish noise exposure assessment criteria for the identified marine fauna species to be assessed, based on applicable guidelines or regulatory requirements.
- Undertake detailed marine noise modelling predictions, for six modelling scenarios (see Table 8-6), as outlined below:
 - VSP airgun array source levels will be modelled using the Gundalf Designer software package, including the far-field signatures, directivities and beam patterns;
 - Drilling, installation and production operations source levels for the proposed project vessels will be derived using empirical formula based on the detailed specifications of the vessels.
 - Broadband noise propagation transmission loss will be modelled using the fluid parabolic equation modelling algorithm RAMGeo at one-third octave band central frequencies;



- o The received levels, as a function of range, depth and frequency, will then be obtained via combination of source spectral levels and transmission loss modelling results; and
- o Cumulative sound exposure level (SEL_{cum}) modelling prediction will be performed considering relevant cumulative operational characteristics (such as exposure duration, VSP discharges, etc.), in line with the “Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area” (ACCOBAMS) guidelines.
- o Post-processing and analysis of the above modelling results will be undertaken to derive relevant zones of impact for injury and behaviour.

Modelling scenarios that have been screened out are presented in Table 8-7.

Table 8-6: Proposed underwater noise modelling scenarios.

No.	Scenario	Key assumptions / considerations
U1	<u>Drilling phase:</u> Cumulative vessel noise during initial well drilling at Venus field (non-impulsive noise) <i>Maximum concentration of vessels before start of SPS installation</i>	• Modelling to consider concurrent drilling of three wells in close proximity taking cognisance of the indicative drilling strategy and schedule (which will determine the representative “worst-case” location). • Modelling to consider a total of seven vessels, each using dynamic positioning (DP), working at nearby well locations: - o Three drill ships; - o Three supply vessels; and - o One support vessel (on standby within the larger Venus field). Modelling Outputs: • Predicted source noise emissions for the combination of offshore vessels using DP. • Maximum sound transmission loss for combined DP sources, including horizontal range and cross sections. • Relevant zones of impact to the physiological (i.e., hearing impairment), physical (hearing damage), and behavioural responses of marine mammals, fish, and turtles when exposed to continuous exposure to offshore vessels. .
U2	<u>Drilling phase:</u> Noise from VSP of a well during initial drilling at Venus field (impulsive noise)	• Modelling to consider VSP noise for one well as this will be representative of noise impact at any well location due to similar bathymetry and water depth across Venus field. • VSP will only be conducted at a few selected wells. VSP will, however, be concurrent to well drilling (Scenario U1). Cumulative noise of U1 and U2 will be qualitatively assessed (as impulsive and non-impulsive noise sources cannot be modelled in one scenario). • VSP will use a 6-gun, 1200 CUI (G-Gun) source array. Modelling Outputs: • Source levels of VSP, including notional signature, far-field signature, power spectral density and beam patterns. • Maximum sound transmission loss for a single VSP pulse from a well, including horizontal range and cross sections. • Relevant zones of impact to the physiological (i.e., hearing impairment), physical (hearing damage), and



No.	Scenario	Key assumptions / considerations
		behavioural responses of marine mammals, fish, and turtles when exposed to: - o Immediate exposure to a single VSP pulse; and - o Cumulative exposure to multiple VSP pulses.
U3	<u>Drilling and installation phase:</u> Cumulative vessel noise during concurrent well drilling and installation of subsea equipment at Venus field (non-impulsive noise)	• Modelling to consider installation of subsea equipment and facilities on the seabed (during summer campaign) while concurrent drilling of up to three wells continues. • Scenario considers total of 13 vessels, each using DP and working throughout the Venus field: - o Seven vessels as per Scenario U1; - o Three subsea installation vessels; and - o Three supply vessels for the subsea installation vessels. Modelling Outputs: • Refer to Scenario U1.
U4	<u>Drilling and installation phase:</u> Cumulative vessel noise from well drilling, subsea installation and FPSO arrival at Venus field (non-impulsive noise) <i>Maximum concentration of vessels during entire project</i>	• Modelling to consider arrival of FPSO (towed by up to four tugs) and installation of mooring lines, while subsea installation (during summer campaign) and concurrent drilling of up to two wells continue. • Scenario considers total of 16 vessels, each using DP and working throughout the Venus field: - o Two drill ships; - o Two associated supply vessel; - o One drilling support vessel; - o Three subsea installation vessels; - o Three installation supply vessels; - o One medium construction vessel; and - o Four tugs (AHT). • Scenario applies to a relatively short period, as tugs will progressively disengage from FPSO and depart Venus field as FPSO is attached to mooring lines. Modelling Outputs: • Refer to Scenario U1.
U5	<u>Production phase:</u> Cumulative vessel noise during transfer of oil from FPSO to DPST at Venus field (non-impulsive noise) <i>Maximum concentration of vessels at Venus field during production period</i>	• Modelling to consider the ~1 day / week period when the DPST is at the Venus field to load oil from the FPSO. • Scenario considers two vessels using DP and operating near the FPSO: - o One DPST vessel (80 m from FPSO for oil transfer); and - o One support vessel (~500 m from FPSO to supervise exclusion zone and assist). • FPSO does not generate underwater noise as it is moored and does not have thrusters / propellers. • Outside of the loading period, only a support vessel and the FPSO are at the Venus field. The support vessel will use a combination of drift, repositioning and DP for positioning, as required at the time. Modelling Outputs: • Refer to Scenario U1.



No.	Scenario	Key assumptions / considerations
U6	<u>Production phase:</u> Cumulative vessel noise during transshipment of oil from DPST to conventional tanker at nearshore location (non-impulsive noise) <i>Maximum concentration of vessels at nearshore location during production period</i>	- Modelling to consider the ~1 day / week period when a conventional tanker is present to load oil stored in the DPST at nearshore transshipment location(s). One tanker will be moored, while the other tanker will be assisted by up to three tugs to hold position. - Scenario considers five vessels operating near each other at the nearshore transshipment location(s): - One tanker using DP; - One tanker moored during transshipment but using propellers when approaching and leaving the site; and - Three tugs (AHT) using DP and supporting tanker positioning. - Outside of the loading period, the tugs may remain near the location, using a combination of drift, repositioning and DP for positioning, as required at the time, or leave for port. Modelling Outputs: - Refer to Scenario U1.

Table 8-7: Underwater noise modelling scenario that have been screened out.

No	Scenario	Reason for scenario exclusion
UE1	Production Phase: Cumulative vessel noise from support vessel and the FPSO at Venus field outside of oil transfer period (non-impulsive noise)	- This scenario represents the conditions that will prevail at the Venus field during the vast majority of project life (~6 days/week during production), when Scenario U5 (DPST loading) does not apply. - The FPSO does not generate underwater noise as it is moored and does not have thrusters / propellers. - The support vessel will use a combination of drift, repositioning and DP for positioning, as required at the time. Supply vessels will call periodically. - This scenario was excluded because the DPST vessel is expected to be the primary source of underwater noise at the Venus field, when present, and this more conservative scenario is modelled in Scenario U5. When the DPST is not present then noise from unrelated vessels (e.g. shipping traffic) would be of similar if not higher relevance for underwater noise in the region.

