TotalEnergies EP South Africa B.V.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE OFFSHORE PRODUCTION RIGHT AND ENVIRONMENTAL AUTHORISATION APPLICATIONS FOR BLOCK 11B/12B – REF NO: 12/4/13 PR

Draft Environmental and Social Impact Assessment Report

CHAPTER 9

REPORT NO: 41105306-358669-10
SEPTEMBER 2023

PUBLIC

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PROJECT NO. 41105306

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CONTENTS

TABLES

FIGURES

9 IMPACT ASSESSMENT – NORMAL OPERATIONS

This section describes the identified potential impacts associated with normal operating conditions for the Project activities included in Section 6 and which have not been screened out (Section 8). The identification of impacts has been informed by various technical (modelling and other specialist) studies that have been conducted for the Project.

9.1 EXPLORATION

9.1.1 AIR EMISSIONS

9.1.1.1 Impacts on Air Quality

9.1.1.1.1 Source of Impact

The emissions inventory for the various phases of the Project is provided in Section 6.10. For the exploration phase, the following emission sources have been identified:

- Combustion of marine fuel in main and auxiliary engines, on the drill unit, supply vessels, and tugboat;
- Combustion of kerosene fuel in helicopter engines;
- Gas flaring during well testing; and
- Combustion of diesel in generators on vessels.

9.1.1.1.2 Project Controls

The following Project controls will be in place:

- TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18–- Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass).
- Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities.
- Ensure that contractors make use of efficient flare tips, as appropriate.
- Optimise well test programme to reduce non-routine flaring as much as possible during the test.
- Commence with well testing during daylight hours where feasible due to poor dispersion potential during night-time hours.
- Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons to minimise emissions and hydrocarbon ‘drop-out’ during well testing.
- Flare inspections and maintenance, as well as performance monitoring, to ensure reduced malfunctions and interruptions.
- Burning emissions from well testing or purging shall be minimised by optimising the burning system design and the testing procedures.

9.1.1.1.3 Potential Impact Description

Modelling results for the operations show that the NO_2 and $PM_{2.5}$ NAAQS are exceeded offshore, for three of the 27 development years (Year 0, Year 1, and Year 10). During the production years, taking place for most of the Project period of 25 years, no exceedances of the NAAQS are predicted; neither offshore nor onshore. Given that the NAAQS are applicable for continuous and

lifetime exposure the indirect negative impact of reduction of human health is unlikely to occur from offshore operations.

The year(s) in which exploration will be undertaken is unknown. Exploration indirect negative impacts are anticipated to be insignificant offshore within Block 11B/12B and onshore with the Project controls. Pollutant concentrations from the Project vessel operations were the main contributor but were simulated to be below the NAAQS for all years with Project controls.

9.1.1.1.4 Sensitivity of Receptors

The exploration area is located more than 80 km offshore and is far removed from any sensitive receptors (e.g. residential areas). The offshore operation emissions are unlikely to have a notable **indirect negative** effect on any sensitive receptor or other offshore activities, other than the Project itself. This said, the sensitivity of receptors in the offshore area to increases in pollutant concentrations is considered **low**.

At the port(s), vessel operations can be anticipated as well as light to medium industry operations such as bulk cargo, break-bulk cargo, and petroleum / organic liquids storage and handling, petroleum product blending and associated support operations such as road and rail operations. Further from the port; usually outside the Towns, there would be heavy industries. The baseline air quality in the port area and nearby residential areas is expected to be poor with elevated pollutant concentrations (Bacalja, Krčum, & Slišković, 2020; Browning & Bailey, 2006; California Air Resources Board, 2011; Hussain, et al., 2022; Toscano & Murena, 2019, in WSP, 2023a). In addition to industry and transport operations there are emissions from residential activities such as personal and public transport operations, and residential fuel burning. The nearby receptors sensitivity to increases in pollutant concentrations is considered **high** as the increase in already elevated concentrations could have significant cumulative detrimental impacts on human health.

9.1.1.1.5 Impact Magnitude (or Consequence)

Based on modelling results, the impact from exploration activities is expected to be a **low intensity** (negligible change which is barely noticeable or may have minimal effect on receptors). The impact will be **regional** and will be of short-term duration offshore and medium-term duration onshore. Thus, the impact magnitude (or consequence) for both onshore and offshore is **very low**.

9.1.1.1.6 Impact Significance

Based on the low sensitivity of the receptors offshore and the very low magnitude, the potential impact of concentrations is considered to be of **negligible** significance without mitigation. Based on the high sensitivity of receptors onshore and the very low magnitude, the potential impact of concentrations in the area of the port is considered to be of **low** significance without mitigation.

9.1.1.1.7 Identified Mitigation Measures

Over and above the Project controls listed above, in order to mitigate the negative impact on climate change during the exploration phase, the following mitigation measures are proposed:

- Optimise rig movement and the logistics (number of trips required to and from the onshore logistics base) to reduce fuel consumption.
- Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes.

- Ensure no incineration of waste occurs within the port limits, subject to obtaining an Atmospheric Emissions Licence.
- Use of onshore power supply during vessel hotelling rather than using onboard generators/boilers, when available.

9.1.1.1.8 Residual Impact Assessment

This potential impact cannot be eliminated as the Project activities will generate emissions resulting in **direct** and **indirect negative** impacts which will affect sensitive receptors. With the implementation of the Project controls and mitigation measures, the intensity of the air quality is reduced to **very low**, however, the residual impact offshore remains **negligible** significance. With the implementation of the Project controls and mitigation measures, the residual impact significance onshore remains **low**.

9.1.1.1.9 Additional Assessment Criteria

Although there is the potential for accumulation, the direct negative impact is considered to be **fully reversible**; however, the indirect negative impact for the most sensitive receptors onshore may be **partially reversible**. Mitigation potential is **medium**, and the loss of resource is **low**. The offshore impact has a high probability of occurring i.e., a **highly likely probability**; while there is a reasonable probability that the onshore impact could occur i.e., the impact is **possible.**

Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.1.1.10 Impacts on GHG Emissions and Climate Change Aspects

It is anticipated that the direct GHG emissions resulting from Project activities that are operated and controlled by TEEPSA will amount to a total of 1,5 $MtCO_2e$. The GHG emissions from the F-A platform will total to 4 $MtCO_2e$ over the Project life span. These GHG emissions will contribute to global climate change, across the various phases of the Project.

9.1.1.1.10.1 Source of Impact

The estimated GHG emissions from exploration activities will result from possible well flow testing (non-routine flaring), and the mobile GHG emissions associated with the drill unit, helicopters, supply vessels and tug boat. The key GHGs for the Project include CO_2, CH_4 and N_2O.

9.1.1.1.10.2 Project Controls

The following Project controls will be in place:

- TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18–- Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass).
- Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities.
- A maintenance plan will be implemented to ensure all diesel equipment receives adequate maintenance to minimise GHGs released to the atmosphere and maximise the energy efficiency.
- The drill unit, pipelaying vessel, support vessels and survey vessel will be required to prepare a Ship Energy Efficiency Management Plan (SEEMP) that complies with the IMO 2022 guidelines.

9.1.1.1.10.3 Potential Impact Description

GHG emissions will contribute to global climate change (indirect **negative impact**). The effect of climate change as a result of increased emissions of heat-trapping GHG's is related to increased temperatures, changing weather patterns and sea level rise.

9.1.1.1.10.4 Sensitivity of Receptors

Due to the international scale and infrequent occurrence of the impact, receptors are considered to be of **low sensitivity**.

9.1.1.1.10.5 Impact Magnitude (or Consequence)

Overall GHG emissions for the exploration phase are calculated as 251 911 TCO_2e. Within the context of the national GHG inventory and targets, this contribution of GHG emissions is considered to be **low intensity**. The impact will however have an **international** impact and will most likely be **permanent**. Based on the above, the magnitude of the negative impact is considered to be **high**.

9.1.1.1.10.6 Impact Significance

Taking into account the **high** magnitude of the impact and the **low sensitivity** of receptors, the impact significance is considered to be **medium**, prior to mitigation.

9.1.1.1.10.7 Identified Mitigation Measures

Over and above the Project controls listed above, in order to mitigate the negative impact on climate change during the exploration phase, the following mitigation measures are proposed:

- Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes.
- Implement effective programmes for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs.
- Optimise helicopter flight paths.
- Optimise well test and monitor the efficiency of the flare programme to reduce burning as much as possible during the test.
- Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons in order to minimise emissions and hydrocarbon 'drop-out' during well testing.

9.1.1.1.10.8 Residual Impact Assessment

With the Project controls and mitigation measures mentioned above, the residual impact could be decreased to **negligible significance**.

9.1.1.1.10.9 Additional Assessment Criteria

The negative impact on climate change during the exploration phase is **definite** and considered to be **irreversible.** Cumulative potential is **likely**.

Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.2 UNDERWATER NOISE

9.1.2.1 Noise from Drill Rig and Support Vessels

9.1.2.1.1 Source of Impact

Drilling of up to four exploration and appraisal wells be undertaken in the Exploratory Priority Area using a drilling unit, supported by one or two tugboats and supply vessels. The source of noise related impacts associated with this activity include operation of the drill unit itself, as well as support tugs and supply vessels.

9.1.2.1.2 Project Controls

- No vessel may approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft.
- Ensure vessel transit speed between the survey/drill area and port is a maximum of 12 knots (22 km/hr), except within 25 km of the coast where it is reduced further to 10 knots (18 km/hr).
- Implement a maintenance plan to ensure all diesel motors and generators receive adequate maintenance to minimise noise emissions.
- TEEPSA and its contractors will undertake Project activities in a manner consistent with good international industry practice and Best Available Techniques.

9.1.2.1.3 Potential Impact Description

Anthropogenic noise can have both direct and indirect negative impacts on marine fauna, by causing direct physical injury to hearing or other organs, (including permanent or temporary threshold shifts), causing disturbance resulting in behavioural changes or displacement from important feeding, breeding or spawning areas, and through masking or interfering with other biologically important sounds (e.g. communication, echolocation, signals and sounds produced by predators or prey).

To address these impacts, an underwater noise modelling study was undertaken (see Appendix 8). Two scenarios were modelled: 1) a worst-case scenario, where an animal would be exposed to drilling noise for 24 hours, and 2) an exposure to drilling noise of 30-minute period, assuming the likelihood that an animal would move away from the source of the noise. The study considered these scenarios at two sites, both close to the coast and sensitive areas.

The model results indicate that the peak pressure levels generated by the drilling unit are sufficient to cause permanent (permanent threshold shifts) and temporary direct physical injury (temporary threshold shifts) to hearing in marine mammals and sea turtles, as well as death or injury to fish.

Based on the worst-case 24-hour exposure noise modelling results, baleen whales (southern right whale *Eubalaena australis*, humpback whale *Megaptera novaeangliae*) and other Very High-Frequency Cetaceans (pygmy sperm whale *Kogia breviceps*, dwarf sperm whale *K. sima*) are likely to be impacted the most with temporary impacts modelled to occur at 9 km and 8.6 km respectively, and permanent injury thresholds predicted to occur at distances of about 250 m and 50 m respectively, from the sound source. The impacts on High Frequency Cetaceans (common dolphin *Delphinus delphis*, killer whale *Orcinus orca*, Atlantic bottlenose dolphin *Tursiops290ispel290n290s*, short-finned pilot whale *Globicephala macrorhynchus*) is much smaller, with temporary impacts

anticipated at distances of less than 400 m, and permanent injury thresholds predicted to occur at distances of about 10 m from the sound source.

For turtles, permanent injury is predicted to occur at 10 m from the source of noise, while temporary impacts are expected within 330 m. For fish with a swim bladder, TTS impacts (i.e., a temporary loss of hearing sensitivity) is predicted to occur only very close to the drilling activity (within 160 m). Temporary effects (TTS) and permanent effects (PTS) are much smaller for the 30-minute exposure scenarios. The maximum 30-minute exposure TTS distance was modelled as 790 m for very high-frequency cetaceans, and 380 m for frequency cetaceans, while the maximum 30-minute exposure PTS distance was modelled as 20 m for low frequency cetaceans and very high-frequency cetaceans.

It is considered likely that most of these highly mobile pelagic species would move away once noise activities commence, with species likely leaving the area. However, this has a cost, and as such, behavioural effects of noise were also considered as part of the modelling study, which includes impacts on individual health and fitness, foraging efficiency, avoidance of predation, swimming energetics and reproductive behaviour (Popper & Hawkins 2016). The maximum thresholds of behavioural disturbance from the drilling source were shown to be 66 km for marine mammals in all hearing groups, 11.8 km for penguins / diving birds, and 10 m for turtles.

9.1.2.1.4 Sensitivity of Receptors

While the area impacted is small relative to the available habitat, it does intersect with major cetacean migratory routes, and while drilling activities are unlikely to cause a significant, irreversible change in habitat use of these species, receptor sensitivity is assessed as **high**. It is expected that the type of noise pollution resulting from proposed drilling activities will affect species that may be present/migrating through Block 11/12B that includes Endangered and Critically Endangered species of turtles, seabirds, cetaceans, large fish, and sharks, which have the potential to be directly harmed by the drilling noise sources.

9.1.2.1.5 Impact Magnitude (or Consequence)

The impact duration is assessed to be of short-term duration. While impacts have the potential to be permanent (in the case of PTS), model results show that species have to be within 10 to 400 m of the noise source (for 24-hour exposure) and within <10 to 20 m (for 30-minute exposure) for permanent threshold shifts/injury to occur.

This is considered to be highly improbable, considering the greater size of the area of behavioural impacts and because most pelagic species likely to be encountered within the Block are highly mobile, and would be expected to move away from the sound source before trauma could occur.

Given the sensitivity of the area, the recorded occurrence of a number of sensitive species within the site, and the uncertainty surrounding the implication of behavioural impacts over the long term, the intensity of the impact is assessed as medium over 24-hours. The magnitude of the impact on marine fauna as result of drilling noise is therefore considered to be **low** (for 24-hour exposure) and **very low** (for 30-minute exposure).

9.1.2.1.6 Impact Significance

The impact for both the 24-hour and 30-minute exposures is assessed to be of **low** significance prior to mitigation.

9.1.2.1.7 Identified Mitigation Measures

- An independent Marine Mammal Observer (MMO) must accompany the pre-drilling survey to undertake validation of cetacean migration/distribution models.
- In the unlikely event of a cetacean sighting within the Permanent Threshold Shift (PTS) threshold distance for the most sensitive species (400 m) immediately prior to drilling commencement, drilling may not commence until an independent Marine Mammal Observer confirms that no cetaceans are present within this PTS radius.

9.1.2.1.8 Residual Impact Assessment

Given the absence of suitable mitigation measures, the intensity, extent and duration of the impact remains unchanged, and therefore the potential impact remains of **low** significance.

9.1.2.1.9 Additional Assessment Criteria

The negative impact of noise from drilling is **definite** and considered to be **fully reversible**. Cumulative potential is possible and mitigation potential is **none**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.2.2 Noise from Vertical Seismic Profiling

Source of Impact VSP is a standard method that is used during well logging and can generate noise that could exceed ambient noise levels. VSP is used to generate a high-resolution stratigraphic profile, which can be used to determine the size and shape of rock formations and oil/ gas deposits, etc. See details in Section 6.

9.1.2.2.1 Project Controls

- TEEPSA and the drilling contractor will ensure that VSP activities are undertaken in a manner consistent with good international industry practice and BAT.

9.1.2.2.2 Potential Impact Description

The underwater noise modelling study undertaken (see Appendix 8) indicated that the peak pressure levels generated with each VSP air gun pulse are sufficient to cause permanent (permanent threshold shifts) and temporary direct physical injury (temporary threshold shifts) to hearing in marine mammals, and sea turtles, as well as death or injury to fish. For a single VSP pulse, the distances at which these impacts occur are very small; permanent damage is expected for very high-frequency cetaceans if they occur within 20 m of VSP operations, with temporary damage at a distance of 50 m; all other cetacean groups, sea turtles and fish would need to be within 10 m of the VSP operations for any damage to occur.

Cumulative impacts (for the estimated 250 pulses over a 24-hour period) had a far greater extent of impact, with temporary damage occurring at a distance of up to 2.2 km for baleen whales (low frequency cetaceans) and 170 m for turtles, and permanent damage predicted at a distance of 200 m for baleen whales. For fish, cumulative impacts of 250 pulses over 24-hours predicted temporary damage to fish both with and without swim bladders at a distance of 370-400 m, and mortality and potential mortal injury of both fish, fish eggs and larvae at 10-30 m.

Behavioural effects of noise must also be considered, as these may affect life functions, including individual health and fitness, foraging efficiency, avoidance of predation, swimming energetics and

reproductive behaviour (Popper & Hawkins 2016). The maximum thresholds of behavioural disturbance from the source were shown to be 2 km for marine mammals in all hearing groups, 350 m for turtles, and 19.2 km for penguins / diving birds.

Since four wells are proposed for the exploration phase, and assuming only one well is assessed at a time, the maximum impacted area for behavioural disturbance at any point in time will equate to some 1 158 km^2 for penguins / diving birds. The majority of Algoa Bay penguins forage within 20 km of the coast, and while they have been recorded as far as 60 km offshore following pelagic shoaling fish species within the 200 m isobath, Block 11B/12B lies more than 75 km offshore below the 200 m contour, and as such, penguin behaviour is unlikely to be directly impacted by VSP activities.

Cape gannets regularly feed as far offshore as 100 km and Cape cormorants have been reported up to 80 km from their colonies, and therefore these species may be impacted behaviourally by VSP activities should sufficient mitigation not be implemented.

9.1.2.2.3 Sensitivity of Receptors

It is considered likely that pelagic species will migrate through the area in proximity to the wells, including Endangered and Critically Endangered species of turtles, seabirds, cetaceans, large fish, and sharks, which have the potential to be directly harmed by the VSP seismic sources. Receptor sensitivity is therefore assessed as **high**.

9.1.2.2.4 Impact Magnitude (or Consequence)

It is considered likely that most of the highly mobile pelagic species would move away once noise activities commence, with species likely leaving the area. This has a behaviour cost; however, the area of behaviour impact is very small (12 km^2 for cetaceans), as is the cumulative area of direct physiological impact for both cetaceans (~15 km^2 TTS, ~0.1 km^2 PTS) and fish (~0.1 km^2 TTS).

The likelihood of VSP activities causing a significant, irreversible change in habitat use of these species is therefore considered unlikely, and the intensity of the impact is assessed as medium. With a local extent and short-term duration (VSP activities typically take place up to 12 hours per well), impact magnitude as a result of VSP is expected to be **very low**.

9.1.2.2.5 Impact Significance

Considering a high receptor sensitivity and very low impact magnitude, impact significance of VSP is anticipated to be **low**.

9.1.2.2.6 Identified Mitigation Measures

The following mitigation measures are proposed:

- Pre-drilling baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to inform placement of wells, with the aim of preventing disturbances to the sensitive and significant VME epifaunal communities, vulnerable habitats (e.g., hard grounds), and structural features (e.g., rocky outcrops).
- A minimum of two dedicated MMO, with a recognised MMO training course, must be on board for marine fauna observation (360 degrees around drilling unit), distance estimation and reporting. One MMO should also have AM) training, should a risk assessment, undertaken ahead of the VSP operation, indicate that the PAM equipment can be safely deployed considering the metocean conditions (specifically current).

