GALP

AMENDMENT OF THE CURRENT ENVIRONMENTAL CLEARANCE CERTIFICATE FOR THE PROPOSED OFFSHORE EXPLORATION WELL DRILLING IN PEL 83 (ORANGE BASIN) OFF THE COAST OF NAMIBIA:

WELL TESTING

ENVIRONMENTAL IMPACT ASSESSMENT AMENDMENT REPORT

June 2023

Prepared for: Windhoek PEL28 B.V. (Galp)

DOCUMENT CONTROL

Report Title	EIA AMENDMENT REPORT FOR THE PROPOSED OFFSHORE EXPLORATION WELL DRILLING IN PEL 83 (ORANGE BASIN) OFF THE COAST OF NAMIBIA: **WELL TESTING**	
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Extracts from original EIA	Lead Practitioner: SLR Environmental Consulting (Namibia) (Pty) Ltd	Report title: Final EIA Report and ESMP for the proposed offshore exploration well drilling in PEL 83 (Orange Basin) off the coast of Namibia (SLR, 2019)
Applicant	Windhoek PEL28 B.V.	
Client	GALP	
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EXECUTIVE SUMMARY

1. GENERAL INTRODUCTION

"PEL83" is a Joint Venture between the block partners, namely Windhoek PEL28 B.V. (a wholly owned subsidiary of Galp Energia E&P B.V (i.e. Galp)), the National Petroleum Corporation of Namibia (NAMCOR) and Custos Investments, holding Petroleum Exploration Licence (PEL) 83. Galp is currently the operator of PEL 83. PEL 83 is located in the Orange Basin off the coast of Namibia. The licence area covers an area of approximately 9 954 m^2 between 108 km and 250 km from the coastline between Lüderitz and Oranjemund in water depths ranging from approximately 500 m to 2 500 m. See Figure 1 for the regional location of PEL 83.

In 2019, Windhoek PEL28 B.V. applied for an Environmental Clearance Certificate (ECC) for the above-mentioned activity, with the successful completion of an Environmental Impact Assessment (EIA) process and the submission of an EIA Report and Environmental and Social Management Plan (ESMP). The Application and associated reports (including the ESMP) was approved by the Ministry of Environment, Forestry and Tourism (MEFT): Department of Environmental Affairs (DEA) and an ECC issued in April 2020. The ECC was renewed in March 2023 and is valid until 2026. The original EIA (SLR, 2019) assessed the drilling of one or possibly two exploration wells in PEL 83, but did not include any well or flow testing related activities.

Galp propose to conduct the well / flow testing activities to reduce the subsurface and/or well performance uncertainties, which will support the appraisal of a discovery. The well testing is therefore undertaken to evaluate well and field performance, diagnose reservoir characteristics, integrate test results with other studies, plan for future development and perform the overall management of the reservoir.

Prior to conducting any well or flow testing activities, an amendment to the current ECC is required from the regulatory authority, the DEA of the MEFT in terms of the Environmental Management Act, 7 of 2007 and its associated Regulations.

Galp appointed Namisun Environmental Projects and Development (Namisun), as an independent environmental consulting company to undertake the required EIA process, to compile the EIA Amendment Report and amend the accompanying ESMP as part of the application process for the necessary amendments to the current ECC.

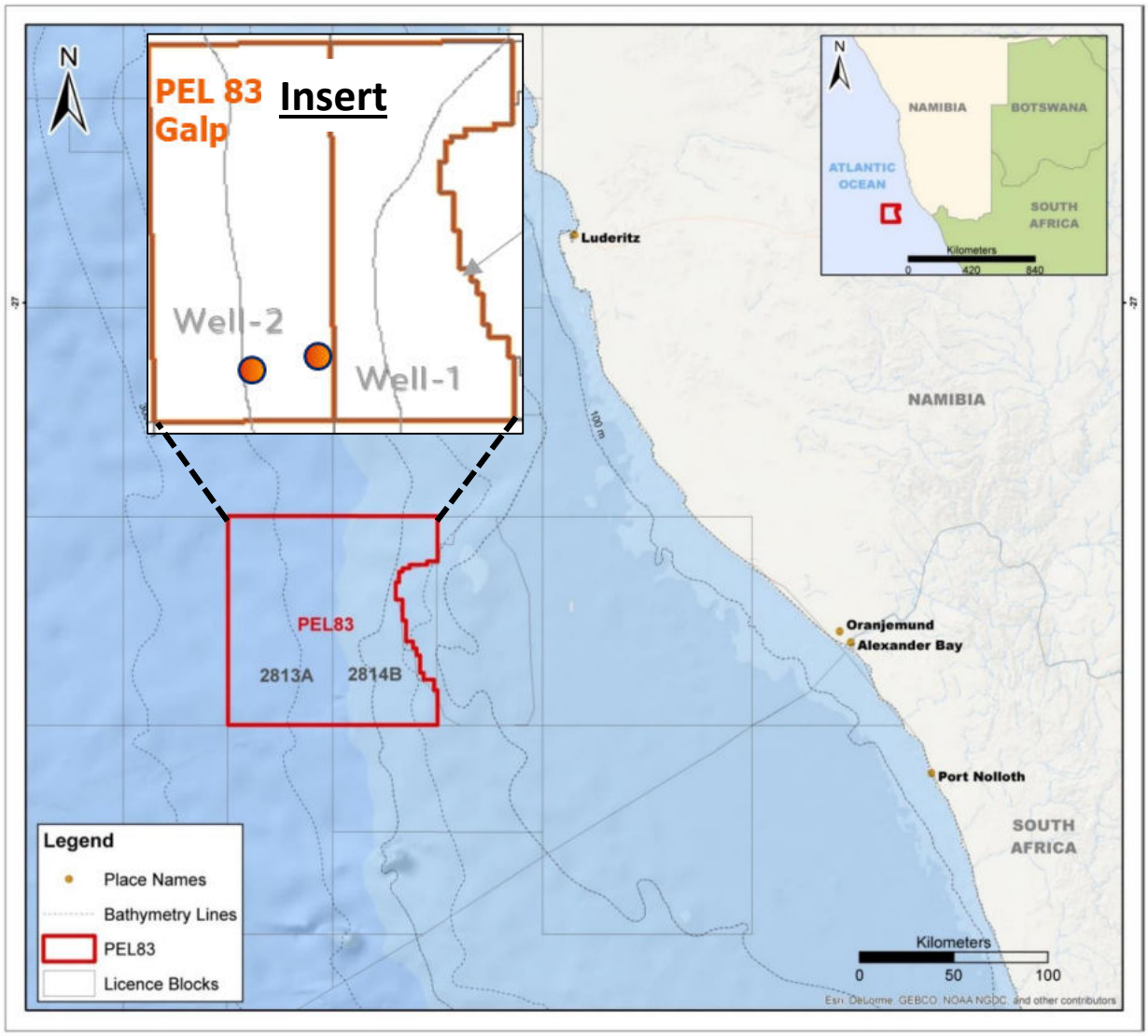

FIGURE 1: LOCATION OF PEL 83 (SLR, 2019) (INSERT SHOWS THE WELL LOCATIONS IN PEL 83)

2. ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

EIAs and amendment applications are regulated by the DEA of the MEFT in terms of the Environmental Management Act, No. 7 of 2007. This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and its associated Regulations were promulgated in January 2012 (Government Gazette No. 4878) in terms of the Act. The ECC in place (valid until 7 March 2026) is based on the EIA process and approved EIA Report (SLR, 2019) and approved ESMP (updated ESMP approved in 2023 as part of the renewal application) and is valid for the drilling of two wells.

The plans proposed by Galp to conduct well / flow testing activities imply changes to the current ECC, which are discussed below. Section 19 of the Regulations to the Act allows for an amendment of an ECC under Section 39 of the Act. An environmental clearance (amendment) is required based on an amendment application, prior to the commencement of the well / flow testing activities.

An amendment application for an ECC will be submitted to the regulating authority MEFT. This (EIA Amendment) Report will be submitted as part of the application. The EIA process includes an internal screening phase; a scoping phase, which includes an impact assessment; and an amendment to the approved ESMP. A final decision relating to the above-mentioned application will be made by MEFT: DEA.

This report is the EIA Amendment Report, the main purpose of which is to provide information relating to the well and flow testing activities and to indicate which environmental aspects and potential impacts have been identified during the internal screening and scoping phases. During the internal screening exercise, Namisun identified the need for the input of a Marine Ecologist. No other specialists have been appointed.

Existing information from the SLR (approved) EIA (2019) was used in this report and has been further augmented by input from the marine ecologist and from comments gathered during consultations with key stakeholders during focus group meetings.

This EIA Amendment Report (with Amended ESMP) will be distributed for public / authority review. I&APs are invited to comment on these documents, which will be available for a review and comment period from 29 **June 2023**. Comments must be sent to Namisun at the telephone number, or e-mail address shown below by no later than **14 July 2023**.

Namisun
Attention: Werner Petrick
E-mail address: wpetrick@namisun.com
Cell number: +264 (0)81 739 4591

3. PROJECT DESCRIPTION

A summary of the key exploration drilling project components is provided in Table 1 below. Amendments to the original approved project description (EIA, SLR, 2019) are indicated in **bold** text in the table.

The commencement date of the well drilling has not yet been fixed; however, the earliest date for commencement of drilling will be November 2023. The expected target drilling depth will be approximately 3 500 m below the seafloor (total depth of 5 050 m from sea surface) and is expected to take approximately two to three months per well to complete.

TABLE 1: SUMMARY OF PROJECT PHASES AND ACTIVITIES (SLR, 2019) AND WELL TESTING (IN BOLD)

Phase		Activity
1. Pre-Drilling Surveys		Operation of seabed survey vessels
		Seabed surveying, including echo sounding, side-scan sonar, sub-bottom profiling and core / grab samples, and Remotely Operated Vehicle (ROV)
2. Drilling	2.1 Mobilisation Phase	Rental of quay space; laydown area and warehouse
		Appointment of local service providers
		Procurement of equipment / materials from the local market
		Rental of accommodation or hotels/ Bed and Breakfast (B&B)
		Mobilisation of Long Lead Items, drilling equipment and bulks
		Transit of drilling unit and supply vessels to drill site
		Discharge of ballast water
	2.2. Operation Phase	Operation of drilling unit and supply vessels
		Operation of helicopters
		Final site selection and seabed survey using a ROV
		Top hole drilling (including spudding)
		Discharge of residual cement during cementing operations
		Discharge of cuttings and drilling fluid
		Wellhead installed on surface casing
		Installation of BOP and riser system connected to the high pressure wellhead housing (HPWHH)
		Bottom hole drilling to final depth
		Well logging and Vertical Seismic Profiling (VSP)
		Plug well with cement and well integrity verification
		Well flow testing (Possible when hydrocarbons are discovered, with each test taking approximately 3 days of flow and flaring.)
	2.3 Demobilisation Phase	Abandonment of wellhead on seafloor
		Drilling unit / supply vessels leave drill site and transit to port or next destination
		Demobilisation of spare Long Lead Items

The only change to the previously described, assessed and approved project activities is therefore the proposal to conduct well / flow testing and associated activities.

A description of the well flow testing operations and related discharges to the marine environment and emissions to the atmosphere is provided below.

3.1 Description of Well Flow Testing operations

Well flow testing is undertaken to determine the economic potential of any discovery thereby reducing the subsurface and/or well performance uncertainties supporting the appraisal of a discovery. It is routinely used to evaluate well and field performance, diagnose reservoir characteristics, integrate test results with other studies, plan for future development, and perform the overall management of the reservoir. At the end of a well test, the well is typically abandoned (i.e. a well that is permanently sealed with no intention of coming back to it later) or suspended (i.e. a well that is safely secured with the intention to come back later for further testing and/or production). Depending on the exploration strategy, a well test could be undertaken in the discovery well and/or subsequent appraisal well(s). Typically one test would be undertaken per exploration well if a resource is discovered.

Prior to the well test, the drilling mud in the well will be removed and the well cleaned with seawater and finally replaced with completion fluids. Completion fluids will be used to keep the well under control, and the fluid weight is defined depending on the pressure downhole. Most completion fluids are composed of calcium chloride and some additives. Upfront toxicity tests at various densities will be conducted on the completion fluid. Prior to discharge, the fluids will be diluted and discharged in batches after passing an oil/grease static sheen test. Any fluid which does not pass the toxicity tests at lower densities (like Calcium Bromide) would be returned to the fluid supplier for re-use or sent to an on-land disposal facility where they typically evaporate the water and recover the salt. One or more zones may be tested per well.

A well test operation will require approximately 30 additional drillship/SS days on location to prepare for and conduct the testing; actual testing may take approximately 48 to 72 hours. A Drill Stem Test (DST) would involve flowing formation fluids, including oil and/or natural gas, up to the drillship/SS where it will flow through special equipment to be separated, measured, and safely disposed using modern high efficiency hydrocarbon burners or flares to maximise combustion of the hydrocarbons. The amount of hydrocarbons produced would depend on the quality of the reservoir but is kept to a minimum to minimise the impact on the environment and avoid wasting potentially marketable oil and/or gas.

The test operation comprises the utilization of a perforating gun which creates holes/channels through the casing and cement, into the reservoir. These holes are called perforations and provide a pathway for fluid to flow from the reservoir into the wellbore. The methodology called Tubing Conveyed Perforation (TCP) uses a tubing conveyed large diameter casing gun (3–1/8 to 5 in.) at the end of the tubing string. This arrangement allows the use of large diameter guns that

perforates the well with the tubing in the hole. There are two techniques, “shoot and drop” or “shoot and pull” where the gun is either left at the bottom of the well or hauled back to the surface. Explosives are always stored in a “bunker” on the drillship/SS rig site in a safe area.

The typical method of correlating a TCP gun string to the desired reservoir location is to use a radioactive marker, which can be used to make very accurate depth correlation of pipe conveyed gun systems. A correlation tag or marker, called Pip tag, is located in the casing threads or the perforation that can quickly and positively be found during positioning the string at the right depth. A wireline gamma ray logging tool is run through the tubing to perform the correlation log. The resulting log will show a large spike at the depth of the pip tag. When this log is compared to the open hole gamma ray log, adjustments can be made to the work string placing the guns on depth. All radiation emitting materials are stored in a contained radiation sealed area on the drillship/SS rig site. The duration of the drill stem test (DST) is expected to last several days. Drill stem tests are multi rate tests designed to determine reservoir characteristics under a variety of flowing conditions. These test rate calculations reflect the maximum capabilities of typical well test equipment.

3.2 Produced Water

There is potential for water being produced from the reservoir during a well flow test, which would be separated from the oily components and treated onboard to reduce the remaining hydrocarbons from these produced waters. The hydrocarbon component would be combusted via hydrocarbon burners or flares, while the water would be temporarily collected in a slop tank. The water is then either directed to:

- Multi-Purpose Tanks (MPT) prior to transfer to supply vessel for onshore treatment and disposal; or
- A dedicated treatment unit where, after treatment is either:
    - Discharged overboard if hydrocarbon content is < 30 mg/l (average of daily readings) or
    - Subjected to a second treatment or directed to a tank prior to transfer to supply vessel for onshore treatment and disposal if hydrocarbon content is > 30 mg/l.

Reinjection of the produced water into the well may be considered as an alternative, if volumes are not able to be managed via the options noted above.

3.3 Flaring

The main sources of emissions to air from the proposed exploration activities will be from vessel engines (drill unit, support vessels and helicopters) and well testing. The helicopters will use kerosene and the vessels will be supplied with marine gas oil (MGO) with less 0.5% sulphur (mass).

During well testing it may be necessary to flare off some of the oil and gas brought to the surface. Flaring produces a flame of intense light and heat at the drill unit. A high-efficiency flare is used to maximise combustion of the hydrocarbons. The amount of hydrocarbons produced would depend on the quality of the reservoir.

It is difficult to estimate accurately the volume of hydrocarbons to be combusted during the well testing (i.e. flaring activities). Galp estimating that between 17 000 barrels of oil per day (BOPD) for 72 hours (3 days) and 8 000 cubic feet per day of methane gas for 72 hours (3 days) could be flared per test. These rates are based on the maximum capacity for typical temporary flaring / well testing equipment. At this stage of the study, it is difficult to predict which kind of fluid will be produced and which fluid rates.

The estimated pollutant emissions for a 3-day flaring operation are provided in Table 2.

TABLE 2: SUMMARY OF TOTAL ESTIMATED POLLUTANT EMISSIONS FOR A SINGLE 3-DAY WELL TEST

		Oil Burn	Gas Flare	Total
Assumed total flaring volume		8,160 m^3	2,746,782 Nm^3	
Pollutant Emissions (m^3)	**PM**	10.7	0.0	10.7
	SO_x	175.1	0.03	175.13
	NO_x	51.25	3.65	54.90
	VOC	0.25	3.09	3.34
	CO	5.38	19.91	25.29

The total estimated greenhouse gas (GHG) emissions for a 3-day flaring operation are summarised in Table 3 below.

TABLE 3: SUMMARY OF TOTAL ESTIMATED GHG EMISSIONS FOR A SINGLE 3-DAY WELL TEST

Source type	Fuel type	Calorific value	Emission Factor			Quantity	GHG Emissions
			CO_2	CH_4	N_2O		
Flaring	Oil burn	43.8 MJ/Kg	73,000 Kg/TJ	3 Kg/TJ	0.6 Kg/TJ	8,031 t	25,399 tCO2eq
	Natural gas	38.1 MJ/m3	2 Kg/TJ	0.012 Kg/TJ	0.000023 Kg/TJ	2,746,782 m3	6,271 tCO2eq
TOTAL							**31,670 tCO_2e**

4. DESCRIPTION OF THE RECEIVING ENVIRONMENT

An understanding of the environment and the sensitivity of the site and surroundings is important to understand the potential impacts of the project. A general overview of the current baseline conditions associated with the proposed project, drawing on the baseline information provided in the 2019 EIA conducted by SLR and updated, where relevant is provided in Chapter 6 of the main Report.

5. IDENTIFICATION AND DESCRIPTION OF POTENTIAL ENVIRONMENTAL IMPACTS THAT ARE LIKELY TO CHANGE AS A RESULT OF THE PROPOSED AMENDMENTS

A summary of the original / approved assessment of potential environmental impacts (SLR, 2019), associated with the proposed exploration drilling programme is presented in Chapter 7 of the main Report.

A few of the originally identified aspects and potential impacts (SLR, 2019) could change as a result of the proposed well testing activities. These relate to the following aspects:

- Oil spill during the well testing operation.
- Water production during the well testing operation and associated discharge into the sea.
- Hydrocarbon 'fall-out' due to incomplete combustion during flaring.

- Additional noise from the well testing activities.
- Additional intense light and heat during flaring.
- Additional air emissions during the well testing and flaring.

Table 4 provides a summary of the above mentioned activities / aspects associated with the amendment to the project and the associated potential impacts. The relevance of the potential impacts ("screening") / qualitative assessment is also presented in the table to determine which aspects / potential impacts need to be assessed in further detail, if necessary.

5.1 Water production during the well testing activities - Discharged overboard

The residual water component produced during well testing can be directed to tanks for transfer to a supply vessel for further onshore treatment and disposal if the hydrocarbon content is >30 mg per litre. Alternatively, the watery fluid can be directly discharged overboard if the hydrocarbon is <30 mg per litre. It is also possible to reinject the produced water into the well if the volumes are not able to be managed via the other two options.

The risk of polluting the sea as a result of the discharge of the produced water overboard is very low because the hydrocarbon-content is low – <30 mg per litre. In addition, the volume of produced water is small.

In case the hydrocarbon-content exceeds 30 mg per litre, the produced water will be contained and transferred to a vessel for onshore treatment and disposal, meaning that it is a non-issue in terms of potential marine pollution.

Considering the low risk, this potential impact is considered insignificant and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.

5.2 Hydrocarbon 'fall-out' due to incomplete combustion during flaring

Inefficient combustion of hydrocarbons can result in the release of unburnt hydrocarbons, which 'drop-out' onto the sea surface and may form a visible slick of oil.

The taxa that may be affected by the 'drop-out' would be pelagic seabirds, turtles, large migratory pelagic fish, and both migratory and resident cetaceans.