8.1.2 Specialist Studies

8.1.2.1 General Terms of Reference for the Specialist Studies

The following general terms of reference will apply to the specialist studies:

- Describe the receiving environment and baseline conditions that exist in the study area (area of influence) and identify any sensitive areas that need special consideration.
- Review the key impacts identified for assessment (see Sections 7.2) and Scoping Comments and Responses Report to ensure that all relevant issues and concerns relevant to fields of expertise are addressed.



- Identify and assess potential impacts of the proposed activities and infrastructure, including any associated cumulative impacts⁷⁰.
- Describe the legal, permit, policy and planning requirements.
- Identify areas where issues could combine or interact with issues likely to be covered by other specialists, resulting in aggravated or enhanced impacts.
- Indicate the reliability of information utilised in the assessment of impacts as well as any constraints to which the assessment is subject (e.g. any areas of insufficient information or uncertainty).
- Where necessary apply the precautionary principle to the assessment of impacts.
- Identify management and mitigation actions using the Mitigation Hierarchy by recommending actions in order of sequential priority. Avoid first, then reduce/minimise, then rectify and then lastly offset (see Section 8.2.7).
- Identify alternatives that could avoid or minimise impacts.
- Determine significance thresholds for limits of acceptable change.
- Where applicable, specialists shall use the assessment method for impact prediction and assigning significance (see Section 8.2).

8.1.2.2 Marine Ecology Impact Assessment

The terms of reference for the marine ecology impact assessment are as follows:

- Describe the benthic and pelagic habitats off the Namibian Coast (Venus field and nearshore transshipment location(s)), identifying sensitive habitats and species that may be affected by the proposed production activities. The description of the baseline environment will be based on published scientific literature, previous studies and existing datasets such as Environmental Baseline Survey (EBS) data collected within Block 2913B (in 2022), MMO records and previous ESIA studies from the region.
- Display the spatial extent of marine conservation areas in relation to the project areas of influence (offshore and nearshore), including MPAs, EBSAs, CBAs and other areas identified as priority areas for conservation.
- Describe seasonal and migratory occurrences of key marine fauna and highlight any species of conservation concern.
- Identify, describe and assess the significance of potential impacts of the proposed production activities on the local marine and coastal environment and marine fauna (including cetaceans, turtles, seals, fish, cephalopods, seabirds, benthic invertebrates and plankton). The assessment is to consider both planned (normal operations) and unplanned events (emergency situations) and will be informed by the technical modelling studies commissioned as part of the overall ESIA (see Section 8.1.1).

⁷⁰ Impacts that in combination with other impacts from the same project or other existing or planned (but reasonably foreseeable) projects affect the same environmental or social resources and/or receptors as the Project. They may be of two types:

- Additive - impacts that may result from the combined or incremental effects of future planned activities (i.e. those developments currently in planning and not included as part of the existing baseline conditions); or
- In-combination - impacts where individual project-related impacts are likely to affect the same environmental or socioeconomic feature (e.g., a combined effect of noise and drill cutting on a receptor acting together in space and time could result in increased effects greater than the individual effects in isolation).



- Identify practicable mitigation measures to avoid and/or reduce the significance of any negative impacts and indicate how these can be implemented during operations (see Section 8.2.7).

8.1.2.3 Fisheries Impact Assessment

The terms of reference for the fisheries impact assessment are as follows:

- Describe the commercial and small-scale fisheries (including mariculture) operating in Namibian waters with a specific focus on the spatial extent and effort of sectors operating within the project's area of influence (offshore and nearshore). The description of the baseline environment will be based on published scientific literature on target species, previous studies and existing catch and effort datasets.
- Undertake a spatial and temporal analysis of recent and historical catch and effort records (obtained from by MFMR) in relation to the project area and operational footprint. This data will also be used to describe the inter-seasonal and inter-annual variability in records.
- Identify, describe and assess the significance of potential impacts of the proposed production activities on commercial and small-scale fisheries (including mariculture) due to exclusion from fishing grounds and changes in catch levels. The assessment will consider both normal operations and unplanned events (emergency situations), and will be informed by the technical modelling studies commissioned as part of the overall ESIA (see Section 8.1.10).
- Identify practicable mitigation measures to avoid and/or reduce the significance of any negative impacts on the fishing industry and indicate how these can be implemented during operations (see Section 8.2.7).

8.1.2.4 Socio-Economic Impact Assessment

The terms of reference for the socio-economic impact assessment are as follows:

- Provide a desktop socio-economic baseline based on available data for the areas and communities (including indigenous people) potentially affected by the proposed project activities (refer to area of influence in Section 6.1), and to describe the historic and current economic size and structure of Namibia. This will be tailored to the extent of potential linkages and impacts of the proposed activities with the local population and nearby communities.
- Assess the identified direct and indirect impacts and benefits of normal operations and potential unplanned events (notably a large oil spill), with particular emphasis on:
 - o Settlement patterns and sense of place.
 - o Potential pressures on resources, goods and services, infrastructure, traffic and land in the Walvis Bay and Lüderitz port areas.
 - o Cumulative impact of increased marine traffic on other sea users.
- Assess potential economic impacts related to normal operations, including:
 - o Macro-economic and fiscal impacts (e.g. contribution to GDP, government revenues, foreign exchange reserves, etc.).
 - o Income and employment-related impacts (e.g. local expenditure and procurement, direct and indirect employment, local skills development, etc.).
 - o Any other impacts on other economic aspects and the wider Namibian economy (e.g. impacts related to corporate social responsibility, public expenditures and



investments, public enterprises, prices, wages, housing and conflicts or trade-offs with other sectors or major investments).

- The impact assessment will be informed by the technical modelling studies commissioned as part of the overall ESIA (see Section 8.1.1).
- Update the social baseline and impact description based on stakeholder comments and conduct additional research, if required.
- Identify practical mitigation measures to avoid and/or reduce predicted social impacts, as well as recommendations for the enhancement of social benefits (see Section 8.2.7).

Some aspects of a socio-economic nature, or with potential social impacts, are addressed in other studies, notably fisheries and cultural heritage. The social and economic specialists will refer to and liaise with those specialists to ensure alignment and avoid overlap.