- MMO's to arrive at ten days before VSP commences.
- Ensure drilling unit vessel is fitted with PAM technology (one or more hydrophones), which detects animals through their vocalisations, should it be possible to safely deploy PAM equipment.
- Undertake a one-hour (as water depths > 200 m) pre-shoot visual and possible acoustic scan (prior to soft-starts / airgun tests) within the 500 m radius mitigation zone in order to confirm there is no cetaceans, turtles, penguins and shoaling large pelagic fish activity close to the source.
- Implement a "soft-start" procedure of a minimum of 20 minutes' duration when initiating the acoustic source (except if testing a single airgun on lowest power).
- Maintain visual observations and possibly acoustic detections within the 500 m mitigation zone continuously during VSP operation to identify if there are any cetaceans present.
- Commence VSP profiling as far as possible during daylight hours with good visibility. However, if this is not possible due to prolonged periods of low visibility (e.g. thick fog) or unforeseen technical issues, which results in a night-time start, the following mitigation measures should be implemented:
  - Ensure that VSP source is only used if PAM technology is in place to detect vocalisations (subject to a risk assessment indicating that the PAM equipment can be safely deployed considering the metocean conditions) or:
  - There have not been three or more occasions where cetaceans, penguins, shoaling large pelagic fish or turtles have been sighted within the 500 m mitigation zone during the preceding 24-hour period; and
  - A two-hour period of continual observation of the mitigation zone was undertaken (during a period of good visibility) prior to the period of low visibility and no cetaceans, penguins, shoaling large pelagic fish or turtles were sighted within the 500 m mitigation zone.

9.1.2.2.7 Residual Impact Assessment

With the implementation of the Project controls and mitigation measures, impact significance is expected to remain **low**.

9.1.2.2.8 Additional Assessment Criteria

The negative impact of noise from VSP is **definite** and considered to be **fully reversible**. Cumulative potential is **unlikely** and mitigation potential is **high**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.3 AMBIENT AIR NOISE LEVELS

9.1.3.1 Noise from Helicopters

9.1.3.1.1 Source of Impact

Sound will be produced by helicopters. These elevated noise levels may disturb faunal species resulting in behavioural changes or displacement from important feeding or breeding areas.

9.1.3.1.2 Project Controls

- No vessel or aircraft may approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft.
- TEEPSA and its contractors will undertake Project activities in a manner consistent with good international industry practice and BAT.
- The operation of helicopters aircraft will be governed by the Civil Aviation Act, 2016 (Act 6 of 2016) and associated regulations.
- Maintain a flight altitude of at least 1 000 m during flight, except when taking off and landing or in a medical emergency.
- Avoid extensive low altitude (<762 m or 2 500 ft) coastal flights and ensuring that the flight path is perpendicular to the coast, as far as possible.

9.1.3.1.3 Potential Impact Description

Transportation of personnel to and from drilling units by helicopter is the preferred method of transfer, with an estimated two round trips per day, (60 round trips per month for 6 months = total 360 trips). The helicopters can also be used for medical evacuations from the drilling unit to shore (at day- or night-time), if required. While the area of exploration is lies 80 to 100 km offshore, the closest commercial airport is in George, and the aircraft will therefore cross over offshore and coastal MPAs, including some sensitive coastal receptors (such as key faunal breeding/feeding areas, bird or seal colonies and nursery areas for commercial fish stocks). In addition, migratory pelagic species transiting through the drill area may also be directly affected.

9.1.3.1.4 Sensitivity of Receptors

Offshore taxa most vulnerable to disturbance by helicopter noise are pelagic seabirds, turtles and cetaceans. Although species listed as globally Endangered or Critically Endangered may potentially occur within the proposed area of construction and the helicopter flight path, their numbers are expected to be low. Onshore, roosting and nesting seabirds and seals are most likely to be impacted by routine helicopter operations across the coastal zone during the construction phase. Some of the seabirds roosting and nesting along the coast are listed by the IUCN as Endangered and include the African Penguin, Bank Cormorant, Cape Cormorant and Cape Gannet.

Low altitude flights over bird breeding colonies could result in temporary abandonment of nests and exposure of eggs and chicks leading to increased predation risk. However, sensitivity of birds to aircraft disturbance is species specific, and is generally lessened with increasing distance or if the flight path is off to the side and downwind. Seals may also experience both visual and acoustic disturbance from low flying aircraft, given that the frequency of aircraft engine noise emissions also overlaps with the hearing ranges of seals (Croft and Li, 2017, in Anchor Environmental, 2023).

Available data indicate that the expected frequency range and dominant tones of sound produced by helicopters overlap with the hearing capabilities of most cetaceans, both odontocetes and mysticetes (Richardson et al. 1995; Ketten 1998). Low altitude flights (especially near the coast) can have a significant disturbance impact on cetaceans during their breeding and mating season (Pisces, 2020). The level of disturbance will depend on the distance and altitude of the aircraft from the animals) particularly the angle of incidence to the water surface) and the prevailing sea conditions. Of particular concern are the potential overlaps in flight paths with migrating Humpback

whales and Southern Right whales inshore of the Block (the former April to December, with calving season from July to October, peaking in early August, and the latter June and November) (Best 2007).

Southern Right whales utilise the sheltered bays of the South Coast to breed and calve, with winter concentrations recorded all along the southern and eastern coasts of South Africa, with the most significant concentration currently on the South Coast between Cape Town and Gqeberha. It is highly likely that several hundred right whales can be expected to pass directly through the Block between May and June and then again November to January. Southern Right calving and nursing activities off the Mossel Bay coast would thus fall within the direct flight path.

Smaller cetaceans in the area include the Indo-Pacific Humpback dolphin, which occurs as a localised population concentrated around shallow reefs in the Plettenberg Bay- Algoa Bay region. Other species of concern that are likely to be encountered frequently in the Block include the Vulnerable Bryde's whales (throughout the year, with peak encounter rates occurring in late summer and autumn), the Endangered Sei whale (peaking in abundance on the East Coast in June and September), and the Vulnerable Sperm whale (high probability throughout the year, increasing in winter).

Based on the above, receptor sensitivity is considered to be **high**.

9.1.3.1.5 Impact Magnitude (or Consequence)

The majority of the transient noise from helicopters will be reflected by the surface of the ocean, with helicopter noise documented to be detectible for less than one minute under water (Richardson et al. 1995, WSP 2023b). Therefore, underwater noise impacts from helicopters are expected to be much less than those from other Project activities. Exposure to noise will be limited in duration (up to two trips per day over the six-months) (**short-term**) per well and will be of a temporary nature while the helicopter passes overhead (although regional in extent). Impact intensity is therefore considered to be **low** resulting in an impact magnitude of **very low**.

Indiscriminate or direct low altitude flying over seabird and seal colonies, or breeding cetaceans could impact fauna behaviour and breeding success. The level of impact will depend on the distance and altitude of the aircraft from the animals and the prevailing sea conditions at the time.

9.1.3.1.6 Impact Significance

Based on the high receptor sensitivity and very low magnitude, the significance of the impact is considered to be **low**.

9.1.3.1.7 Identified Mitigation Measures

Over and above the Project controls listed above, the following mitigation measures are proposed:

- Ensure that all flight paths avoid the Mossel Bay (Seal Island seal colony) and Robberg Peninsula (seabird and seal colonies).
- Brief of all pilots on the ecological risks associated with flying at a low altitude along the coast or above marine mammals.

9.1.3.1.8 Residual Impact Assessment

With the implementation of the Project controls and recommended mitigation measures, impact significance will be **low**.

9.1.3.1.9 Additional Assessment Criteria

Probability of the impact is **highly likely**. The loss of resources is **medium** and mitigation potential **medium**. Cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.3.2 Noise from Support Vessels

9.1.3.2.1 Potential Impact Description

Sound will be produced by support vessels. These elevated noise levels may disturb faunal species resulting in behavioural changes or displacement from important feeding or breeding areas. Vessel noise would primarily take place in the exploration drill area, and along the route taken by the support vessels between the drilling unit and port.

9.1.3.2.2 Project Controls

- Implement a maintenance plan to ensure all diesel motors and generators receive adequate maintenance to minimise noise emissions.
- TEEPSA and its contractors will undertake Project activities in a manner consistent with good international industry practice and BAT.

9.1.3.2.3 Sensitivity of Receptors

Migratory pelagic species transiting through the exploration drill areas may be directly affected. The taxa most vulnerable to disturbance by underwater noise are turtles, large migratory pelagic fish and marine mammals. Some of the species potentially occurring in the drill / construction areas, are considered regionally or globally 'Critically Endangered' (e.g. Southern bluefin tuna, leatherback turtle and blue whale), 'Endangered' (e.g. Whale Shark, Shortfin Mako Shark, Fin and Sei whales), 'Vulnerable' (e.g. bigeye tuna, blue marlin, loggerhead turtle, oceanic whitetip shark, dusky shark, great white shark, longfin mako and sperm whale, Bryde's and humpback whales) or 'near threatened' (e.g. striped marlin, blue shark, longfin tuna/albacore and yellowfin tuna).

Although species listed as globally Endangered or Critically Endangered may potentially occur in the area, Block 11B/12B is located in a main marine traffic route, already experiencing elevated marine traffic and vessel noise. Thus, the sensitivity of receptors to vessel noise is considered to be **medium.**

9.1.3.2.4 Impact Magnitude (or Consequence)

The sound levels radiating from vessels in transit and surveying range from 160 to 220 dB re 1 µPa at 1 m at frequencies of 5 to 500 Hz, depending on size and speed (NRC, 2003, in Anchor Environmental, 2023). As Block 11B/12B is located in a main traffic route that passes around southern Africa, the shipping noise component of the ambient noise environment is expected to be significant within and around the Block.

Previous noise modelling work has noted that the there is significant local shipping traffic and relatively strong metocean conditions in Block 11B/12B, and so the ambient noise levels are expected to be in the range 90-130 dB re 1 µPa for the frequency range 10 – 10 kHz. Note that underwater noise from vessels in transit is not considered to be of sufficient amplitude to cause direct physical injury to marine life, even at close range.

Due to their extensive distributions, the numbers of pelagic species (large pelagic fish, turtles and cetaceans) encountered during the construction phase is expected to be low and considering they are highly mobile and able to move away from the sound source before trauma could occur, the intensity of potential injury or behavioural disturbance as a result of vessel noise is rated **low**. Furthermore, the construction and drill areas are located in a main marine traffic route and thus is in an area already experiencing increased marine traffic and vessel noise.

This duration of the impact would be limited to the short-term and extend **regionally** (behavioural disturbances would be expected up to 100 km from the drill site, as well as vessel movement between logistics base and drilling unit). The potential physiological injury or behavioural disturbance as a result of drilling support vessel noise would thus be of **low** magnitude.

9.1.3.2.5 Impact Significance

Based on the medium receptor sensitivity and low magnitude, the significance of the impact is considered to be **low**.

9.1.3.2.6 Identified Mitigation Measures

Over and above the Project controls listed above, the following mitigation measure is proposed:

- Implement noise abatement measures to ensure an adequate acoustical insulation of the engines, compressors, turbines (enclose engines) and gas flow lines and valves (lagging, in-line silencers, etc.).

9.1.3.2.7 Residual Impact Assessment

With the implementation of the Project controls and recommended mitigation measures, impact significance will reduce to **very low**.

9.1.3.2.8 Additional Assessment Criteria

Probability of the impact is **likely**. The loss of resources is **low** and mitigation potential **low**. Cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.4 LIGHT EMISSIONS

9.1.4.1 Light from Drill Rig and Support Vessels

9.1.4.1.1 Source of Impact

During the exploration phase, the drill rig and vessels associated with drilling activities are likely to be the greatest source of artificial light at night.

9.1.4.1.2 Potential Impact Description

Artificial light at night is a significant source of light pollution that interferes with the natural cycles of light and darkness and modifies the intensity, spectra, frequency and duration of light reaching and penetrating the natural water bodies, including the ocean's surfaces, and natural landscapes (CWA 2020, Nelson et al. 2021, Thompson 2013, Zapata et al. 2019, in Anchor Environmental, 2023).

There is a wealth of information that illustrates that artificial light at night influences animal orientation, circadian rhythm (nocturnal and diel activity), spatial distribution, habitat use, migration/dispersal, foraging efficiency and predatory behaviour, schooling behaviour in fish, stress

hormones, and reproduction and life history traits (Bassi et al. 2022, Brüning et al. 2018, Nelson et al. 2021, Thompson 2013, in Anchor Environmental, 2023). Artificial light at night can influence the different levels of ecosystem organisation from individual organisms' physiology and behaviour through to ecosystem function and provision of ecosystem services (Zapata et al. 2019, in Anchor Environmental, 2023).

The biological effects of artificial light at night include metabolic disruption, oxidative stress, immunological dysfunction, sleep loss, energy expenditure and altered growth rate (Bedrosian et al. 2011, Gaston et al. 2015, Navara & Nelson 2007, Raap et al. 2015, Wyse et al. 2011, in Anchor Environmental, 2023). These effects are linked to organisms' internal rhythms that are driven by daily, seasonal, and lunar light cycles (Gaston et al. 2017, in Anchor Environmental, 2023).

9.1.4.1.3 Project Controls

TEEPSA will ensure that the contractors undertake the drilling operation in a manner consistent with good international industry practice and BAT.

9.1.4.1.4 Sensitivity of Receptors

Species listed as globally Endangered or Critically Endangered may potentially occur in Block 11B/12B, however the Block is located in a main marine traffic route already experiencing the increased marine traffic and vessel noise. Thus, the sensitivity of receptors to vessel noise is considered to be **medium**.

9.1.4.1.5 Impact Magnitude (or Consequence)

The amount of light spill that will reach the areas surrounding the vessels is unknown but will be influenced to a large degree by climate/atmospheric conditions. Artificial skyglow (direct lighting emitted or reflected upwards, scattered in the atmosphere and reflected back to the ground; Kyba et al. 2011, in Anchor Environmental, 2023) can spread light pollution hundreds of kilometres from its source (Luginbuhl et al. 2014, in Anchor Environmental, 2023).

The extent of the impact is therefore considered to be **local** (i.e., confined to within the Block and its nearby surroundings), of **short-term** duration. Given that the Block is located along a main marine traffic route, the area is already impacted by increased anthropogenic lighting, and the intensity of the impact is therefore considered to be **low** for the exploration phase, resulting in an impact magnitude of **very low**.

9.1.4.1.6 Impact Significance

Based on the medium receptor sensitivity and very low magnitude, the significance of the impact is considered to be **low**.

9.1.4.1.7 Identified Mitigation Measures

The following mitigation measures are proposed:

- Reduce the lighting to a minimum compatible with safe operations whenever and wherever possible to reduce nocturnal faunal attraction.
- Position light sources, if possible and consistent with safe working practices, in places where emissions to the surrounding environment can be minimised i.e., aim lighting downward rather than out to sea.

- Implement best practice mitigation measures for reducing lighting impacts (including the use of red filters).
- Include training on how to care for downed seabirds as part of induction and ongoing awareness training.
- Monitor the presence of seabirds and identify mortalities, even when birds do not land on the vessel, especially in foggy conditions and at night.
- Report ringed/banded birds to the appropriate ringing/banding scheme (details are provided on the ring).

9.1.4.1.8 Residual Impact Assessment

With the implementation of the Project controls and recommended mitigation measures, impact significance will reduce to **very low**.

9.1.4.1.9 Additional Assessment Criteria

The probability of the impact is **possible**. The loss of resources is **medium** and mitigation potential **low**. Cumulative potential is possible. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.4.2 Light from Well Flow Testing

9.1.4.2.1 Source of Impact

Well (flow) testing is undertaken to determine the economic potential of any discovery before the well is abandoned or suspended. One test would be undertaken per exploration well if a resource is discovered. Testing may take 3 to 4 days to complete and involves burning hydrocarbons at the well site. A high-efficiency flare is used to maximise combustion of the hydrocarbons.

9.1.4.2.2 Project Controls

- TEEPSA will ensure that the contractors undertake the drilling operation, including well flow testing, in a manner consistent with good international industry practice and BAT.

9.1.4.2.3 Potential Impact Description

The intense light from flaring at night will increase the ambient light offshore. This increased lighting may disturb and disorientate pelagic seabirds and may result in behavioural and physiological effects on fish and cephalopods causing them to be drawn towards the lights where they become easy prey for seabirds and other fish.

While the effects of operational lights can be mitigated (e.g., by pointing them downwards rather than out to sea, use of red filters etc.), the effect of the very bright light emitted by flaring cannot be and this is likely to overwhelm the operational lighting. Indeed, the intense light from flaring at night will increase ambient lighting in offshore areas. However, the light from flaring would be in addition to the other operational lights on the drilling unit and thus not as intense if it were the sole light source.

9.1.4.2.4 Sensitivity of Receptors

Although species listed as globally Endangered or Critically Endangered may potentially occur in the area, Block 11B/12B is located in a busy marine traffic route and thus is in an area already experiencing increased marine traffic and operational lighting. Sensitivity of receptors is considered of **medium** significance.

9.1.4.2.5 Impact Magnitude (or Consequence)

The extent of impact is **local** specific, while the duration will be **short-term** (10 days per well). Thus, the magnitude (or consequence) is considered to be **very low**.

9.1.4.2.6 Impact Significance

With a receptor sensitivity of medium and impact magnitude of very low, impact significance is considered to be **very low**.

9.1.4.2.7 Identified Mitigation Measures

The following mitigation measures have been recommended:

- Optimise well test and monitor the efficiency of the flare programme to reduce burning as much as possible during the test.
- If disorientated, but otherwise unharmed seabirds are found/caught, they must be kept in a dark space and be released during daylight hours.
- Include training on how to care for downed seabirds as part of induction and ongoing awareness training.

9.1.4.2.8 Residual Impact Assessment

With the implementation of the Project controls and mitigation measures, impact significance will remain **very low**.

9.1.4.2.9 Additional Assessment Criteria

The probability of the impact is **definite**. The loss of resources is **medium** and mitigation potential **medium**. Cumulative potential is **possible**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.5 PRODUCED WATER DISCHARGE

9.1.5.1 Source of Impact

Hydrocarbon ‘drop-out’ during flaring may cause a visible slick of oil on the ocean surface. Hydrocarbon ‘drop-out’ occurs when inefficient combustion of hydrocarbons during flaring causes unburnt hydrocarbons to drop onto the sea surface. Hydrocarbons may also be introduced into the surrounding environment through the discharge of produced water. “Produced water” is a term used in the oil and gas industry to describe the water that is brought to the surface along with oil and gas during the extraction process.

9.1.5.2 Project Controls

- TEEPSA will ensure that the contractors undertake the drilling operation, including well flow testing, in a manner consistent with good international industry practice and BAT.
- Produced water will be treated onboard before being discharged or transported to shore. Following the onboard treatment process, if the hydrocarbon content is below 30 mg/L, the produced water may be discharged into the marine environment, if the hydrocarbon content exceeds 30 mg/L, the produced water will either be treated again or be transported to shore to be treated.
- Develop and implement a Project-specific Waste and Discharge Management Plan.

- All disposals at sea should strictly adhere to MARPOL 73/78 b(International Convention for the Prevention biodiversity of Pollution from Ships, 1973).

9.1.5.3 Potential Impact Description

The release of hydrocarbons into the marine environment may have toxic effects on marine fauna. Produced water contains a variety of contaminants, including hydrocarbons at varying concentrations and if discharged into the marine environment can result in toxic effects, possibly leading to increased mortality rates of marine fauna. Additionally, the toxicity may affect the faunal health (e.g., respiratory damage).

9.1.5.4 Sensitivity of Receptors

Due to the location of Block 11B/12B, it is expected that any hydrocarbon 'drop-out' will be diluted and dispersed rapidly. Given the prevailing wind and current directions, it will likely disperse in a south-westerly direction, away from the coastline. It is likely that the species that may be affected by this are pelagic species of fish, birds, turtles and cetaceans, due to the distance offshore. These receptors include species of conservation concern, but they are unlikely to respond to what are expected to be relatively minor changes in water quality.

Although species listed as globally Endangered or Critically Endangered may potentially occur in Block 11B/12B, treatment of produced water will ensure reduced hydrocarbon concentrations in the discharges and reduced sensitivity of marine fauna to these discharges. In addition, the Block is located in a main marine traffic route and thus is in an area already experiencing increased marine traffic and operational discharges.

Based on the above, receptor sensitivity is rated as **medium**.

9.1.5.5 Impact Magnitude (or Consequence)

If water from the reservoir dopes flow with the hydrocarbons to the surface during the well test, the hydrocarbon component will be separated and flared. The impact of hydrocarbon 'drop-out' during flaring is therefore of low intensity and limited to the drilling location, resulting in an impact of **very low** magnitude.