The drill area (i.e. PEL 83) is located more than 108 km from the coast at its closest point and is thus far removed from any coastal receptors. The dominant wind and current direction will also ensure that any discharges move mainly in a north-westerly direction away from the coast (SLR,

2029). Given the offshore location of the drill area, hydrocarbon 'drop-out' is expected to disperse rapidly and is unlikely to have an impact on sensitive coastal receptors. Due to the distance offshore, it is only likely to be pelagic species of fish, birds, turtles and cetaceans that may be affected by potential hydrocarbon 'drop-out', some of which are species of conservation concern, but they are unlikely to respond to the minor changes in water quality. Furthermore, the two well locations (see Figure 1) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas (see section 6.4.4 of the main report).

Considering the low risk, this potential impact is considered insignificant and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.

5.3 Air pollution - Additional air emissions during the well testing activities

The emissions to the atmosphere were assessed as part of the 2019 EIA, relating to the following activities, with the potential to cause short-term reductions in local air quality close to the emissions source:

- Exhaust gas emissions produced by the combustion of gas or liquid fuels in turbines, boilers, compressors, pumps and other engines for power and heat generation.
- Fugitive emissions associated with leaking tubing, valves, connections, flanges, open-ended lines, pump seals, compressor seals, pressure relief valves or tanks, and hydrocarbon loading and unloading operations.
- Incineration of waste on board the drilling unit and survey / support vessels.

The additional air emissions as a result of flaring during well testing will contribute cumulatively to the overall air emission associated with the exploration activities (see Table 2 and Table 3).

However, as assessed in the original / approved EIA (SLR, 2019), given the offshore location of the licence area (between 108 km and 250 km offshore), air emissions are expected to disperse rapidly and there is no potential for accumulation of air pollution leading to any detectable long-term impact. The potential impact of emissions will be relatively localised and remains of limited duration.

Although emissions will definitely occur as a result of the various exploration activities (including the flaring activities and possible incomplete combustion of hydrocarbons during flaring) it is at a far offshore location away from any sensitive receptors (i.e. third parties). Furthermore, the two

well locations (see Figure 1) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas (see section 6.4.4 of the main report).

The cumulative contribution of flaring to the overall air emissions will not be significant and as a result no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.

5.4 Intense light and heat during flaring

Flaring during well testing produces a flame of intense light and heat at the drill unit. Drilling (and flaring) activities would be undertaken in the offshore marine environment, over 108 km from the shore at its closest points and thus far removed from any sensitive coastal receptors (e.g. bird or seal colonies) and range of most coastal seabirds, but could still directly affect some migratory pelagic transiting through the area where drilling will be undertaken. The increased ambient lighting may disturb and disorientate pelagic seabirds feeding in the area. This increased lighting may also result in indirect physiological and behavioural effects on fish and cephalopods, as these may be drawn to the lights at night where they maybe more easily preyed upon by other fish and seabirds (SLR, 2023a). The sensitivity of receptors to increased lighting is considered to be medium. Furthermore, the two well locations (see Figure 1) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas (see section 6.4.4 of the main report).

The increase in ambient lighting in the offshore environment due to flaring would, however, be limited to the area in the immediate vicinity of the drill rig over a short-term. Taking this and the medium sensitivity of the receptors into considerations, the potential for behavioural disturbance as a result of flaring is therefore considered to be of low significance and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.

5.5 Additional noise emissions during the well testing activities

Noise from pre-drilling sonar surveys; from vessels and drilling operations and from Vertical Seismic Profiling (VSP) operations were assessed as part of the 2019 EIA. The potential impacts associated with these activities were assessed as insignificant to very low with mitigation.

A large diameter gun that fires a series of explosive charges and thus perforates the well with tubing in the hole will be conducted as part of the well testing. This will happen a maximum of 2 times corresponding to 2 different test intervals.

With these charges being conducted at the bottom of the well (i.e. 4 500 m), the noise that would be experienced at the seabed is expected to be low.

Furthermore, the flaring activities would generated noise on the drilling vessel (i.e. above sea level). These activities would be undertaken in the offshore marine environment, over 108 km from the shore at its closest points and thus far removed from any sensitive coastal receptors (e.g. bird or seal colonies) and range of most coastal seabirds, but could still directly affect some migratory pelagic transiting through the area where flaring will be undertaken. The noise may disturb and disorientate pelagic seabirds feeding in the area. This increased noise may also result in indirect physiological and behavioural effects on fish.

The above mentioned activities would contribute (cumulatively) to the exploration noise. However, seeing that these activities are of short duration, highly localised and of potentially medium sensitivity (the two well locations (see Figure 1) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas, the cumulative contribution of these impacts will not be significant and as a result no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.

5.6 Well testing activities - Oil spill during the well testing operation / reduction of water quality (unplanned event)

The potential impacts of accidental / unplanned oil pollution (i.e. small operations spills and large well blow-out) were assessed during the original EIA process and were also cumulative considered as part of the original assessment. Three blow-out scenarios were modelled and assessed, i.e. 8-day blow-out scenario; and 30-day blow-out scenario at two locations.

Small operational spills were also assessed. A small spill in the licence area has a negligible probability (<1%) of reaching the shore, even without the implementation of any oil spill response measures. The well testing activities could increase the possibility of a ‘small spill’ in the licence area (in the unmitigated scenario), however, with mitigation the impact significant rating will not change.

An oil spill can cause several environmental impacts, such as toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) of marine fauna or affecting faunal health (e.g. respiratory damage). Subsequently, strict preventative measures, controls and responses are standard requirements of Galp and are also contained in the original ESMP.

The risk of a blow-out event and associated oil spill is considered very unlikely (SLR, 2019). The proposed well testing activities is unlikely to change the 2019 assessment findings because the oil spill scenario considered was already the worst case scenario.

Considering the above mentioned, the potential impacts / significant rating associated with of an oil spill from the well testing activities will not change and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.

6. SUMMARY OF ENVIRONMENTAL AND POTENTIAL IMPACTS AND PROJECT CONTROLS AND MANAGEMENT AND MITIGATION MEASURES

Based on the discussions in section 7.1.2, no aspect / potential impact requires further assessment (see Table 10). However, Galp will ensure that the proposed drilling campaign (including the proposed well testing activities) is undertaken in a manner consistent with good international industry practice and Best Available Technique (BAT).

Management and mitigation measures

With reference to section 1, an ECC was issued for the proposed exploration well drilling activities in PEL 83 and an ESMP was developed and approved by MEFT. The ECC was renewed in March 2023 and the (updated) ESMP approved. Additional management and mitigation measures relating to the proposed amendment are included in the updated ESMP, attached in Appendix E.

7. WAY FORWARD

The way forward is as follows:

- Distribute draft report to I&APs for review and comments.
- Obtain comments and update the reports where relevant.
- Submit the final documents to MME and MEFT.
- MME and MEFT review the documentation and provide record of decision.

8. ENVIRONMENTAL IMPACT STATEMENT AND CONCLUSIONS

It is Namisun's opinion that the environmental aspects and potential impacts relating to the proposed amendment and the associated facilities and activities have been successfully identified, described and appropriately re-assessed.

No further (detailed) assessment is required because the potential cumulative impacts (i.e. contributions) is unlikely to change the significance ratings of the original EIA (SLR, 2019). Reference is made to the updated ESMP (see Appendix E) for relevant management and mitigation measures, though.

It is recommended that, if MEFT provides a positive decision on the application for the proposed project changes, they should include a condition to the clearance that Galp must implement all commitments in the EMP (Amendment).

EIA AMENDMENT REPORT FOR THE PROPOSED OFFSHORE EXPLORATION WELL DRILLING IN PEL 83 (ORANGE BASIN) OFF THE COAST OF NAMIBIA: WELL TESTING

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APPENDICES:

ACRONYMS AND ABBREVIATIONS

The list of acronyms and abbreviations used in this report are summarized in the table below:

Acronyms / Abbreviations	**Definition**
BAT	Best Available Technique
BID	Background information document
BOP	Blow-out preventer
BOPD	Barrels of oil per day
CV	Curriculum vitae
DEA	Department Environmental Affairs
DST	Drill Stem Test
EBSA	Ecologically or Biologically Significant Areas
EAP	Environmental Assessment Practitioner
EAPAN	Environmental Assessment Professionals Association of Namibia
ECC	Environmental Clearance Certificate
EIA	Environmental Impacts Assessment
ESMP	Environmental and Social Management Plan
Galp	Galp Energia E&P B.V
ha	Hectares
HPWHH	high pressure wellhead housing
I&APs	Interested and / or affected parties
IBA	Important Bird Area
IFC	International Finance Corporation
IMMA	Important Marine Mammal Area
KBAs	Key Biodiversity Areas
km	kilometres
MPAs	Marine protected areas
MEFT	Ministry of Environment, Forestry and Tourism
MME	Ministry of Mines and Energy
MFMR	Ministry of Fisheries and Marine Resources
MGO	Marine gas oil
MPT	Multi-Purpose Tank
NAMCOR	National Petroleum Corporation of Namibia
NSCNP	Namib-Skeleton Coast National Park
NIMPA	Namibian Islands' Marine Protected Area
Namisun	Namisun Environmental Projects and Development
PEL	Petroleum Exploration Licence
Pisces	Pisces Environmental Services (Pty) Ltd
(Pty) Ltd	Proprietary Limited
ROV	Remotely Operated Vehicle
SLR	SLR Environmental Consulting (Namibia) (Pty) Ltd
SOBM	Synthetic Oil-Based Mud
TCP	Tubing Conveyed Perforation

VSP	Vertical Seismic Profiling
WBM	Water-based mud

1 INTRODUCTION

This chapter describes the purpose of the report, briefly describes the background and proposed project / amendments, summarizes the legislative requirements, explains the report structure, summarize assumptions and limitations of the study, and explains how the input from Interested and Affected Parties (I&APs) was included.

1.1 PURPOSE OF THIS REPORT

This Environmental Impact Assessment (EIA) Amendment Report has been compiled as part of the EIA amendment application process for the proposed offshore exploration well and flow testing activities of the Project.

This report describes and assesses proposed changes associated with the approved facilities and activities and based on this assessment, the existing (approved) environmental management and mitigation measures are reviewed and where relevant, changes / additional measures were documented as part of an amended Environmental and Social Management Plan (ESMP).

Registered Interested and / or Affected Parties (I&APs) are being provided with the opportunity to comment on this EIA report (see Section 1.6). Once the comment period closes, the report will be updated to a final report with due consideration of the comments received, and will be submitted to the Ministry of Mines and Energy (MME): Directorate of Petroleum Affairs (i.e. Competent Authority) and the Ministry of Environment, Forestry and Tourism (MEFT) for decision-making.

1.2 BACKGROUND AND CONTEXT FOR THE PROPOSED AMENDMENT

“PEL83” is a Joint Venture between the block partners, namely Windhoek PEL28 B.V. (a wholly owned subsidiary of Galp Energia E&P B.V (i.e. Galp)), the National Petroleum Corporation of Namibia (NAMCOR) and Custos Investments, holding Petroleum Exploration Licence (PEL) 83. Galp is currently the operator of PEL 83.

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approved by the Ministry of Environment, Forestry and Tourism (MEFT): Department of Environmental Affairs (DEA) and an ECC issued in April 2020. The ECC was renewed in March 2023 and is valid until 2026.

The original EIA (SLR, 2019) assessed the drilling of one or possibly two exploration wells in PEL 83, but did not include any well or flow testing related activities.

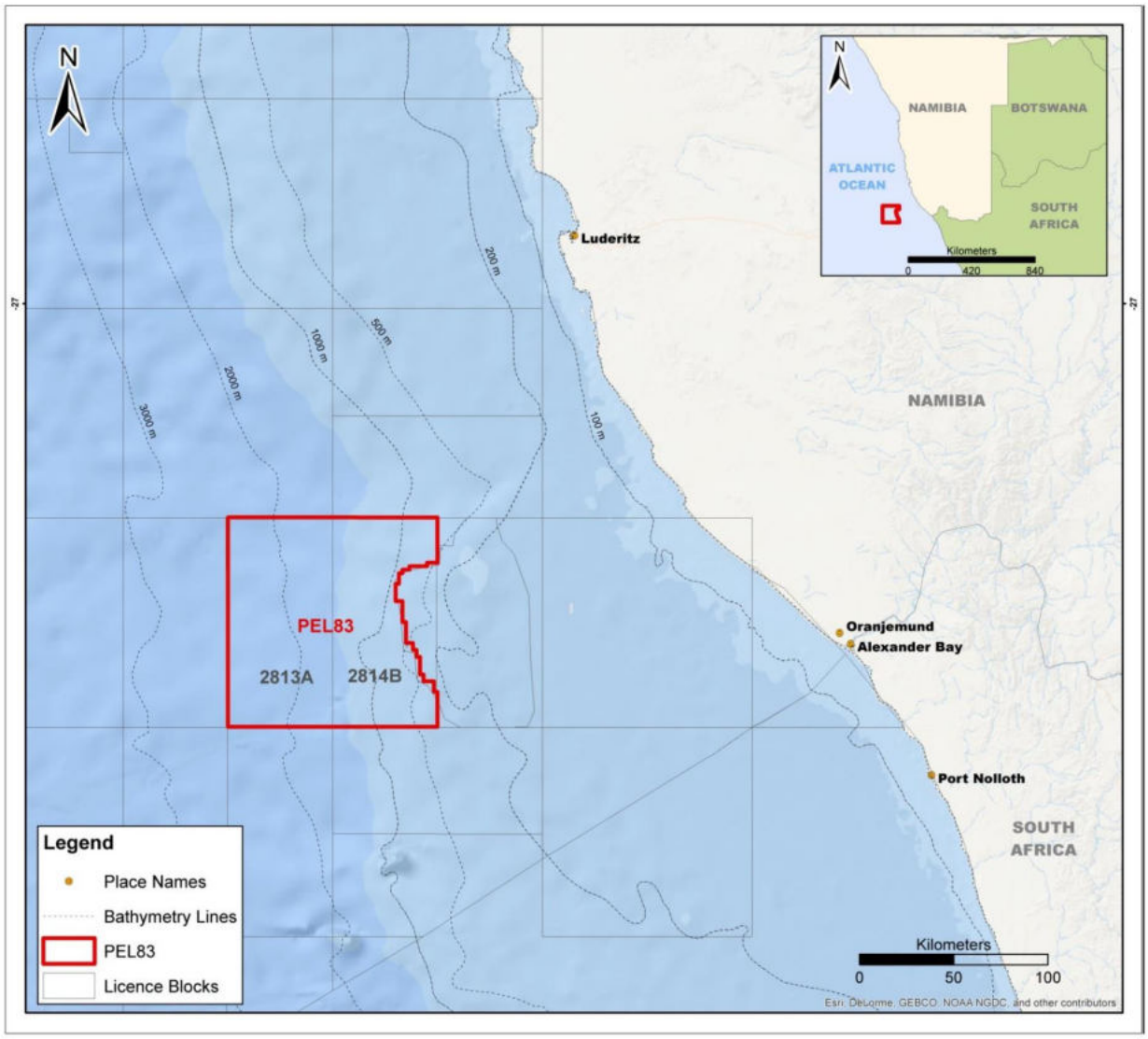

FIGURE 1: LOCATION OF PEL 83 (SLR, 2019)

Prior to conducting any well or flow testing activities, an amendment to the current ECC is required from the regulatory authority, the DEA of the MEFT in terms of the Environmental Management Act, 7 of 2007 and its associated Regulations.

Galp appointed Namisun Environmental Projects and Development (Namisun), as an independent environmental consulting company to undertake the required EIA process, to compile the EIA Amendment Report and amend the accompanying ESMP as part of the application process for the necessary amendments to the current ECC.

It is thought that this EIA Amendment Report and Amended ESMP will provide sufficient information for MME and MEFT to make an informed decision regarding the additional activities, and whether an ECC for the proposed amendments can be issued or not.

1.3 MOTIVATION (NEED AND DESIRABILITY) FOR THE PROJECT AND AMENDMENT APPLICATION

The "need and desirability" of the proposed project from the perspective of wider society and policy 'fit' is addressed in terms of the following:

- White Paper on the Energy Policy (1998);
- Vision 2030;
- The Fifth National Development Plan;
- Namibia's Industrial Policy;
- Regional and local planning guidance; and
- Oil and gas sector history, policy and promotion initiatives.

The above sources were reviewed and discussed in the original EIA (SLR, 2019) and a brief summary is provided below.

The policy compatibility review has showed that Namibian policy is broadly aimed towards improving socio-economic welfare through the sustainable utilisation of the country's natural resources. NDP5 plans to accomplish economic progression by developing value added industrialisation, substituting imports for locally produced goods, creating value-chains of production, and to accelerate SME development. Although Namibian policy is increasingly focussed on beneficiation and the creation of downstream opportunities, it is still recognised that upstream industries involving resource extraction play an important role in the overall goal of achieving the full potential which the country's resources can offer. The overall conclusion is that the proposed project will be largely compatible with key socio-economic policies and plans provided environmental and other risks can be adequately mitigated.

The need and desirability for the proposed exploration well drilling activities and the associated well testing, now being proposed, is economic and strategic in nature. The project has the potential to benefit the country, society and surrounding communities (Lüderitz and Walvis Bay) both directly and indirectly; although only in the short-term. Direct economic benefits will be derived from employment and wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the increased spending power of employees' (SLR, 2019).

Galp propose to conduct the well / flow testing activities to reduce the subsurface and/or well performance uncertainties, which will support the appraisal of a discovery. The well testing is therefore undertaken to evaluate well and field performance, diagnose reservoir characteristics,

integrate test results with other studies, plan for future development and perform the overall management of the reservoir.

1.4 INTRODUCTION TO THE EIA PROCESS

EIAs and amendment applications are regulated by the DEA of the MEFT in terms of the Environmental Management Act, No. 7 of 2007. This Act was gazetted on 27 December 2007 (Government Gazette No. 3966) and its associated Regulations were promulgated in January 2012 (Government Gazette No. 4878) in terms of the Act.

The ECC in place (valid until 7 March 2026) is based on the EIA process and approved EIA Report (SLR, 2019) and approved ESMP (updated ESMP approved in 2023 as part of the renewal application) and is valid for the drilling of one or possibly two wells.

The plans proposed by Galp to conduct well / flow testing activities imply changes to the current ECC, which are discussed below.

Section 19 of the Regulations to the Act allows for an amendment of an ECC under Section 39 of the Act. An environmental clearance (amendment) is required based on an amendment application, prior to the commencement of the well / flow testing activities.

The overall objectives of this assessment process are to:

- Provide information on the well / flow testing activities.
- Describe the current environment in which the project will be situated by updating relevant information from the previous (approved) EIA (SLR, 2019) (where required).
- Identify / update, in consultation with interested and affected parties (I&APs) the potential environmental (and social) aspects associated with the well / flow testing activities.
- (Re-)assess the potential impacts associated with the well / flow testing activities.
- Review management and mitigation measures required to avoid impacts or to mitigate such impacts to acceptable levels by updating the approved ESMP, where required.

1.4.1 KEY AMENDMENTS TO THE APPROVED ECC

To include well / flow testing activities.

1.4.2 EIA (AMENDMENT) PROCESS FOR THE PROPOSED PROJECT

An amendment application for an ECC will be submitted to the regulating authority MEFT. This (EIA Amendment) Report will be submitted as part of the application. The EIA process includes an internal screening phase; a scoping phase, which includes an impact assessment; and an

amendment to the approved ESMP. A final decision relating to the above-mentioned application will be made by MEFT: DEA.

This report is the EIA Amendment Report, the main purpose of which is to provide information relating to the well and flow testing activities and to indicate which environmental aspects and potential impacts have been identified during the internal screening and scoping phases.

During the internal screening exercise, Namisun identified the need for the input of a Marine Ecologist. No other specialists have been appointed.

Existing information from the SLR (approved) EIA (2019) was used in this report and has been further augmented by input from the marine ecologist and from comments gathered during consultations with key stakeholders during focus group meetings.

It is thought that this EIA Amendment Report and the accompanying amended ESMP associated with the proposed project provides sufficient information for the DEA of the MEFT to make an informed decision regarding the proposed changes and the application for an amendment to the current ECC.