8.1.2.5 Cultural Heritage Impact Assessment

The terms of reference for the intangible cultural heritage impact assessment are as follows:

- Utilise both primary and secondary data collected to describe, discuss and analyse the receiving environment and baseline conditions in the project's area of influence as they pertain to issues of culture, spiritual and religious uses of the sea and coast to determine the prevalence, frequency, importance and commonality of cultural and spiritual uses of the oceans and coast. The primary research will, *inter alia*, determination of prevalence, frequency, importance and commonality of cultural and spiritual uses of the oceans and coast. Primary data collection in Lüderitz, Walvis Bay, Swakopmund and Henties Bay will be supported by extensive existing cultural heritage and anthropological fieldwork and research conducted between 2022 and 2024 for offshore exploration activities in southern Namibia (including Windhoek, Lüderitz, Swakopmund, Bethanie, Keetmanshoop, Tsumeb and Tsintsabis) in recent years (2022 to 2024).
- Identify, describe and assess the significance of potential impacts (normal operation and unplanned events) of the proposed project on identified cultural heritage, including spiritual and religious uses of / connections to the sea and coast and their cultural valuation of these assets.
- Identify practicable mitigation measures to avoid and/or reduce potential negative impacts on aspects of culture and spiritual/religious uses of the sea and coast and /or enhance potential benefits (see Section 8.2.7).

8.1.2.6 Human Rights Impact Assessment

Human rights screening is currently being undertaken to identify potential human rights issues areas. If required, *based on screening results*, a comprehensive human rights impact assessment will be conducted, providing a detailed analysis of the salient human rights impacts that the project might cause, contribute to, or be directly linked to, including the development of mitigation measures and action plans to improve the project's human rights management systems.

- The human rights assessment will be undertaken through a collaborative process of assessment, monitoring, and reporting that comprehensively aligns with the following standards: UN Guiding Principles on Business and Human Rights (2011); Declaration on Fundamental Principles and Rights at Work (1998); (Draft Committee, 1948) Universal Declaration of Human Rights (1948) and other international human rights standards, and Voluntary Principles on Security and Human Rights (2000).

The terms of reference for the human rights impact assessment are as follows:



- Human Rights Screening
 - o Undertake a desktop review and analysis of the relevant documentation and studies with a focus on human rights, labour rights, environmental, socio-economic, and cultural considerations to identify, assess and prioritize high-level potential human rights impacts.
 - o Conduct preliminary online internal engagement with a multi-disciplinary team, focusing solely on internal consultations. This will lead to the initial identification and assessment of impacts and the development of mitigation measures.
 - o Provide recommendations on the need for a comprehensive human rights impact assessment and other mitigation measures.
- Human Rights Impact Assessment, if required
 - o Review and update desktop information from the human rights screening phase, involving gathering and analysing of available data, engagements with corporate team on impacts and systems gaps, and site visit planning.
 - o Undertake a site visit focusing on the collection of issue specific information and from other internal and external engagement to identify and assess rights holder impacts.
 - o Integrate site visit insights with findings from desktop research to ensure that all relevant human rights issues are identified.

Compile a comprehensive impact assessment, including recommendations on mitigation measures to address salient actual and potential impacts and how they will be addressed in the ESMP.

8.1.2.7 Air Quality Impact Assessment

The specific terms of reference for the air quality impact assessment are as follows:

- Contextualise the study area by undertaking a desktop review for the project area of influence, including national air quality legislation, prevailing meteorological conditions, ambient air quality and sensitive human receptors.
- Establish an emissions inventory from key emission sources, including fuel combustion, fugitive losses, evaporative emissions, etc. The pollutants of focus will include sulphur dioxide (SO₂), oxides of nitrogen (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and particulate matter (PM).
- Undertake dispersion modelling (see Table 8-8) using the CALPUFF Modelling System⁷¹ to evaluate the surface-level impacts of emissions from the nearshore transshipment location(s). The modelling will simulate the impacts of the pollutant array from the vessels involved in a single transshipment operational scenario and, depending on the significance, a single transshipment spill scenario (Table 8-1). No offshore dispersion modelling is considered necessary within the Venus Field due to offshore activities occurring over 300 km from the coast far removed from sensitive coastal receptors. Modelling scenarios that have been screened out are presented in Table 8-3 to Table 8-9.

⁷¹ CALPUFF is an advanced non-steady-state meteorological and air quality modelling system. The model has been listed by the U.S. Environmental Protection Agency as an alternative model for assessing long range transport of pollutants and for certain near-field applications involving complex meteorological conditions (<https://calpuff.org/>).



- Describe and assess air quality impacts of particulate and gaseous emissions of normal operations and unplanned events (e.g. spill and well blow-out) on the receiving environment through comparison of calculated ambient concentrations with national standards and international guidelines, as applicable.
- Identify and recommend practicable air quality monitoring and mitigation measures to avoid and/or reduce any negative impacts (see Section 8.2.7).

Table 8-8: Proposed air quality modelling scenarios.

No.	Scenario	Key assumptions / considerations
A1	<u>Production phase:</u> Transshipment of crude oil from DPST to conventional tanker (Nearshore)	• Considers the ~1 day / week period when a conventional tanker is present to load oil stored in the DPST. One tanker will be moored, while the other tanker will be assisted by up to three tugs to hold position. • Scenario considers five vessels operating near each other at nearshore transshipment location(s): - o One tanker using DP; - o One tanker moored during transshipment but using propellers when approaching and leaving the site; and - o Three tugs (AHT) using DP and supporting tanker positioning. • Outside of the loading period, the tugs may remain near the location, using a combination of drift, repositioning and DP for positioning, as required at the time, or leave for port. • WRF (meteorological datasets) will be used for modelling. Modelling Outputs: • Predicted pollutant concentrations within 25 km from nearshore transshipment location(s) for SO₂, NO_x, CO, PM₁₀, PM_{2.5} and NMVOC. • Short-term (i.e. 1-hour and 24-hour) and long-term (i.e. annual) averages for comparison with national standards and international guidelines.
A2	<u>Operation phase:</u> Spill during crude oil transshipment from DPST to conventional tanker (Nearshore)	• Considers surface evaporation and dispersion from an accidental crude oil spill, depending on the significance of the modelling. • WRF (meteorological datasets) will be used for modelling. • Scenario will be based on spill modelling data (see Scenario O1 and O2 in Table 8-4). Modelling Outputs: • Predicted pollutant concentrations from an accidental spill • NMVOC, speciated for benzene (where possible); and • Short-term (i.e. 1-hour and 24-hour) averages for comparison with national standards and international guidelines.



Table 8-9: Air quality modelling scenarios that have been screened out.