Similarly, the impact of produced water discharge during flaring is of low intensity and limited to the drilling location, resulting in an impact of **very low** magnitude.

9.1.5.6 Impact Significance

Given the medium receptor sensitivity and very low magnitude, the impact significance of hydrocarbon 'drop-out' and produced water discharge during flaring is considered to be of **very low significance**.

9.1.5.7 Identified Mitigation Measures

The following mitigation measures are proposed:

- Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons and minimise hydrocarbon 'drop-out' during well testing.

9.1.5.8 Residual Impact Assessment

With the implementation of the Project controls and mitigation measures, impact significance is expected to remain **very low**.

9.1.5.9 Additional Assessment Criteria

The probability of the impact is **definite**. The loss of resources is **low** (produced water) to **medium** (hydrocarbon 'drop out') and mitigation potential **medium**. Cumulative potential is unlikely. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.6 DISCHARGE OF DRILLING FLUID AND CUTTINGS

9.1.6.1 Drilling Discharge Modelling

The information in this section is extracted from the following reports:

- The Marine Impact Assessment Report (Anchor Environmental, 2023), attached to this ESIA report as Appendix 11.
- Drilling Discharges Modelling Report conducted, for the western Project Development Area (Sintef, 2023), attached in Appendix 7.
- Drilling Discharges Modelling Reports conducted for two discharge points in the eastern Exploratory Priority Area (HES, 2021c) and (HES, 2021d), both attached in Appendix 7 of the ESIA report.

9.1.6.1.1 Approach and Methodology

Production, exploration and appraisal well drilling in Block 11B/12B will result in a discharge of drill cuttings, namely water-based muds. Water-based muds will be used in the well drilling stages. Drilling muds are used to lubricate the drill bit and to maintain well pressure (Dalmazzone et al. 2004, Atkinson 2010). Once complete, as much of the drill fluids as possible are recovered, and the remainder, along with the drill cuttings (to which some drill fluid inevitably remains adhered) and chemical additives of various compositions, is disposed of, either onshore in authorised landfill sites or discharged at sea (Dalmazzone et al. 2004, Atkinson 2010).

The specific composition of the discharge is dependent on the specific stage of drilling and equipment employed. Releases of drilling fluid can occur at the drilling location near the seabed or at the vessel/platform location near the water surface.

Drilling materials of concern include dissolved and deposited metals and chemicals, heavy metals in barite (Barium sulfate $BaSO_4$), a common weighting material used to formulate high-density drilling fluids), particles in mud and cuttings. These drilling materials impact both water and sediment quality through the introduction of toxic compounds, decreased oxygen levels, deposition of particle matter on the sea floor and changes in sediment grain structure (Ditlevsen, 2023).

SINTEF Ocean (Sintef, 2023) and H-Expertise Services S.A.S (HES, 2021c, d) used the DREAM (Dose-related Risk and Effects Assessment Model) model to assess deposition, spreading and potential environmental risk (and the associated Environmental Impact Factor (EIF) values) for the water column and the sediment caused by the planned drilling operations in the western Project Development Area and eastern Exploratory Priority Area respectively.

The DREAM model has been used by all oil and gas operators on the Norwegian Continental Shelf as a modelling platform for calculating the Environmental Impact Factors for Produced Water

Discharges (EIFPW) as an indicator of environmental risk from produced water discharges (Sintef, 2023). The DREAM model has been further updated as a basis for calculation of a similar EIF for drilling discharges (EIFDD) (Sintef, 2023). DREAM also includes a sediment module which simulates processes in the sediment to account for stressors like sedimentation processes, burial, oxygen demand from biodegradation in addition to toxicity of the sedimented chemicals (Sintef, 2023) (**Figure 9-1**).

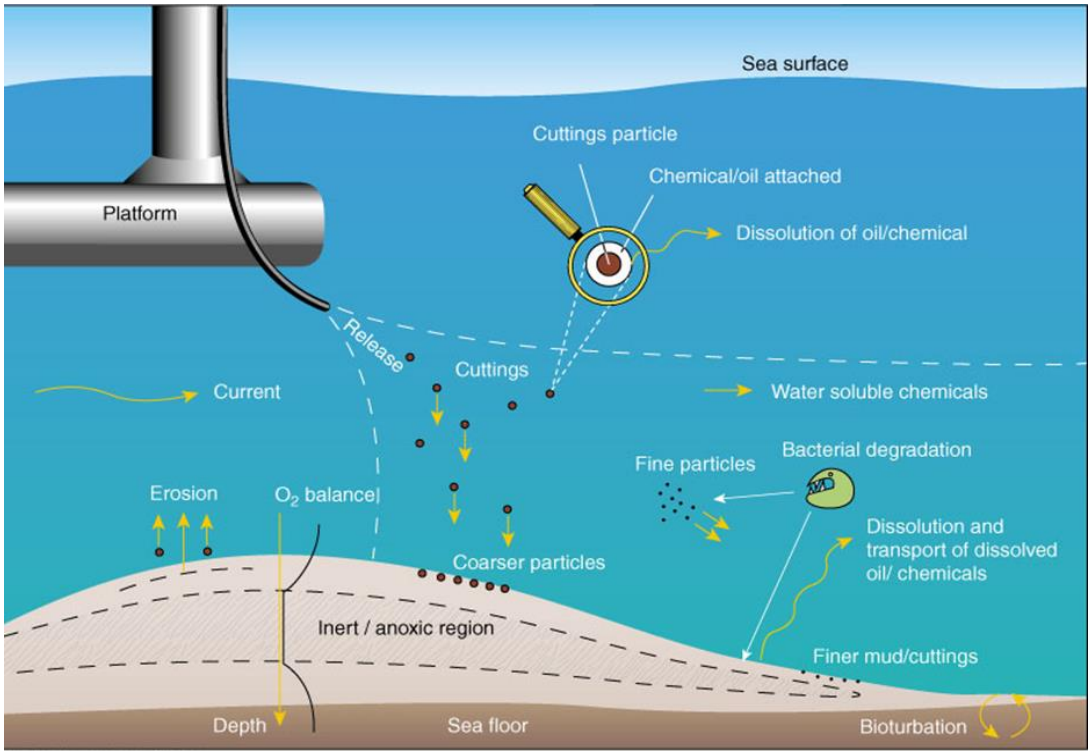

Figure 9-1–- Sketch of processes in the DREAM model. In the water column the model accounts for attached chemicals which might dissolve into the water column as well as stress from particles during the simulation period. At the end of the simulation period, the sediment module computes processes in the sediment compartment (HES 2021c, d; Sintef, 2023)

Environmental risk in the DREAM system is based on two concepts: the Predicted Environmental Concentration (PEC) and the Predicted No Effect Concentration (PNEC) (Sintef, 2023):

- The PEC is the calculated concentration of a chemical in the environment (in this case, the water column) over time and space introduced into the environment via a discharge. DREAM calculates the PEC for dissolved compounds (Pow < 1 000) and for particles that may be present in the discharge, accounting for the influence of ambient currents, vertical and horizontal transport and mixing, evaporation at the sea surface, biodegradation, and adsorption-desorption dynamics, using site specific meteorology and hydrodynamics inputs (the latter is usually imported from outputs generated by 3-dimensional and time-variable hydrodynamic models, or via observed ocean current profiles generated from measurements at a specific location). DREAM follows a “particle”, or Lagrangian approach. The model generates numerical particles at the discharge point, which are transported with the currents and turbulence in the sea. Different

properties, such as the mass of various compounds, densities and sinking velocities, are associated with each particle to represent the characteristics of a discharged compound. Model particles can also represent different states or phases, such as bubbles, droplets, dissolved matter and solid matter. The formulas and calculations for various processes (spreading, fate calculations, etc.) are given in Reed & Hetland (2002) and Rye et al. (2008) and are mainly based on recommendations from the European Commissions' technical guidance document on environmental risk assessment (EU-TGD) (European Commission 2003).
In sediments, PEC is represented by the chemical concentration in the porewater, the % oxygen depletion in the oxygenated layer, the layer thickness of the deposited layer and the change in the medium sediment grainsize, respectively. After deposition, the level of exposure to these stresses is calculated by diagenetic equations as described by Rye et al (2006) and Durgut et al (2015). Discharges from a drilling rig to the sea are rather intermittent and time variable, with various composition and amounts of the mud discharged from each drilling section. This causes corresponding time variability in the recipient concentrations.

- The PNEC is a measure in toxicity studies that represents the concentration of a chemical compound in either water or sediments below which marks the limit below which no adverse effects of exposure in an ecosystem are measured. This PNEC is usually derived from results of laboratory toxicity tests and must be provided for each compound to be considered in the discharge. Guidelines on how the PNEC for water and sediment are derived from laboratory toxicity test results are available from the EU (ECHA 2008). Details on PNECs for added chemicals in the water column and sediments can be found in Johnsen et al. (2000) and Altin et al. (2015), respectively. There are also non-toxic stressors (i.e., stressors that are due to physical changes in the environment, rather than toxicity effects) with derived species sensitivity distributions from laboratory studies for suspended clays, burial and grainsize change (Smit et al. 2008a).
  Based on this work, the PNEC for burial was set to a deposited layer of 0.65 cm, and the PNEC for the change in oxygen content was set to 20% reduction of oxygen (in terms of mg O_2/m^2 sediment surface) by considering the effect of reduced redox potential on the diversity of the benthic fauna (Ditlevsen 2023). The PNECs for the sediment stressors are included in DREA''s sediment module directly, while PNECs for chemical components follow as input data with these components.

The ratio of PEC / PNEC gives an indication of the likelihood that there will be adverse effects as a result of exposure to a specific chemical. In this way, the DREAM model is a risk assessment tool; it determines the risk level (HES, 2021c, d). The level of environmental impacts on the water column, on the sediments and across the broader marine ecosystem can be compared using a calculated Environmental Impact Factor (EIF) (HES, 2021c, d).

To calculate an EIF, the exposure concentrations (PEC) are translated to a risk probability. As per Ditlevsen (2023), this risk probability is the "probability that a randomly selected species in the environment is exposed to concentrations exceeding the No Observed Effect Concentration (NOEC)" i.e., the highest tested concentration for which there are no statistically significant difference of effect ($p<0.05$) when compared to the control group in long-term ecotoxicity studies. As such, a risk probability of 5% is often used as a cut-off point assuming that risk is unacceptable if more than 5% of the species are exposed above their chronic NOEC (Smit et al. 2008).

Therefore, it has been suggested that the concentration at which the risk probability is 5% corresponds to the PNEC, implying that when the PEC/PNEC equals 1, the risk probability equals 5% (Karman et. al. 1994, HES, 2021c, d, Sintef, 2023). The larger the PEC/PNEC ratio, the larger the percentage of species that may be potentially impacted (HES, 2021c, d). The PNEC is derived from LC50 values calculated form toxicity studies (LC50, or Lethal concentration 50, is the amount of a substance required to kill 50% of test animals during a predetermined observation period and are used as a general indicator of a substance's acute toxicity).

The overall risk for the sediment results from all compounds from the drilling discharge that ended up in the sediment and all non-toxic stressors is calculated by the DREAM model in space and time within the model domain. **1 EIF is the unit for the reference water volume or sea floor area where the risk for an effect on the most sensitive species exceeds 5%** (more than 5% of the most sensitive species are at risk). 1 EIF equates to 100x100x10 m^3 in the water column (100 000 m^3), and 1 EIF equates to 100x100 m on the sea floor (10 000 m^2; i.e.100 EIF = 1 km^2) (Sintef, 2023).

The EIFDD for both water and sediment varies over time because wind and current conditions change over time, and because discharges from a drilling rig to the sea are also intermittent and change over time (Sintef, 2023). This is accounted for in the DREAM model, and results are presented as the duration of maximum EIF for both water and sediment.

The EIF approach also enables the quantification of the contribution of the various compounds in the discharge (toxicity) and the non-toxic stressors to the overall environmental risk. This enables the identification of the highest risk contributors in the discharge and facilitates the definition and selection of cost-effective risk mitigation measures based on best available technology.

9.1.6.1.2 Discharge Configuration and Scenarios Modelled

For the western Project Development Area, two pseudo-well sites (Discharge Point 4 and Discharge Point 5, **Figure 9-2**) were simulated across four seasons, as presented in **Table 9-1**. The water depth assumed for Discharge Point 4 is approximately 1 200 m, and around 1 800 m for Discharge Point 5 (Sintef, 2023). For more details about the model set up (including discharge volumes and composition), see Sintef (2023).

Table 9-1–- Modelled drilling discharge environmental scenarios for the western Project Development Area

Season	Discharge Point 4	Discharge Point 5	Simulation Duration
	Simulation start times		
Summer: Scenario 1 (Dec-Jan-Feb)	2015-12-26 15:00	2015-12-24 03:00	Water = 35 days Sediment = 35 days+ 10 years
Autumn: Scenario 2 (Mar-Apr-May)	2013-03-12 09:00	2013-03-12 09:00	
Winter: Scenario 3 (Jun-Jul-Aug)	2016-08-14 09:00	2015-08-12 00:00	
Spring: Scenario 4 (Sep-Oct-Nov)	2014-10-19 12:00	2015-10-15 03:00	

Sintef (2023)

As the exact locations of the wells to be drilled within the area Block 11B/12B eastern Exploratory Priority Area are as yet unknown (and still dependent on exploratory outcomes), drilling modelling

studies assessed two pseudo-well sites (Discharge Point 1 and 2, see Figure 9-2) were simulated across four seasons (four base-case runs, and one optional run), as presented in Table 9-2. Discharge Point 1 is located at ~1 254 m depth, and Discharge Point 2 is located at around 690 m (HES 2021c, d). These sites were selected because they were closest to the coast, and close to areas of high sensitivity areas at two different depths, and hence present worst-case scenarios from impact assessment perspective. For more details about the model set up (including discharge volumes and composition), see HES (2021c, d) for Discharge Points 1 and 2, respectively.

Table 9-2–- Modelled drilling discharge environmental scenarios for the eastern Exploratory Priority Area

Season	Discharge Point 1	Discharge Point 2	Simulation Duration
	Simulation start times		
SUMMER: Scenario 1 (January 2012)	2012-01-01	2012-01-01	Water = 45 days Sediment = 45 days + 10 years
AUTUMN: Scenario 2 (March 2012)	2012-03-01	2012-03-01	
WINTER: Scenario 3 (June 2012)	2012-06-01	2012-06-01	
SPRING: Scenario 4 (September 2012)	2012-09-01	2012-09-01	
SUMMER: Scenario 5 (January 2012)	2012-01-01	2012-01-01	Water = 62 days Sediment =62 days + 10 years

HES (2021c, d)

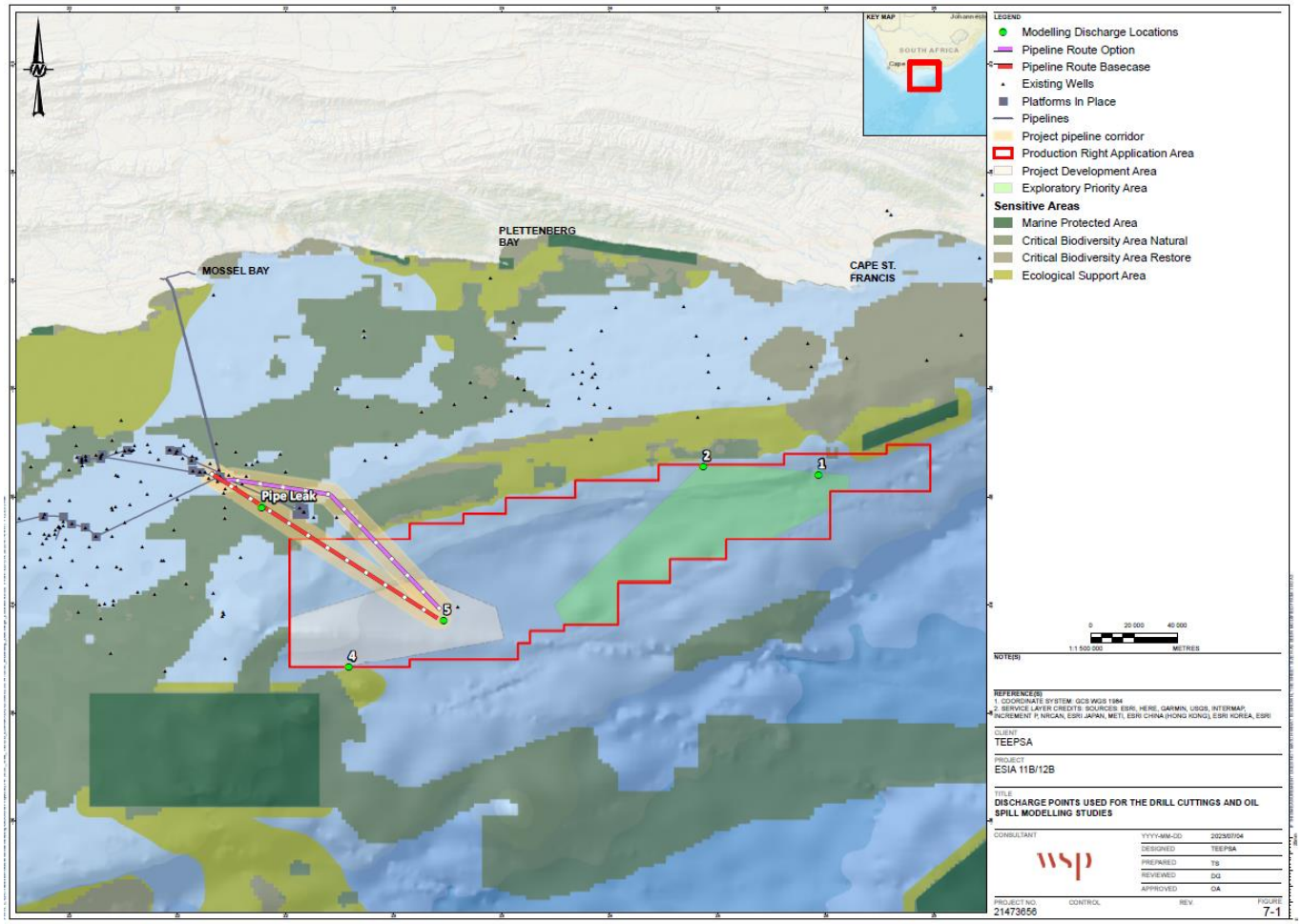

Figure 9-2–- Locations of the drilling discharges modelling points in Block 11B/12B (Discharges Points 4 and 5 in the western Project Development Area, and Discharge Points 1 and 2 in the eastern Exploratory Priority Area). Pipe leak location was used for oil spill modelling – see Section 10 for details.

The drill cuttings DREAM model specifies two types of discharges, dependent on depth and operational requirements:

- The cuttings of the drilled top-hole sections (i.e., riserless drilled sections at the start of the drilling process, see Figure 9-3) will be discharged directly at the sea floor. The coarser part of the particle content in the discharges will deposit on the sea floor almost immediately, while the finer particles and dissolved chemicals will be transported along the sea floor with the ambient currents.
- The discharges from the deeper drilling sections (in the deeper portion of the well, refer to Figure 9-3) will be drilled from the rig using Water-Based Muds (WBM). For these sections, discharges will be made from the drill ship10 m below sea surface.

In the model, the discharge is represented by numerical particles, where each numerical particle carries the respective amount of chemicals and particulate material. The numerical particles are transported with the currents and sink due to their density. There are different numerical particle classes for dissolved (chemicals) and particulate matter (undissolved chemicals, mud and cuttings) (Sintef, 2023).

The simulation itself is performed with two different modules in DREAM, the first being the transport and fate module, that computes dissolution and degradation in the water column and settling on the sea floor for a period of 35 days. The second module, the sediment module, computes long-term processes on the sea floor and is run for 10 years to assess toxicity, oxygen change, grain size change and burial (notice that the sediment module is run independently of environmental data i.e., it does not simulate the re-suspension and re-distribution of bottom sediments, resulting in very conservative results).