The EIA process and corresponding activities which have been undertaken for this project are outlined in Table 1. The process that was followed was in accordance with the requirements outlined in the EIA Regulations of 2012.

TABLE 1: THE EIA PROCESS

Objectives	Corresponding activities
PHASE I: Project initiation & Internal Screening (April - May 2023)	
• Information requirements • Initiate the EIA Scoping process	• Project initiation meetings with Galp to discuss the proposed project and EIA / ECC (Amendment) Application process. • Early identification of environmental aspects and potential impacts that might change because of the well / flow testing activities. • Identify key stakeholders and review / update the Galp EIA I&AP database.
PHASE II – Combined Scoping & Assessment Phase and updated ESMP (May – July 2023)	
• Involve I&APs in the scoping process through information sharing. • Identify further potential environmental issues	• Notify authorities and I&APs of the proposed EIA amendment process (distribute background information document (BID), telephone calls, e-mails, newspaper advertisements and site notice). • I&AP registration and initial comments. • Key stakeholder (focus group) meetings

associated with the proposed amendment. • Determine the terms of reference for additional assessment input. • Consider alternatives. • Identify any fatal flaws. • Provide further details associated with the potentially affected environment. • Assessment of potential environmental impacts associated with the proposed project. • Develop management and mitigation measures. • ECC amendment application. • Receive feedback on the application.	• Include I&AP issues and concerns in the studies and assessments. • Input from Marine Ecologist. • Compilation of EIA Amendment Report and ESMP (Amendment). • Distribute EIA Amendment Report and ESMP to relevant authorities and registered I&APs for review. • Update and finalise EIA Amendment Report with ESMP. • Online submission of the final report onto the MEFTs portal. • Submit Application and finalised EIA Amendment Report with ESMP and I&APs comments to MME and MEFT for decision-making.

1.4.3 EIA (AMENDMENT) REPORT

The main purpose of this EIA (amendment) Report is to indicate which environmental aspects relate to the well testing activities and to provide additional assessment and/or mitigation measures, where required. Table 2 outlines the report content.

TABLE 2: SCOPING REPORT TEMPLATE

Chapter	Objective
Chapter 1: Introduction	Describes the report purpose, briefly describes the project background / proposed amendments, summaries legislative requirements, explains the report structure, summarised assumptions and limitations of the study and explains how I&APs can comment.
Chapter 2: EIA process and Methodology	Outlines the EIA process, including the I&AP consultation process.
Chapter 3: Legal Framework	Provides an overview of relevant Namibian policies and applicable Namibian legislation

Chapter 4: Overall Project Description & Proposed Amendments	Brief summary of the activities assessed during the original EIA process (SLR. 2019). Describes the proposed well testing activities after the wells have been drilled.
Chapter 5: Alternatives	This chapter summarise the project alternatives.
Chapter 6: Description of the current environment	Provides a general overview of the current baseline conditions associated with the proposed Project, drawing on the baseline information provided in the 2019 EIA.
Chapter 7: Identification and Description of potential impacts	This chapter outlines the environmental aspects and potential impacts that could change because of the proposed changes to the project as a result of well testing (i.e. amendment to the approved EIA). It reasons potential cumulative impacts and provides the relevance (screening) / qualitative assessment of potential impacts.
Chapter 8: Way forward	Explain the way forward in term of completing the EIA process and final submission of the Amendment Application.
Chapter 9: Conclusion and Recommendations	EIA Conclusion and impact statement.
Chapter 10: References	Reference list.

1.4.4 EIA TEAM

Namisun Environmental Projects and Development (Namisun) is an independent environmental consultancy firm appointed by Galp to undertake the amendment process.

Werner Petrick, the EIA project manager, has more than twenty-three years of relevant experience in conducting / managing EIAs, compiling EMPs and implementing EMPs and Environmental Management Systems (EMSs). Werner has a B. Eng (Civil) degree and a master's degree in environmental management and is certified as lead environmental assessment practitioner (EAP) and reviewer under the Environmental Assessment Professionals Association of Namibia (EAPAN).

Alexandra Speiser, the EIA project assistant, holds an MSC in Geology and Environmental Management and has more than twenty years of experience in environmental management, managing environmental assessment, the implementation of EMPs in Namibia.

Dr Andrea Pulfrich of Pisces Environmental Services (Pty) Ltd (Pisces) is the Marine Ecologist. Andrea has a PhD in Fisheries Biology from the Institute for Marine Science at the Christian-Albrechts University, Kiel, Germany. As Director of Pisces since 1998, Andrea has considerable experience in undertaking specialist environmental impact assessments, baseline and monitoring studies, and Environmental Management Programmes relating to hydrocarbon exploration,

marine diamond mining and dredging and thermal/hypersaline effluents. She is a member of the South African Council for Natural Scientific Professions, South African Institute of Ecologists and Environmental Scientists, and International Association of Impact Assessment (South Africa).

The relevant curriculum vitae (CV) documentation is attached as Appendix A.

1.5 Assumptions and Limitations

The assumption and limitation during the preparation of the ECC amendment are:

- Namisun assumed that all technical information provided by Galp and their Technical Team is correct and valid at the time it was provided.
- It is assumed that the baseline descriptions and assessments conducted as part of the original EIA (SLR, 2019) are accurate.
- The EIA (amendment) process focuses only on the proposed additional well / flow testing activities of the Galp offshore exploration Project.
- The wells will be drilled Q4 2023 / Q1 2024 and well testing will happen in Q1 2024, possibly ending in Q2.
- There will be no significant changes to the project description or surrounding environment between the completion of the ECC amendment process and implementation of the proposed project that could substantially influence findings and recommendations of this ECC amendment.

1.6 Opportunity to Comment

This EIA Amendment Report (with Amended ESMP) will be distributed for public / authority review. I&APs are invited to comment on these documents, which will be available for a review and comment period from **29 June 2023**. Comments must be sent to Namisun at the telephone number, or e-mail address shown below by no later than **14 July 2023**.

Namisun

Attention: Werner Petrick

E-mail address: wpetrick@namisun.com

Cell number: +264 (0)81 739 4591

2 EIA PROCESS (SCOPING AND ASSESSMENT) METHODOLOGY

This chapter outlines the EIA (Scoping and impact assessment) methodology and I&AP consultation process followed in the EIA (amendment) process.

2.1 INFORMATION COLLECTION

Namisun obtained baseline information and a description of the proposed project activities from Galp to identify the environmental aspects associated with the proposed project; and to assess the potential impacts.

Information for the preparation of this EIA Amendment Report was sourced from:

- The original (approved) "EIA Report for the offshore exploration well drilling Project in PEL 83 (SLR, 2019).
- Input from the marine ecologist (Andrea Pulfrich – Pisces)
- Technical information provided by Galp.
- Consultations and focus group meetings with I&APs.
- Other relevant EIAs, i.e. "Application for amendment of ECC exploration and appraisal well drilling in PEL 39" (SLR, 2023) and ESIA for Proposed Exploration and Appraisal Well Drilling in Block 2912 off the South Coast of Namibia, prepared for TEEPNA (SLR, 2023a).
- .

2.2 SCOPING REPORT STRUCTURE

The structure of this EIA Amendment Report is outlined in Table 3, following largely the Scoping Report requirements as set out in Section 8 of the EIA Regulations (2012).

TABLE 3: REPORT STRUCTURE

Component	Report reference
(a) Details of the Environmental Assessment Practitioner (EAP) who prepared the report	Section 1.4.4 and Appendix A
(b) A description of the proposed activity (i.e., proposed amendments)	Chapter 4
(c) A description of the environment that may be affected by the activity and the way the physical, biological, social, economic, and cultural aspects of the environment may be affected by the proposed activity	Chapters 6, 7 and 8
(d) A description of the need and desirability of the proposed listed activity and identified potential alternatives to the proposed listed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Section 1.3, Chapter 5, 7 and 8

Component	Report reference
(e) An identification of laws and guidelines that have been considered in the preparation of the Scoping Report.	Chapter 3
(f) Details of the public consultation process conducted in terms of Regulation 7(1) in connection with the application, including:	Section 2.3
(i) steps that were taken to notify potentially interested and affected parties of the proposed application;	Section 2.3.2 and 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;	
(iii) a list of all persons, organisations and organs of state that were registered in terms of Regulation 22 as interested and affected parties in relation to the application; and	Section 2.3.1 and Appendix D
(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	Section 2.3.3
(g) An indication of the methodology used in determining the significance of potential effects / A description and assessment of the significance of 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	Chapter 7
(h) A description and comparative assessment of all alternatives identified during the assessment process	Chapter 5
(i) A description of all environmental issues that were identified during the assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 7
(j) An assessment of each identified potentially significant effect	
(k) A description of any assumptions, uncertainties and gaps in knowledge	Section 1.5
(l) A management plan	Appendix E
(m) An opinion as to whether the proposed listed activity must or may not be authorised, and if the opinion is that it must be authorised, any conditions that must be made in respect of that authorisation	Chapter 9
(n) A non-technical summary of the information	Executive Summary

2.3 PUBLIC PARTICIPATION PROCESS

A detailed public participation process was conducted as part of the original (approved) EIA for the proposed project to ensure that all persons and or organisations that may be affected by, or interested in, the proposed exploration activities were informed of the activities and could register their views and concerns (SLR, 2019). Similarly, as part of the amendment application process, the I&APs were informed of the proposed well testing activities, in addition to the approved well drilling and associated activities, to raise further (associated) views and concerns.

Section 2.3.1 provides a summary of I&APs informed of the amendment application process and the proposed well testing activities. Section 2.3.2 describes the process that was followed and the issues that were identified are summarized in Section 2.3.3.

2.3.1 INTERESTED AND AFFECTED PARTIES

The broad list of persons, group of persons or organisations that were informed about the amendments and were requested to register as I&APs, should they be interested and or affected, include:

- Government and parastatals – National, Regional and Local, including (amongst others) the following:
    - The Directorate of Directorate of Petroleum Affairs at the MME.
    - The DEA at the MEFT.
    - MFMR.
    - Lüderitz Town Council.
    - Karas Regional Council.
    - Namport.
- Fishing Associations and Companies.
- Maritime Affairs.
- Oil and Gas Industry and other businesses.
- Non-government organisation (i.e. Namibia Chamber of Environment and Earthlife Namibia).
- Other I&APs that registered on the project.

The full stakeholder database for this project is included in Appendix D of this report. Note: Appendix D1 is the full / complete list of I&APs that were informed via emails. This list is an updated list from the original (complete) I&AP database developed during the original (approved)

EIA (SLR, 2019). Appendix D2 provides a summarised list of all registered I&APs (i.e. registered as part of the EIA Amendment application process).

2.3.2 STEPS IN THE CONSULTATION PROCESS

Table 4 sets out the steps that were followed as part of the consultation process.

TABLE 4: CONSULTATION PROCESS WITH I&APS

TASK	DESCRIPTION	DATE
Notification - regulatory authorities and I&APs		
I&AP identification	The 2019 Galp stakeholder database was updated. This database is updated as and when required. A copy of the I&AP database is attached in Appendix D.	May 2023 – ongoing
Distribution of Background Information Document (BID)	Copies of the BID were distributed via email to authorities and I&APs on the stakeholder database and copies were made available on request by any other I&AP. The purpose of the BID was to inform I&APs and authorities about the proposed activities (i.e. approved well drilling activities and specifically the well testing activities), the assessment process being followed, possible environmental impacts and ways in which I&APs could provide input / comments to Namisun. A copy of the notifications and BID are attached in Appendix B.	May 2023
Site notices	A poster (i.e. "site notice") was placed at the Luderitz Public Library to notify I&APs of the proposed project amendment and the EIA process being following. Photos of the site notice that were displayed are attached in Appendix B.	May – June 2023
Newspaper Advertisements	Block advertisements were placed in the Market Watch (on 17 May and 24 May 2023) as part of the following newspapers: • The Namibian Sun • Die Republikein • Allgemeine Zeitung Copies of the advertisements are attached in Appendix B.	May 202
Key stakeholder and focus group meetings and submission of comments		
Focus group meetings	The above mentioned notifications and adverts stated the following: "Focus Group meetings are planned within the comments and registration period. Should you like to be invited to one of the Focus Group meetings, please contact Namisun". Focus group meetings: • Ministry of Fisheries and Marine Resources (MFMR)	May/June 2023

TASK	DESCRIPTION	DATE
	on 23 May 2023 (refer to Appendix C for the minutes of the meeting). • MME: Directorate of Petroleum Affairs – meeting to be arranged during the (draft) report review period. Various follow up emails were also sent to key Stakeholders (i.e. Fishing Association) indicating that Focus Group Meetings can be arranged on request.	
Comments and responses	All comments received via e-mail are included in Appendix C. A summary of questions / comments / issues raised (with responses) during the meetings and received per email are documented in section 2.3.3 and were incorporated in this report, where relevant.	May - June 2022
Review of EIA Amendment Report by I&APs and authorities and submission of Application to MME and MEFT		
I&APs and authorities review of EIA Amendment Report with ESMP (Addendum)	A hard copy and electronic copy of the EIA Amendment Report with the amended ESMP are available for review at the Lüderitz Public Library. Electronic copies of the report are also available on request from Namisun. Summaries of the report will be distributed to all relevant authorities and registered I&APs on the I&AP database via e-mail (see Appendix B). Authorities and I&APs have the opportunity to review the draft report and submit comments in writing to Namisun. The comments period commenced on the 29 June 2023 and the closing date for comments is 14 July 2023.	June 2023
MME and MEFT review of Final EIA Amendment Report and decision on Application	Namisun will consider all the comments received during the review period. A copy of the final report with the Application Form, including comments from authorities and I&AP, will be submitted to the MME for their review and recommendation to MEFT who will do the final review for decision-making.	June/July 2023
Communicate decision to I&APs	MEFT's decision regarding the ECC application will be communicated to all registered I&APs via email.	After MEFT's review period

2.3.3 SUMMARY OF THE ISSUES RAISED

The questions / comments / issues raised by I&APs during the meetings and received per email, with responses, are summarised in Table 5.

TABLE 5: SUMMARY OF COMMENTS BY I&APS WITH REPONSES

COMMENT / QUESTIONS / ISSUE RAISED	NAME / ORGANISATION	METHOD	RESPONSE
General			
Can you please register me as interested and affected party for the above mentioned project?	(T. Kanime) Affirmative Reposition Organization – Namibia	E-mail dated 17 May 2023	Noted.
I hereby request to be registered as an I&AP for the EIA: Please would you also forward me the BID and the site map (kmz) or the edge coordinates?	EIA Tracking and Monitoring in Namibia Namibian Environment and Wildlife Society (N. Iipinge)	E-mail dated 22 May 2023	Noted. BID was sent.
Please register me as an I&AP.	O&L (A. Nantinda)	E-mail dated 23 May 2023	Noted. BID was sent.
I kindly ask you to gegiter ne as an I&AP.	Earthlife Namibia (B. Kohrs).	WhatssApp Message dated 23 May 2023	Noted.
Comments related to well testing			
Quantification of expected greenhouse gas emissions	(T. Kanime) Affirmative Reposition Organization – Namibia	E-mail dated 23 May 2023	Refer to sections 4.2 and 7.
Comments related to the general well drilling activities (not specifically related to the well testing activities)			
Rent-A-Drum want to register as an interested party in the EIA. Will it be possible	Rent-a-Drum (J. Swart)	E-mail dated 23 May 2023	The BID was sent to Rent-a-Drum.

COMMENT / QUESTIONS / ISSUE RAISED	NAME / ORGANISATION	METHOD	RESPONSE
to forward for us the BID document to be able to see where the applicable meetings will be held and to participate with the feedback?			Furthermore, Namisun called Mr Swart and it was agreed that the comments by Mr Swart relating to possible on-shore waste disposal as part of the exploration well drilling is part of the scope of the "bigger" project and Galp will liaise with Rent-a-Drum outside the Amendment Application process. Both parties agreed that the requirement for specific "EIA meeting" was therefore not required and Namisun shared Rent-a-Drums email and comments with Galp for their further action.
Seabed risks arising from lost tools (e.g., historical anchors, ship wrecks, etc.)	(T. Kanime) Affirmative Reposition Organization – Namibia	E-mail dated 23 May 2023	Even though these aspects are not specifically related to the proposed well testing (amendment) activities, the following in terms of the risks: With reference to the original (approved) EIA, Pre-drilling surveys may be undertaken prior to drilling in order to confirm baseline conditions at the drill site and to identify and delineate any geo-hazards that may impact the proposed exploration drilling operations. Pre-drilling surveys may involve sonar surveys, sediment sampling, water sampling and Remotely Operated Vehicle (ROV) activities (SLR, 2019). See section 4.3 (Table 8).
The practical environmental monitoring program which shall be followed and its performance evaluation	(T. Kanime) Affirmative Reposition Organization – Namibia	E-mail dated 23 May 2023	A monitoring programme was prepared as part of the approved ESMP (SLR, 2019). The updated ESMP is attached as Appendix E, taking the proposed well testing activities into account.

COMMENT / QUESTIONS / ISSUE RAISED	NAME / ORGANISATION	METHOD	RESPONSE
I currently have a suggestion: Will you also consider adding an Oceanographer (to complement the Biologist report) and since it's a drilling activity, the geologist and hydrologist can also be of great value.	O&L (A. Nantinda)	E-mail dated 23 May 2023	This EIA (Amendment) process relates to the well testing activities (only). The well drilling and associated activities were already assessed and approved and will not be re-assessed. Therefore, involving these other "specialists" etc. would not be required for this amendment application.

Refer to Appendix C for a summary of emails received and minutes of meetings.

3 LEGAL FRAMEWORK

The original / approved EIA Report (SLR, 2019) provides the Namibian administrative framework and described the relevant Namibian legislation and international conventions / treaties that are applicable to the proposed Offshore Exploration Well Drilling in PEL 83. This chapter provides a summary of the relevant Namibian policies and applicable Namibian legislation and international conventions / treaties without repeating the details.

The Republic of Namibia has five tiers of law and a few guiding policies relevant to environmental assessment and protection, which include the Constitution of the Republic of Namibia, statutory law, common law, customary law and international law.

As the main source of legislation, the Constitution of the Republic of Namibia (1990) makes provision for the creation and enforcement of applicable legislation. Article 95 (1) of the Constitution says: *"The State is obliged to ensure maintenance of ecosystems, essential ecological processes and biological diversity and utilisation of living natural resources on a sustainable basis for the benefit of Namibians both present and future"*.

In this context and in accordance with the constitution, Namibia has passed numerous laws intended to protect the natural environment and mitigate against adverse environmental impacts.

3.1 POLICIES AND LEGAL FRAMEWORKS APPLICABLE TO OIL AND GAS EXPLORATION

The relevant policies and acts, applicable to oil and gas exploration (including the well testing) include the following:

- Environmental Assessment Policy for Sustainable Development and Environmental. Conservation, 1995.
- Environmental Management Act, 2007.
- EIA Regulations 2012.
- Minerals Policy of Namibia (2004).
- Petroleum (Exploration and Production) Act, 1991.
- Petroleum (Exploration and Production) Act Regulations (1999).

3.2 OTHER LAWS AND POLICIES APPLICABLE TO GAS AND OIL EXPLORATION

Other relevant legislation relevant to the proposed exploration activities (including well testing) are summarised below:

Petroleum:

- Petroleum Products and Energy Act (No. 13 of 1990) and relevant regulations.
- Petroleum Laws Amendment Act (No. 24 of 1998).
- Petroleum (Taxation) Act (No. 3 of 1991).

Transport and Maritime:

- Marine Traffic Act (No. 2 of 1981) (as amended by the Marine Traffic Amendment Act (No. 15 of 1991).
- The Merchant Shipping Act (No. 57 of 1951).
- Namibian Ports Authority Act (No. 2 of 1994) and Port Regulations.
- Civil Aviation Act (No. 6 of 2016) and associated regulations.
- Road Traffic and Transport Act (No. 22 of 1999).
- Wreck and Salvage Act (No. 4 of 2004).
- Territorial Sea and Exclusive Economic Zone of Namibia Act (No. 3 of 1990).
- The Territorial Sea and Exclusive Economic Zone of Namibia Amendment Act (No. 30 of 1991).