No.	Scenario	Description and rationale for exclusion
AE1	<u>Drilling and installation phase:</u> Vessel activity from well drilling, subsea equipment installation and FPSO arrival (Venus field)	- Considers arrival of FPSO (towed by up to four tugs) after installation of mooring lines, while subsea installation (during summer campaign) and concurrent drilling of up to two wells continue. - Scenario considers total of 18 vessels, each using DP and working throughout the Venus field: - Two drill ships; - Two associated supply vessel; - One drilling support vessel; - Three installation vessels; - Three installation supply vessels; - One medium construction vessel; and - Four tugs (AHT). - Scenario applies to a relatively short period, as tugs will progressively disengage from FPSO and depart Venus field as FPSO is attached to mooring lines. - Rationale: Scenario has been screened out as the Venus field is over 240 km from the coast far removed from sensitive coastal receptors and dominant winds in the region (namely the prevailing southerly wind trajectories which are expected to transport emissions away from the coast).
AE2	<u>Production phase:</u> Vessel activity and fugitive emissions during transfer of oil from FPSO to DPST (Venus field)	- The ~1 day / week period when the DPST is at the Venus field to load oil from the FPSO. - Two vessels using DP and operating near the FPSO: - One DPST vessel (80 m from FPSO for oil transfer); and - One support vessel (~500 m from FPSO to supervise exclusion zone and assist). - FPSO does not generate significant emissions as it is moored and does not have thrusters / propellers. - Outside of the loading period, only a support vessel and the FPSO are at the Venus field. The support vessel will use a combination of drift, repositioning and DP for positioning, as required at the time. - Rationale: Refer to Scenario AE1.

8.1.2.8 GHG Emissions and Climate Change Risk Assessment

The specific terms of reference for the Green House Gas (GHG) Emissions and climate change risk assessment are as follows:

- Undertake a desktop review of the relevant local legislation, policies and plans to understand the legislative and policy context within which the project will be developed. This review will be limited to Namibia's climate-related legislation, policies and plans, and relevant international climate-related standards and guidelines, namely EP4, IFC Performance Standards and relevant World Bank EHS guidelines.
- Undertake a desktop review of the latest climate data to identify the historical and projected changes in climate. This review will be based on information sourced from Clim.Systems, which provides site-specific climate data for a range of metrics, including extreme wind speed, extreme precipitation, heatwave days, mean sea level rise, sea water temperature and wave height.



- Undertake a desktop review to identify climate-related natural hazards, such as extreme heat, cyclones, etc., which could adversely affect the Project. This will be based on information sourced from the “Global Facility for Disaster Reduction and Recovery’s Think Hazard!” and published literature. Based on information sourced from the other specialist studies, this assessment will also highlight if there are any Project-affected communities, priority ecosystem services or biodiversity that may be adversely affected by climate change.
- Undertake a desktop review of Namibia’s Updated NDC, National Climate Change Strategy & Action Plan 2013 – 2020 and National Climate Change Policy for Namibia to determine the country’s national climate commitments. This includes both the climate mitigation and adaptation measures.
- Quantify the Projects’ direct (scope 1) and indirect (scope 2) GHG emissions for the execution (drilling, installation and start-up), operational (production) and decommissioning / closure phases. This includes GHG emissions from the fuel consumption of the vessels and helicopter, the gas consumption and fugitive emissions of the FPSO and non-routine venting. The quantification will be based on information provided by TEEPNA and relevant, industry guidelines, such as the American Petroleum Institute (API).
- Estimate the Project’s indirect (scope 3) emissions (processing and consumption of sold hydrocarbon) over the life of the Project and evaluate the potential contribution of total GHG emissions (direct and indirect) to global atmospheric GHG contributions and carbon budget.
- Undertake a qualitative assessment of the physical (i.e., related to physical impacts of climate change) and transitional risks (i.e., impacts related to the transition to a lower-carbon economy) to the Project, as well as the opportunities that may arise from the transition to a lower carbon economy. This assessment will consider the vulnerability and exposure of the Project’s infrastructures and operations to the adverse effects of climate change. The assessment will also broadly consider the compatibility of the Project with Namibia’s national climate commitments.
- Undertake an assessment of the significance of the contribution of the Project’s GHG emissions to Namibia’s national GHG inventory over the life of the Project (scope 1 and 2 emissions). The assessment would also consider the impact of the Project’s GHG emissions in relation to the country’s NDC emission reduction targets.
- Identify appropriate measures to avoid and/or mitigate the climate-related risks to the Projects and the Projects’ GHG emissions.

8.1.2.9 Waste Management Study

The specific terms of reference for the waste management study are as follows:

- Conduct a desktop review of existing policies and legal framework including:
 - o International Provisions;
 - o Namibian legislative framework and standards; and
 - o Municipal plans, including Walvis Bay, Lüderitz & Aus Town council waste management mandates and current practices.
- Compile a waste inventory of the main anticipated waste streams (quantity and type) generated during the project life.
- Obtain information on current and future plans for general and hazardous waste management (liquid and solid), such as drill cuttings and drilling muds, in the region from local municipal council and waste management companies offering services (at Lüderitz and Walvis Bay), as well as potential recyclers / entrepreneurs in the area.



- Compile a Waste Management Report, which will include sections on the waste baseline inventory, waste management options plan, Good International Industry Practice and a waste road map. A credible and robust waste inventory/baseline is critical for the development of a project specific Waste Management Plan. Furthermore, this study will inform the socio-economic study (see Section 8.1.2.4).

8.1.2.10 Closure and Decommissioning Study

The objective of the study is to determine the environmental and social requirements that would exist at the end of the operational lifespan of the project, and to identify appropriate management and mitigation measures to address the closure-related risks. This study will inform the other specialist studies, including marine ecology, fisheries, social, economic studies, cultural heritage and climate change. The specific terms of reference for the closure and decommissioning study are as follows:

- Compile a policy framework for closure and relevant guidelines:
 - o Develop and compile a framework in collaboration with TEEPNA and identified stakeholders, taking into account Namibian guidelines, regulations and international best practice (e.g. Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009).
 - o Consider local and neighbouring country guidelines and regulations, and the Association for the Advancement of Cost Engineering guidelines.
- Develop a technical decommissioning strategy with associated risks and mitigations:
 - o Develop the technical decommissioning strategy based on the policy framework engagement outcomes.
 - o Expand the strategy to include more detailed risk identification and mitigation measures.
 - o Adapt the format based on initial findings and existing policies, risk registers, and procedures of TEEPNA.
 - o Develop an aspects, activities and risk register to facilitate the decommissioning strategy.
- Develop a monitoring programme for potential latent or residual risks (legacy):
 - o Propose a monitoring programme based on specialist studies.
 - o Consolidate and summarize specialist monitoring with insurance that closure and decommissioning risks, procedures, mitigations and costs are sufficiently covered to meet developer and stakeholder requirements.
- Develop a financial provision estimation method:
 - o Estimate the financial provision required to perform the proposed operation and possible subsequent rehabilitation and/or remediation of latent or residual environmental impacts.
 - o Confirm the method of financial provision.

8.2 Proposed Method for Assessing Impact Significance

This section sets out the approach and method for the assessment of impacts for the Project and defines the terminology applied and the steps used to evaluate impact significance.