The results from the simulated drilling operations together with their computed Environmental Impact Factor (EIF) are presented below for both the western Project Development Area sites (modelled by Sintef, 2023) and the eastern Exploratory Priority Area sites (modelled by HES, 2021c, d). Note that EIF = 1 is the area of 100x100 m where the risk for environmental effects exceeds 5%. It is assumed that the concentration at which the risk probability is 5% corresponds to the PNEC, and when PEC/PNEC = 1, the risk probability equals 5%.

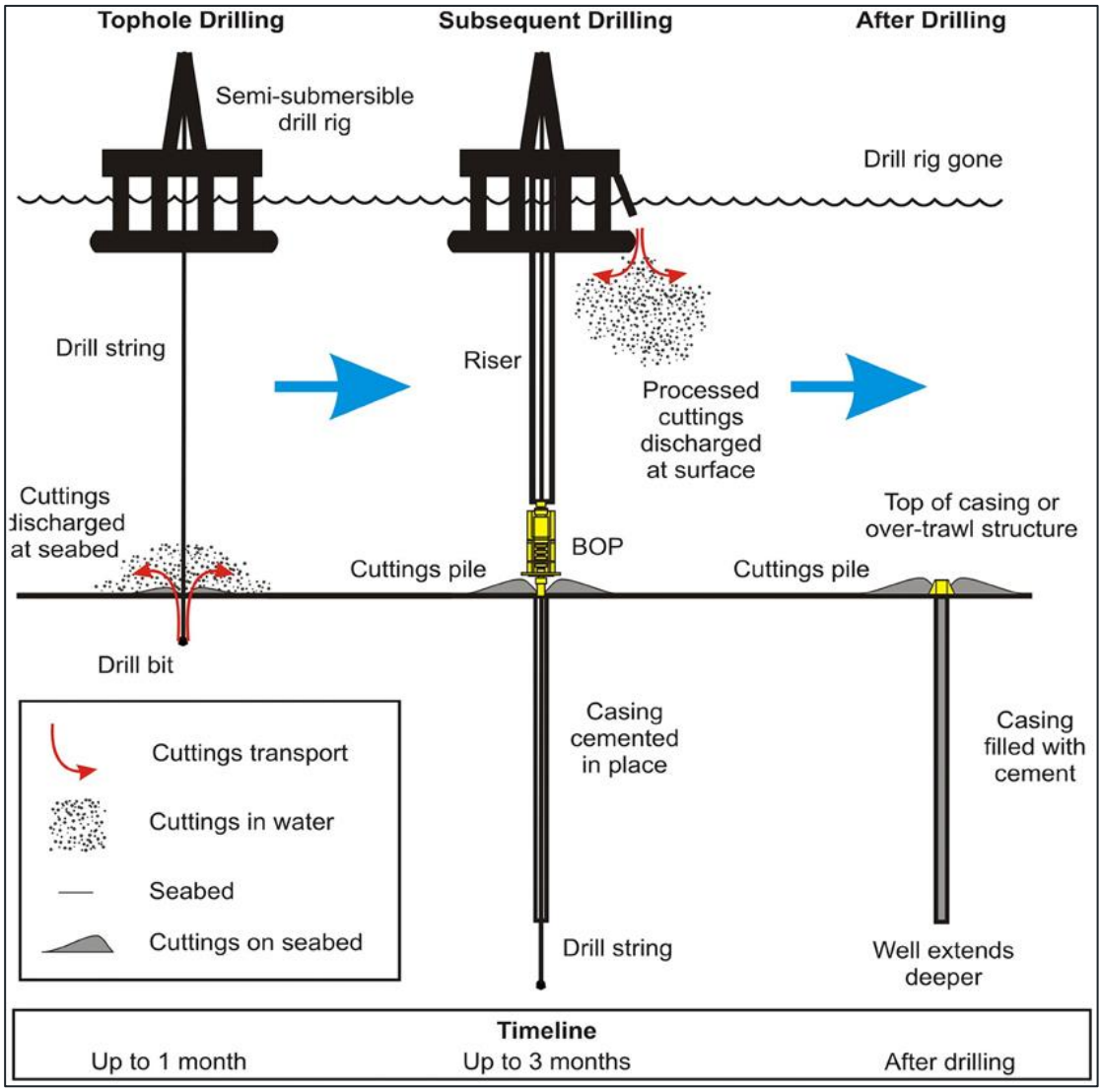

Figure 9-3–- Primary sediment discharges resulting from deep-water drilling activities. These effects are nearly identical whether a semi-submersible rig (as shown) or a drillship is used for drilling and are similar for both exploratory and production drilling (Cordes et al. 2016)

9.1.6.1.3 Modelling Results–- Western Project Development Area

9.1.6.1.3.1 Modelled effects on the water column

The model results indicate that, for the upper water column (0 to 100 m depth), the discharge from the rig 10 m below sea-surface sinks down to about 40 m depth, with the spatial distribution mostly driven by the predominant S/SW currents (Figure 9-4) (Sintef, 2023). In the lower water column (1 100 to 1 300 m depth for Discharge Point 4), the finer particle discharge from the drilled top-hole sections remains in suspension and is transported along the seabed with the ambient currents for Discharge Point 4 (Figure 9-5). For Discharge Point 5 however, the plume becomes “attached’ to the benthos immediately after discharge, and the total extent of the plume is smaller than that of Discharge Point 4 (Figure 9-5). Note that as the lower water column is also subject to lower ambient

current speeds, elevated concentrations persist for longer periods than in the surface waters (Sintef, 2023).

Across the modelled seasons, the area of impact (the EIF) for lower water column discharge is greater than that of the upper water column for Discharge Point 4 (mean EIF = 11 802 and 10 724 respectively), while for Discharge Point 5, the EIF for the upper water column is greater than that of the lower (mean EIF = 11 802 and 8 681 respectively). This is likely because of the plume attachment to the bottom for the Discharge Point 5 drilling discharge (as shown in **Figure 9-5**), which results in a smaller overall area of impact.

The greatest environmental impact extent (i.e., highest EIF) on the upper water column are expected to occur under modelled summer conditions (December to February) for Discharge Point 4 (max EIF = 12 616) and under modelled spring conditions (September to November) for Discharge Point 5 (max EIF = 14 536) (Figure 9-4 and Table 9-3). For the lower water column, the greatest impacts are expected to occur in autumn (March to May) for Discharge Point 4 (max EIF = 12 332), and in winter (June to August) for Discharge Point 5 (max EIF = 8 773) (Figure 9-5 and Table 9-3). These results indicate that there appears to be no single modelled 'worst-case' season, and that impacts are predominately determined by well location.

Concentrations in the water-column are shown to spread rapidly and dilute with the currents (Sintef, 2023). In the upper water column, the maximum EIF of 14 536 occurred at Discharge Point 5 during spring (conservative estimated area of impact = 126 km^2) and lasted for two days (**Table 9-3**). This 'peak' impact is associated with the mud discharge at the end of the drilling period (Sintef, 2023). Prior to this mud discharge, the EIF values over the stimulated discharge period did not exceed 4 000, lasting around 5 days maximum (Figure 9-6).

In the lower water column, the maximum EIF of 12 332 occurred at Discharge Point 4 during autumn (conservative estimated area of impact = 64 km^2) and lasted for 2.5 days (Table 9-3). While Discharge Point 5 has a lower maximum EIF, with an estimated area of impact of 44 km^2, the duration of the impact is longer, with maximum EIF conditions persisting for approximately five days across all seasons (Figure 9-5).

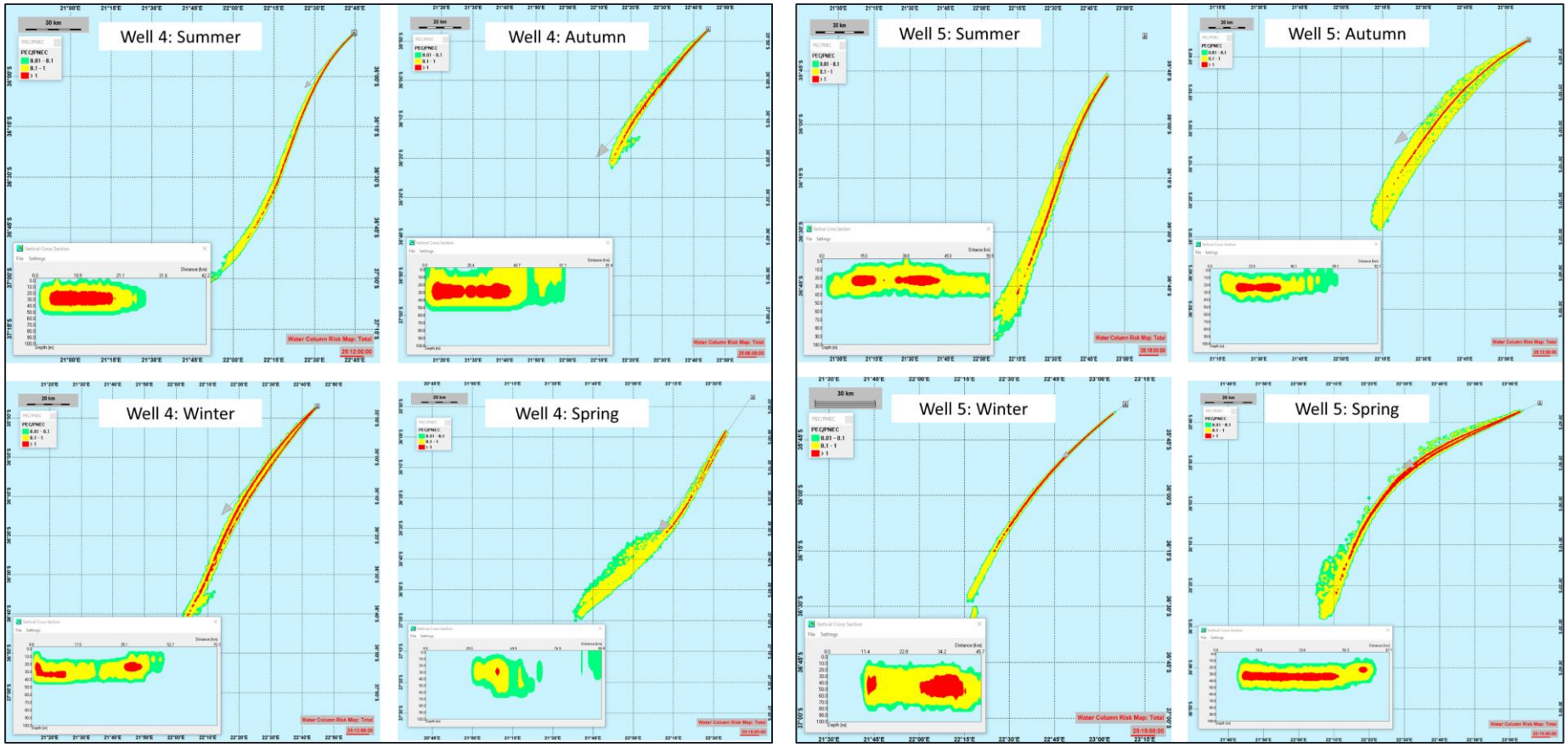

Figure 9-4–- Maximum instantaneous (i.e., time instance snapshot) EIF for the upper water column between 0-100 m for all modelled seasons. The snapshot occurs ~25 days after start, when the discharge is released from the rig. The vertical cross section shows the PEC/PNEC ratio in the water column along the grey arrow (Sintef, 2023)

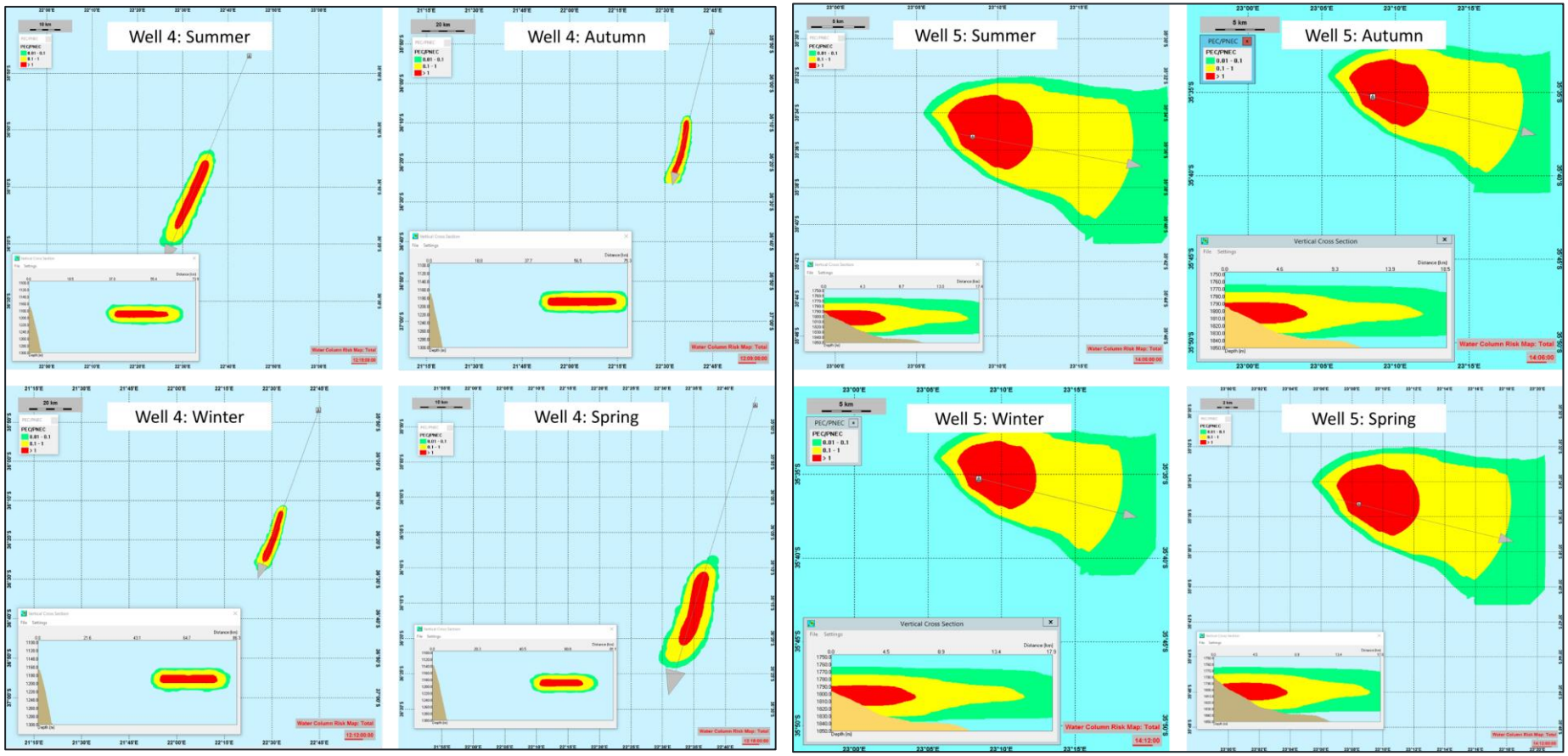

Figure 9-5–- Maximum instantaneous (i.e., time instance snapshot) EIF for the lower water column between 1100-1300 m for Discharge Point 4, and 1750-1850 m for Discharge Point 5 for all modelled seasons (Sintef, 2023)

Table 9-3–- Summary of upper and lower water column EIF results for Discharge Points 4 and 5.

Season		Maximum instantaneous EIF	Seawater volume of impact (km^3) assuming 1 EIF = 100x100x10 m	Estimated area of impact (km^2)[42]	Duration of max. EIF	Maximum instantaneous EIF
Upper water column						
Discharge Point 4	Summer	12 616	1.2616	63	~ 1.25 days	Barium-sulfate 84%
	Autumn	9 232	0.9232	46	~ 1.25 days	Barium-sulfate 86%
	Winter	12 016	1.2016	116	~ 1.25 days	Barium-sulfate 83%
	Spring	9 032	0.9032	45	~ 1.25 days	Barium-sulfate 85%
Discharge Point 5	Summer	10 148	1.0148	77	~ 2 days	Barium-sulfate 82%
	Autumn	8 156	0.8156	77	~ 1.25 days	Barium-sulfate 84%
	Winter	14 220	1.422	58	~ 1.5 days	Barium-sulfate 85%
	Spring	14 536	1.4536	126	~ 2 days	Barium-sulfate 83%
Lower water column						
Discharge Point 4	Summer	11 639	1.1639	65	~ 2.5 days	Barium-sulfate 63% Bentonite 20%
	Autumn	12 332	1.2332	64	~2.5 days	Barium-sulfate 59% Bentonite 23%
	Winter	11 972	1.1972	67	~2.5 days	Barium-sulfate 59% Bentonite 22%
	Spring	11 265	1.1265	64	~2.5 days	Barium-sulfate 66% Bentonite 16%

[42] The Estimated Area of Impact (km^2) calculates the EIF area of impact using GIS plume analysis.

Season		Maximum instantaneous EIF	Seawater volume of impact (km^3) assuming 1 EIF = 100x100x10 m	Estimated area of impact (km^2)[42]	Duration of max. EIF	Maximum instantaneous EIF
Discharge Point 5	Summer	8 605	0.8605	43	~ 5 days	Barium-sulfate 70% Bentonite 14%
	Autumn	8 623	0.8623	44	~5 days	Barium-sulfate 70% Bentonite 14%
	Winter	8 773	0.8773	43	~5 days	Barium-sulfate 71% Bentonite 14%
	Spring	8 722	0.8722	44	~5 days	Barium-sulfate 68% Bentonite 15%

Sintef, 2023

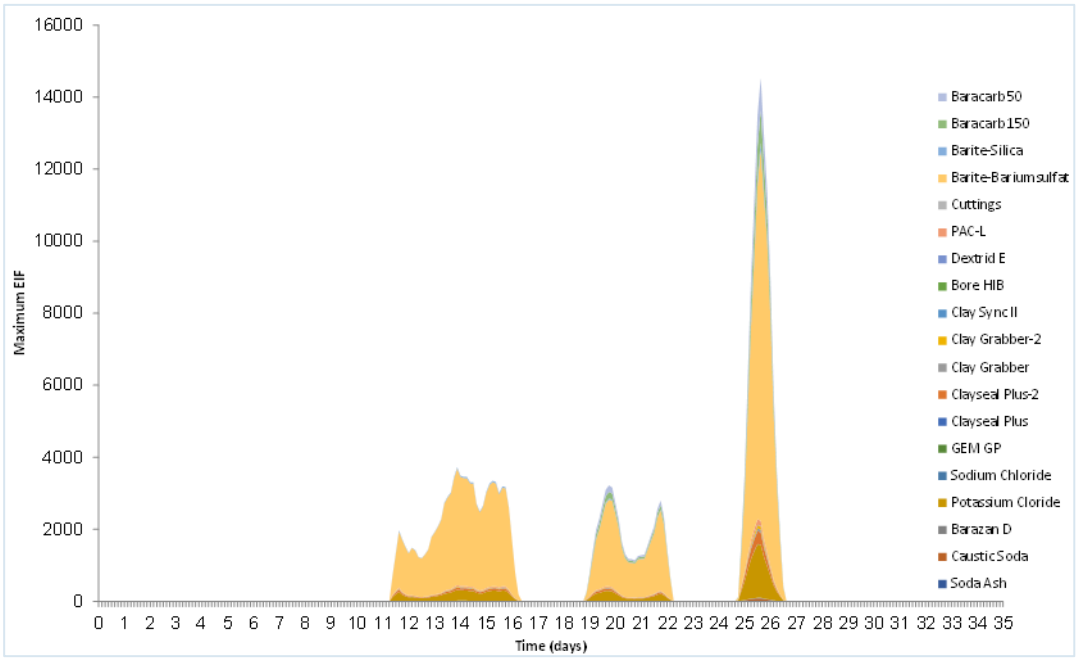

Figure 9-6–- Time series development of the EIF for the upper water column, for Discharge Point 5 season 4 (Spring) (Sintef, 2023)

The model results indicate that the primary environmental impacts of drill discharge and cuttings release in the upper water column are linked to the discharge of particulate matter, and in particular, the release of barium sulfate (i.e., barite) (PNEC of 0.115 mg/L), and to both barite and bentonite (PNEC of 0.170 mg/L) in the lower water column (Table 9-3) (Sintef, 2023). Barite makes up 70 to 80% of the WBMs used for drilling during the riserless stage.