Pollution:

- Atmospheric Pollution Prevention Ordinance (Ordinance 11 of 1976).
- Dumping at Sea Control Act (No. 73 of 1980).
- International Convention for the Prevention of Pollution from Ships Act (No. 2 of 1986).
- International Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties Act (No. 64 of 1987).
- Prevention and Combating of Pollution of Sea by Oil Act (No. 6 of 1981) and associated Regulations.
- Marine Notice (No. 2 of 2012): Transfer of Oil Outside Harbours.

Environment/Conservation:

- Marine Resources Act (No. 27 of 2000) and accompanying regulations.
- Nature Conservation Ordinance (No. 4 of 1975).
- Nature Conservation Amendment Act (No. 5 of 1996).
- National Heritage Act (No. 27 of 2004).
- Water Act (No. 54 of 1956).
- Water Resources Management Act (No. 24 of 2004).

Hazardous Substances:

- Hazardous Substances Ordinance (Ordinance 14 of 1974).
- The Hazardous Substances Ordinance 14 of 1974: Group I Hazardous Substances.

Labour:

- Labour Act (No. 11 of 2007).
- Regulations relating to the health and safety of employees at work (GN 156 of 1997).
- Employee's Compensation Act (No. 30 of 1941), as amended.

Health:

- Health Act (No. 21 of 1988).

Other policies, plans and guidelines applicable proposed exploration activities (including well testing.

- White Paper on the Energy Policy, 1998.
- Namibia Vision 2030.
- Fifth National Development Plan 2017/18 – 2021/22 (NDP5).
- Harambee Prosperity Plan.
- Strategic Plan, 2017/2018 – 2021/2022.
- Policy for Prospecting and Mining in Protected Areas and National Monuments, 1999.
- Policy for the Conservation of Biotic Diversity and Habitat Protection, 1994.
- National Policy on Prospecting and Mining in Protected Areas (2018).
- National Waste Management Policy (2010).
- National Biodiversity Strategy and Action Plan (NBSAP) 1 and 2 (draft).
- National Agriculture Policy (2015).
- New Equitable Economic Empowerment Framework Policy, 2011.
- National Environmental Health Policy (2002).

3.3 INTERNATIONAL LAWS AND CONVENTIONS RATIFIED BY THE NAMIBIAN GOVERNMENT

Relevant international conventions and treaties which the Namibian Government has been ratified and which have become law through promulgation of national legislation are listed below.

Air and Atmosphere:

- Kyoto Protocol on the Framework Convention on Climate Change, 1997.
- Montreal Protocol on Substances that Delete the Ozone Layer, 1987.
- Paris Agreement (United Nations Framework Convention on Climate Change) 2016.
- United Nations Framework Convention on Climate Change – UNFCCC (1992).
- Vienna Convention for the Protection of the Ozone Layer, 1985.

Chemicals and Waste:

- Convention on the control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel, 1989).
- Stockholm Convention on Persistent Organic Pollutants (2001).

Flora, Fauna and Protected Areas:

- African Convention for the Conservation of Nature and Natural Resources (Algeria, 1968) and the revised version (Maputo, 2003).
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity (2000).
- Convention on Biological Diversity, 1992.
- Convention on International Trade of Wild Fauna and Flora Endangered Species (1973) (CITES).
- Convention on Wetlands of International Importance (Ramsar Convention, 1971).
- International Convention for the Conservation of Atlantic Tunas (ICCAT).
- Memorandum of Understanding (MoU) concerning Conservation Measures of Marine Turtles of the Atlantic Coast of Africa (1999).
- United Nations Convention to Combat Desertification in those Countries Experiencing serious Drought and/or Desertification, Particularly in Africa (1994).

Marine Pollution:

- International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78).
- 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).
- International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention).
- International Convention on the establishment of an International Fund for Compensation for Oil Pollution Damage (The Fund Convention), 1971.
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Convention) and 1996 Protocol.
- International Convention relating to Intervention on the High Seas in case of Oil Pollution Casualties (1969).
- Protocol on the Intervention on the High Seas in Cases of Marine Pollution by substances other than oil (1973).

Marine Safety:

- Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS).
- International Convention for the Safety of Life at Sea, 1974 (SOLAS) with its protocol of 1978.
- The International Convention on Load Lines, 1966 and its protocol of 1988.
- International Convention on Standards of Training, Certification and Watch-keeping for Seafarers, 1978.

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).
- Convention of the International Maritime Organisation (IMO), 1948.
- United Nations Law of the Sea Convention, 1982, (UNCLOS).

Archaeology and Cultural Heritage:

- Convention concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972).

Fishing:

- Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1993).
- Convention on the Conservation and Management of Fishery Resources in the South-East Atlantic Ocean (2001).

4 PROJECT DESCRIPTION

This chapter provides a summarised description of Galp's proposed Offshore Exploration Well Drilling in PEL 83, referring to the 2019 EIA Report (SLR, 2019) (details are not repeated). It further explains Galp's proposed amendments to the "originally planned / approved Project", i.e. well testing activities.

4.1 GENERAL PROJECT INFORMATION

4.1.1 DETAILS OF THE APPLICANT

Company name:	Windhoek PEL28 B.V. Physical: Dr. Frans Indongo Street, Frans Indongo Gardens - 15th Floor - Erf 1657, Windhoek Postal: Rua Tomás da Fonseca – Torre A, 1600-209, Lisboa, Portugal
Contact (responsible) person:	Daniel Rodrigues (Geoscientist)
Telephone / Fax:	+ 351 963 858 838
E-mail:	daniel.rodrigues@galp.com

As stated in section 1.2, PEL83" is a Joint Venture between the block partners, namely Windhoek PEL28 B.V. (a wholly owned subsidiary of Galp Energia E&P B.V), the National Petroleum Corporation of Namibia (NAMCOR) and Custos Investments. Galp is currently the operator of PEL. Galp holds an 80% controlling interest in Petroleum Exploration Licence (PEL) 83, while NAMCOR and Custos each hold 10%. Galp is currently the operator of PEL 83.

4.1.2 PROJECT OVERVIEW AND BACKGROUND

In 2019 Galp undertook an EIA process (SLR, 2019) for the proposed Offshore Exploration Well Drilling in PEL 83 and related activities and infrastructure. This EIA was approved by the MEFT and an ECC granted (see sections 1.4 and 2 for further details).
A brief summary of the activities and infrastructure that were included in the original EIA (SLR, 2019) are provided in sections 4.1.3 and 4.1.4.:

4.1.3 MAIN PROJECT COMPONENTS / INPUTS FOR DRILLING

4.1.3.1 DRILLING UNIT

The two wells will be drilled using a semi-submersible drilling vessel (rig). The vessel choice will be made depending upon rig availability, design specifications, safety and metocean conditions.

The drilling unit will be held in position by dynamic positioning thrusters, as anchoring is not possible in deep water, practical such as in the licence area. While the unit is operating, a temporary 500 m operational safety zone will be imposed around the drilling vessel.

4.1.3.2 SUPPLY VESSELS

Supply vessels will call into port regularly during the course of the drilling campaign to support / service the drilling unit. Up to three supply vessels might be utilised, which will facilitate equipment, material and possibly crew transfers (depending on helicopter transfer feasibility) between the drilling unit and the shore base. Supply vessels can also be used for medical evacuations if needed.

4.1.3.3 HELICOPTERS

The preferred method of transfer of personnel to and from the drilling unit will be by helicopter and it is estimated that there will be at least four daylight flights (approximately 40 people) per week to and from the drilling unit and Lüderitz or a suitable location nearby. The helicopters can also be used for medical evacuations from the drilling unit to shore (at day- or night-time), if required.

4.1.3.4 ONSHORE LOGISTICS BASE

The primary onshore logistics base will be located in either the Port of Lüderitz or the Port of Walvis Bay. Lüderitz is the preferred port due to proximity to the licence area. The shore base will provide for the storage of materials and equipment (including pipes, drilling fluid, cement, chemicals, diesel and water) that will be transported by sea to / from the drilling vessel. The shore base will also be used for offices (with communications and emergency procedures / facilities), accommodation, waste management services, bunkering vessels, and stevedoring / customs clearance services.

4.1.4 WELL DRILLING OPERATION

4.1.4.1 MOBILISATION

The drilling unit and supply vessels could sail directly to the well site from outside Namibian waters or via a Namibian port during mobilisation. The stability and trim of the drilling unit and the support vessels will be maintained by pumping seawater into designated ballast tanks and released to sea during mobilisation and transit to site.

Casings, mud components, cement and other components and material will be brought in country on the drilling unit itself or imported via a container vessel directly to the onshore logistics base from where the supply vessels will transfer it to the drilling unit.

4.1.4.2 DRILLING SEQUENCE OR STAGES

A well will be created by drilling a 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 hole is drilled, casings of steel pipe (which provide structural integrity to the newly drilled wellbore), are placed in the hole and permanently cemented into place. The diameter of the well will decrease with increasing depth.

Drilling is essentially undertaken in two stages, namely the riserless and risered drilling stages (see Figure 2).

Initial (riserless) drilling stage

‘An initial section of conductor pipe (30 or 36 inch in diameter), approximately 80 m in length, will be either jetted or drilled and then cemented into place. The conductor is run in the shallow unconsolidated sediment section to prevent the sides of the well from caving in. Subsequently, a low pressure wellhead is placed on top of the conductor.

Below the conductor, a 26 inch diameter hole will be drilled to a depth of approximately 850 m below the seabed. 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; which provides the entry point to the subsurface and it is the connection point to the BOP.

These initial hole sections will be drilled using seawater (with viscous sweeps) and water-based mud (WBM). All cuttings and drill fluids from this initial drilling stage will be discharged directly onto the seafloor’ (SLR, 2019).

Risered drilling stage

‘This stage commences with the lowering of a blow-out preventer (BOP) and installing it onto the wellhead. The BOP is designed to seal the well and prevent any uncontrolled release of fluids from the well (a ‘blow-out’). A marine riser is then installed together with the BOP, which makes the connection between the drilling unit and the wellhead. The riser isolates the drilling fluid and cuttings from the environment, thereby creating a “closed loop system”.

Drilling is continued by lowering the drill string through the riser, BOP and casing, and then rotating the drill string. During the risered drilling stage, should the WBMs not be able to provide the necessary characteristics, a low toxicity Synthetic Oil-Based Mud (SOBM) will 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 sides of the hole to the drilling unit.

The cuttings are removed from the returned drill mud, treated to reduce oil content and discharged overboard' (SLR, 2019).

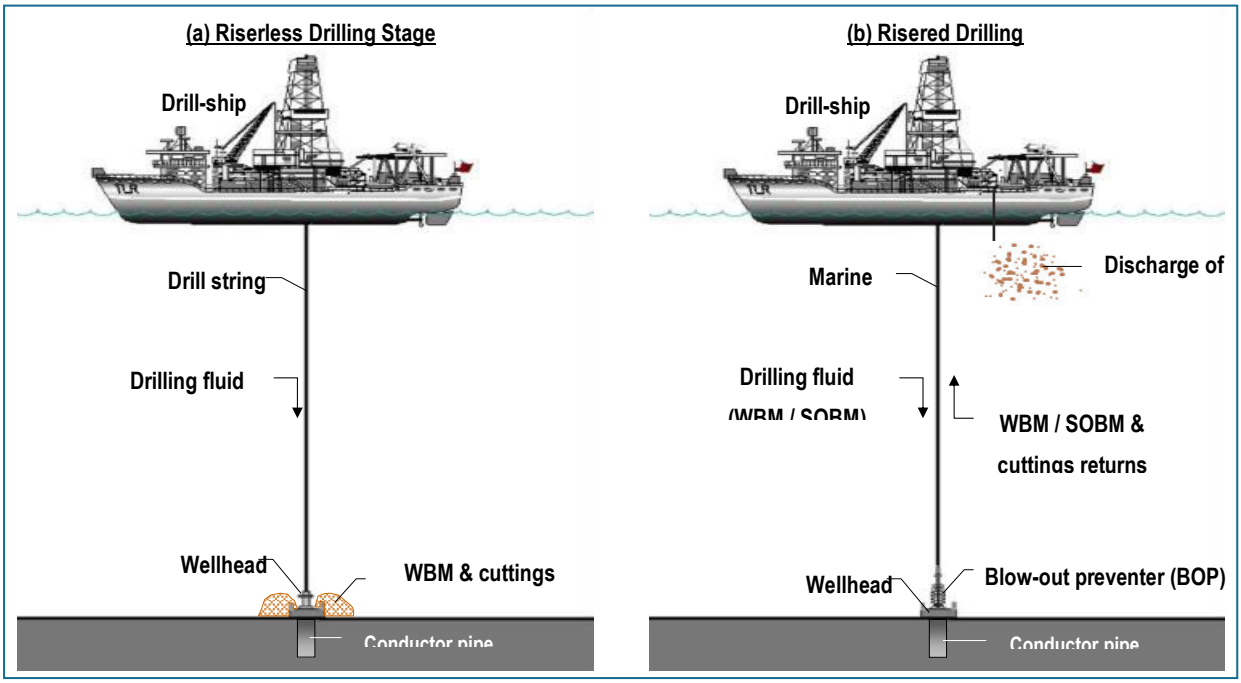

FIGURE 2: DRILLING STAGES: (A) RISERLESS DRILLING STAGE; AND (B) RISERED DRILLING STAGE.

4.1.4.3 WELL LOGGING AND TESTING

After reaching the target depth the well will be logged and tested, including Vertical Seismic Profiling (VSP). VSP uses a small airgun array, which generates a peak sound pressure level around 235 dB re 1µPa at 1 m in the 5 to 100 Hz range. The sound exposure levels around 210 dB re 1µPa^2·S @ 1 m, decreasing rapidly with distance from the source. The volumes and the energy released into the marine environment are significantly smaller than what is required or generated during conventional seismic surveys. VSP is expected to take approximately 8 to 12 hours per well to complete, however, this will depend on the well's depth and number of stations being profiled.

Galp now proposes to undertake well or flow testing, as this was not included in the original EIA (SLR, 2019) an amendment has to be undertaken to the existing ECC. The related activities to the well and flow testing are described in chapter 4.2.

4.1.4.4 DEMOBILISATION PHASE

After the exploration well(s) have been sealed, tested for integrity and temporary abandoned (for later re-entry for Drill stem test (DST) operation, the wellhead (with a maximum height of approximately 4 m and a diameter of less than 1 m) will be left on the seafloor with an abandonment cap.

With the exception of the abandoned wellhead(s) and any cuttings deposited on the seabed, no further physical remnants of the drilling operation will be left on the seafloor. The drill-ship and supply vessels will demobilise from the offshore licence area and either mobilise to the following drilling location or relocate into port or a regional base for maintenance, repair or resupply.

4.2 PROPOSED AMENDMENTS TO INCLUDE WELL / FLOW TESTING ACTIVITIES

The only change to the previously described, assessed and approved project activities is the proposal to conduct well / flow testing and associated activities.

A description of the well flow testing operations and related discharges to the marine environment and emissions to the atmosphere is provided below.

4.2.1 DESCRIPTION OF WELL FLOW TESTING OPERATIONS

Well flow testing is undertaken to determine the economic potential of any discovery thereby reducing the subsurface and/or well performance uncertainties supporting the appraisal of a discovery. It is routinely used to evaluate well and field performance, diagnose reservoir characteristics, integrate test results with other studies, plan for future development, and perform the overall management of the reservoir. At the end of a well test, the well is typically abandoned (i.e. a well that is permanently sealed with no intention of coming back to it later) or suspended (i.e. a well that is safely secured with the intention to come back later for further testing and/or production). Depending on the exploration strategy, a well test could be undertaken in the discovery well and/or subsequent appraisal well(s). Typically one test would be undertaken per exploration well if a resource is discovered.

Prior to the well test, the drilling mud in the well will be removed and the well cleaned with seawater and finally replaced with completion fluids. Completion fluids will be used to keep the well under control, and the fluid weight is defined depending on the pressure downhole. Most

completion fluids are composed of calcium chloride and some additives. Upfront toxicity tests at various densities will be conducted on the completion fluid. Prior to discharge, the fluids will be diluted and discharged in batches after passing an oil/grease static sheen test. Any fluid which does not pass the toxicity tests at lower densities (like Calcium Bromide) would be returned to the fluid supplier for re-use or sent to an on-land disposal facility where they typically evaporate the water and recover the salt. One or more zones may be tested per well.

A well test operation will require approximately 30 additional drillship/SS days on location to prepare for and conduct the testing; actual testing may take approximately 48 to 72 hours. A Drill Stem Test (DST) would involve flowing formation fluids, including oil and/or natural gas, up to the drillship/SS where it will flow through special equipment to be separated, measured, and safely disposed using modern high efficiency hydrocarbon burners or flares to maximise combustion of the hydrocarbons. The amount of hydrocarbons produced would depend on the quality of the reservoir but is kept to a minimum to minimise the impact on the environment and avoid wasting potentially marketable oil and/or gas.

The test operation comprises the utilization of a perforating gun which creates holes/channels through the casing and cement, into the reservoir. These holes are called perforations and provide a pathway for fluid to flow from the reservoir into the wellbore. The methodology called Tubing Conveyed Perforation (TCP) uses a tubing conveyed large diameter casing gun (3–1/8 to 5 in.) at the end of the tubing string. This arrangement allows the use of large diameter guns that perforates the well with the tubing in the hole. There are two techniques, “shoot and drop” or “shoot and pull” where the gun is either left at the bottom of the well or hauled back to the surface. Explosives are always stored in a “bunker” on the drillship/SS rig site in a safe area.

The typical method of correlating a TCP gun string to the desired reservoir location is to use a radioactive marker, which can be used to make very accurate depth correlation of pipe conveyed gun systems. A correlation tag or marker, called Pip tag, is located in the casing threads or the perforation that can quickly and positively be found during positioning the string at the right depth. A wireline gamma ray logging tool is run through the tubing to perform the correlation log. The resulting log will show a large spike at the depth of the pip tag. When this log is compared to the open hole gamma ray log, adjustments can be made to the work string placing the guns on depth. All radiation emitting materials are stored in a contained radiation sealed area on the drillship/SS rig site. The duration of the drill stem test (DST) is expected to last several days. Drill stem tests are multi rate tests designed to determine reservoir characteristics under a variety of flowing conditions. These test rate calculations reflect the maximum capabilities of typical well test equipment.

4.2.2 PRODUCED WATER

There is potential for water being produced from the reservoir during a well flow test, which would be separated from the oily components and treated onboard to reduce the remaining hydrocarbons from these produced waters. The hydrocarbon component would be combusted via hydrocarbon burners or flares, while the water would be temporarily collected in a slop tank. The water is then either directed to:

- Multi-Purpose Tanks (MPT) prior to transfer to supply vessel for onshore treatment and disposal; or
- A dedicated treatment unit where, after treatment is either:
  - Discharged overboard if hydrocarbon content is < 30 mg/l (average of daily readings) or
  - Subjected to a second treatment or directed to a tank prior to transfer to supply vessel for onshore treatment and disposal if hydrocarbon content is > 30 mg/l.

Reinjection of the produced water into the well may be considered as an alternative, if volumes are not able to be managed via the options noted above.

4.2.3 FLARING

The main sources of emissions to air from the proposed exploration activities will be from vessel engines (drill unit, support vessels and helicopters) and well testing. The helicopters will use kerosene and the vessels will be supplied with marine gas oil (MGO) with less 0.5% sulphur (mass).

As described in 4.2.1, during well testing it may be necessary to flare off some of the oil and gas brought to the surface. Flaring produces a flame of intense light and heat at the drill unit. A high-efficiency flare is used to maximise combustion of the hydrocarbons. The amount of hydrocarbons produced would depend on the quality of the reservoir but is kept to a minimum to minimise the impact on the environment and avoid wasting potentially marketable oil and/or gas.

It is difficult to estimate accurately the volume of hydrocarbons to be combusted during the well testing (i.e. flaring activities). Galp is estimating for a 72 hours (3 days) well test up to 51 000 bbl of hydrocarbons to be flared, per test. These rates are based on the maximum capacity for typical temporary flaring / well testing equipment. At this stage of the study, it is difficult to predict which kind of fluid will be produced and which fluid rates.

The estimated pollutant emissions for a 3-day flaring operation are provided in Table 6.