8.2.1 Approach to Impact Assessment

The identification and assessment of environmental and social impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental and social impacts associated with proposed activities. Impacts are identified throughout the ESIA process by independent EAPs, from specialist studies and public participation, and refined using available baseline information, modelling data and project design information.

For potentially significant impacts or those of stakeholder concern, the impact identification and evaluation process involve the following main steps:

8.2.1.1 Step 1: Define the Area of Influence

The area of influence of the Project is defined as a basis for defining the boundaries for baseline data gathering by taking into consideration the spatial extent of potential direct and indirect impacts of the Project. Direct impacts of the Project are typically located within a smaller area around the project activities (i.e. in the direct area of influence), while indirect impacts typically extend across a wider area and often relate to the socio-economic sphere of influence of the Project. The area of influence will possibly be reassessed in the Impact Assessment Phase based on technical modelling results.

8.2.1.2 Step 2: Identification of Potential Impacts

Potential impacts (both positive and negative) of a Project are identified through a process of examining the potential for interactions between project activities and environmental and social receptors (or features). This requires consideration of the range of project activities across different phases of the project (planning, exploration, construction, operation and decommissioning) and the potential for interactions on each of the environmental receptors, features or aspects occurring in the project area of influence. The results are then presented in an 'environmental and social interaction matrix' format (see Table 7-1). For each project activity, the degree of interaction is rated through colour coding the level and type of interaction in the matrix. This matrix approach to impact identification is designed to highlight where interactions may occur as a way of focussing the impact assessment.

8.2.1.3 Step 3: Compile Impacts – Aspects Register

An impacts-aspects register (see Table 7-2) is typically prepared during the Scoping Phase as a basis for further elaborating the potential impacts identified through the initial impact identification stage. For each of the project activities, different aspects associated with the activity and their potential impacts are tabulated. This systematic approach provides a basis for planning the scope of specialist studies to ensure the correct information is obtained to conduct a detailed assessment of the project impacts. It also enables identification of the linkages between different specialist scopes and overlapping impacts, and where there are interdependencies on data and reporting to enable an integrated impact assessment. For instance, social specialists are typically reliant on other specialists for inputs such as water quality, air quality or noise effects and this needs to be factored into work scopes and scheduling. The presentation of an Impacts-Aspects Register further provides stakeholders with a degree of confidence that the specialists and environmental assessment practitioners have adequately identified potential impacts at an early stage.



8.2.1.4 Step 4: Impact Evaluation

Evaluation of impact significance follows a stepwise process as set out below with reference to definitions in Section 8.2.2.

4a: Assign sensitivity ratings to receptors

The sensitivity of a receptor is defined on a scale of Very Low, Low, Moderate, High or Very High guided by the definitions for biophysical, ecological and social receptors in Section 8.2.3. These are derived from the baseline information, which shall be used to support the sensitivity ratings in the description of impact.

4b: Determine the impact magnitude (or consequence) ratings

Magnitude (or Consequence) is determined based on a combination of the “intensity”, “duration” and “extent” of the impact following the designations set out in Section 8.2.4. Magnitude (or Consequence) is assigned to the **pre-mitigation impact** (i.e., before additional mitigation measures are applied, but taking into account embedded controls specified as part of the project description) **and residual impacts** after additional mitigation is applied.

4c: Determine impact significance rating

The significance of an impact is a function of the magnitude and the sensitivity of the impact determined using the matrix table in Section 8.2.5 and is assigned to the predicted impact **pre-mitigation and post-mitigation (residual)** after considering all possible feasible mitigation measures in accordance with the mitigation hierarchy.

4d: Applying the mitigation hierarchy

Identification of mitigation measures in accordance with the mitigation hierarchy is done throughout the ESIA process with emphasis placed on avoiding significant impacts where feasible. The mitigation hierarchy, as specified in IFC Performance Standard 1, which is widely regarded as a best practice approach to managing risks, is based on a hierarchy of decisions and measures, as presented in Figure 8-1 and Table 8-18 (see Section 8.2.7).

Certain avoidance mitigation measures may be identified early in the Scoping Phase and become ‘embedded’ into the project design and specified in the project description (e.g., drilling sites may be confirmed to avoid (buffers) sensitive seafloor areas). These embedded controls are not ‘added’ to the list of mitigation measures or used to determine the post-mitigation significance. Additional mitigation measures may be identified during the impact assessment process and those agreed with the proponent will be used to assess the post-mitigation significance ratings. These may include measures such as helicopters to avoid fly-over of islands at certain heights.

4e: Assign additional ratings to describe the impact

Qualifying ratings are assigned to criteria such as probability (or likelihood of the impact occurring), confidence (in the impact prediction), mitigation potential, extent of resource loss (as defined in Section 8.2.6), reversibility of impact and potential for cumulative impacts.

8.2.2 Definitions of Impact Types and Criteria Used

8.2.2.1 Impact Types

Table 8-10 below defines the criteria used to categorise and describe impacts.



Table 8-10: Impact Categorisation and Description

Term	Definition
Nature of Impact	The direction of impact and whether it leads to an adverse effect (negative), beneficial effect (positive) or no effect (neutral)
Positive	An impact that is considered to represent an improvement to the baseline conditions or introduces a positive change to a receptor.
Negative	An impact that is considered to represent an adverse change from the baseline conditions or receptor or introduces a new adverse effect.
Neutral	An impact that has no or negligible effect on the receptor.
Type	Cause and effect relationship between the project activity and the nature of effect on receptor
Direct	Impacts that result from a direct interaction between a proposed project activity and the receiving environment (e.g., effluent discharge and receiving water quality). Sometimes referred to as primary impacts.
Indirect	Impacts that are not a direct result of a proposed project, often produced away from or as a result of a complex impact pathway. Sometimes referred to as secondary impacts.
Induced	A type of indirect impact resulting from factors or activities caused by the presence of the Project, but which are not always planned or expected (e.g., human in-migration along new access or for jobs creating increased demand on resources).
Residual	The impacts that remain after implementation of the project and all associated mitigation, and other environmental and social management measures.

8.2.2.2 Definitions of Impact Assessment Criteria and Categories Applied

Definitions of the criteria used in assessing impact significance and the assigned categories, and the additional criteria used to describe the impacts, are summarised in Table 8-11 below.