The primary environmental risk from the discharge of drill cuttings is to the benthic environment, as a result of biochemical effects from drilling fluids, smothering, reduced oxygen levels in the sediment and changes in sediment composition. Therefore, bottom water environmental risks of the proposed drilling activities are considered to be of particular importance in the assessment of impacts (see Section 9.1.6.2.). Assuming one well is drilled at a time, no more than ~126 km^2 of water in the upper water column, and no more than 44 km^2 of bottom water column will experience elevated concentrations of barite and bentonite for more than 5 days at a time (Table 9-3). Cumulatively, should all six production wells be drilled, the impact will last for a total of 30 days.

Drill discharge modelling results do show that, depending on the well location, potential impacts can extend beyond the confines of Block 11B/12B. Indeed, the modelled maximum cumulative risk throughout the water column at any time for both Discharge Point 4 and Discharge Point 5 (for the discharge from the drill ship 10 m below sea surface) intersects with the Southwest Indian Seamounts Marine Protected Area to the southwest of Block 11B/12B (Figure 9-7). The modelled cumulative plume discharge for Discharge Point 4 overlaps substantially with the MPA in all seasons in both the upper and lower water columns, while for Discharge Point 5, there is no overlap in the lower water column with the MPA at all (Figure 9-7).

For Discharge Point 4, the maximum extent of modelled cumulative overlap with the MPA in the surface waters (for values both above and below the PNEC) is 4 117 km^2, representing an area covering ~92% of the surface waters of the MPA (Table 9-4). For the bottom waters, the maximum extent of modelled EIF overlap with the MPA is 895 km^2 (~20% pf the MPA) (Table 9-4). However, for Discharge Point 4, the greatest extent of overlap with the MPA where the PNEC > 5 occurs during winter and covers just under 10% of the area of the MPA surface waters (Table 9-4, Figure 9-7). For the bottom waters, the greatest extent of overlap with the MPA resulting from drilling at Discharge Point 4 (where the PNEC > 5) occurs during summer and covers ~4.5% of the bottom water area of the MPA (Table 9-4).

Table 9-4–- Upper and lower water column maximum cumulative extent of impact and overlap with the Southwest Indian Seamounts MPA for Discharge Points 4 and 5 across all seasons

Season		Area (Km^2)				Proportion of overlap area of plume > PNEC with MPA
		Total area of plume	Total area of plume in MPA	Total area of plume > PNEC	Total area of plume > PNEC in MPA	
Upper water column						
Discharge Point 4	Summer	6966	953	487	228	5.06
	Autumn	26192	4117	414	313	6.95
	Winter	10727	1212	619	448	9.96
	Spring	15330	1981	393	320	7.10
Discharge Point 5	Summer	7963	1446	854	167	3.7
	Autumn	13392	2728	722	196	4.4
	Winter	12110	3603	412	67	1.5
	Spring	12797	2324	1337	451	10.0

Season		Area (Km^2)				Proportion of overlap area of plume > PNEC with MPA
		Total area of plume	Total area of plume in MPA	Total area of plume > PNEC	Total area of plume > PNEC in MPA	
Lower water column						
Discharge Point 4	Summer	1707	873	308	204	4.53
	Autumn	2117	895	198	100	2.23
	Winter	1517	270	737	152	3.37
	Spring	2343	585	411	137	3.05

Sintef (2023)

For Discharge Point 5, the maximum extent of modelled cumulative EIF overlap in the upper water column (for values both above and below the PNEC) is 3 603 km^2, representing an area covering 80% of the MPA. However, the area of modelled EIF within the MPA that exceeds the 5% threshold (i.e., falls above the PNEC) is 67 km^2, representing some ~ 1.5% of the area of the MPA. Model results show that for Discharge Point 5, the greatest extent of modelled cumulative overlap with the MPA where the PNEC > 5 occurs during spring and covers some 10% of the area of the MPA surface waters.

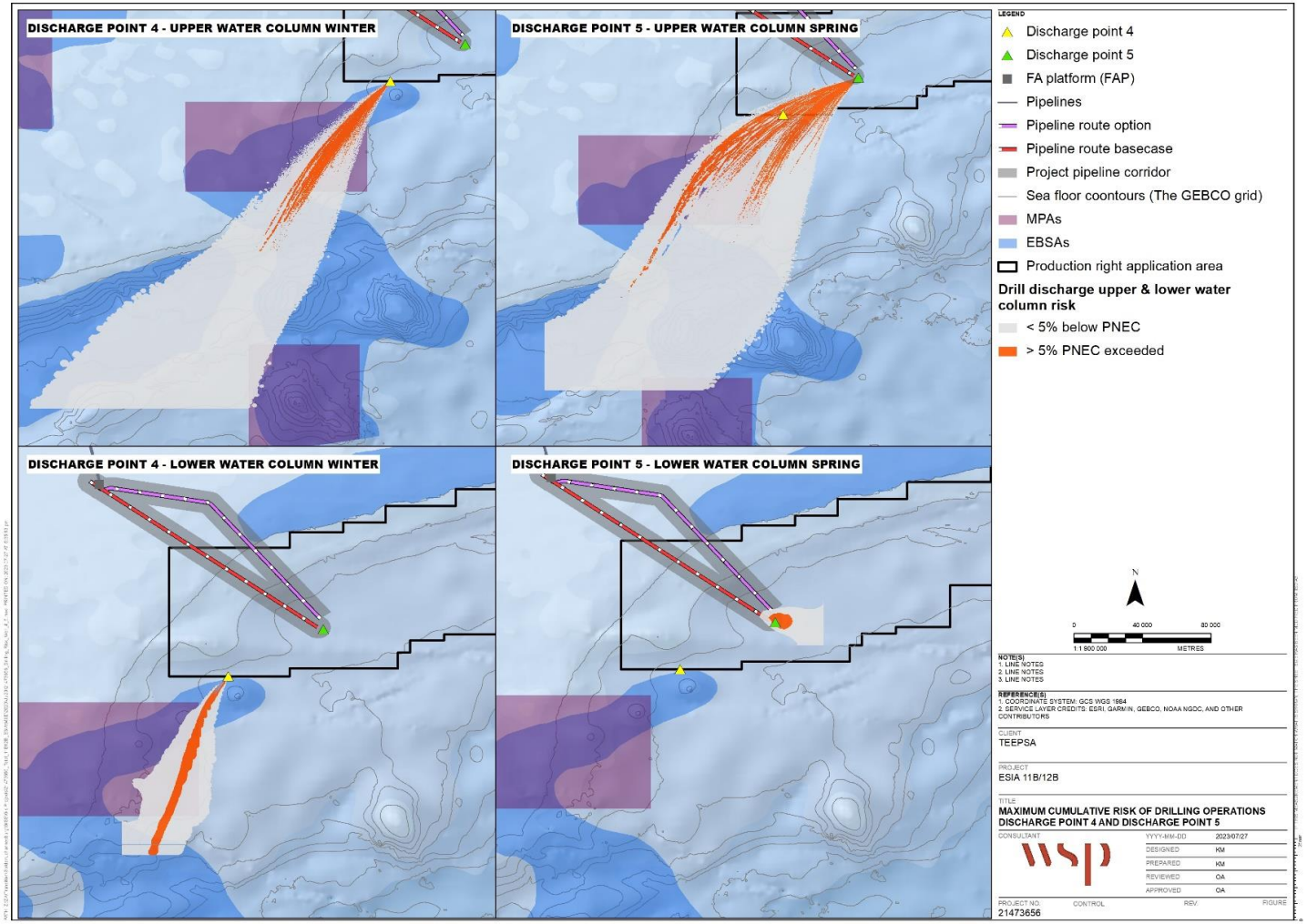

Figure 9-7–- Maximum cumulative risk of drilling operations throughout the water column during winter for Discharge Point 4 and spring for Discharge Point 5 (Sintef, 2023)

9.1.6.1.3.2 Modelled effects on sediment

The model results indicate that deposited material in the sediment will occur within a radius of 250 to 300 meters from the discharge point, with the thickest areas of deposition areas closest to the well comprising cuttings discharged from the top-hole sections, which, as the cuttings discharges are located on the sea floor, will deposit immediately after discharge (Sintef, 2023). The model results indicate that the primary environmental impacts of drill discharge and cuttings release on sediments is burial, and grain size change (Table 9-5) (Sintef, 2023).

Simulations shows that impact on the sediment caused by discharge from rig are negligible for all seasons, with EIF < 1 (Sintef, 2023). Impacts from top-hole discharge are also low, with low EIF values of between 0.75 to 1.5 for Discharge Point 4, and 0.5 to 0.75 for Discharge Point 5. The impacts on the sediment for proposed drilling activities at Discharge Point 5 are lower than those for Discharge Point 4 (Table 9-5). The highest EIF occurred in winter for Discharge Point 4 (EIF = 1.5, for a converted area of impact of 150 m^2) (Sintef, 2023) (Table 9-5).

Table 9-5 - Summary of sediment EIF results for Discharge Points 4 and 5 across the four modelled seasons

Season		Maximum EIF (sea floor area 50x50 m)	Area of impact (m^2)	Duration of max. EIF (for EIF>1)	Dominant risk contributor
Sediment (0-100 m depth)					
Discharge Point 4	Summer	1.5	150	~ 4.3 years	Burial 74%, Grain size change 26%,
	Autumn	0.75	75	~ 4.3 years	Burial 73%, Grain size change 27%
	Winter	1.5	150	~ 4.3 years	Burial 73%, Grain size change 27%
	Spring	1	100	~ 4.3 years	Burial 73%, Grain size change 27%
Discharge Point 5	Summer	0.75	75	~ 4.5 years	Burial 65%, Grain size change 35%,
	Autumn	0.75	75	~ 4.5 years	Burial 64%, Grain size change 36%
	Winter	0.5	50	~ 4.5 years	Burial 65%, Grain size change 35%
	Spring	0.75	75	~ 4.5 years	Burial 64%, Grain size change 36%

Sintef, 2023

Modelled drilling at Discharge Point 4, at the end of 10 years (assuming no simulation of sediment redistribution) shows that sediment deposition will occur predominately in a south west pattern, with a worst-case deposition of 30 mm thick in an area of ~5 000 m^2 around the drilling site, and a sediment deposition of 10 to 30 mm thick covering an area of ~2 500 m^2. The PNEC for burial (6.5 mm) is predicted to cover an area of approximately 25 000 m^2 (~0.025 km^2).

For Discharge Point 5, sediment deposition will occur in a more uniform pattern closer to the drill site, resulting in a deposition of 30 mm thick in an area of ~5 000 m^2 around the drilling site at the end of 10 years. A sediment deposition of 10 to 30 mm thick is predicted to cover an area of ~2 500 m^2. PNEC for burial (6.5 mm) is predicted to cover an area of approximately 175 000 m^2 (~0.175 km^2).

The environmental risk on the sea floor and in the sediment was presented as spatial distribution on a map and snapshots in time (see Sintef, 2023). For Discharge Point 4, the model results show no risk in the sediment after four years, despite the relatively high EIF value (as per **Table 9-5**) i.e., it is assumed that the duration of impact on sediment lasts up to four years (Sintef, 2023). For Discharge Point 5 however, a risk of 5 to10 % remains in the sediment after four years in an area of 2 500 m^2, with an estimated recovery time of approximately 4.5 years (Table 9-5).

9.1.6.1.4 Modelling Results–- Eastern Priority Exploratory Area

9.1.6.1.4.1 Modelled effects on the water column

The model results indicate that, for Discharge Point 1, significant risk in the water column as a result of riserless drilling (the initial stages of the drilling) occurs 8.5 to 9.5 km away and at depths of 1 200 to 1 300 m (depending on the season), following the deep-sea current to the west / south-west (Table 9-6, Figure 9-8). The risk is predominantly linked the quantity of Barite to be used in the mud of the riserless sections (HES, 2021c).

The worst-case EIF occurred in winter (Table 9-6). A significant risk due to the discharge of the sections drilled with a riser (linked to the hydrochloric acid present in the Clayseal Plus to be used in these sections) has also been observed extending 18 to 34 km away from the discharge point (in winter and autumn, respectively) toward south-west (at 0 to 100 m depth below sea surface) (Figure 9-8, Table 9-6) (HES, 2021c).. This risk, while significant, is intermittent, and limited scale (restricted to small patches around the drill site) and duration, persisting for 11.8 to 13.5 days (when EIF>0) and disappearing completely after operations end (in this case, after 43 days) (Table 9-6) (HES, 2021c).

Table 9-6–- Summary of water column EIF results for Discharge Points 1 and 2[43]

Scenario/Season		Maximum instantaneous EIF	Maximum distance at risk around the discharge point (km)	Duration (days) with EIF > 0	Dominant risk contributor
The Estimated Area of Impact (km^2) could not be calculated, because no GIS data was provided 1	Scenario 1 (Summer)	11695	8.5 km (lower water column); 25 km (upper water column)	13.5	Barite: 94%
	Scenario 2 (Autumn)	10559	9 km (lower water column); 34 km (upper water column)	12.2	Barite: 95%
	Scenario 3 (Winter)	11350	9.5 km (lower water column); 18 km (upper water column)	11.8	Barite: 94%
	Scenario 4 (Spring)	11119	8.7 km (lower water column); 19 km (upper water column)	12.1	Barite: 94%
	Scenario 5 (Summer, longer duration)	11976	10 km (lower water column); 25 km (upper water column)	25.5	Barite: 92%
Discharge Point 2	Scenario 1 (Summer)	11016	30 km (lower water column); 24 km (upper water column)	15.9	Barite: 90%
	Scenario 2 (Autumn)	11168	15 km (lower water column); 10 km (upper water column)	4.2	Barite: 93%
	Scenario 3 (Winter)	10136	35 km (lower water column); 21 km (upper water column)	12.2	Barite: 92%
	Scenario 4 (Spring)	12000	12 km west and 5.5 km south-east (lower water column); 11 km (upper water column)	4.7	Barite: 92%
	Scenario 5 (Summer, longer duration)	9504	35 km (lower water column); 12 km (upper water column)	19.2	Barite: 89%

HES, 2021c,d

For Discharge Point 2, significant risk in the water column as a result of riserless drilling (the initial stages of the drilling) occurs up to 35 km away and at depths of 600 to 700 m (in winter), following the deep-sea current to the west / south-west, while in the spring, this plume extends 12 km west and 5.5 km south-east (Figure 9-9). The risk is predominantly linked the quantity of Barite to be used in the mud of the riserless sections (HES, 2021d). The worst-case EIF occurred in spring (Figure 9-9, Table 9-6).

[43] The Estimated Area of Impact (km^2) could not be calculated, because no GIS data was provided.

A significant risk due to the discharge of the sections drilled with a riser (linked to the hydrochloric acid present in the Clayseal Plus to be used in these sections) has also been observed extending 10 to 24 km away from the discharge point (in winter and autumn, respectively) toward south-west (at 0 to 100 m depth below sea surface) (Figure 9-9) (HES, 2021d). This risk, while significant, is intermittent, and limited scale (restricted to small patches around the drill site) and duration, persisting (EIF>0) for 4.2 to 15.9 days and disappearing completely after operations end (after 43 days) (Table 9-6) (HES, 2021c).

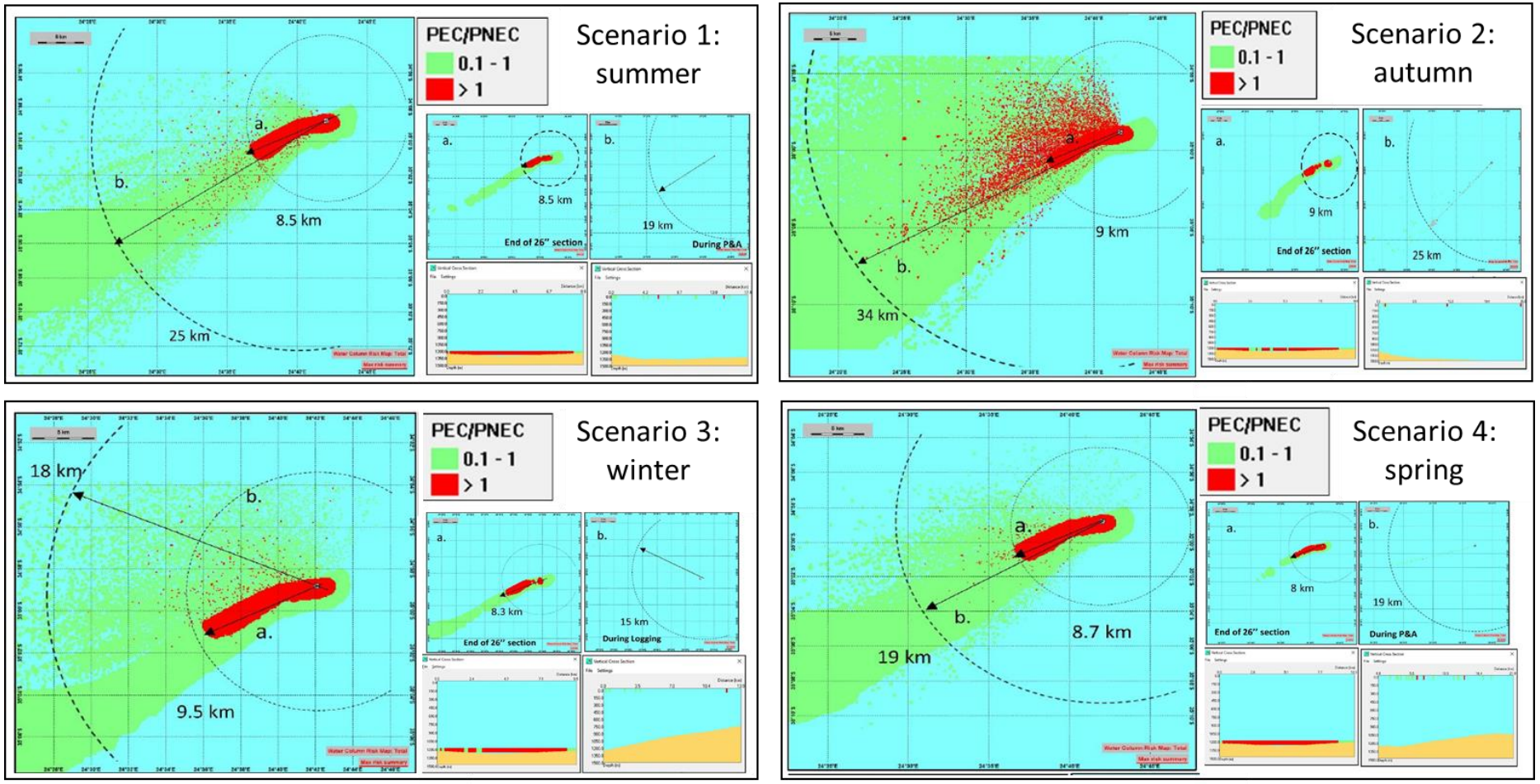

Figure 9-8–- Maximum cumulative risk of drilling operations throughout the water column at any time for Discharge Point 1 across all modelled scenarios/seasons (HES, 2021c)