TABLE 6: SUMMARY OF TOTAL ESTIMATED POLLUTANT EMISSIONS FOR A SINGLE 3-DAY WELL TEST

		Oil Burn	Gas Flare	Total
Assumed total flaring volume		8,160 m^3	2,746,782 Nm^3	
Pollutant Emissions (m^3)	**PM**	10.7	0.0	10.7
	SO_x	175.1	0.03	175.13
	NO_x	51.25	3.65	54.90
	VOC	0.25	3.09	3.34
	CO	5.38	19.91	25.29

The total estimated greenhouse gas (GHG) emissions for a 3-day flaring operation are summarised in Table 7 below.

TABLE 7: SUMMARY OF TOTAL ESTIMATED GHG EMISSIONS FOR A SINGLE 7-DAY WELL TEST

Source type	Fuel type	Calorific value	Emission Factor			Quantity	GHG Emissions
			CO_2	CH_4	N_2O		
Flaring	Oil burn	43.8 MJ/Kg	73,000 Kg/TJ	3 Kg/TJ	0.6 Kg/TJ	8,031 t	25,399 tCO2eq
	Natural gas	38.1 MJ/m3	2 Kg/TJ	0.012 Kg/TJ	0.000023 Kg/TJ	2,746,782 m3	6,271 tCO2eq
TOTAL							**31,670 tCO_2e**

4.3 SUMMARY OF PROJECT DESCRIPTION

A summary of the key exploration drilling project components is provided in Table 8 below. Amendments to the original approved project description (EIA, SLR, 2019) are indicated in **bold** text in the table.

The commencement date of the well drilling has not yet been fixed; however, the earliest date for commencement of drilling by November 2023. The expected target drilling depth will be approximately 3 500 m below the seafloor (total depth of 5 050 m from sea surface) and is expected to take approximately two to three months per well to complete.

TABLE 8: SUMMARY OF PROJECT PHASES AND ACTIVITIES (SLR, 2019) AND WELL TESTING (IN BOLD)

Phase		Activity
1. Pre-Drilling Surveys		Operation of seabed survey vessels
		Seabed surveying, including echo sounding, side-scan sonar, sub-bottom profiling and core / grab samples, and Remotely Operated Vehicle (ROV)
2. Drilling	2.1 Mobilisation Phase	Rental of quay space; laydown area and warehouse
		Appointment of local service providers
		Procurement of equipment / materials from the local market
		Rental of accommodation or hotels/ Bed and Breakfast (B&B)
		Mobilisation of Long Lead Items, drilling equipment and bulks
		Transit of drilling unit and supply vessels to drill site
		Discharge of ballast water
	2.2. Operation Phase	Operation of drilling unit and supply vessels
		Operation of helicopters
		Final site selection and seabed survey using a ROV
		Top hole drilling (including spudding)
		Discharge of residual cement during cementing operations
		Discharge of cuttings and drilling fluid
		Wellhead installed on surface casing
		Installation of BOP and riser system connected to the high pressure wellhead housing (HPWHH)
		Bottom hole drilling to final depth
		Well logging and Vertical Seismic Profiling (VSP)
		Plug well with cement and well integrity verification
		Well flow testing (Possible when hydrocarbons are discovered, with each test taking approximately 3 days of flow and flaring.)
	2.3 Demobilisation Phase	Abandonment of wellhead on seafloor
		Drilling unit / supply vessels leave drill site and transit to port or next destination
		Demobilisation of spare Long Lead Items

5 ALTERNATIVES

This chapter describes the various alternatives that were considered as part of the planning of this project and amendment.

5.1 ALTERNATIVES CONSIDERED IN THE 2019 EIA

The original / approved EIA Report (SLR, 2019) provides a description of the alternatives associated with the proposed Offshore Exploration Well Drilling and assessed these accordingly. These (assessment) details will not be repeated in this report. The alternatives, previously considered, relate to the following (with updates where relevant):

1. **Site / location alternatives**: The 2019 EIA Assumed that the wells could be drilled anywhere within the licence area and assessed the potential impacts accordingly.

   Galp has however now made the decision on the final well location, based on a number of factors, including further detailed analysis of the seismic data, the geological target, etc. Galp is therefore currently preparing the necessary pre-well activities to minimize any potential risks, including a Shallow Hazard study (completed in February 2023) over the area and an Environmental Baseline Survey over the location.

   The proposed two well locations are indicated in Figure 3.

2. **Exploration well drilling activities:** No other activity alternatives (i.e. other than "well drilling") were considered in the EIA process. However relevant pre-drilling activities and associated potential impacts were described and assessed in the 2019 EIA.

3. **Number of wells:** The 2019 EIA assessed the potential impacts associated with two wells. Galp currently plan to drill two wells.

4. **Scheduling:** The 2019 EIA considers the implications of drilling in different seasons. With reference to section 4.3, Galp plan to commence with the exploration drilling programme in Q4 2023.

5. **Technology / process:** A semi-submersible drilling vessel will be used.

   Different options relating to the drilling method, drilling fluid, drill cutting disposal method and well completion options were all considered and assessed as part of the 2019 EIA.

6. **No-go option:** As stated in the 2019 EIA (SLR, 2019), the No-Go alternative represents the option not to proceed with exploration drilling, which leaves the project areas of influence (i.e. offshore licence block, Lüderitz and Walvis Bay) in their current state except

for variation by natural causes and other human activities. It thus represents the current status quo and the baseline against which all potential project-related impacts are assessed. Furthermore, should the exploration drilling activities be undertaken, without the proposed (additional) well testing Galp will not be in a position to reduce the subsurface and/or well performance uncertainties and evaluate well and field performance, diagnose reservoir characteristics, and better plan for future development. Potential environmental impacts associated with the well testing activities are described in Chapter 7.

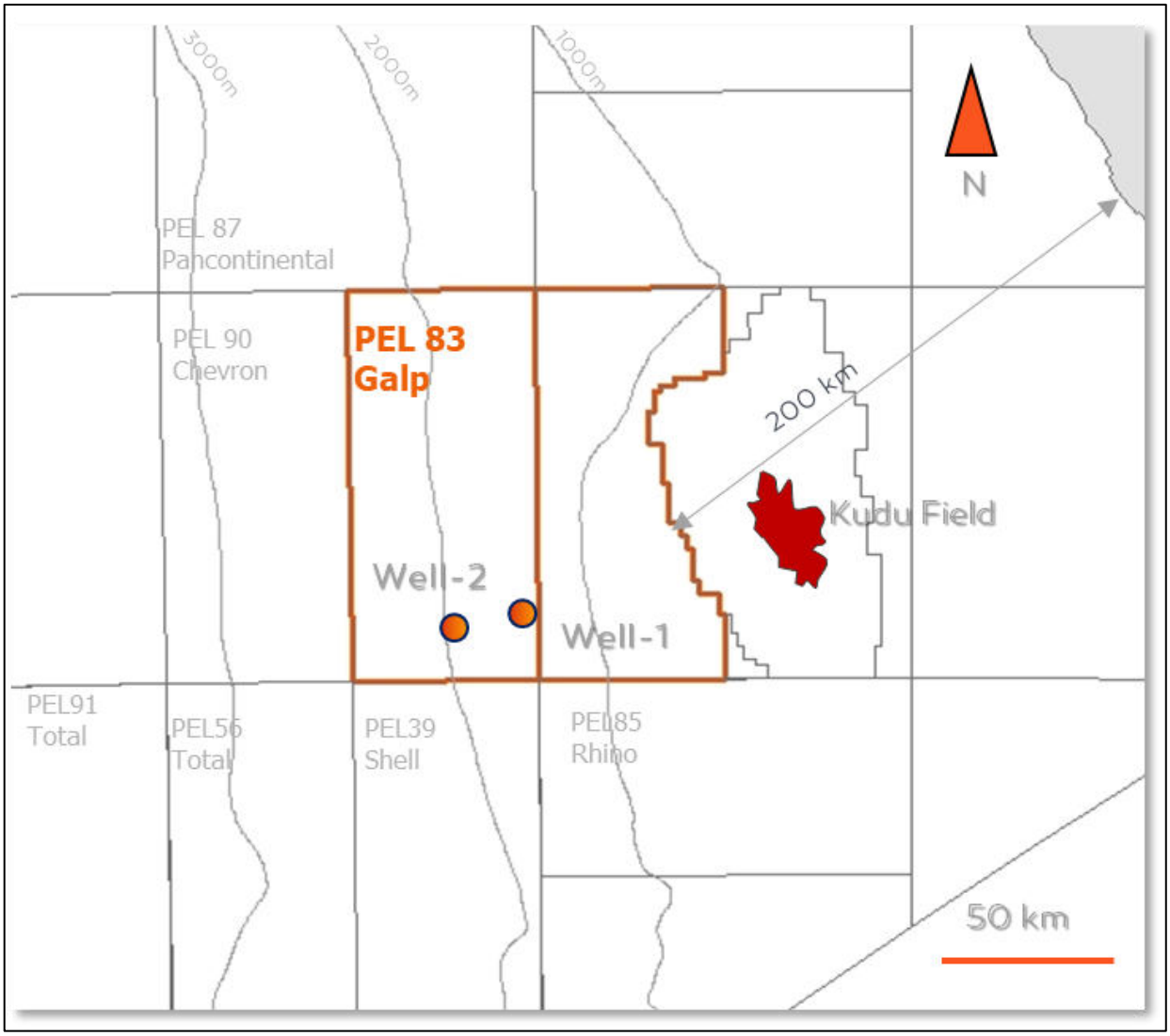

FIGURE 3: AREA WITHIN PEL 83 WHERE GALP PROPOSES TO DRILL THE TWO EXPLORATION WELLS

5.2 ALTERNATIVES RELATING TO THE WELL TESTING ACTIVITIES

With reference to section 4.2, various options being considered by Galp, relating to the well testing activities, include:

1. **Tubing Conveyed Perforation:** Two techniques, “shoot and drop” or “shoot and pull” where the gun is either left at the bottom of the well or hauled back to the surface. From an environmental impacts point of view there is no difference to the two options.
2. **Produced water:** Different disposal options for the possible water being produced from the reservoir during a well flow test are further discussed in chapter 6 and the amended ESMP.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

An understanding of the environment and the sensitivity of the site and surroundings is important to understand the potential impacts of the project. This chapter provides a general overview of the current baseline conditions associated with the proposed project, drawing on the baseline information provided in the 2019 EIA conducted by SLR and updated, where relevant.

This chapter was compiled by utilizing the following sources of information:

- The original "EIA Report for the Galp offshore exploration drilling Project" (SLR, 2019).
- Input from the marine biologist (Andrea Pulfrich) in the relevant sections.
- The knowledge baseline for Marine Spatial Planning in Namibia (MFMR, 2021).
- Technical information provided by Galp.
- Consultations and focus group meetings with I&APs.

Various references were made in the respective Specialist Reports from the original EIA (SLR, 2019), which will not be repeated in the sections below.

6.1 GEOPHYSICAL CHARACTERISTICS

The width of the continental shelf of southern Namibia is variable. Off the Orange River the shelf is wide (230 km) narrowing to the north and reaching its narrowest point (90 km) off Chameis Bay, before widening again to 130 km off Lüderitz. The Orange Bank (Shelf or Cone), offshore of the Orange River, comprise three low mounds rising to about 160 m on the outer shelf. North of Chameis Bay, the shelf becomes a stepped feature, with a low step having an elevation between roughly 400 - 450 m below mean sea level. Approximately 140 km south of the licence area the Tripp Seamount is located, which rises from the seabed at approximately 1 000 m to a depth of 150 m.

Unconsolidated sediment cover on the continental shelf 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. Sediments in the licence area are expected to be dominated by muddy sands, sandy muds, mud and some sand.

6.2 BIOPHYSICAL CHARACTERISTICS

The climate of the Namibian coastline is categorised as hyper-arid with typically low, unpredictable winter rains and strong predominantly southerly / south-easterly winds. The main physical drivers of the nearshore Benguela Region are winds, 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. Average annual precipitation ranges from 16.4 mm at Lüderitz to 51.5 mm at Oranjemund. Coastal fog is a regular occurrence, this may affect helicopter operations between the drilling unit and the Lüderitz airport.

The Namibian coastline is strongly influenced by the Benguela Current system. The coastal upwelling of cold nutrient-rich water is an important centre of plankton production, which supports a global reservoir of biodiversity and biomass of sea life.

The wave regime along the southern African West Coast shows no strong seasonal variation with virtually all swells throughout the year coming from the south-west to south direction. In winter there is a slight increase in swell, the wind direction stays the same.

6.3 BIOLOGICAL CHARACTERISTICS

Biogeographically, the study area falls into the cold temperate Namaqua Bioregion, which extends from Sylvia Hill, north of Lüderitz in Namibia to Cape Columbine in South Africa. The portion of the licence area that extends beyond the shelf break onto the continental slope and into abyssal depths falls into the Atlantic Offshore Bioregion. The Namibian coastline is characterised by coastal, wind-induced upwelling, is the principle physical process that shapes the marine ecology of the central Benguela region. The Benguela system is characterised by the presence of cold surface water, high biological productivity, and highly variable physical, chemical and biological conditions.

In general, benthic community structure and distribution is determine by water depth and sediment grain size. The periodic intrusion of low oxygen water masses in the deep water shelf areas of the southern Africa West Coast is likely to also contribute to benthic community variability. All benthic habitats in PEL 83 have been assigned a threat status of “Least Threatened” by the Benguela Current Commission Spatial Biodiversity Assessment. Substantial shelf areas in the productive Benguela region are potentially be capable of supporting rich, cold water, benthic, filter-feeding communities. Such communities will also be expected with topographic features such Tripp Seamount 140 km south of PEL 83.

Figure 4 shows the preferred spawning grounds of numerous commercially exploited fish species located off central and southern Namibia. Their eggs and larvae form an important contribution to the ichthyoplankton in the region. These spawning areas occur inshore and northward of the licence area, however, one of the known Orange Roughy spawning areas falls within the PEL 83. Thus, plankton, zooplankton and ichthyoplankton abundances are expected to be comparatively low within the licence area itself.

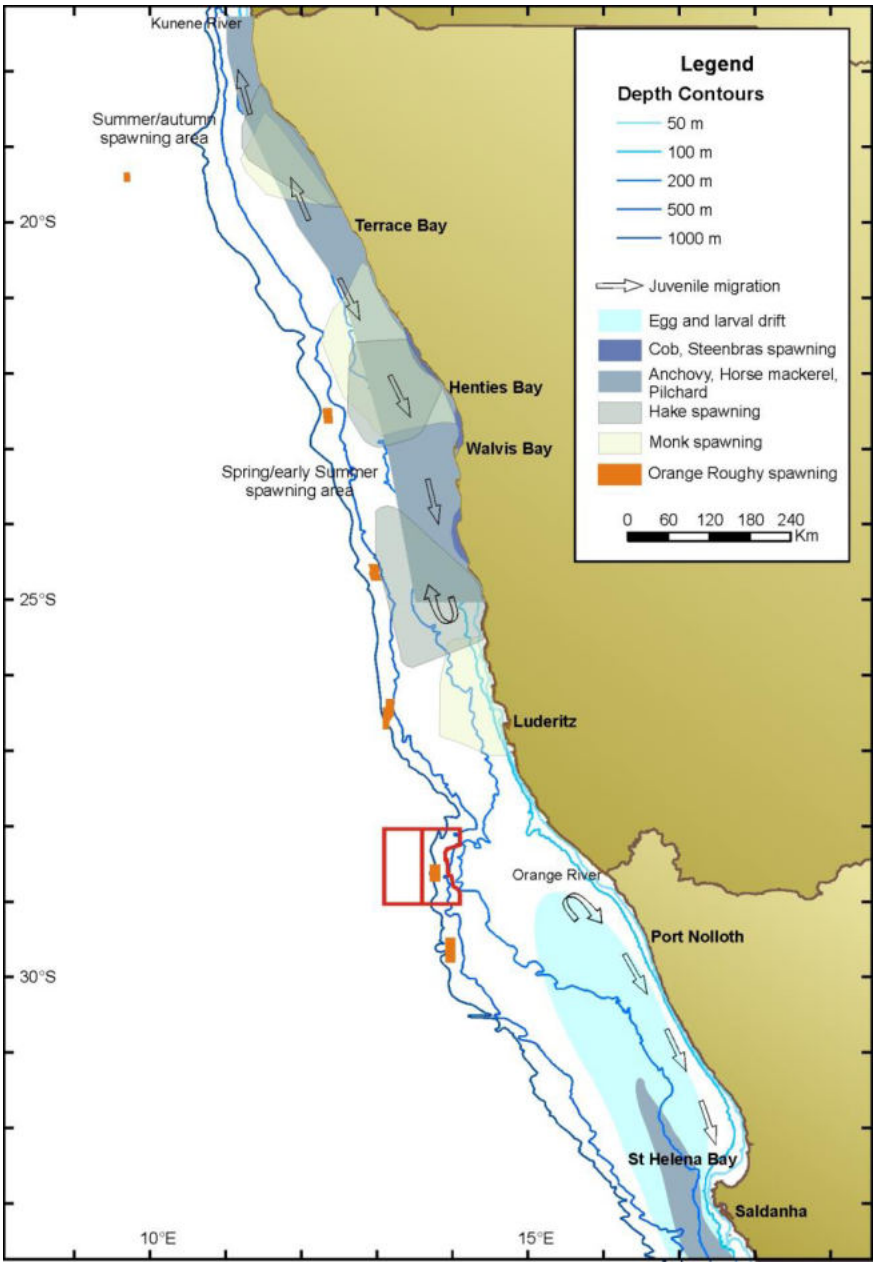

FIGURE 4: PEL 83 IN RELATION TO MAJOR SPAWNING AREAS (MFMR, 2021)

The fish fauna off the Namibian coast shows a relatively low diversity of species compared with warmer oceans due to the cold temperate nature of the region. However, the upwelling nature of the region results in huge biomasses of specific species that supports a commercially important fishery.

The Namibian coastline sustains large populations of breeding and foraging seabird and shorebird species. Most of the seabird species breeding in Namibia feed relatively close inshore (10-30 km). The nearest seabird colonies to the licence area are at Lüderitz Lagoon, Halifax and

Possession Islands, all of which are important bird areas and provide a vital breeding habitat. Although drilling activities will be located in the offshore marine environment, more than 108 km offshore, far removed from any sensitive coastal receptors, these colonies could be affected by helicopter flights between the drilling unit and Lüderitz airport.

Migratory pelagic seabirds that could possible transit through PEL 83 include Atlantic Yellow-Nosed and Black-browed Albatrosses.

Five of the eight species of turtle worldwide occur off Namibia (Bianchi *et al.* 1999). Limited information is available on marine turtles in Namibian waters, although the leatherback turtle (*Dermochelys coriacea*), which are known to frequent the cold southern ocean, are the most commonly-sighted turtle species in the region. In addition, the loggerhead turtle (*Caretta caretta)* could be as well encountered within the licence area.

Thirty-three species of whales and dolphins are known or likely to occur in Namibian waters. 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 continental slope (200 to 2 000 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 Cape fur seal is the only seal species that has breeding colonies along the Namibian coast. The closest seal colonies to the licence area are at van Reenen Bay and Baker's Bay approximately 90 km and 80 km inshore and to the north-east of the licence area in the Tsau//Khaeb-Sperrgebiet National Park.

6.4 Socio-Economic Environment

6.4.1 Fishing

The spatial distribution and catch effort of the commercial fishing sectors that operate off the coast of Namibia are given below. Figures 5 to 8 provides information of the four fisheries that may be affected by the offshore exploration well drilling.

- Demersal trawl: This fishery operates between depths of 200 m and 850 m. The grounds used by the demersal trawl fishery coincide with the eastern border of the licence area (see Figure 5). Approximately 1.7% of the total fishing ground used by the sector lies within the PEL area. Of the total landings recorded by the sector taken within the licence area in water depths less than 900 m approximates 1.6% (993 tons), while effort amounts to 2.9% (160 trawls) of the total effort expended by the sector during the period 2005 to 2018.