Table 8-11: Definitions of Impact Assessment Criteria and Categories

Criterion	Definition	Categories
Sensitivity	Sensitivity is a rating given to the importance and/ or vulnerability of a receptor (e.g., conservation value of a biodiversity feature or cultural heritage resource or social receptor).	Very Low Low Medium High Very High
Magnitude (or Consequence)	A term describing the actual change predicted to occur to a resource or receptor caused by an action or activity or linked effect. It is derived from a combination of Intensity, Extent and Duration and takes into account scale, frequency and degree of reversibility.	Very Low Low Medium High Very High
Intensity	A descriptor for the degree of pressure an impact is likely to have on the receptor which takes into account scale and frequency of occurrence (e.g. toxicity of a chemical, level of noise, etc.).	Very Low Low Medium High



Criterion	Definition	Categories
Extent	The spatial scale over which the impact will occur.	Site Local National Regional International
Duration	Time scale over which the consequence of the effect on the receptor/s will last. [Note that this does not apply to the duration of the project activity]. The terms 'Intermittent' and 'Temporary' may be used to describe the duration of an impact.	Short-term Medium-term Long-term Permanent
Probability	A descriptor for the likelihood of the impact occurring. Most assessed impacts are likely to occur, but Probability is typically used to qualify and contextualise the significance of unplanned events or major accidents.	Unlikely Possible Likely Highly Likely Definite
Confidence	A descriptor for the degree of confidence in the evaluation of impact significance.	Low Medium High Certain
Mitigation potential	A descriptor for the degree to which the impact can be mitigated to an acceptable level.	None Very Low Low Medium High
Loss of Irreplaceable resources	A descriptor for the degree to which irreplaceable resources will be lost, fragmented or damaged.	Low Medium High
Reversibility	A descriptor for the degree to which an impact can be reversed.	Irreversible Partially Reversible Fully Reversible
Cumulative	A descriptor of the potential for an impact to have cumulative impacts to arise.	Unlikely Possible Likely

8.2.3 Determination of Sensitivity

Sensitivity is a term that covers the 'importance' (e.g., value of an ecological receptor or heritage resource) or 'vulnerability' (e.g., ability of a social receptor to cope with change) of a receptor to a project-induced change. It takes into account 'Irreplaceability' - measure of the value of, and level of dependence on, impacted resources to society and/ or local communities, as well as of consistency with policy (e.g., conservation) targets or thresholds.

Broad definitions of sensitivity ratings for social, ecological and physical/abiotic receptors are defined in Table 8-12 below. These are not exhaustive and may be modified on a case-by-case basis, as appropriate. Additional ratings can be developed for other receptors such as cultural heritage.



Table 8-12: Sensitivity Categorisation and Description

Sensitivity Rating	Definition
Very Low	The receptor population is not particularly sensitive, e.g. not threatened in any way, highly resilient and/or mostly distributed beyond the impact zone.
Low	The receptor population is somewhat sensitive, e.g. near threatened, with some resilience and/or widely distributed beyond the impact zone.
Medium	The receptor population is sensitive, e.g. threatened, has some resilience <u>and</u> a considerable portion is distributed <u>within</u> the impact zone.
High	The receptor population is highly sensitive, e.g. endangered, has low resilience <u>and</u> a large portion is distributed <u>within</u> the impact zone.
Very High	The receptor population is very highly sensitive, e.g. protected and/or critically endangered, has low resilience <u>and</u> is primarily distributed <u>within</u> the impact zone.

8.2.4 Determination of Magnitude (or Consequence)

8.2.4.1 Definitions of Criteria Used to Derive Magnitude (or Consequence)

The term 'magnitude' (or 'consequence') describes and encompasses all the dimensions of the predicted impact including:

- the nature of the change (what is affected and how);
- its size, scale or intensity;
- degree of reversibility; and
- its geographical extent and distribution.

Taking the above into account, Magnitude (or Consequence) is derived from a combination of 'Intensity', 'Duration' and 'Extent'.

The criteria for deriving Intensity, Extent and Duration are summarised Table 8-13 below.

Table 8-13: Categorisation and Description for Intensity, Extent and Duration

Criteria	Rating	Description
Criteria for ranking of the INTENSITY of environmental impacts taking into account reversibility and scale	VERY LOW	Negligible change (severity), disturbance or nuisance which is barely noticeable and has minimal effect.
	LOW	Minor (slight) change (severity), disturbance or nuisance which is easily tolerated and does not affect overall functioning.
	MEDIUM	Moderate change (severity), disturbance or discomfort caused to receptors that affects overall functioning.
	HIGH	Prominent change (severity), or large degree of modification, disturbance or degradation that materially impairs or impedes functioning.
Criteria for ranking the EXTENT / SPATIAL SCALE of impacts	SITE	Impact is limited to the immediate footprint of the activity and immediate surrounds within a confined area.
	LOCAL	Impact is confined to within the project concession / licence area and its nearby surroundings.
	REGIONAL	Impact is confined to the region, e.g., coast, basin, catchment, municipal region, district, etc.



Criteria	Rating	Description
	NATIONAL	Impact may extend beyond district or regional boundaries with national implications.
	INTERNATIONAL	Impact extends beyond the national scale.
Criteria for ranking the DURATION of impacts	SHORT TERM	The duration of the impact will be < 1 year or may be intermittent.
	MEDIUM TERM	The duration of the impact will be 1-5 years.
	LONG TERM	The duration of the impact will be 5-25 years, but where the impact will eventually cease either because of natural processes or by human intervention.
	PERMANENT	The impact will endure for the reasonably foreseeable future (>25 years) and where recovery is not possible either by natural processes or by human intervention.

8.2.4.2 Determining Magnitude (or Consequence) Ratings

Once the intensity, extent and duration are defined based on the definitions set out in Section 8.2.4.1, the magnitude (or Consequence) of negative and positive impacts is derived based on Table 8-14 below. It should be noted that there may be times when these definitions may need to be adjusted to suit the specific impact where justification should be provided. For instance, the permanent loss of the only known occurrence of a species in a localised area of impact can only achieve a “High” magnitude rating, but could, in this instance, warrant a Very High rating. The justification for amending the rating should be indicated in the impact table.

Table 8-14: Magnitude Determination

Magnitude (or Consequence) Rating	Description *
VERY HIGH	Impacts could be EITHER: of high intensity at a regional level and endure in the long term ; OR of high intensity at a national level in the medium or long term ; OR of medium intensity at a national level in the long term .
HIGH	Impacts could be EITHER: of high intensity at a regional level and endure in the medium term ; OR of high intensity at a national level in the short term ; OR of medium intensity at a national level in the medium term ; OR of low intensity at a national level in the long term ; OR of high intensity at a local level in the long term ; OR of medium intensity at a regional level in the long term .
MEDIUM	Impacts could be EITHER: of high intensity at a local level and endure in the medium term ; OR of medium intensity at a regional level in the medium term ; OR of high intensity at a regional level in the short term ; OR of medium intensity at a national level in the short term ; OR of medium intensity at a local level in the long term ; OR of low intensity at a national level in the medium term ; OR of low intensity at a regional level in the long term .
LOW	Impacts could be EITHER



Magnitude (or Consequence) Rating	Description *
	of low intensity at a regional level and endure in the medium term; OR of low intensity at a national level in the short term; OR of high intensity at a local level and endure in the short term; OR of medium intensity at a regional level in the short term; OR of low intensity at a local level in the long term; OR of medium intensity at a local level and endure in the medium term.
VERY LOW	Impacts could be EITHER of low intensity at a local level and endure in the medium term; OR of low intensity at a regional level and endure in the short term; OR of low or medium intensity at a local level and endure in the short term. OR Zero to very low intensity with any combination of extent and duration.