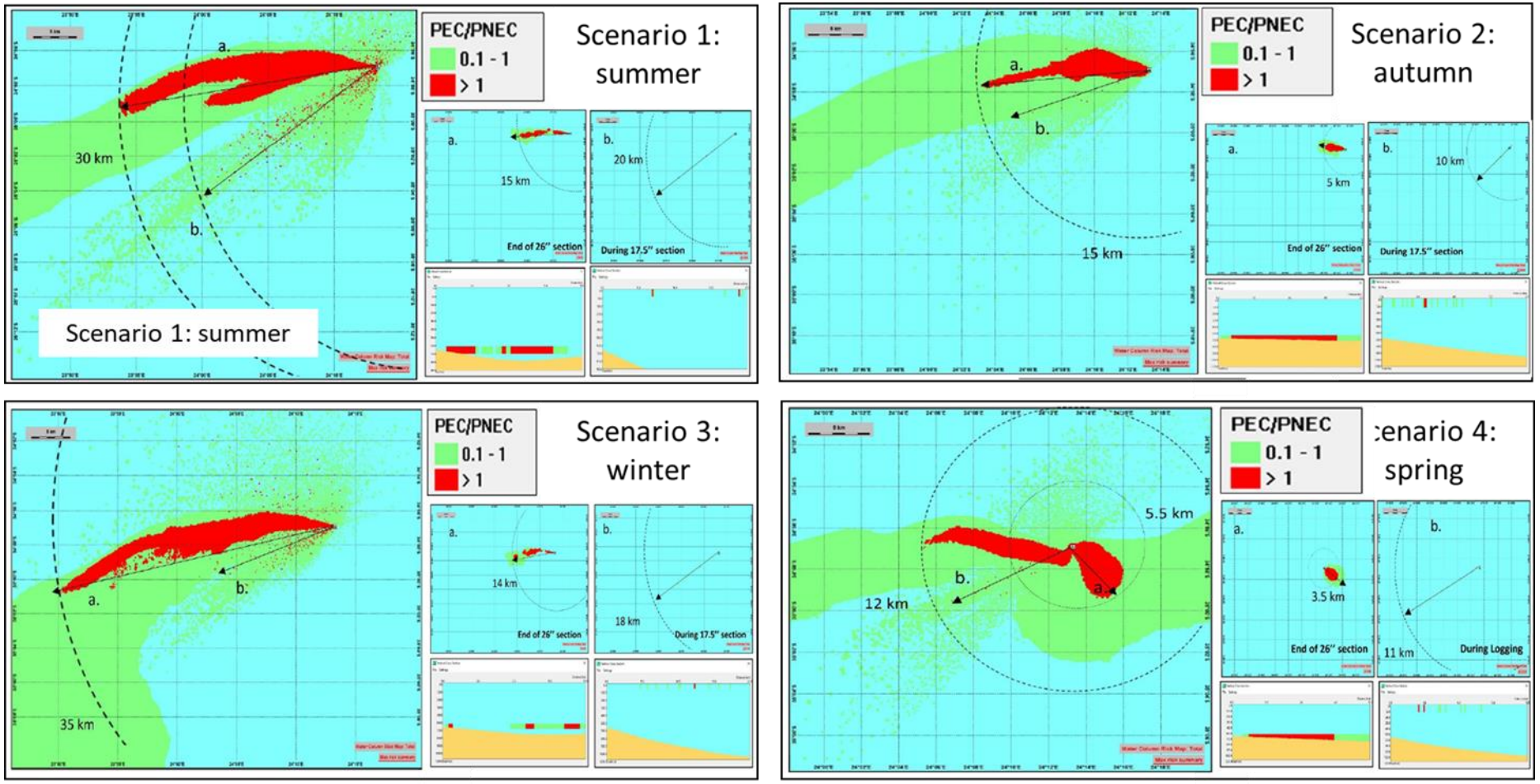

Figure 9-9–- Maximum cumulative risk of drilling operations throughout the water column at any time for Discharge Point 2 across all modelled scenarios/seasons (HES, 2021d)

Model results show that, under Scenario 5 (longer duration drilling), there are higher EIF values for Discharge Point 1 (i.e., a larger area of impact) than under the base cases Scenarios (Figure 9-10), and that the duration of the impact is longer (with EIF > 0 for 25.5 days) (Figure 9-10). Again, this risk is predominantly linked the quantity of Barite to be used in the mud of the riserless sections, and with hydrochloric acid present in the Clayseal Plus in the sections drilled with a riser (HES, 2021c, d). Model results show that this risk disappears completely after operations end (HES, 2021c, d).

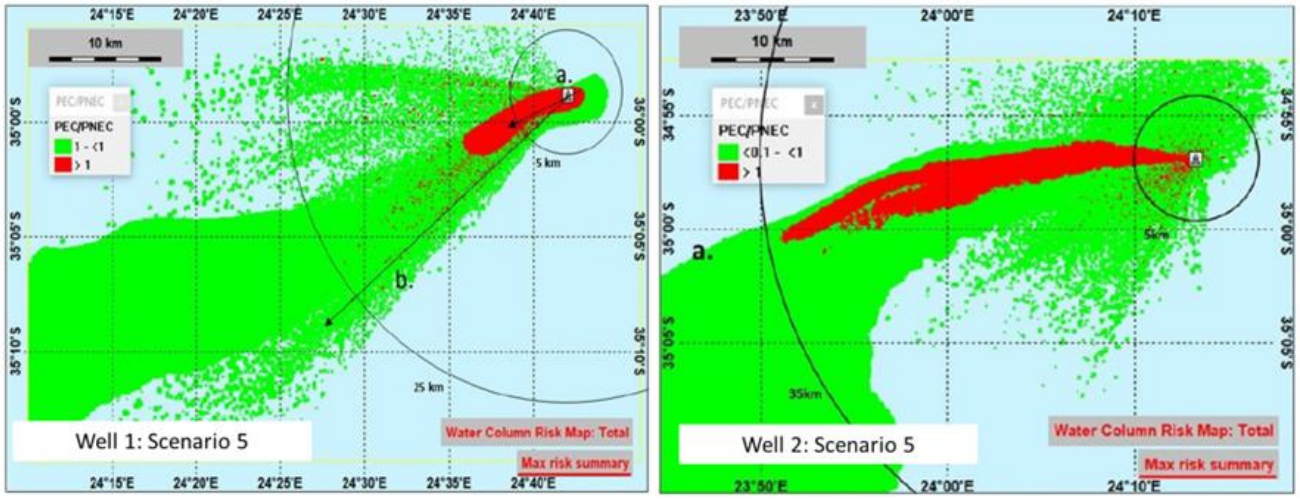

Figure 9-10–- Maximum cumulative risk of drilling operations throughout the water column at any time for (left) Discharge Point 1 and (right) Discharge Point 2 for Scenario 5 (HES, 2021c, d)

The extent of overlap of the drill discharge modelling results with surrounding areas of sensitivity and significance was estimated by georeferencing and overlaying onto a base map in GIS (refer to Figure 9-11). Based on this method, for drilling during summer, the maximum area of impact (i.e., PNEC > 5) for drilling at Discharge Point 1 was estimated as 19.75 km^2, and as 76.64 km^2 for Discharge Point 2 (Figure 9-11). There is no overlap of the area of modelled impact with the Kingklip Corals EBSA for drilling during summer at either Discharge Point 1 or 2 (Figure 9-11). However, as the final position of these wells have not been finalised, site specific drill discharge modelling studies must be conducted for individual well sites prior to the commencement drilling to demonstrate that the impact plume (PEC/PNEC > 1) in the bottom water column is not expected to intersect with any sensitive species (VME indicators), areas (such as MPAs or EBSAs), habitats or structures.

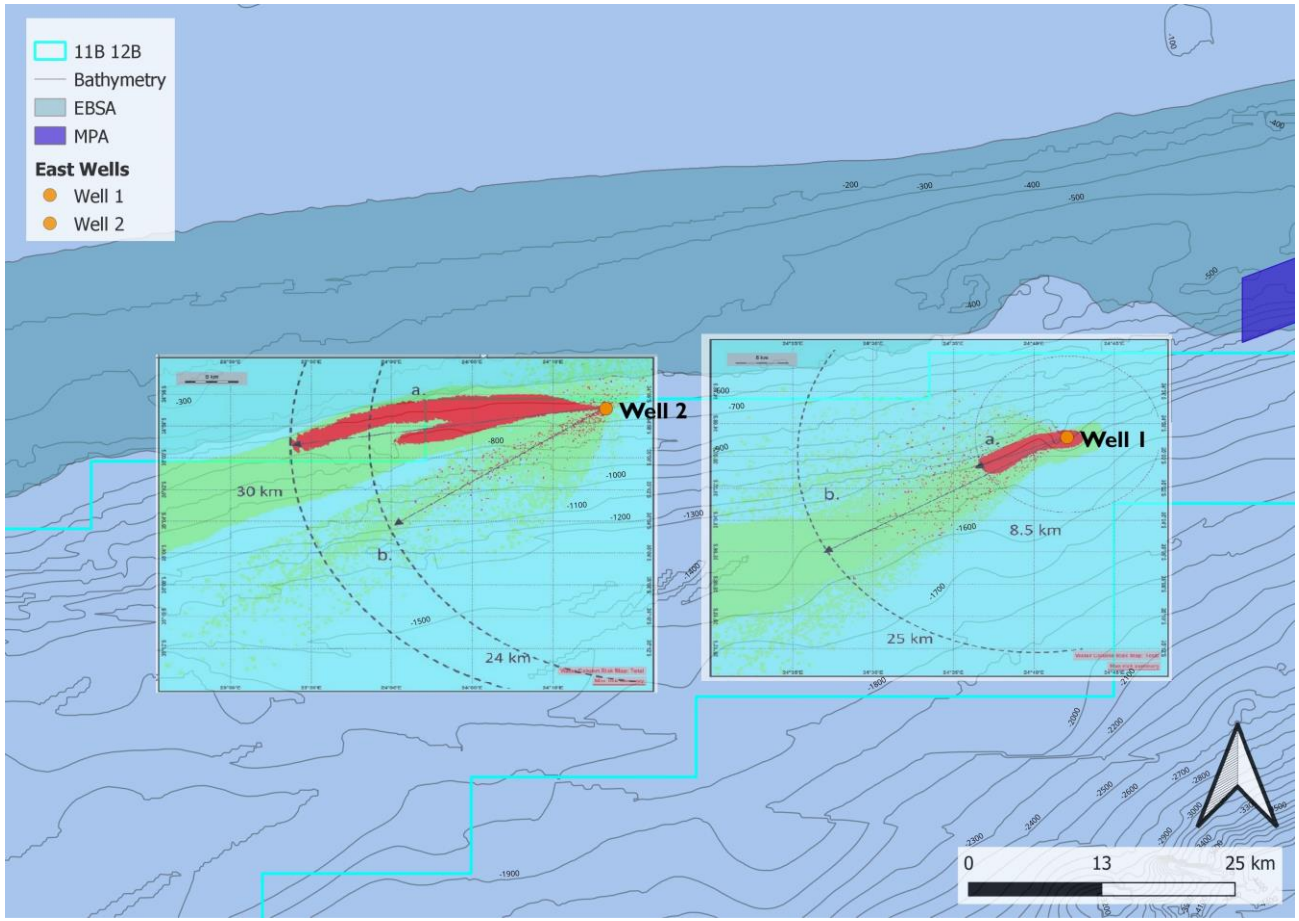

Figure 9-11–- Maximum cumulative risk of drilling operations throughout the water column for Discharge Points 1 and 2 in summer, indicating potential overlap with the Southwest Port Elizabeth Corals MPA (dark blue) and the Kingklip Corals EBSA (light blue) (HES, 2021c, d). Red = > 1 PNEC

9.1.6.1.4.2 Modelled effects on sediment

Modelled results show that, across all scenarios, oxygen depilation (i.e., anoxia risk) in the sediment is close to zero for both Discharge Points 1 and 2, because of limited biodegradation of the chemicals in the sediment resulting from the properties of the chemicals used (i.e., no chemicals with log327ispw >3 will be discharged) (HES, 2021c, d).

The model results again indicate that deposited material in the sediment will occur relatively close the discharge point for Discharge Point 1 (up to 225 m around the well in the spring) but extend further away for Discharge Point 2 (400 m to the west/south-west in autumn) (HES, 2021c, d). The model results indicate that the primary environmental impacts of drill discharge and cuttings release on sediments is grain size change (Table 9-7) (HES, 2021c, d).

Simulations shows that impact on the sediment caused by discharge from rig at the eastern wells are higher than that of the western wells (Discharge Points 4 and 5) across all seasons, with EIF > 1, and are higher for Discharge Point 2 (EIF = 2 to 6 for base case simulations, and 11 for extended drilling) than Discharge Point 1 (EIF = 1-2) (Table 9-7) (HES, 2021c, d). The area of risk (where PNEC >5) for sediments is lower for Discharge Point 1 than Discharge Point 2, with an area of impact of 2 500 to 5 000 m^2 for Discharge Point 1, and 5 000 to 10 000 m^2 for Discharge Point 2 (base case drilling) (Table 9-7). The extended drilling scenario (Scenario 5) results in a much larger area of impact of 27 500 m^2 for Discharge Point 2 (Table 9-7) (HES, 2021c, d).

Table 9-7–- Summary of sediment EIF results for Discharge Points 1 and 2 across the five modelled scenarios

Scenario/Season		Maximum EIF (sea floor area 50x50 m)	Calculated area of impact (m^2)	Distance of significance risk from discharge point (m)		Duration of max. EIF (for EIF>1)	Dominant risk contributor
				Without smoothing	With smoothing		
Discharge Point 1	Scenario 1 (Summer)	1	2 500	100, to the east	160	~4 years	Grain size change 81% Thickness deposit 19%
	Scenario 2 (Autumn)	1	2 500	125, to the southeast	180	~4 years	Grain size change 82% Thickness deposit 18%
	Scenario 3 (Winter)	2	5 000	200, to the west	165	~4 years	Grain size change 80% Thickness deposit 19%
	Scenario 4 (Spring)	2	5 000	225, around the well	165	~4 years	Grain size change 79% Thickness deposit 21%

Scenario/Season		Maximum EIF (sea floor area 50x50 m)	Calculated area of impact (m^2)	Distance of significance risk from discharge point (m)		Duration of max. EIF (for EIF>1)	Dominant risk contributor
				Without smoothing	With smoothing		
	Scenario 5 (Summer, longer duration)	1	2 500	140, around the well	180	~4 years	Grain size change 92% Thickness deposit 8%
Discharge Point 2	Scenario 1 (Summer)	2	5000	170 around the well	175	~4 years	Grain size change 76% Thickness deposit 24%
	Scenario 2 (Autumn)	6	15000	400 to the west/south-west	280	~4 years	Grain size change 77% Thickness deposit 23%
	Scenario 3 (Winter)	6	15000	200, around the well	165	~4 years	Grain size change 75% Thickness deposit 25%
	Scenario 4 (Spring)	4	10000	160, around the well	150	~4 years	Grain size change 80% Thickness deposit 20%
	Scenario 5 (Summer, longer duration)	11	27500	720 to the west/south-west	325	~4 years	Grain size change 86% Thickness deposit 14%

For Discharge Point 1, at the end of four years after the operations (after which there is no more environmental risk in the sediment), model results show that sediment deposition occurs predominately around the drill site, with a worst-case (autumn) deposition within a 150 m radius around the discharge point (without smoothing; 325 m with smoothing) for an area of impact of 0.07 km2 (unsmoothed) (HES, 2021c). The highest sediment deposit concentrations are localized very close to the discharge point, with most (28 mm) of the accumulation accumulating via the discharge of the top whole sections (42'' and 26'') drilling (HES, 2021c).

For Discharge Point 2, there are again no more environmental risks predicted in the sediment at the end of four years after the operations, with sediment deposition orientated south-west from discharge point. Modelled worst-case deposition also occurred in autumn, within a 105 m radius from the discharge point (without smoothing; 350 m with smoothing) for an area of impact of 0.03 km^2 (unsmoothed) (HES, 2021c). The highest sediment deposit concentrations again were predicted to fall very close to the discharge point and are again accumulated via the discharge of the top-hole sections drilling (HES, 2021c).

9.1.6.2 Impact Assessment

9.1.6.2.1 Biochemical and Toxicity Water Column and Benthic Impacts

9.1.6.2.1.1 Potential Impact Description

Since it is anticipated that only Water Based Muds (WBMs) will be used in the drilling process, the impacts associated with the discharge of WBMs have been assessed in this section. The primary impacts related to the discharge of WBMs include direct toxicity and bioaccumulation. The effects may be of significance in terms of:

- Chronic accumulation of persistent contaminants in the marine environment;
- Acute or chronic effects on biota and within the human food-chain (i.e. indirect effects on human health and commercial interests); and
- Acute or chronic effects on other biota (i.e. indirect effects on biodiversity).

Furthermore, cementing of the drill well will be undertaken to form a cement sheath that can provide structural support for the casings, to seal off different areas, and protect the casing from corrosive fluids. Typically, cement and cement additives are not discharged from drilling units. However, during the initial cementing operation, excess cement emerges out of the top of the well and onto the seafloor to ensure the conductor pipe is cemented all the way to the seafloor. Discharge of excess cement around the wellbore and leaching of cement additives into the surrounding water column could be toxic to marine life.

For the eastern exploration wells (assuming one well is drilled at a time), toxicity effects are of higher concern in the lower water column (and linked to the riserless drilled sections), extending up to 35 km from the drill site, and is modelled to last 15.9 days under base case drilling scenarios, while a longer drilling time frame will result in the duration of up to 25.5 days per well. Cumulatively, should all four exploration wells be drilled, the impact will last for a total of up to 63 days under base case drilling scenarios, and 102 days under the longer drilling time frame.

9.1.6.2.1.2 Project Controls

- Disposal of excess cement and additives at sea should strictly adhere to MARPOL73/78 (International Convention for the Prevention of Pollution from Ships, 1973).
- Ensure only low-toxicity, low bioaccumulation potential and partially biodegradable additives are used in drilling fluid and cement.
- Low-toxicity biodegradable detergents should be used in the cleaning of deck spillages.
- Development and implementation of Chemical Management Plan.
- Development and implementation of a Waste and Discharge Management Plan.

9.1.6.2.1.3 Sensitivity of Receptors

Given the importance of the area in general for VME indicator species (both within and outside of the MPAs and EBSAs), the benthic sensitivity of the proposed drilling areas in the Exploratory Priority Area is considered to be **high**. Model results however show that, under 2012 environmental conditions, impact from drill discharge plumes from the drilling of wells in the eastern Exploratory Priority Area are not expected to overlap with the Kingklip Corals EBSA to the north.

9.1.6.2.1.4 Impact Magnitude (or Consequence)

Assuming that the WBMs to be used in drilling of the well do not contain spotting fluids or lubricating hydrocarbons, the impact intensity of discharges of these drilling fluids to both the water column and the sediments is considered to be **medium**. The area affected by discharged drilling fluids/cuttings would be relatively **localised** with impacts that can extend up to 35 km in the lower water, depending on the site of the well. The duration of the impact is likely to occur over the **medium term**.

The impact related to the discharge of the excess cement around the wellbore and leaching of the additives into the surrounding water column is considered to be **extremely localised**, the duration **short term** and the intensity **very low**.

9.1.6.2.1.5 Impact Significance

Assuming that the WBMs to be used in drilling of the well do not contain spotting fluids or lubricating hydrocarbons, the impacts of discharges of these drilling fluids to both the water column and the sediments are considered of **low** significance. The impact related to the discharge of the excess cement around the wellbore and leaching of the additives into the surrounding water column is considered to be of **low** significance.

9.1.6.2.1.6 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

- Pre-drilling baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to inform placement of wells, with the aim of preventing disturbances to declared / proclaimed sensitive areas and habitats.
- If complete avoidance mitigation is not possible, an out-of-kind offset/compensatory mechanism needs to be developed as part of a Biodiversity Action Plan (BAP), if required (see Section 9.2.1 of the marine ecology and fisheries impact assessment report for details).
- Implement suitable measures to minimise cement spillages to the environment.

9.1.6.2.1.7 Residual Impact Assessment

With the implementation of the mitigation measures, the residual impacts are expected to be of **low** significance.

9.1.6.2.1.8 Additional Assessment Criteria

The impact is **definite** and is considered to be **partially reversible**. The mitigation potential is **low**. The loss of resource is **low**, and the cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.6.2.2 Turbidity and Smothering Impacts on Marine Environment

9.1.6.2.2.1 Potential Impact Description

Discharge of drilling muds, fluids and cuttings have a potentially adverse impact on the environment, in that their discharge directly onto the seafloor adjacent to the wellbore where they would primarily have a smothering impact on sedentary benthic species.