- Large pelagic long-line: Fishing effort is widespread predominantly along the shelf break between the 500 m and 2 000 m isobaths. The grounds used by the pelagic long-line fishery coincide with the licence area (see Figure 6). An average of 59.1 tons of catch per year (2.6% of the total catch) was taken within the licence area over the period 2008 to 2013, while effort expended amounted to 34 500 hooks (1.9% of the total effort).
- Demersal long-line: Demersal long-lining is expected to occur in similar areas used by the hake-directed trawling. Grounds used by the demersal long-line fishery coincide with the eastern border of the licence area (see Figure 7). The licence area covers approximately 1.7% of the total fishing ground used by the sector. Catch taken in the licence area (2005 – 2018), mainly inshore of the 500 m depth contour, approximates to 1.1% (113 tons per year) of the national landings reported by the sector. The effort expended within the licence area, mainly inshore of the 500 m depth contour, amounts to 1.5% (625 000 hooks per year) of the total effort expended by the sector.
- Tuna pole: Aggregations of tuna are known to occur near Tripp Seamount (approximately 140 km south of the licence area) and the highest effort levels are recorded in this area. The grounds used by the tuna pole fishery coincide with the licence area (see Figure 8). An average of 1.3% (70 poles per year) of the overall effort expended by the sector was recorded within PEL 83 over the period 2009 to 2013. Effort increases in the inshore areas adjacent to the licence area.

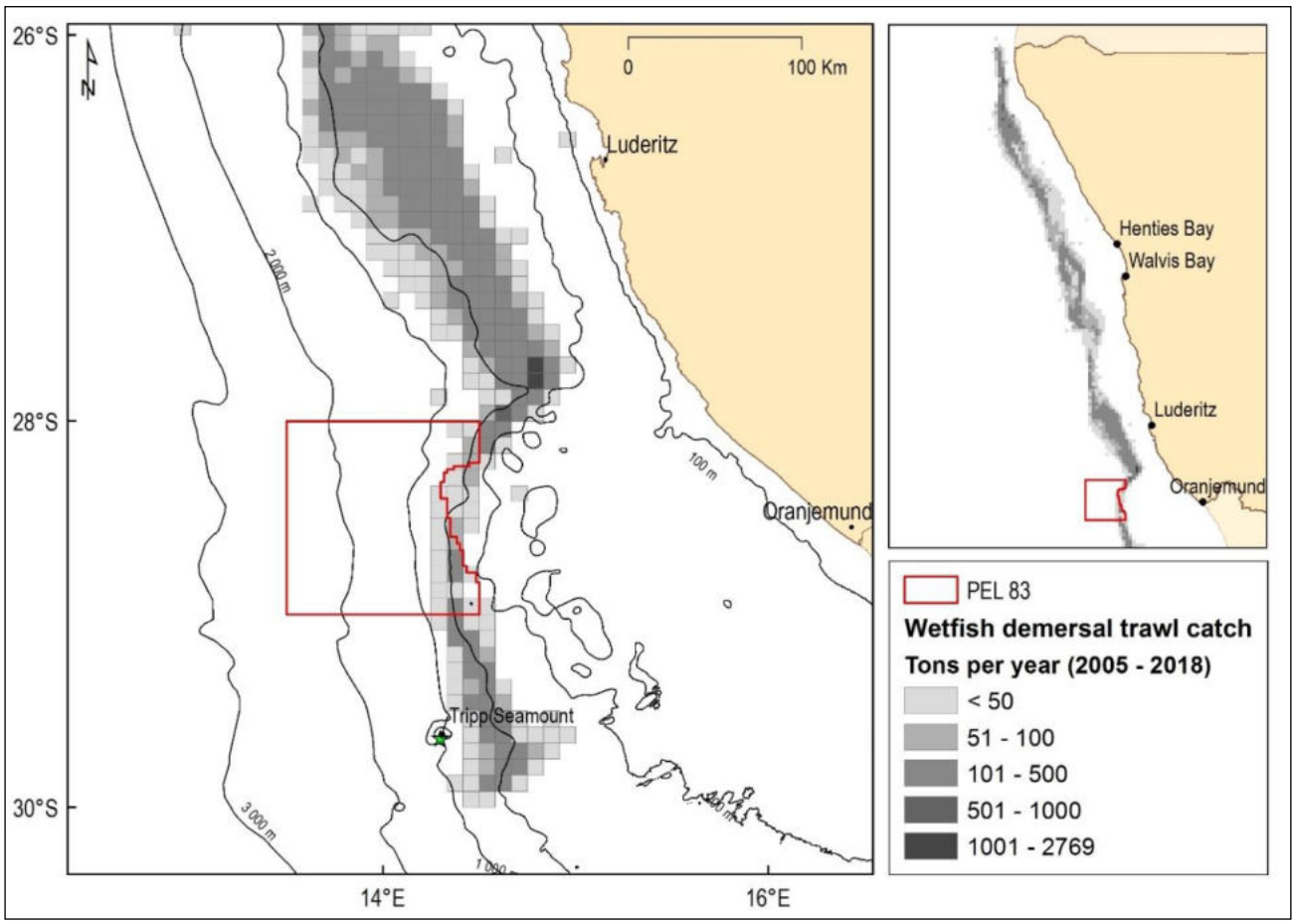

FIGURE 5: PEL83 IN RELATION TO HAKE-DIRECTED DEMERSAL TRAWL (2005-2018) (SLR, 2019)

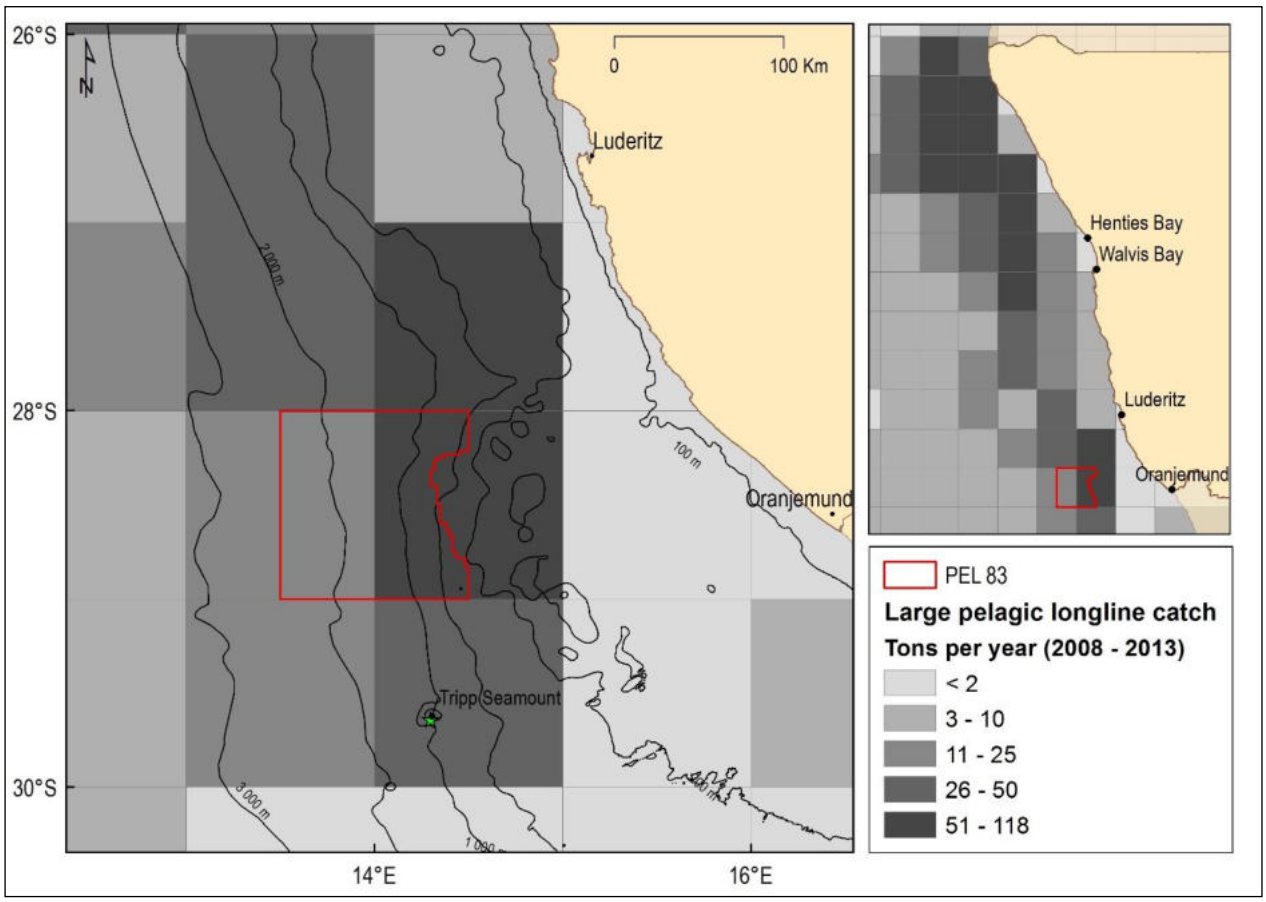

FIGURE 6: PEL83 IN RELATION TO LARGE PELAGIC LONG-LINE EFFORT OFF THE COAST OF NAMIBIA (2008 – 2013) (SLR, 2019)

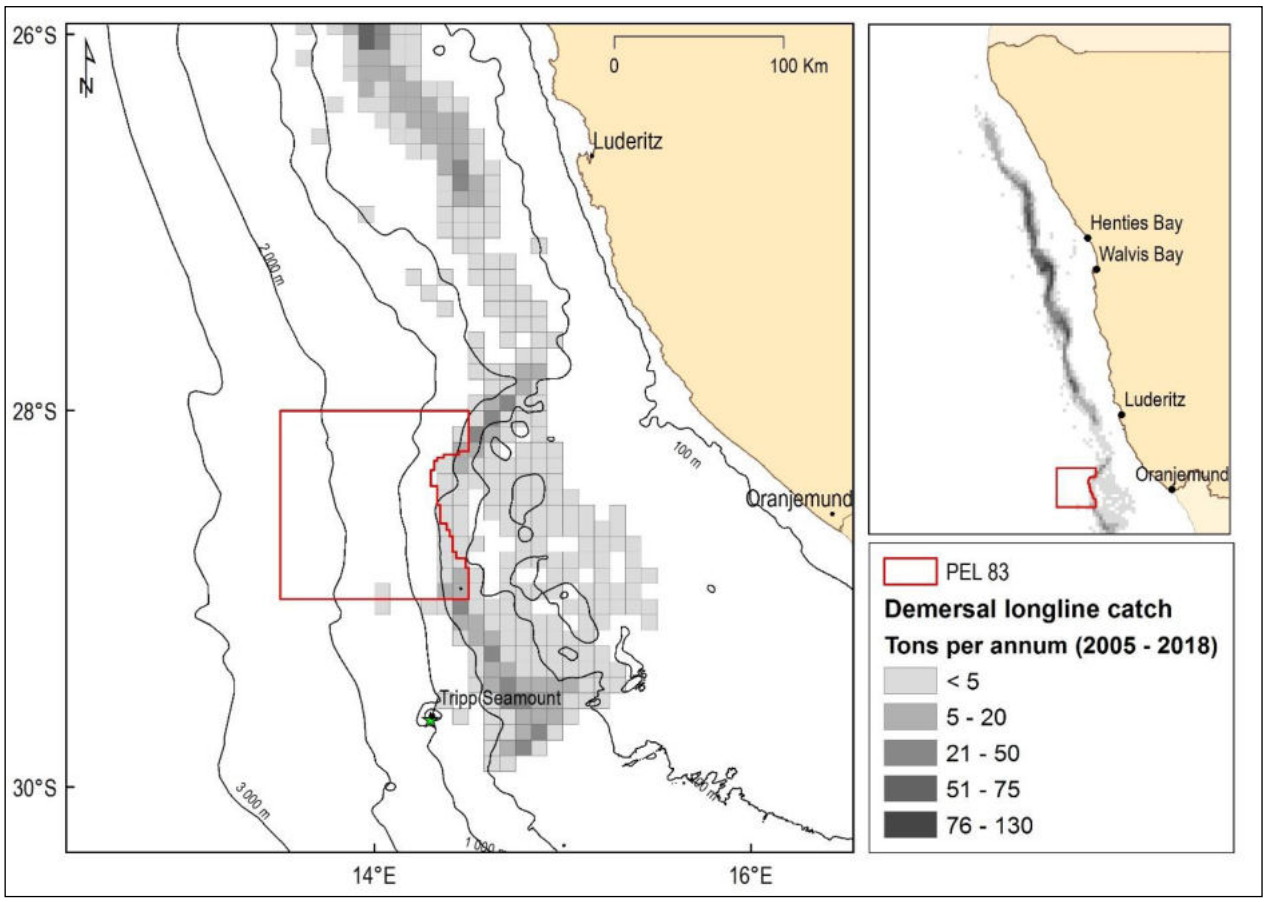

FIGURE 7: PEL83 IN RELATION TO THE CATCH LANDED BY THE DEMERSAL LONG-LINE FISHERY TARGETING CAPE HAKE (2005-2018) (SLR, 2019)

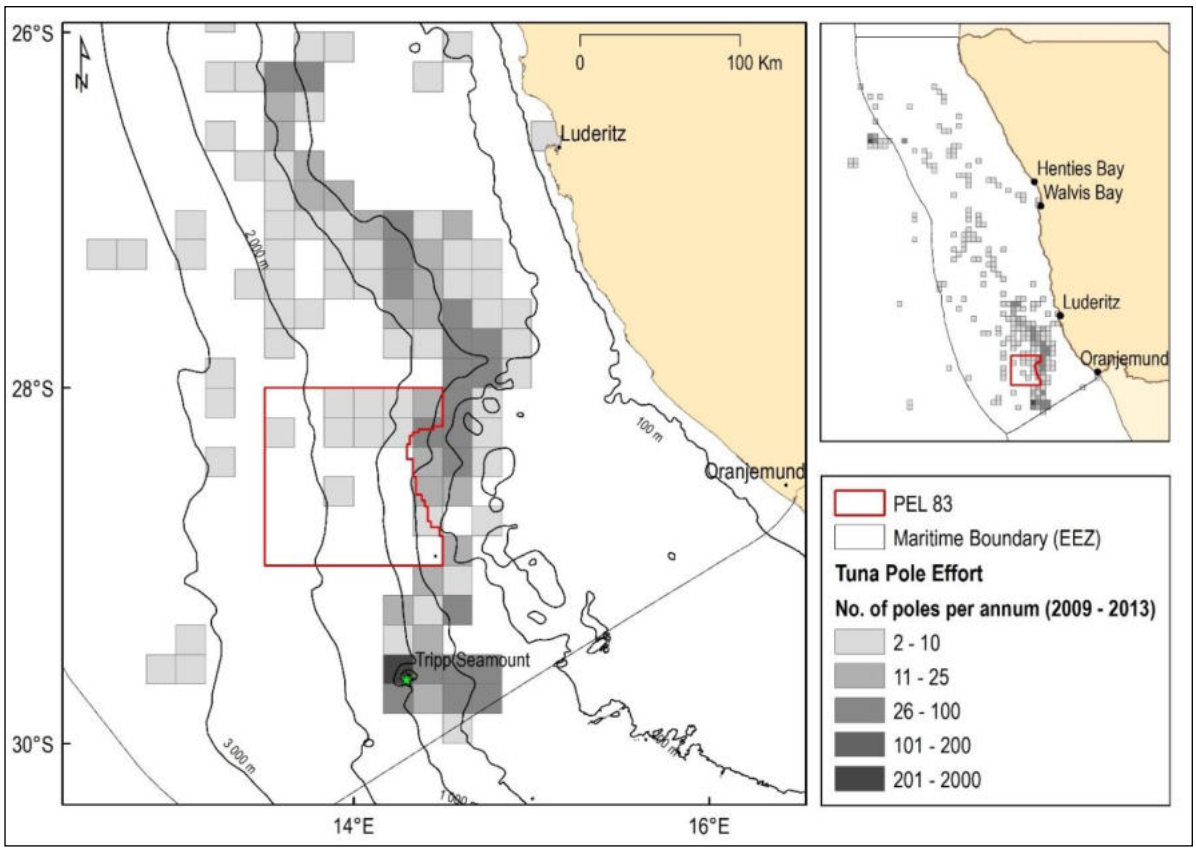

FIGURE 8: PEL83 IN RELATION TO TUNA POLE FISHING EFFORT (2009 – 2013) (SLR, 2019)

In addition, small pelagic purse-seine, mid-water trawl, deep-water trawl, traditional line-fish, deep-sea crab, west Coast Rock lobster and any mariculture projects do not overlap with the PEL 83 area.

6.4.2 SHIPPING

The majority of the international shipping traffic is located on the outer edge of the continental shelf. Traffic inshore of the continental shelf along the West Coast largely comprises fishing and mining vessels, especially off the coast of Oranjemund, which is inshore of the licence area. The licence area is located on the eastern boundary of the main traffic routes that pass around southern Africa. There are also intense density of traffic routes along the inshore edges and eastern section of the licence area.

6.4.3 MINING

At present marine diamond mining is limited to the southern half of the Namibian offshore, approximately 50 km to the east of the licence area.

6.4.4 CONSERVATION AREAS

The coastline of Namibia is part of a continuum of protected areas that stretch along the entire Namibian coastline from Southern Angola into Namaqualand in South Africa and was recently proclaimed as the Namib-Skeleton Coast National Park (NSCNP). The NSCNP incorporates four terrestrial Management Areas, namely the Skeleton Coast National Park, the Dorob National Park, the Namib-Naukluft National Park and the Tsau//Khaeb-Sperrgebiet National Park (see Figure 9).

The Namibian Islands' Marine Protected Area lies inshore and northwards of PEL 83, with the closest point (southern boundary of the NIMPA) being just over 60 km to the east. See Figure 9 for PEL 83 in relation to the Namibian coast, illustrating sanctuaries, conservation areas and marine protected areas (MPAs).

PEL 83 overlaps with the Orange Seamount and Canyon Complex Ecologically or Biologically Significant Areas (EBSA) (i.e. Impact Management Zone) as well as the Ecological Support Area (see Figure 10). The EBSA have been identified as being of high priority for place-based conservation measures under the Convention of Biological Diversity.

Despite the development of the offshore EBSAs 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. Most of PEL 83 falls within continental slope habitats that are 'not protected', with only the inshore portions considered 'moderately protected' (see Figure 11).

Three coastal Ramsar sites exist in Namibia (including Walvis Bay Wetland, Sandwich Harbour and Orange River Mouth) that fall within the broader project area. The licence area overlaps with one proposed Important Bird Area (IBA). Various marine IBAs have also been proposed in Namibian territorial waters, with a candidate trans-boundary marine IBA suggested off the Orange River mouth. The Atlantic Southeast 21 IBA specifically targets the protection of Atlantic Yellow-nosed Albatross, Black-browed Albatross and White-chinned Petrels. (Refer to Figure 12).