* Note: For any impact that is considered to be “Permanent” or “International” apply the “Long-Term” and “National” ratings, respectively. For impacts at the “Site” or “Local” level apply the “Local” level rating.

8.2.5 Determination of Impact Significance

8.2.5.1 Matrix to Derive Impact Significance

The significance of an impact is based on expert judgement of the sensitivity (importance or vulnerability) of a receptor and the magnitude (or consequence) of the effect that will be caused by a project-induced change.

In summary, the impact assessment method is based on the following approach:

$$\text{Significance} = \text{Magnitude (or Consequence)} \times \text{Sensitivity}$$

$$\text{Where Magnitude (or Consequence)} = \text{Intensity} + \text{Extent} + \text{Duration}$$

Once ratings are applied to each of these parameters the matrix presented in Table 8-15 is used to derive Significance.

Table 8-15: Matrix for Determining Significance

		SENSITIVITY				
		VERY LOW	LOW	MEDIUM	HIGH	VERY HIGH
MAGNITUDE (OR CONSEQUENCE)	VERY LOW	NEGLECTABLE	NEGLECTABLE	VERY LOW	LOW	LOW
	LOW	VERY LOW	VERY LOW	LOW	LOW	MEDIUM
	MEDIUM	LOW	LOW	MEDIUM	MEDIUM	HIGH
	HIGH	MEDIUM	MEDIUM	HIGH	HIGH	VERY HIGH
	VERY HIGH	HIGH	HIGH	HIGH	VERY HIGH	VERY HIGH



8.2.5.2 Definitions of Significance Ratings

Broad definitions of impact significance ratings are provided in Table 8-16 below. Impacts of 'High' and 'Very High' significance require careful evaluation during decision-making and need to be weighed up against potential long-term socioeconomic benefits of the project to inform project authorisation. Where there are residual biodiversity impacts of 'High' and 'Very High' significance this will require careful examination of offset feasibility and confirmation that an offset is possible prior to decision-making.

Table 8-16: Definitions of Significance Ratings

Significance Rating	Interpretation
Very High	Impacts where an accepted limit or standard is far exceeded, changes are well outside the range of normal variation, or where long-term to permanent impacts of large magnitude (or consequence) occur to highly sensitive resources or receptors. For adverse residual impacts of very high significance, there is no possible further feasible mitigation that could reduce the impact to an acceptable level or offset the impact, and natural recovery or restoration is unlikely. The impact may represent a possible fatal flaw and decision-making will need to evaluate the trade-offs with potential social or economic benefits. Potential risks associated with the project (e.g. unplanned events, such as accidents or incidents) that are not anticipated as part of normal operations may, however, be viewed slightly differently. The probability of such incidences is extremely low. Furthermore, the nature, timing and location of such incidences – in the highly unlikely event that they occur – are not reasonably foreseeable – they cannot be reasonably anticipated, modelled and assessed in the same way as the foreseeable impacts of normal operations. As such, reasonable 'worst-case' scenarios for unplanned events are typically modelled and assessed, with an inference that actual impacts, should the unplanned event take place, will be similar to or less than the assessed scenario presented herein. The probability in environmental impact assessment typically relates to the probability that a reasonably foreseeable impact of a planned project activity occurs (for example, whether pollution will reach or affect a receptor). With the assessment of unplanned events, an additional element probability must be considered: (1) the probability of the unplanned event occurring and, if it does, (2) the more typically considered probability of a receptor being impacted if the unplanned event takes place. Positive social impacts of very high significance would be those where substantial economic or social benefits are obtained from the project for significant duration (many years).
High	Impacts where an accepted limit or standard is exceeded; impacts are outside the range of normal variation or adverse changes to a receptor are long-term. Natural recovery is unlikely or may only occur in the long-term and assisted and ongoing rehabilitation is likely to be required to reduce the impact to an acceptable level. High significance residual impacts warrant close scrutiny in decision-making and strict conditions and monitoring to ensure compliance with mitigation or other compensation requirements. Potential risks associated with the project (e.g. unplanned events, such as accidents or incidents) that are not anticipated as part of normal operations may, however, be viewed slightly differently.



Significance Rating	Interpretation
	Positive social impacts of high significance would be those where considerable economic or social benefits are obtained from the project for an extended duration in the order of several years.
Medium	Moderate adverse changes to a receptor where changes may exceed the range of natural variation or where accepted limits or standards are exceeded at times. Potential for natural recovery in the medium-term is good, although a low level of residual impact may remain. Medium impacts will require mitigation to be undertaken and demonstration that the impact has been reduced to as low as reasonably practicable (even if the residual impact is not reduced to Low significance). Positive social impacts of medium significance would be those where a moderate level of benefit is obtained by several people or a community, or the local, regional or national economy for a sustained period, generally more than a year.
Low	Minor effects will be experienced, but the impact magnitude (or consequence) is sufficiently small (with and without mitigation) and well within the range of normal variation or accepted standards, or where effects are short-lived. Natural recovery is expected in the short-term, although a low level of localised residual impact may remain. In general, impacts of low significance can be controlled by normal good practice but may require monitoring to ensure operational controls or mitigation is effective. Positive social impacts of low significance would be those where a few people or a small proportion of a community in a localised area may benefit for a few months.
Very Low	Very minor effects on resources or receptors are possible but the predicted effect represents a minimal change to the distribution, presence, function or health of the affected receptor, and no mitigation is required .
Negligible	Predicted impacts on resources or receptors of very low or low sensitivity are imperceptible or indistinguishable from natural background variations, and no mitigation is required .

8.2.6 Additional Assessment Criteria

Additional criteria that are taken into consideration in the impact assessment process to further describe the impact and support the interpretation of significance in the impact assessment process include:

- the probability (likelihood) of the impact occurring (assuming the activity and / or event occurs);
- the degree to which impacts can be reversed;
- the degree to which impacts may cause irreplaceable loss of resources;
- the degree to which impacts can be avoided;
- the degree to which the impacts can be mitigated; and
- the extent to which cumulative impacts may arise from interaction or combination from other planned activities or projects.

Definitions for these supporting criteria are indicated in Table 8-17 below.



Table 8-17: Categorisation and Description of Additional Assessment Criteria.