The cuttings of a single well drilled is estimated to produce a maximum total cuttings weight of 694 metric tonnes discharged at the surface, and 421 tonnes discharged directly to the seafloor (as modelled by Sintef, 2023). The hypothetical dispersion and fates of cuttings following discharge to the ocean are shown in Figure 9-12.

The impacts of smothering are both direct (mortality and clogging of feeding mechanisms) and indirect (loss of benthic prey to predators, possible disturbance to spawning and/or recruitment). The cuttings form a highly localised cone-shaped spoil mound around the wellbore, which gets thinner towards the periphery. The magnitude of the impact on benthic fauna is dictated by the amount of sediment (i.e., depth of burial), the life-history derived tolerances of species to smothering (i.e., filter feeders are more sensitive that deposit feeders), the duration of impact, and the nature of the depositing sediments.

In areas where natural sedimentation rates are high (e.g., in proximity to river mouths or wave-disturbed shallow waters), the ability of taxa to migrate through deposited sediments is likely to be high. On the other hand, relatively immobile species occurring in areas where sedimentation rates are naturally low would be more susceptible to smothering such as in the deeper waters of Block 11B/12B below the 200 m isobath (Blood, 2015, in Anchor Environmental, 2023).

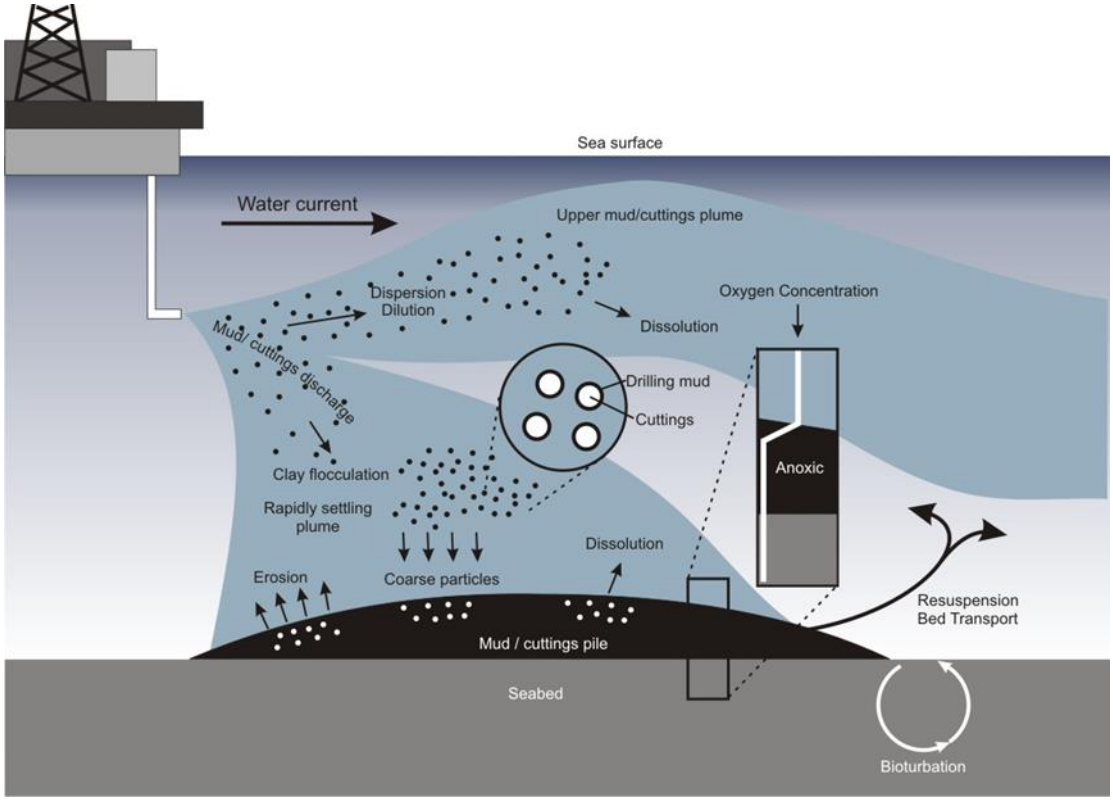

Figure 9-12–- The fate of drill cuttings (adapted from Neff, 2005, in Anchor Environmental, 2023)

It is noted that turbidity plumes arising from the drilling of wells and discharge of cuttings would cease to exist on completion of drilling activities. No further increased turbidity would be expected during extraction of the resource. Increased turbidity of near-bottom waters through disposal of cuttings at the wellbore and sea surface may place transient stress on sessile and mobile benthic

organisms, by negatively affecting filter-feeding efficiency of suspension feeders or through disorientation due to reduced visibility (Blood, 2015). However, in most cases, sub-lethal or lethal responses occur only at concentrations well in excess of those anticipated at the wellbore. Increased turbidity can impact light penetration, particularly in shallow marine waters.

The dispersion modelling results show the primary environmental impacts of drill discharge and cuttings release on sediments is linked to burial and grain size change. Modelled drilling impacts on sediment deposition thickness after 10 years (assuming no simulation of sediment redistribution) shows that sediment deposition will either occur predominately in a southwest pattern, or in a more uniform pattern closer to the drill site, depending on site selection.

For Discharge Points 1 and 2, the area of deposition (0.1->20 mm thick) occurs over an (unsmoothed) area of 0.07 km^2 and 0.03 km^2, respectively. For Discharge Points 1 and 2, there is no predicted environmental risk in the sediments four years after operations. Deposited material in the sediment is modelled to occur relatively close to the discharge point for Point 1 (up to 225 m around the well in the spring) but extends further away for Discharge Point 2 (400 m to the west/south-west in autumn), with grain size change assessed to be the primary environmental impact.

Simulations shows that impact on the sediment caused by discharge from discharge points in the eastern Exploratory Priority Area is higher than that for discharge points in the western Project Development Area across all seasons, with EIF > 1, and are higher for Discharge Point 2 (EIF = 2-6 for base case simulations, and 11 for extended drilling) than Discharge Point 1 (EIF = 1-2). The area of risk (where PNEC >5) for sediments is lower for Discharge Point 1 than Discharge Point 2, with an area of impact of 2 500 to 5 000 m^2 for Discharge Point 1, and 5 000 to 10 000m^2 for Discharge Point 2 (base case drilling). The extended drilling scenario (Scenario 5) results in a much larger area of impact of 27 500 m^2 for Discharge Point 2.

9.1.6.2.2.2 Project Controls

- Risered cuttings will be discharged via a caisson at greater than 5 m below surface.
- Monitoring and management measures must be implemented in accordance with standard well control practices to assist in detection and control of uncontrolled releases.

9.1.6.2.2.3 Sensitivity of Receptors

The sensitivity of receptors ranges from **medium** (infauna and pelagic marine biota) to **high** (epifauna).

9.1.6.2.2.4 Impact Magnitude (or Consequence)

The impact of smothering as a result of drilling discharges is highly dependent on the community composition of the site. Changes in abundance and diversity of infaunal, benthic communities in response to deposited cuttings are typically detected within a few hundred metres of the discharge, with recovery of the benthos observed to take from several months to several years after drilling operations had ceased (Thiel & Schriever 1990, Bluhm et al. 1995, Jennings & Kaiser 1998, Atkinson 2010, Biccard et al. 2018, in Anchor Environmental, 2023).

The impact is **localised**, and recovery is expected within a few years (within five years). Therefore, given the relatively small impact footprint, it is expected that the benthic macrofaunal community would recover to a point within the range of natural variability (i.e., where the effects of the impact(s)

are no longer discernible) relatively quickly after the cessation of drilling. The smothering effects resulting from the discharge of drilling solids at the wellbore is therefore assessed to have an impact of **medium** intensity on the infauna of unconsolidated sediments in the cuttings footprint, whereas discharges from the drill unit would have a **low** intensity impact.

The relatively short duration of the turbidity plumes and their small spatial extent is expected to have negligible potential negative impacts on the pelagic system communities (namely on phytoplankton and ichthyoplankton production, fish, cetacean and turtle migration routes and spawning areas). The impact of increased turbidity in the water column and elevated suspended sediment concentrations on pelagic communities are considered to be **localised**, **short term** (days) and of **very low** consequence.

Considering the depth of the proposed drilling activities (approximately 200 m) these is rarely any significant light penetration at these depths (NOAA, 2023, in Anchor Environmental) and therefore impacts of turbidity increases on light availability at this depth are considered **negligible**.

However, the impacts of the by-products of oil exploitation, including drill cuttings, drill mud, and wastewater discharge, can smother and ultimately negatively impact sensitive deep water epifaunal communities, including cold water coral (Roberts & Cairns 2014, in Anchor Environmental, 2023). Modelling results indicate that environmental effects in the lower water column are expected to ensure for a very short duration, up to 2.5 days maximum. However, benthic effects are modelled to endure for up to five years. Therefore, should the cuttings footprint overlap with vulnerable communities on hard ground, the smothering effects could potentially have an impact of substantial consequence, and recovery would only be expected over the medium to long-term (>10 years) due to their long generation times. This impact is considered to be of **high** magnitude.

9.1.6.2.2.5 Impact Significance

The impact significance, without mitigation, of increased turbidity in the water column and elevated suspended sediment concentrations on infaunal communities is assessed as **low**, on pelagic communities as **very low** and on epifaunal communities as **high**. Impacts of turbidity increases on light availability are considered **negligible**.

9.1.6.2.2.6 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

- Pre-drilling baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to inform placement of wells, with the aim of preventing disturbances to sensitive species and habitats.
- If complete avoidance mitigation is not possible, an out-of-kind offset/compensatory mechanism needs to be developed as part of a Biodiversity Action Plan (BAP), if required (see Section 9.2.1 of the marine ecology and fisheries impact assessment report for details).
- Consider implementing innovative technologies and operational procedures for drilling solids discharges to minimise turbidity and smothering impacts.

9.1.6.2.2.7 Residual Impact Assessment

With the implementation of the identified mitigation measures, residual impact significance will be **very low** for pelagic fauna, **low** for benthic infauna and **medium** for benthic epifauna.

9.1.6.2.2.8 Additional Assessment Criteria

Impact probability ranges from **highly likely** (pelagic fauna) to **definite** (infauna and epifauna communities). Reversibility ranges from **partially reversible** (infauna and epifauna communities) to **fully reversible** (pelagic fauna). The mitigation potential is **low**. The loss of resource is **low** for infauna and pelagic fauna, but **high** for epifauna. Cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.7 PHYSICAL DISTURBANCE OF SEAFLOOR SEDIMENTS

9.1.7.1 Impact on Maritime Heritage and Palaeontological Impacts

9.1.7.1.1 Source of Impact

Up to four exploration and appraisal wells will be drilled in the eastern Exploratory Priority Area of the Block. During drilling activities, 36- or 42-inch holes will be drilled to depths of 70 m, thereafter further sections will then be drilled at a 26-inch diameter to a depth of approximately 1 070 m.

In respect of maritime heritage and palaeontological resources, direct impacts can arise where development on and in the seabed intersect with fossil material, where they are disturbed and/or damaged by activities such as installation of the exploration and appraisal wells. Indirect or downstream effects of the deposition of drill cuttings on fossil material, should it occur, is unlikely to have a negative impact.

9.1.7.1.2 Project Controls

- TEEPSA will ensure that the contractors undertake the drilling operation in a manner consistent with good international industry practice and BAT.
- TEEPSA will ensure that contractors undertake the proposed exploration drilling is undertaken in compliance with the applicable requirements in MARPOL 73/78.

9.1.7.1.3 Potential Impact Description

The drilling activities will result in disturbance to seafloor sediments and may result in direct impacts on fossilised materials, where fossiliferous bedrock underlies the seabed and intersect with the drilling activities. The recording and reporting of any fossil material would offset the potential impacts and would change the impact status from negative to positive because of a potential benefit to palaeontological research and knowledge that could accrue from such information.

9.1.7.1.4 Sensitivity of Receptors

Research has shown that terrestrial geological strata extend out onto the continental shelf and although there is no palaeosensitivity map for this offshore area, there is high probability that important fossils occur on the continental shelf. The geology of the submerged landscape has been correlated with the exposed onshore geology and the northern extremities of Block 11B/12B lie, in places, on the Cenozoic Bredasdorp Group, calcareous sands and aeolianites, on terrestrial exposures, which have marine, estuarine and terrestrial fossils of Quaternary age and are potentially very highly fossiliferous.

This has been demonstrated by the recovery of fossilised whalebone during a scientific demersal trawl in Block 11B/12B in 1993, and by the recent finds of apparently fossilised whale bone and possible fossilised wood made during the TEEPSA environmental baseline surveys in late 2022.

Furthermore, although unlikely, the possibility does exist for the remains of currently unknown and unrecorded wrecks to be present in Block 11B/12B.

Based on the above, the palaeo sensitivity of the site is considered to be **high.**

9.1.7.1.5 Impact Magnitude (or Consequence)

Given the very limited intrusion into or disturbance of the seabed anticipated from the exploration and appraisal well drilling activities, the likelihood of encountering fossilised materials is reduced, thus the impact intensity on palaeontological resources is considered to be **low.** Impacts would be limited to the footprint of the well drilling activities and are thus considered to be **localised**. Should fossilised materials be impacted, the duration of the impact is considered to be **permanent**, due to the finite and non-renewable nature of palaeontological material and the association that it cannot be recovered if disturbed, damaged or destroyed. The magnitude of the impact is therefore considered to be **low.**

9.1.7.1.6 Impact Significance

The impact on palaeontological resources resulting from well drilling activities is considered to be of **low** significance.

9.1.7.1.7 Identified Mitigation Measures

The following mitigation measures are proposed:

- Check for the potential for fossil and/or shipwreck-related material in or on the seabed, as part of the pre-drilling clearance surveys.
- Should fossils / shipwreck-related material be identified through the pre-drilling survey or during drilling, this information must be recorded and passed on to an appropriate specialist and SAHRA must be notified through the implementation of the Chance Finds Procedure.
- Implement a buffer of at least 50 m around such a site or material to ensure that it is further not impacted by the activities in Block 11B/12B.
- Include training on fossil and/or shipwreck-related material as part of the induction and awareness training programme for the Project.

9.1.7.1.8 Residual Impact Assessment

The residual impact is assessed to be of **low** significance.

9.1.7.1.9 Additional Assessment Criteria

The impact is **possible** and is considered to be **irreversible**. The mitigation potential is **low**. The loss of resource is **high** where resources are lost but has the potential to result in positive impacts due to the potential benefits to palaeontological research and knowledge that could accrue from such information. Th cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.8 MARITIME SAFETY ZONES

9.1.8.1 Impact on Fisheries

9.1.8.1.1 Source of Impact

A temporary statutory safety zone of 500 m would be required from the drilling unit during drilling operations. Following installation, a safety zone of 500 m from each well would be requested.

9.1.8.1.2 Potential Impact Description

Exploration activities in the marine environment can potentially negatively impact fisheries and mariculture by reducing catch and/or catch-per-unit-effort (CPUE) thereby increasing costs and decreasing profit with knock-on socio-economic impacts for communities and business involved in fishing (throughout the supply and marketing chain) (CapMarine 2010, 2018).

The exploration well drilling activities could impact on the fishing sector as a result:

- The temporary exclusion of fishing activities during exploration (drilling, flaring, etc.); and
- The potential exclusion of demersal fisheries from operating in the areas around an abandoned well head due to the risk of obstruction or snagging of fishing gear.

9.1.8.1.2.1 Project Controls

- Prior to commencement of drilling, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office.
- These stakeholders should again be notified at the completion of exploratory activities and when the support vessels are off-location. The Notice to Mariners should give notice of (1) the co-ordinates of the exploration area, (2) an indication of the proposed timeframes of the drilling activities, and (3) an indication of the 500 m safety zones and the proposed safe operational limits of the exploratory activities.
- These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.

9.1.8.1.2.2 Sensitivity of Receptors

Exploration activities in the eastern Exploratory Priority Area would directly overlap three fisheries. The squid fishery and offshore demersal trawl fishery overlap with the northern portion of the eastern Exploratory Priority Area, while the large pelagic fishery overlaps roughly 90% of the eastern Exploratory Priority Area.

Commercial squid jigging activity in the area of overlap is high (area fished 90% of the time) which suggest this area is important for fishing value and catch. As the squid fishery is centred around this area of the South Africa's territorial waters, the potential impact of exploration on the wider fishery is significant and catch rates could drop significantly areas affected by exploration activities (CapMarine, 2017). This is either through direct overlap with fishing activities or underwater noise impacts that would be associated with exploration.

The overlap with the offshore demersal trawl fishery is not as severe. A small amount of fishing activity is undertaken in the northern area of the eastern Exploratory Priority Area, but this area is <1% of total offshore trawling grounds and the area is only fished 40% of the time.

Approximately 90% of the eastern Exploratory Priority Area overlaps with the large pelagic fishery, with some of the most fished areas in this area. This area totals 38.6% of the total large pelagic fishing grounds. Of this area, almost 50% is fished > 70% of the time so this area is regularly fished. As evidence suggests, pelagic species have more sensitive hearing (thresholds at lower frequencies) than demersal species, and that catch rates could drop significantly areas affected by exploration activities (CapMarine, 2017).

There will also be an overlap with the small-scale fishers, particularly around the squid catch opportunities (TAC of the squid catch is to be reapportioned to the small-scale sector), which could translate into 0.44% of the overall squid catch (Anchor Environmental, 2023).

Based on the above, the sensitivity of the demersal trawl fishery, squid fishery and large pelagic fishery is rated as **medium**.

9.1.8.1.2.3 Impact Magnitude (or Consequence)

The negative impact on the fishing industry is anticipated to have mainly a **local** impact. However, this impact is considered to be a **long-term** impact, should the well/s be temporarily abandoned. The impact intensity on squid and large pelagic fisheries is rated as **medium** and on demersal trawl as **low**. Taking the above into consideration, the resulting impact magnitude for squid, SSF's and large pelagic fisheries, will be **medium** and **low** for demersal trawl fisheries .

9.1.8.1.2.4 Impact Significance

Taking into account the magnitude of the negative impacts on the activities of the squid and large pelagic fisheries (medium) and the demersal trawl fishery (low) to **medium** (squid fishery, SSF's, demersal trawl fishery and large pelagic fishery) sensitivity of receptors, the impact significance is considered to be **low** (demersal trawl fishery) and **medium** (squid fishery, SSF's and large pelagic fishery).

9.1.8.1.2.5 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

- Maintain adequate safety clearance between fishing vessels and exploratory vessels and equipment through at-sea communications with vessels in the vicinity of the drill area.

9.1.8.1.2.6 Residual Impact Assessment

Through the implementation of the Project controls and proposed mitigation measures, the residual impact significance is considered to be **very low** (demersal trawl fishery) and **medium** (squid fishery, SSF's and large pelagic fishery).

9.1.8.1.2.7 Additional Assessment Criteria

The negative impact on the fishing sector due to safety zones during the exploration phase is considered **fully reversible**, with **low mitigation potential**. Loss of resources is low and the cumulative potential unlikely. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.9 SPENDING ON LOCAL GOODS, SERVICES AND LABOUR

9.1.9.1 Impact on Economic Output and GDP

9.1.9.1.1 Source of Impact

Procuring goods and services in South Africa for the exploration phase will result in an increase in local economic activities, resulting in GDP growth. This impact will result from the drilling of up to four (4) exploration wells over a period of four to six months per well.