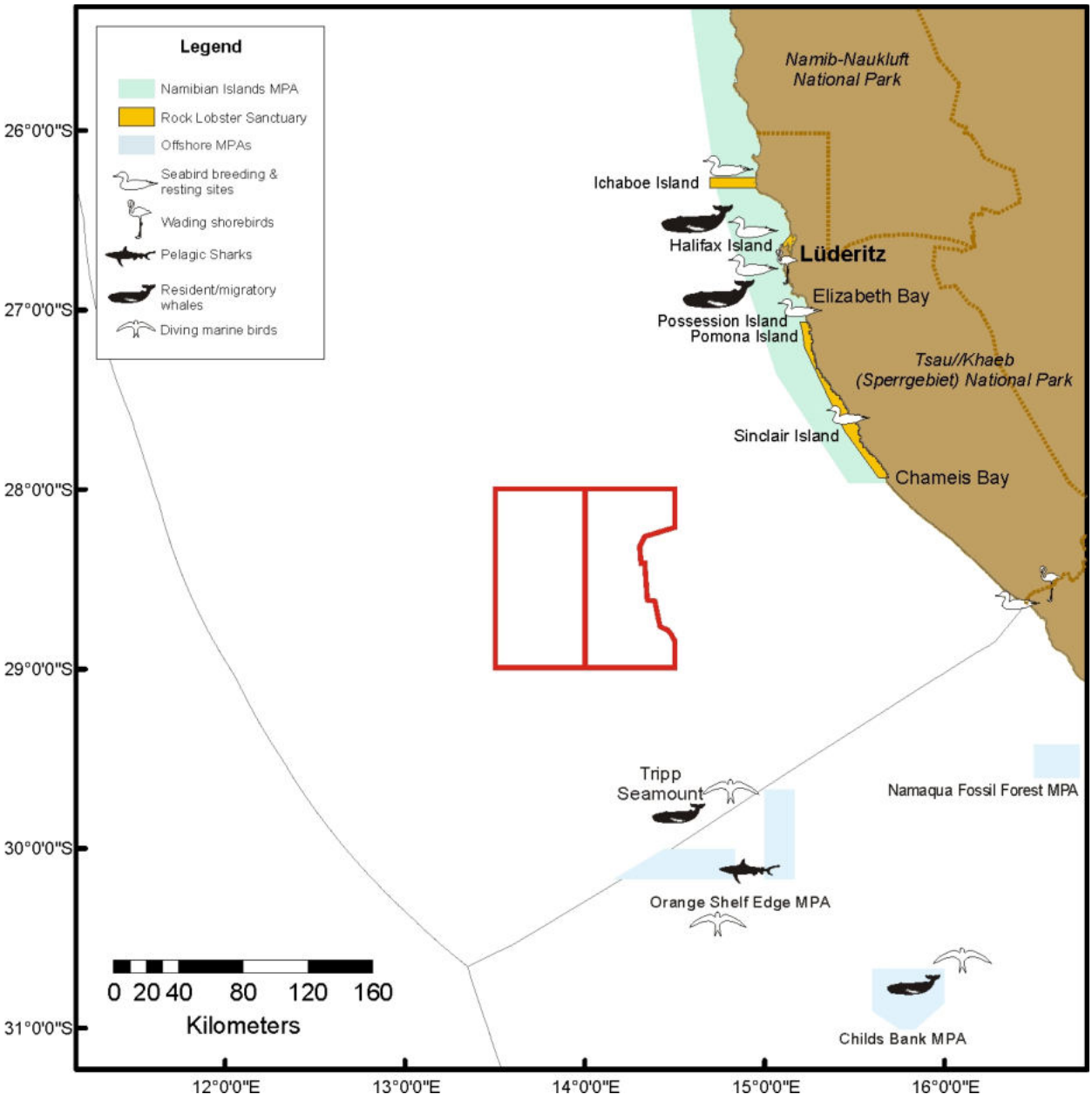

FIGURE 9: PEL 83 (RED POLYGON) IN RELATION THE NAMIBIAN COAST, ILLUSTRATING SANCTUARIES, CONSERVATION AREAS AND MARINE PROTECTED AREAS (MPAS) (MFMR, 2021)

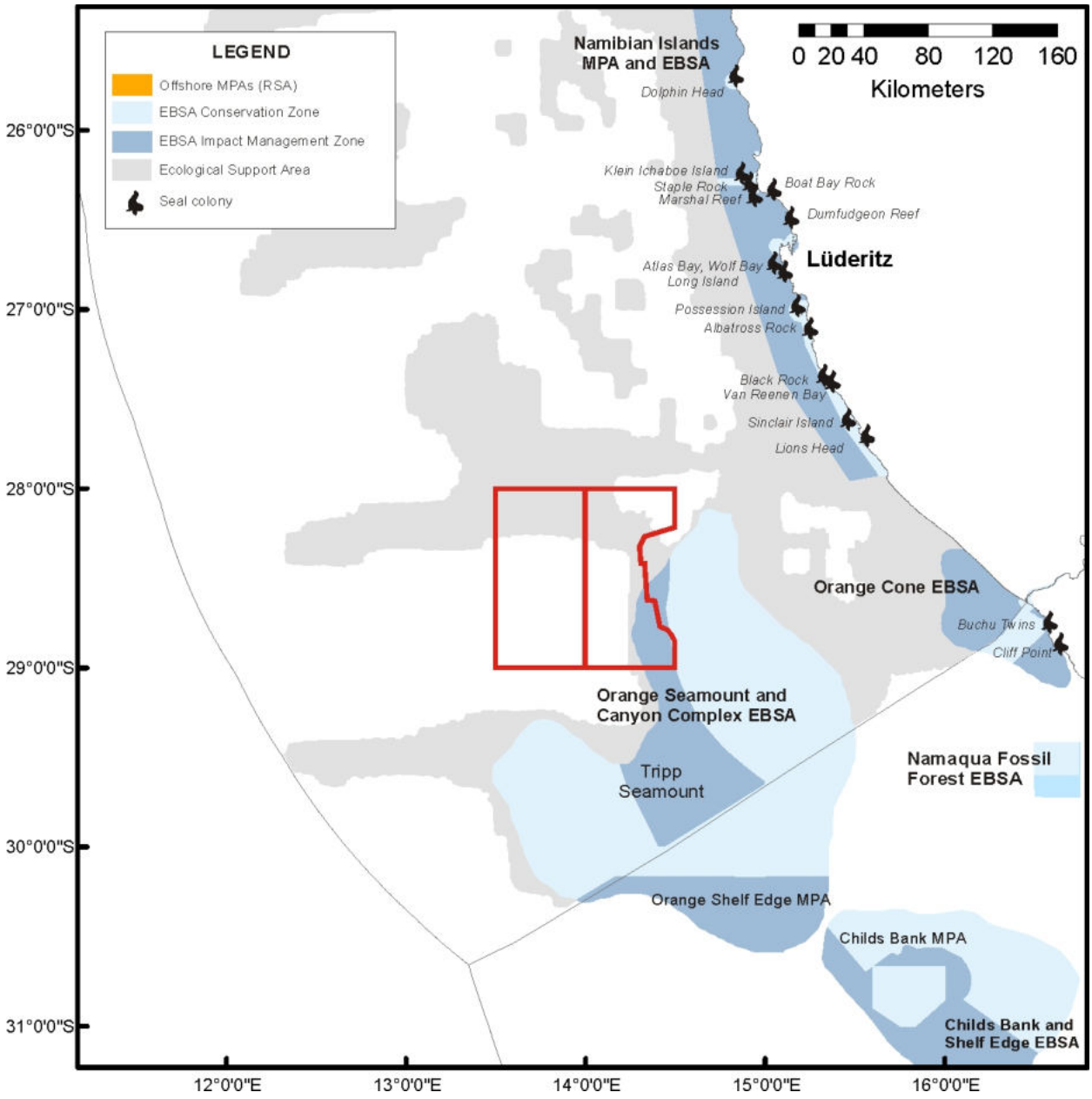

FIGURE 10: PEL 83 IN RELATION TO IN RELATION TO ECOLOGICALLY AND BIOLOGICALLY SIGNIFICANT AREAS (EBSAS) AND THE MARINE SPATIAL PLANNING ZONES WITHIN THESE (MFMR, 2021)

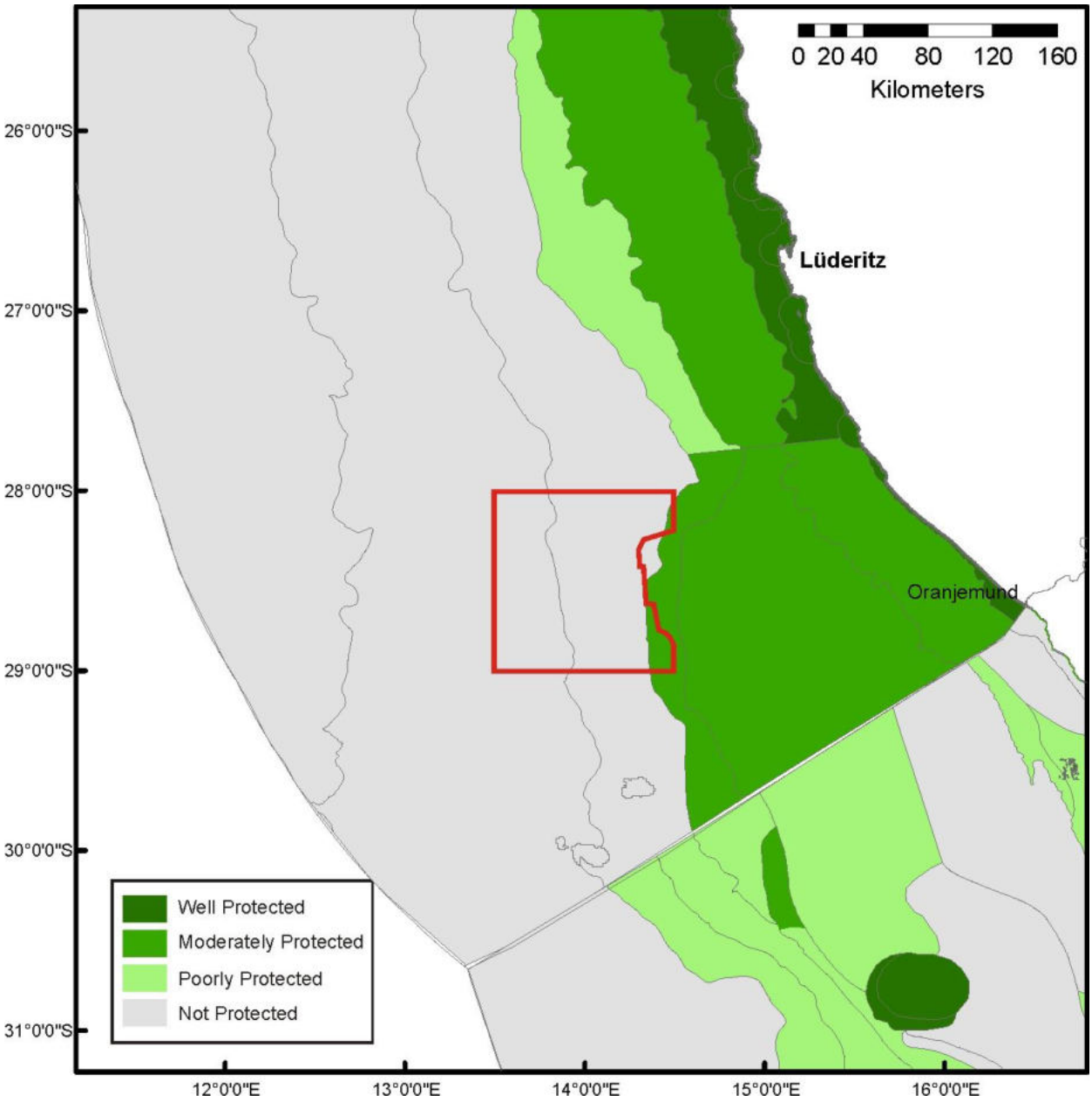

FIGURE 11: PEL 83 IN RELATION TO IN RELATION TO THE PROTECTION LEVELS OF BENTHIC HABITAT TYPES (MFMR, 2021)

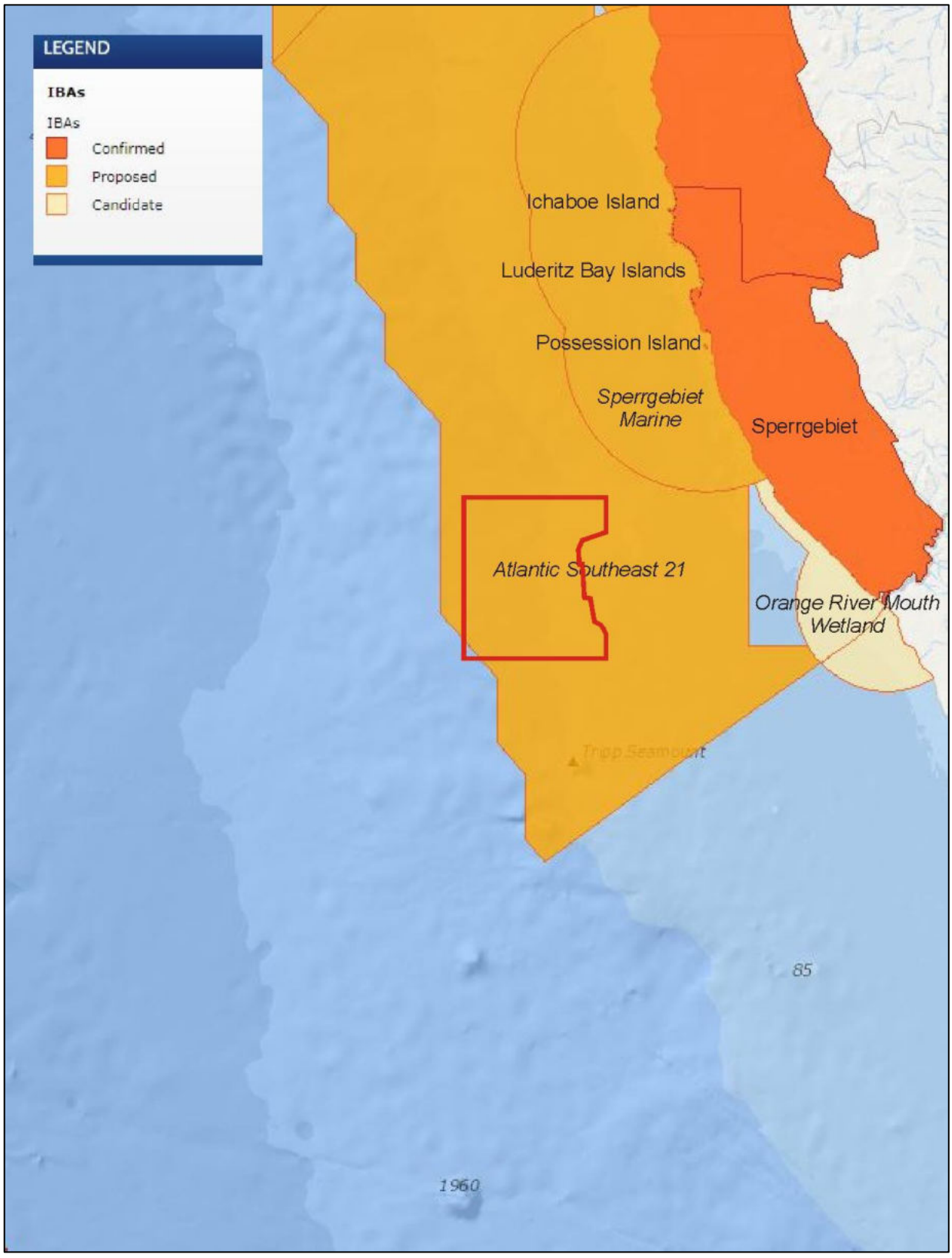

FIGURE 12: PEL 83 IN RELATION TO MARINE IBAS (HTTPS://MAPS.BIRDLIFE.ORG/MARINEIBAS)

Important Marine Mammal Areas (IMMAs) were introduced in 2016 by the IUCN Marine Mammal Protected Areas Task Force to support marine mammal and marine biodiversity conservation. Complementing other marine spatial assessment tools, including the EBSAs and Key Biodiversity Areas (KBAs), 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.

Although much of the west coast of southern Africa has not yet been assessed with respect to its relevance as an IMMA, the coastline from the Olifants River mouth on the West Coast to the Mozambiquan border overlaps with three declared IMMAs namely the:

- Southern Coastal and Shelf Waters of South Africa IMMA (166 700 km^2),
- Cape Coastal Waters IMMA (6 359 km^2), and
- South East African Coastal Migration Corridor IMMA (47 060 km^2).

These all lie well to the south of PEL 83.

7 IDENTIFICATION AND DESCRIPTION OF POTENTIAL ENVIRONMENTAL IMPACTS THAT ARE LIKELY TO CHANGE AS A RESULT OF THE PROPOSED AMENDMENTS

This chapter outlines the environmental aspects and potential impacts that could change because of the proposed changes to the project as a result of well testing (i.e. amendment to the approved EIA). It reasons potential cumulative impacts and provides the relevance (screening) / qualitative assessment of potential impacts.

7.1 ASPECTS AND POTENTIAL IMPACTS

7.1.1 IMPACT ASSESSMENT SUMMARY FROM THE APPROVED EIA AND THE POTENTIAL FOR ADDITIONAL IMPACTS DUE TO WELL TESTING ACTIVITIES

A summary of the original / approved assessment of potential environmental impacts (SLR, 2019), associated with the proposed exploration drilling programme is provided in Table 9. The proposed well testing activities and associated aspects and potential impacts that might change are also indicated in Table 9.

TABLE 9: SUMMARY OF THE SIGNIFICANCE OF THE POTENTIAL IMPACTS ASSOCIATED WITH THE PROPOSED EXPLORATION DRILLING PROGRAMME IN PEL83 (SLR, 2019) WITH INDICATION OF POTENTIAL ADDITIONAL IMPACTS DUE TO WELL TESTING ACTIVITIES

Note: (1) VL = Very Low; L = Low; M = Medium; H = High; VH = Very High; Insig. = Insignificant; +ve = Positive

(2) * indicates that no mitigation is possible and/or considered necessary, thus significance rating remains.

Activities	Aspects	Impacts	Significance		Potential for additional impacts as a result of the proposed well testing activities
			Without mitigation	With mitigation	
NORMAL OPERATIONS					
Impacts on the bio-physical environment					
Emissions to the Atmosphere:					
Emissions from the operation of the drilling unit, support vessels and helicopters and incineration of waste	Local reduction in air quality	Physiological effect on marine fauna and contribution to global greenhouse gas emissions	VL	VL	Yes, additional air emissions during the well testing. Refer to Table 10 for further details.
Discharge of wastes to sea:					
Discharge of waste to sea (e.g. deck and machinery space drainage, sewage and galley wastes)	Local reduction in water quality	Impact marine fauna includes physiological effects, increased food source and increased predator - prey interactions	VL	INSIG.	Yes, “produced water” (see section 4.2.2) discharged overboard. Furthermore, there is the potential for hydrocarbon “drop-out’ from the inefficient combustion of hydrocarbons during flaring. Refer to Table 10 for further details.
Discharge ballast water	Introduction of invasive alien species	Loss of biodiversity and ecosystem function	M	L	Not relevant.

Activities	Aspects	Impacts		Significance		Potential for additional impacts as a result of the proposed well testing activities
				Without mitigation	With mitigation	
Discharge of cuttings, drilling fluid and cement	Physical disturbance of the seabed sediments and increased sediment in the water column	Smothering by cuttings, drilling fluid and cement	Unconsolidated sediments	VL	VL	Not relevant (no further discharges to sea).
			Hard substrates	L - M	INSIG.	
		Toxicity and bioaccumulation effects on marine fauna	WBM and Cement	VL	INSIG.	
			SOBM	VL	VL	
		Increased water turbidity and reduced light penetration		Insig.	INSIG.*	
		Reduced physiological functioning of marine organisms due to indirect biochemical effects		Insig.	INSIG.*	
Physical disturbance of the seabed sediments:						
Seabed survey, spudding and wellhead installation	Physical disturbance and removal of sediments, and increased turbidity near the seabed	Physical damage to, mortality of and physiological effects on benthic faunal communities	Pre-drilling sampling and surveys	Insig.- VL	INSIG.-VL*	Not relevant.
			Drilling	VL	VL	Not relevant.
Noise:						
Noise emissions from pre-drilling sonar surveys	Increased underwater ambient noise levels in the vicinity of the survey vessel	Direct physical injury to hearing or other organs, masking of biologically significant sounds and behavioural changes		Insig.	INSIG.*	Not relevant.
	Increased underwater ambient noise levels	Behavioural changes and masking of biologically significant sounds		VL	VL*	Not relevant.

Activities	Aspects	Impacts	Significance		Potential for additional impacts as a result of the proposed well testing activities
			Without mitigation	With mitigation	
Noise emissions from the operation of the drilling unit and support vessels	in the vicinity of the drill site and between site and Lüderitz / Walvis Bay	Physiological injury and the avoidance of feeding and/or breeding areas	Insig.	INSIG.*	Yes, the well testing and associated activities will create additional noise. Refer to Table 10 for further details.
Noise emissions from VSP	Increased underwater ambient noise levels in the vicinity of the drill site	Direct physical injury to hearing or other organs	Insig.	INSIG.	Not relevant.
		Masking of biologically significant sounds and behavioural changes	VL	VL*	
Noise emissions from helicopter operations	Increased ambient noise levels (air)	Masking of biologically significant sounds and behavioural changes or displacement from important feeding or breeding areas	VL - L	INSIG.	Even though additional helicopter flights are expected as a results of the well testing activities, the potential noise impacts / impact rating will not change, taking the ESMP commitments into account.
Vessel lighting:					
Lighting from the operation of the drilling unit and support vessels helicopters, and well testing	Increase in ambient lighting	Disorientation and mortality of marine birds, and increased predator - prey interactions	Insig.	INSIG.	Yes, intense lighting and heat created by the flare. Refer to Table 10 for further details.