Criteria	Rating	Description
Criteria for determining the PROBABILITY of impacts	UNLIKELY	Where the possibility of the impact to materialise is very low either because of design or historic experience, i.e. $\leq 5\%$ chance of occurring.
	CONCEIVABLE	Where the impact could occur but is not reasonably expected to occur i.e. 5-35% chance of occurring.
	POSSIBLE	Where the impact could occur but is not reasonably expected to occur i.e. 35-65% chance of occurring.
	PROBABLE / LIKELY	Where there is a reasonable probability that the impact would occur, i.e. >65 to $\leq 95\%$ chance of occurring.
	HIGHLY LIKELY / DEFINITE	Where there is certain to occur i.e. >95 to 100% chance of occurring.
Criteria for DEGREE TO WHICH AN IMPACT CAN BE REVERSED	FULLY REVERSIBLE	Where the impact can be completely reversed.
	PARTIALLY REVERSIBLE	Where the impact can be partially reversed and is temporary.
	IRREVERSIBLE	Where the impact cannot be reversed and is permanent.
Criteria for DEGREE OF IRREPLACEABLE RESOURCE LOSS	NONE	It will not cause irreplaceable loss.
	LOW	Where the activity results in a marginal effect on an irreplaceable resource.
	MEDIUM	Where an impact results in a moderate loss, fragmentation or damage to an irreplaceable receptor or resource.
	HIGH	Where the activity results in an extensive or high proportion of loss, fragmentation or damage to an irreplaceable receptor or resource.
Criteria for DEGREE TO WHICH IMPACT CAN BE AVOIDED	HIGH	The impact can be avoided through the implementation of preventative mitigation measures.
	MEDIUM	The impact cannot be avoided, but mitigation measures can reduce the significance.
	LOW	The impact cannot be avoided but can be mitigated to acceptable levels through rehabilitation and restoration.
	NONE	The impact cannot be avoided, and consideration should be given to compensation and offsets.
Criteria for the DEGREE TO WHICH IMPACT CAN BE MITIGATED	HIGH	Mitigation can be easily applied or is considered standard operating practice for the activity and will reduce the impact significance rating.
	MEDIUM	Mitigation is feasible and will may reduce the impact significance rating.
	LOW	Some mitigation is possible but will have a marginal effect in reducing the impact significance rating.
	NONE	No mitigation is possible, or mitigation, even if applied, would not change the impact.
Criteria for POTENTIAL FOR CUMULATIVE IMPACTS	UNLIKELY	There is a low likelihood of cumulative impacts arising.
	POSSIBLE	Cumulative impacts with other activities or projects may arise.
	LIKELY	Cumulative impacts with other activities or projects, either through interaction or in combination, can be expected.



8.2.7 Application of the Mitigation Hierarchy

A key component of this ESIA process is to explore practical ways of avoiding or reducing potentially significant impacts of the proposed activities. These are commonly referred to as mitigation measures and are incorporated into the “project” as part of the ESMP. Mitigation is aimed at preventing, minimising or managing significant negative impacts to as low as reasonably practicable and optimising and maximising any potential benefits of the proposed activities. The mitigation measures are established through the consideration of legal requirements, best practice industry standards and specialist input from the ESIA team.

The mitigation hierarchy, as specified in IFC Performance Standard 1, which is widely regarded as a best practice approach to managing risks, is based on a hierarchy of decisions and measures, as presented in Figure 8-1 and described in Table 8-18. This is aimed at ensuring that wherever possible potential impacts are mitigated at source rather than mitigated through restoration after the impact has occurred. Any remaining significant residual impacts are then highlighted, and additional actions are proposed.

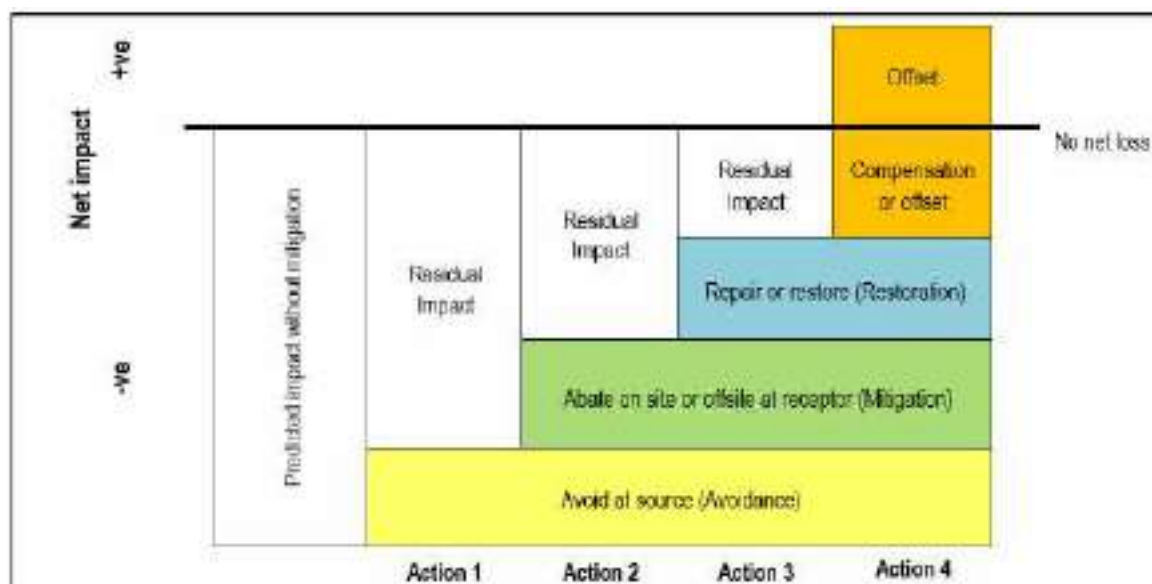


Figure 8-1: Mitigation Hierarchy

Adapted from: www.thebiodiversityconsultancy.com

Table 8-18: Sequential Application of the Mitigation Hierarchy

Avoid at Source	Avoiding or reducing at source is essentially ‘designing’ the Project so that a feature causing an impact is designed out (e.g., a waste stream is eliminated).
Abate on Site	This involves adding something to the basic design or procedures to abate the impact (often called ‘end-of-pipe’) or altered (e.g., reduced waste volume) and is referred to as minimisation. Pollution controls fall within this category.
Abate Offsite/at Receptor	If an impact cannot be abated on-site, then measures can be implemented off-site – an example disposing of waste generated on-board at a proper waste facility onshore. Measures may also be taken to protect the receptor.
Repair or Restore	Some impacts involve unavoidable damage to a resource, e.g., shoreline pollution arising from an oil spill. Repair essentially involves restoration and reinstatement type measures, such as clean-up of the shoreline.
Compensate or Offset	Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage and general intrusion might be



Avoid at Source	Avoiding or reducing at source is essentially 'designing' the Project so that a feature causing an impact is designed out (e.g., a waste stream is eliminated).
	appropriate. An example could be compensation for loss of earnings if fisheries were to be permanently impacted by a Project activity.



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