Activities	Aspects	Impacts	Significance		Potential for additional impacts as a result of the proposed well testing activities
			Without mitigation	With mitigation	
Physical presence of subsea infrastructure:					
Abandonment of the well(s) on the seafloor	Increased hard substrate on seafloor	Increase in benthic biodiversity and biomass	VL (neutral)	VL (neutral)*	Not relevant.
Impacts on the socio-economic environment					
Local project spending:					
Employment of local staff and purchase of goods and services	Temporary spending injection (salaries, fees, rentals, etc.)	Increased economic activity linked to employment and incomes (salaries, fees, rentals, etc.)	VL (+ve)	L (+ve)	Even though the well testing activities would require additional drillship/SS days on location and associated additional temporary spending injection (i.e. salaries, fees, rentals, etc. the potential positive impact rating will not change, taking the ESMP commitments into account.
Macro-economic variables:					
Payments to the Namibian government in the form of revenues, direct project expenditure and importation of products	Increased government revenues in the form of licence area rental charges and indirect taxes, as well as changes to Namibia's balance of payments	Increase in income and the balance of payments will be positively affected	VL (+ve)	VL (+ve)	No change to the potential positive impact rating, taking the ESMP commitments into account.

Activities	Aspects	Impacts		Significance		Potential for additional impacts as a result of the proposed well testing activities
				Without mitigation	With mitigation	
Physical presence of drilling unit and subsea infrastructure:						
Safety zone around drilling unit and abandonment of well head on the seafloor	Exclusion from fishing grounds	Loss of catch and / or increased fishing effort	Demersal trawl (<900 m depth)	L	L	The well testing activities would require additional drillship/SS days on location, increasing the exclusion from fishing grounds time period. The potential impacts / rating is unlikely to change, taking the ESMP commitments into account.
				Note: no impact in water depth > 900 m		
			Deep-water trawl	VL	VL	
			Large pelagic long-line	VL	VL	
			Demersal long-line	Insig.	INSIG.	
			Tuna pole	Insig.	INSIG.	
Safety zone around drilling unit	Exclusion from shipping routes	Interference with key shipping routes (detour)		VL	VL	The well testing activities would require additional drillship/SS days on location, increasing the exclusion from shipping routes time period. The potential impacts / rating is unlikely to change, taking the ESMP commitments into account.

Activities	Aspects	Impacts		Significance		Potential for additional impacts as a result of the proposed well testing activities
				Without mitigation	With mitigation	
Noise:						
Noise from pre-drilling sonar surveys	Increased underwater ambient noise levels in the vicinity of the survey area	Loss of catch and / or increased fishing effort due to behavioural changes or displacement of fish from important feeding areas	Demersal trawl, large pelagic long-line, demersal long-line and tuna pole	Insig.	INSIG.*	Not relevant.
Noise emissions from vessels and drilling operations	Increased underwater ambient noise levels in the vicinity of the drill site	Loss of catch and / or increased fishing effort due to behavioural changes or displacement of fish from important feeding areas	Demersal trawl, large pelagic long-line, demersal long-line and tuna pole	VL	VL*	Yes, the well testing and associated activities will create additional noise. Refer to Table 10 for further details.
Noise emissions from VSP operations	Increased underwater ambient noise levels in the vicinity of the drill site	Loss of catch and / or increased fishing effort due to behavioural changes or displacement of fish from important feeding areas	Demersal trawl, large pelagic long-line, demersal long-line and tuna pole	VL	VL	Not relevant.

Activities	Aspects	Impacts		Significance		Potential for additional impacts as a result of the proposed well testing activities
				Without mitigation	With mitigation	
Discharge of wastes to sea:						
Discharge of well drill cuttings and cement	Increased sediment in the water column and accumulation of sediment on the seabed	Loss of catch and / or increased fishing effort due to affect predator–prey interactions	Demersal trawl, large pelagic long-line, demersal long-line and tuna pole	Insig.	INSIG.	Not relevant (no further discharges to sea).
UNPLANNED EVENTS						
Small operational spill	Reduction of water quality	Toxic effect on faunal health (e.g. respiratory damage) and mortality (e.g. suffocation and poisoning)		L	INSIG.	See Table 10 for further details.
		Impact on commercial fishing through exclusion from polluted areas and reduced recruitment		VL - L	INSIG.-VL	
		Exclusion of sea-based tourism activities		VL	INSIG.	
Large well blow-outs	Reduction of water quality	Effect on faunal health (e.g. respiratory damage) or mortality (e.g. suffocation and poisoning)		VH	M-H	
		Impact on commercial fishing through exclusion from polluted areas, reduced recruitment and fishing gear damage		H - VH	L - M	
		Impact on tourism through the exclusion of sea-based tourism activities		L	VL	
Dropped objects	Physical disturbance of the seabed	Physical damage to and mortality of benthic species / habitats		Insig.	INSIG.	Even though the well testing activities would

Activities	Aspects	Impacts		Significance		Potential for additional impacts as a result of the proposed well testing activities
				Without mitigation	With mitigation	
	Increased hard substrata available for colonisation	Increased the benthic biodiversity and biomass		Insig. (neutral)	INSIG. (neutral)	require additional drillship/SS days on location, the potential for dropped objects and associated impacts would be similar to that previously assessed and the impacts / impact rating will not change, taking the ESMP commitments into account.
	Reduction of water quality	Toxicity and bioaccumulation effects	Marine fauna	VL	INSIG.	
			Commercial fishing	Insig.	INSIG.	

7.1.2 IMPACT ASSESSMENT SUMMARY FROM THE APPROVED EIA AND THE POTENTIAL FOR ADDITIONAL IMPACTS DUE TO WELL TESTING ACTIVITIES

With reference to section 4.2, well testing involves the flowing of formation fluids, including oil and or natural gas, from the well to the drillship where the fluid flows through special equipment and is separated and measured to conduct tests as part of the appraisal of a discovery. Each test can take seven days to be conducted and is done to diagnose reservoir characteristics, integrate test results with other studies, plan for future development, and to perform the overall management of the reservoir. During the flow period, the water component of the fluid brought on-board will be separated from the oily components and treated on-board to reduce its remaining hydrocarbon-content further. The hydrocarbons are combusted at the well site by high-efficiency burners in a process known as flaring. During this process oil can escape and cause a spill into the marine environment. The produced water, on the other hand, can also escape and pollute the marine environment.

Also, if burners used during flaring have poor efficiency, this can lead to hydrocarbon 'drop-out' or 'fall-out', which leaves a thin oil sheen on the sea surface. Incomplete combustion of hydrocarbons also results in hydrocarbon emission to the air, which have deleterious climatic effects

With reference to Table 9, a few of the originally identified aspects and potential impacts (SLR, 2019) could change as a result of the proposed well testing activities. These relate to the following aspects:

- Oil spill during the well testing operation.
- Water production during the well testing operation and associated discharge into the sea.
- Hydrocarbon 'fall-out' due to incomplete combustion during flaring.
- Additional noise from the well testing activities.
- Additional intense light and heat during flaring.
- Additional air emissions during the well testing and flaring.

Table 10 provides a summary of the above mentioned activities / aspects associated with the amendment to the project and the associated potential impacts. For context, the description of the potential impacts should be read with the corresponding descriptions of the current receiving environment (see Chapter 6 of this report).

The relevance of the potential impacts ("screening") / qualitative assessment is also presented in Table 10 to determine which aspects / potential impacts need to be assessed in further detail, if necessary.

TABLE 10: KEY ENVIRONMENTAL IMPACTS AND ASPECTS ASSOCIATED WITH THE WELL FLOW TESTING

ACTIVITY / FACILITY	ASPECT	POTENTIAL IMPACT AND RELEVANCE (SCREENING) OF POTENTIAL IMPACT
Well testing activities; Large well blow-outs (unplanned event)	Oil spill during the well testing operation / reduction of water quality	Potential impacts: • Pollution (of the marine environment) • Effect on faunal health (e.g. respiratory damage) or mortality (e.g. suffocation and poisoning) • Impact on commercial fishing through exclusion from polluted areas, reduced recruitment and fishing gear damage • Impact on tourism through the exclusion of sea-based tourism activities Discussion: The potential impacts of accidental / unplanned oil pollution (i.e. small operations spills and large well blow-out) were assessed during the original EIA process and were also cumulative considered as part of the original assessment. Three blow-out scenarios were modelled and assessed, i.e. 8-day blow-out scenario; and 30-day blow-out scenario at two locations. Small operational spills were also assessed. A small spill in the licence area has a negligible probability (<1%) of reaching the shore, even without the implementation of any oil spill response measures. The well testing activities could increase the possibility of a 'small spill' in the licence area (in the unmitigated scenario), however, with mitigation the impact significant rating will not change (i.e. the Oil Spill Contingency Plan also covers the well testing operations). An oil spill can cause several environmental impacts, such as toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) of marine fauna or affecting faunal health (e.g. respiratory damage). Subsequently, strict preventative measures, controls and responses are standard requirements of Galp and are also contained in the original ESMP. The risk of a blow-out event and associated oil spill is considered very unlikely (SLR, 2019). The proposed well testing activities is unlikely to change the 2019 assessment findings because the oil spill scenario considered was already the worst case scenario.

ACTIVITY / FACILITY	ASPECT	POTENTIAL IMPACT AND RELEVANCE (SCREENING) OF POTENTIAL IMPACT
		Considering the above mentioned, the potential impacts / significant rating associated with of an oil spill from the well testing activities will not change and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.
Water production during the well testing activities - Discharged overboard	Pollution (of the marine environment)	Potential impacts: • Pollution (of the marine environment). • Effect on faunal health (e.g. respiratory damage) or mortality (e.g. suffocation and poisoning). Discussion: The residual water component produced during well testing can be directed to tanks for transfer to a supply vessel for further onshore treatment and disposal if the hydrocarbon content is >30 mg per litre. Alternatively, the watery fluid can be directly discharged overboard if the hydrocarbon is <30 mg per litre. It is also possible to reinject the produced water if the volumes are not able to be managed via the other two options. The risk of polluting the sea as a result of the discharge of the produced water overboard is very low because the hydrocarbon-content is low – <30 mg per litre. In addition, the volume of produced water is small. In case the hydrocarbon-content exceeds 30 mg per litre, the produced water will be contained and transferred to a vessel for onshore treatment and disposal, meaning that it is a non-issue in terms of potential marine pollution. Considering the low risk, this potential impact is considered insignificant and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.
Flaring	Hydrocarbon 'fall-out' due to incomplete	Potential impacts: • Pollution (of the marine environment). • Impacts on marine fauna.

ACTIVITY / FACILITY	ASPECT	POTENTIAL IMPACT AND RELEVANCE (SCREENING) OF POTENTIAL IMPACT
	combustion during flaring	Discussion: Inefficient combustion of hydrocarbons can result in the release of unburnt hydrocarbons, which 'drop-out' onto the sea surface and may form a visible slick of oil. The taxa that may be affected by the 'drop-out' would be pelagic seabirds, turtles, large migratory pelagic fish, and both migratory and resident cetaceans (SLR, 2023a). PEL 83 is located more than 108 km from the coast at its closest point and is thus far removed from any coastal receptors. The dominant wind and current direction will also ensure that any discharges move mainly in a north-westerly direction away from the coast (SLR, 2023). Given the offshore location of the drill area, hydrocarbon 'drop-out' is expected to disperse rapidly and is unlikely to have an impact on sensitive coastal receptors. Due to the distance offshore, it is only likely to be pelagic species of fish, birds, turtles and cetaceans that may be affected by potential hydrocarbon 'drop-out', some of which are species of conservation concern, but they are unlikely to respond to the minor changes in water quality. Furthermore, the two well locations (see Figure 3) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas (see section 6.4.4). Considering the low risk, this potential impact is considered insignificant and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.
Flaring	Air pollution - Additional air emissions during the well testing activities	Potential impacts: • Physiological effect on marine fauna and contribution to global greenhouse gas emissions. Discussion: The emissions to the atmosphere were assessed as part of the 2019 EIA, relating to the following activities, with the potential to cause short-term reductions in local air quality close to the emissions source: • Exhaust gas emissions produced by the combustion of gas or liquid fuels in turbines, boilers, compressors, pumps and other engines for power and heat generation.

ACTIVITY / FACILITY	ASPECT	POTENTIAL IMPACT AND RELEVANCE (SCREENING) OF POTENTIAL IMPACT
		• Fugitive emissions associated with leaking tubing, valves, connections, flanges, open-ended lines, pump seals, compressor seals, pressure relief valves or tanks, and hydrocarbon loading and unloading operations. • Incineration of waste on board the drilling unit and survey / support vessels. The additional air emissions as a result of flaring during well testing will contribute cumulatively to the overall air emission associated with the exploration activities (see Table 6 and Table 7). However, as assessed in the original / approved EIA (SLR, 2019), given the offshore location of the licence area (between 108 km and 250 km offshore), air emissions are expected to disperse rapidly and there is no potential for accumulation of air pollution leading to any detectable long-term impact. The potential impact of emissions will be relatively localised and remains of limited duration. Although emissions will definitely occur as a result of the various exploration activities (including the flaring activities and possible incomplete combustion of hydrocarbons during flaring) it is at a far offshore location away from any sensitive receptors (i.e. third parties). Furthermore, the two well locations (see Figure 3) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas (see section 6.4.4). The cumulative contribution of flaring to the overall air emissions will not be significant and as a result no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.
Flaring	Intense light and heat during flaring.	Potential impacts: • Impacts on pelagic seabirds. • Impacts on other Marine Fauna (i.e. fish and cephalopods). Discussion: Flaring during well testing produces a flame of intense light and heat at the drill unit. Drilling (and flaring) activities would be undertaken in the offshore marine environment, over 108 km from the shore at its closest points and thus far removed from any sensitive coastal receptors (e.g. bird or seal colonies) and range of most coastal seabirds, but could still directly affect some migratory pelagic seabirds transiting

ACTIVITY / FACILITY	ASPECT	POTENTIAL IMPACT AND RELEVANCE (SCREENING) OF POTENTIAL IMPACT
		through the area where drilling will be undertaken. The increased ambient lighting may disturb and disorientate pelagic seabirds feeding in the area. This increased lighting may also result in indirect physiological and behavioural effects on fish and cephalopods, as these may be drawn to the lights at night where they maybe more easily preyed upon by other fish and seabirds (SLR, 2023a). The sensitivity of receptors to increased lighting is considered to be medium. Furthermore, the two well locations (see Figure 3) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas (see section 6.4.4). The increase in ambient lighting in the offshore environment due to flaring would, however, be limited to the area in the immediate vicinity of the drill rig over a short-term. Taking this and the medium sensitivity of the receptors into considerations, the potential for behavioural disturbance as a result of flaring is therefore considered to be of low significance and no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.
Well testing (perforating gun) and flaring	Additional noise emissions during the well testing activities: • Increased underwater ambient noise levels in the vicinity of the drill site due to gun that fires a series of explosive charges. • Air-borne noise above sea level	Potential impacts: • Direct physical injury to hearing or other organs, masking of biologically significant sounds and behavioural changes. • Behavioural changes and masking of biologically significant sounds. • Physiological injury and the avoidance of feeding and/or breeding areas. Discussion: Noise from pre-drilling sonar surveys; from vessels and drilling operations and from Vertical Seismic Profiling (VSP) operations were assessed as part of the 2019 EIA. The potential impacts associated with these activities were assessed as insignificant to very low with mitigation (see Table 9). With reference to section 4.2.1 a large diameter gun that fires a series of explosive charges and thus perforates the casing and wellbore with tubing in the hole will be conducted as part of the well testing. This means that on each testing there will be a discharge of the guns at reservoir depth. This will happen a maximum of 2 times during testing.

ACTIVITY / FACILITY	ASPECT	POTENTIAL IMPACT AND RELEVANCE (SCREENING) OF POTENTIAL IMPACT
	where flaring is implemented.	With these charges being conducted at the bottom of the well (i.e. 4 500 m), the noise that would be experienced at the seabed is expected to be low. Furthermore, the flaring activities would generated noise on the drilling vessel (i.e. above sea level). These activities would be undertaken in the offshore marine environment, over 108 km from the shore at its closest points and thus far removed from any sensitive coastal receptors (e.g. bird or seal colonies) and range of most coastal seabirds, but could still directly affect some migratory pelagic transiting through the area where drilling will be undertaken. The noise may disturb and disorientate pelagic seabirds feeding in the area. This increased noise may also result in indirect physiological and behavioural effects on fish (SLR 2023a). The above mentioned activities would contribute (cumulatively) to the exploration noise. However, seeing that these activities are of short duration, highly localised and of potentially medium sensitivity (the two well locations (see Figure 3) will be located in the centre and western half of the PEL, respectively, well outside the environmental sensitive areas (see section 6.4.4), the cumulative contribution of these impacts will not be significant and as a result no further assessment is required. However, refer to the ESMP for relevant management and mitigation measures.

7.2 SUMMARY OF ENVIRONMENTAL AND POTENTIAL IMPACTS AND PROJECT CONTROLS AND MANAGEMENT AND MITIGATION MEASURES

Based on the discussions in section 7.1.2, no aspect / potential impact requires further assessment (see Table 10). However, Galp will ensure that the proposed drilling campaign (including the proposed well testing activities) is undertaken in a manner consistent with good international industry practice and Best Available Technique (BAT).

7.2.1 MANAGEMENT AND MITIGATION MEASURES

With reference to section 1.2, an ECC was issued for the proposed exploration well drilling activities in PEL 83 and an ESMP was developed and approved by MEFT. The ECC was renewed in March 2023 and the (updated) ESMP approved.

Additional management and mitigation measures relating to the proposed amendment are included in the updated ESMP, attached in Appendix E.

8 WAY FORWARD

The way forward is as follows:

- Distribute draft report to I&APs for review and comments.
- Obtain comments and update the reports where relevant.
- Submit the final documents to MME and MEFT.
- MME and MEFT review the documentation and provide record of decision.

9 ENVIRONMENTAL IMPACT STATEMENT AND CONCLUSION

It is Namisun's opinion that the environmental aspects and potential impacts relating to the proposed amendment and the associated facilities and activities have been successfully identified, described and appropriately re-assessed.

No further (detailed) assessment is required because the potential cumulative impacts (i.e. contributions) is unlikely to change the significance ratings of the original EIA (SLR, 2019). Reference is made to the updated ESMP (see Appendix E) for relevant management and mitigation measures, though.

It is recommended that, if MEFT provides a positive decision on the application for the proposed project changes, they should include a condition to the clearance that Galp must implement all commitments in the EMP (Amendment).

10 REFERENCES

MINISTRY OF FISHERIES AND MARINE RESOURCES (MFMR), 2021. Current Status Report: Knowledge Baseline for Marine Spatial Planning in Namibia. Second Edition. MFMR, Windhoek: Namibia.

SLR. 2019. Proposed offshore exploration well drilling in PEL83, Orange Basin, Namibia. Final EIA Report and ESMP.

SLR. 2023. Application for amendment of Environmental Clearance Certificate exploration and appraisal well drilling in Petroleum Exploration License 39 (PEL 0039) for Shell Namibia Upstream B.V. SLR Project No.: 733.19019.00002, Report No.: 1. MEFT Reference: APP-001119. Unpublished report.

SLR. 2023a. ESIA for Proposed Exploration and Appraisal Well Drilling in Block 2912 off the South Coast of Namibia, prepared for TEEPNA.

APPENDIX A: CV

APPENDIX B: INFORMATION SHARING RECORD

APPENDIX C: MINUTES OF MEETINGS AND COMMENTS RECEIVED

APPENDIX D: STAKEHOLDER DATABASE

APPENDIX E: AMENDED EMP