9.1.9.1.2 Project controls

In accordance with Section 41 of the Mineral Petroleum Resources Development Plan Regulations (MPRD regulations), a SLP is required for the Project as well as the development of a Procurement Progression Plan. Based on the draft SLP (2025 – 2029) that has been drafted for the Project, the following will be considered when procurement occurs:

- "During the life of the production operation, HDP companies will be given preferential status for the supply of goods and services to the operation, provided that they comply with HSE, security & safety quality, price, schedule, quantity, suitability and delivery requirements.
- All local suppliers will be selected on a tendering procedure basis in compliance with the company local content policy.
- TEEPSA will develop a database to define the HDP and status of its potential suppliers, which will include elements of ownership as well as management.
- The production operation will, from inception, set up its procurement systems to track the ownership status of its suppliers in line with required B-BBEE classifications.
- Current and all future non-HDP suppliers will be either part of "strengthening, development" or Joint Venture programs, depending on their level of competitiveness and importance to the Project.
- Suppliers will be encouraged to subcontract portions of their work to HDPs, or procure goods and services from HDPs, or otherwise assist in promoting the progression of HDPs in the industry.
- The production operation will consider implementing specific measures to promote HDP success, which may include breaking procurement contracts up into smaller packages, waiver or relaxation of deposits and guarantees, early payment cycles, and simplification of tender procedures, with simplified standard contracts. This will of course depend on the scope of work involved and the risk potential.
- Contractors will be required to maximise local content through the employment and training of HDPs:
  - HDPs should be provided opportunities to be recruited and to improve their skill sets in order to build their capabilities.
  - For all training and employment, first priority is given to HDPs.
- Through the provision of goods and services by local companies and HDPs.
- Through technology transfer & capacity building programs, aiming at enhancing the performance/capacity of local companies in petroleum activities to encourage local investment and participation."

9.1.9.1.3 Potential Impact Description

Procuring goods and services will benefit suppliers directly involved in the exploration activities, resulting in indirect benefits through backward linkages in the value chain. Those employed in direct and indirect activities will earn an income, resulting in induced spending in the economy. The increased production activities because of the procurement processes outlined in Section 9.1.9.1.2 will positively impact the GDP. The combined impact for the exploration phase (in 2022 prices) is indicated in Table 9-8.

Table 9-8 – Exploration period impact on production and GDP

Impact	Direct	Indirect	Induced	Total
Economic output	R425.3 million	R248.9 million	R258.4 million	R932.5 million
GDP	R219.7 million	R113.5 million	R104.1 million	R437.3 million

Source: Urban-Econ SAM modelling, 2023

9.1.9.1.4 Sensitivity of Receptors

It is anticipated that the majority of the positive impact during the exploration phase on economic output and GDP will be in the primary study area[44]. Considering the GDP impact relative to the size of the primary study area economy, the receptors are considered to be of **low sensitivity**.

9.1.9.1.5 Impact Magnitude (or Consequence)

The positive impact on economic output and GDP is anticipated to be mainly **regional**. However, this impact is considered to be a **short-term** impact, as it will only occur for the duration of exploration activities. Considering the total impact of local expenditure during the exploration phase, and the duration of the project, the intensity of the positive impact on economic output and GDP is considered to be **medium**. The magnitude of the positive impact on economic output is therefore considered to be **low**.

9.1.9.1.6 Impact Significance

Given the low sensitivity of receptors and the low magnitude of the potential positive impact on economic output and GDP during the exploration phase, the impact is considered to be of **very low significance**.

[44] The primary study area encompasses towns close to the shore that can accommodate marine servicing and manufacturing industries to supply goods and services required during the development and operations phases of the project. Such towns include Cape Town, Gqeberha, Saldanha Bay, and East London. Thus, the primary study area for the economic impact assessment was delineated as the stretch of land along the Indian and Atlantic Oceans between Saldanha Bay and East London.

9.1.9.1.7 Identified Enhancement Measures

In order to enhance the positive impact on economic output and GDP during the exploration phase, the following enhancement measure is proposed:

- Increase procurement of goods and services from South African businesses, as appropriate.

9.1.9.1.8 Residual Impact Assessment

The proposed enhancement measure will increase the positive impact on economic output and GDP during the exploration phase. However, since the degree to which local spending can be increased for the exploration well drilling phase cannot be determined with the information available at the time of report writing, the magnitude of the impacts cannot be assessed and hence the residual impact has been kept as **very low significance**.

9.1.9.1.9 Additional Assessment Criteria

The positive impact on economic output and GDP due to spending during the exploration phase is considered **irreversible.** There could be potential during the exploration phase to increase local spending. However, it is unlikely (due to the lack of local capabilities and skill levels) that all spending during this phase can be local. The mitigation impact is, therefore, considered to be **very low**. There will be no loss of resources. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.9.2 Impact on Jobs

9.1.9.2.1 Source of Impact

The increased levels of economic output due to local spending in the exploration phase will positively impact jobs. This impact will result from the drilling of up to four (4) exploration wells over a period of four to six months per well.

9.1.9.2.2 Project Controls

Per Section 41 of the MPRD regulations, an SLP is required for the Project and the development of a Procurement Progression Plan. Based on the draft SLP (2025 – 2029), the following points that directly link to employment will be considered when procurement occurs:

- “Contractors will be required to maximise local content through the employment and training of HDPs:
- HDPs should be provided opportunities to be recruited and to improve their skill sets and advance their capabilities.
- For all training and employment, first priority is given to HDPs.”

9.1.9.2.3 Potential Impact Description

The procurement of goods and services will have a positive impact on jobs either by sustaining existing jobs or creating new jobs (on-shore and off-shore). Those employed in direct and indirect activities will earn an income, resulting in induced spending in the economy. The combined impact for the exploration phase (in 2022 prices) are indicated in Table 9-9.

Table 9-9 – Exploration period impact on employment

Impact	Direct	Indirect	Induced	Total
Employment	205 jobs	331 jobs	342 jobs	878 jobs

Source: Urban-Econ SAM modelling, 2023

Local spending during the exploration phase of the project will support 878 jobs, of which 205 will be directly related to the Project. The direct jobs can mainly be attributed to the contractors and suppliers involved in the Project, and not direct jobs created by TEEPSA during the exploration phase, as these are anticipated to be minimum. The main sectors estimated to benefit from employment during the exploration phase include mining, trade and accommodation, real estate and business services, and transport and storage.

9.1.9.2.4 Sensitivity of Receptors

It is anticipated that the majority of the positive impact during the exploration phase on employment will be in the primary study area. Taking into consideration the employment impact relative to employment in the primary study area, the positive impact is considered to be of **low** sensitivity.

9.1.9.2.5 Impact Magnitude (or Consequence)

The positive impact on employment is anticipated to have mainly a **regional impact**. However, this impact is considered to be a **short-term** impact, as it will only occur for the duration of exploration activities. Considering the total impact of local expenditure during the exploration well drilling phase and the duration of the project, the intensity of the positive impact on employment is considered to be **medium**. Therefore, the magnitude of the proposed positive impact on employment is considered **low**.

9.1.9.2.6 Impact Significance

Given the low sensitivity of receptors and the high magnitude of the potential **positive impact** on employment during the exploration well drilling phase of the proposed project, it is considered to be of **very low significance**.

9.1.9.2.7 Identified Enhancement Measures

In order to enhance the positive impact on employment, the following enhancement measures are proposed:

- Employ local labour (iZoI) to increase benefits to the local community where feasible.
- Community/ stakeholder engagement on procurement/ employment/ skills development opportunities.
- Engage with local forums, business chambers, tourism offices, and collective organisations in order to disclose information and ascertain any issues and/ or concerns.

9.1.9.2.8 Residual Impact Assessment

The mitigation measures are anticipated to enhance the positive impact on employment during the exploration phase. However, since the degree to which local spending can be increased for the exploration well drilling phase cannot be determined with the information available at the time of

report writing, the magnitude of the impacts cannot be assessed and hence the residual impact has been kept as **very low significance**.

9.1.9.2.9 Additional Assessment Criteria

The positive impact on employment due to spending during the exploration well drilling phase is considered **irreversible.** There could be potential during the exploration well drilling phase to increase local spending, enhancing the positive impact on employment. However, it is unlikely (due to the lack of local capabilities and skill levels) that all spending during this phase can be local. The mitigation impact is therefore considered to be **medium**. There will be no loss of resources. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.1.9.3 Impact on Household Income

9.1.9.3.1 Source of Impact

The positive impact on employment during the exploration phase will positively impact household income. This impact will result from the drilling of up to four (4) exploration wells over a period of four to six months per well.

9.1.9.3.2 Project Controls

Per Section 41 of the Mineral Petroleum Resources Development Plan Regulations (MPRD regulations), a SLP is required for the project and the development of a Procurement Progression Plan. Based on the draft SLP (2025 – 2029), the following points that directly link to employment will be considered when procurement occurs:

- Contractors will be required to maximise local content through the employment and training of HDPs.
- HDPs should be provided opportunities to be recruited and to improve their skill sets and advance their capabilities.
- For all training and employment, first priority is given to HDPs.

9.1.9.3.3 Potential Impact Description

New and sustained employment opportunities will have a positive impact on household income. Household spending will also result in induced positive economic effects. The combined impact for the exploration phase (in 2022 prices) is indicated in Table 9-10.

Table 9-10 – Exploration period impact on household income

Impact	Direct	Indirect	Induced	Total
Income	R79.5 million	R43.8 million	R41.9 million	R165.2 million

Source: Urban-Econ SAM modelling, 2023

The jobs that will be supported through the exploration well drilling phase of the project will benefit household income to the value of R165.2 million, of which R79.5 million will be directly related to the proposed project. The main sectors estimated to benefit from household income during the exploration well drilling phase include mining, trade and accommodation, real estate and business services, and transport and storage.

9.1.9.3.4 Sensitivity of Receptors

It is anticipated that the majority of the positive impact during the exploration phase on employment will be in the primary study area. Taking into consideration the employment impact relative to employment in the primary study area, the positive impact is considered to be of **low sensitivity**.

9.1.9.3.5 Impact Magnitude (or Consequence)

The positive impact on household income is anticipated to be mainly regional. However, this impact is considered to be a **short-term** impact, as it will only occur for the duration of exploration activities. Considering the total impact of local expenditure during the exploration well drilling phase and the duration of the project, the intensity of the positive impact on household income is considered to be **medium**. The magnitude of the proposed positive impact on household income is therefore considered to be **low**.

9.1.9.3.6 Impact Significance

Given the low sensitivity of receptors and the high magnitude of the potential positive impact on employment during the exploration well drilling phase of the proposed project, it is considered to be of **very low significance**.

9.1.9.3.7 Identified Enhancement Measures

In order to enhance the positive impact on household income during the exploration phase, the following enhancement measure is proposed:

- Investigate opportunities to increase local procurement and localise expenditure.
- Explore opportunities to employ as many people from the local communities as possible.
- Community/ stakeholder engagement on procurement/ employment/ skills development opportunities.

9.1.9.3.8 Residual Impact Assessment

The mitigation measures are anticipated to enhance the positive impact on employment during the exploration phase. However, since the degree to which local spending can be increased for the exploration phase cannot be determined with the information available at the time of report writing, the magnitude of the impact cannot be assessed and hence the residual impact has been kept as **very low** significance.

9.1.9.3.9 Additional Assessment Criteria

The positive impact on employment due to spending during the exploration phase is considered **irreversible**. There could be potential during the exploration phase to increase local spending, which will enhance the positive impact on employment. However, it is unlikely (due to the lack of local capabilities and skill levels) that all spending during this phase can be local. The enhancement impact is therefore considered to be **medium**. There will be **no loss of resources**.

Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.2 OFFSHORE SURVEYS

9.2.1 PHYSICAL DISTURBANCE OF SEAFLOOR SEDIMENT

9.2.1.1 Source of Impact

Seafloor sampling will possibly be undertaken to collect sea floor sediment samples for environmental baseline data collection and studies as well as for monitoring of the environment during / post operations. It can also be used to supplement geotechnical and geophysical studies. TEEPSA is also proposing to deploy metocean buoys within the Block in order to measure oceanographical, meteorological and possibly acoustic data, i.e., currents, waves, water temperature, ambient water noise levels, wind and air parameters.

9.2.1.2 Potential Impact Description

The deployment of metocean buoys, seafloor sampling and ROV surveys will cause disturbance to the benthic substrate.

9.2.1.3 Sensitivity of Receptors

Block 11B/12B falls within an area of **medium** sensitivity, but a **very high** receptor sensitivity is anticipated should the survey area fall within the Kingklip Corals EBSA and the Port Elizabeth Corals Marine Protected Area completely.

9.2.1.4 Impact Magnitude (or Consequence)

The area of impact is considered to be highly site specific, limited to, for example, the turbidity plume generated by the ROV thrusters (a few metres around the ROV and/or ROV flight track), or in the immediate vicinity of any metocean mooring system. The crushing of biota related to receivers and surveys mooring would also highly be localised.

The impact is considered to be of low intensity, and of temporary duration, with transient turbidity effects as sediments would redeposit after the ROV has departed the area or after initial mooring deployment. Impact magnitude will therefore be **very low**.

9.2.1.5 Impact Significance

Considering the medium receptor sensitivity and very low impact magnitude, impact significance is expected to be **low**.

9.2.1.6 Identified Mitigation Measures

The following mitigation measures are proposed:

- Prohibit the placement of receivers or metocean buoys in any area that is designated as a marine sensitive area.

9.2.1.7 Residual Impact Assessment

With mitigation, residual impact significance is expected to reduce to **very low**.

9.2.1.8 Additional Assessment Criteria

The mitigation potential is considered to be **medium**, and cumulative potential **unlikely**. Loss of resources will be **low**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.2.2 UNDERWATER NOISE

9.2.2.1 Noise from Sonar Profiling

9.2.2.1.1 Source of Impact

Sonar surveys will be carried out using a Kongsberg EM 712 MBES system (or equivalent) within the Project Development Area and along the pipeline corridor with a worst-case sonar operating frequency of 40 kHz.

9.2.2.1.2 Potential Impact Description

The underwater noise modelling study undertaken by WSP (2023b) (Appendix 8) indicated that the peak pressure levels generated with each sonar profiling activities are sufficient to cause permanent (permanent threshold shifts) and temporary direct physical injury (temporary threshold shifts) to hearing in marine mammals, as well as death or injury to fish.

Worst-case cumulative impacts (over a 24-hour period) are expected to result in Permanent Threshold Shift (PTS) for high frequency cetaceans at 275-300 m from the source, and at less than 10 m for low frequency cetaceans, and at around 10 m for true seals and other marine carnivores. Maximum single impacts are even smaller, causing PTS at 60-70 m from the source for very high frequency cetaceans, and at <10 m for other marine species.

Worst-case (cumulative) temporary effects occurred at 20 m for low frequency cetaceans was predicted, 70-80 m for high frequency cetaceans, and 640-860 m for very high frequency cetaceans. Physical impacts on fish mortality and potential mortal injury or recoverable injury to fish are estimated at 20 and 40 m, respectively, while the predicted cumulative thresholds distances (over 24-hours exposure) were less than 10 m for all fish, fish eggs and fish larvae.

The maximum predicted behavioural threshold distances for sonar survey activities were 1.8 km for marine mammals, and 2.45 km for penguin/diving birds. Given that sea turtles have a frequency hearing range of below approximately 2 kHz, there are no expected behavioural impacts of high frequency sonar sources on these species (Finneran et al. 2017, in Anchor Environmental, 2023).

9.2.2.1.3 Sensitivity of Receptors

Receptor sensitivity is assessed as high.

9.2.2.1.4 Impact Magnitude (or Consequence)

The intensity of the impact is assessed as high, occurring locally over the short term. Impact magnitude is therefore assessed as **low**.

9.2.2.1.5 Impact Significance

Considering the high receptor sensitivity and very low impact magnitude, impact significance is expected to be **low**.

9.2.2.1.6 Identified Mitigation Measures

The following mitigation measures are recommended:

- Prohibit undertaking of sonar surveys in any area that is designated as a marine sensitive area.
- Implement relevant mitigation measures for VSP – see Section 9.1.2.2.6.

9.2.2.1.7 Residual Impact Assessment

With the implementation of the recommended mitigation measure, impact significance will remain **low**.

9.2.2.1.8 Additional Assessment Criteria

The mitigation potential is considered to be **low**, and cumulative potential **unlikely**. Loss of resources will be **low**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.2.3 MARITIME SAFETY ZONES

9.2.3.1 Impacts on Fisheries

9.2.3.1.1 Source of Impact

TEEPSA is also proposing to mobilise metocean buoys within the Block in order to measure oceanographical, meteorological and possibly acoustic data, i.e., currents, waves, water temperature, ambient water noise levels, wind and air parameters. Metocean survey scope will be defined depending on the need for complementary parameters for this harsh weather conditions area. The wave buoy would require a temporary safety zone of between 500 m and 2 km radius on the sea surface (depending on the water depth). All vessels would be excluded from entering this safety zone.

9.2.3.1.1.1 Project Controls

- Prior to commencement of the surveys, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office.
- These stakeholders should again be notified at the completion of survey activities and when the survey vessels are off-location. The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed timeframes of the survey activities, and (3) an indication of the safety zones and the proposed safe operational limits of the survey activities.
- These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.

9.2.3.1.2 Potential Impact Description

The temporary exclusion of fishing activities in portions of the Block could lead to reduced catch and/or CPUE, thereby increasing costs and decreasing profit with knock-on socio-economic impacts for communities and business involved in fishing (throughout the supply and marketing chain) (CapMarine 2010, 2018).

9.2.3.1.3 Sensitivity of Receptors

See Section 9.1.8.1.2.2.

9.2.3.1.4 Impact Magnitude (or Consequence)

Same as for Section 9.1.8.1.2.3.

9.2.3.1.5 Impact Significance

Same as for Section 9.1.8.1.2.4.

9.2.3.1.6 Identified Mitigation Measures

The following mitigation measures are proposed, over and above the Project controls listed above:

- Maintain adequate safety clearance between fishing vessels and survey vessels and equipment through at-sea communications with vessels in the vicinity of the survey area.
- Appoint an on-board fisheries liaison officer (FLO) to facilitate communication with fishing vessels whilst on location. The FLO should report daily on vessel activity and respond and advise on action to be taken in the event of encountering fishing gear in the survey area.

9.2.3.1.7 Residual Impact Assessment

Refer to Section 9.1.8.1.2.6.

9.2.3.1.8 Additional Assessment Criteria

Same as for Section 9.1.8.1.2.7. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3 CONSTRUCTION

9.3.1 AIR EMISSIONS

9.3.1.1 Impacts on Air Quality

9.3.1.1.1 Source of Impact

The emissions inventory for the various phases of the Project is provided in Section 6.11. For the construction phase, the following emission sources have been identified:

- Combustion of marine fuel in main and auxiliary engines, on the drill unit, supply vessels, and tugboat;
- Combustion of kerosene fuel in helicopter engines;
- Gas flaring during well testing; and
- Combustion of diesel in generators on vessels.

9.3.1.1.2 Project Controls

See Section 9.1.1.1.2.

9.3.1.1.3 Potential Impact Description

See Section 9.1.1.1.3.

9.3.1.1.4 Sensitivity of Receptors

The production area is located more than 160 km offshore and is far removed from any sensitive receptors (e.g. residential areas). The offshore operation emissions are unlikely to have a notable **indirect negative** effect on any sensitive receptor or other offshore activities, other than the Project itself. This said, the sensitivity of receptors in the offshore area to increases in pollutant concentrations is considered **low**.

At the port(s); vessel operations can be anticipated as well as light to medium industry operations such as bulk cargo, break-bulk cargo, and petroleum / organic liquids storage and handling, petroleum product blending and associated support operations such as road and rail operations. Further from the port; usually outside the Towns, there would be heavy industries. The baseline air

quality in the port area and nearby residential areas is expected to be poor with elevated pollutant concentrations (Bacalja, Krčum, & Slišković, 2020; Browning & Bailey, 2006; California Air Resources Board, 2011; Hussain, et al., 2022; Toscano & Murena, 2019, in WSP, 2023a). In addition to industry and transport operations there are emissions from residential activities such as personal and public transport operations, and residential fuel burning. The nearby receptors sensitivity to increases in pollutant concentrations is considered **high** as the increase in already elevated concentrations could have significant detrimental impacts on human health.

9.3.1.1.5 Impact Magnitude (or Consequence)

Refer to Section 9.1.1.1.5.

9.3.1.1.6 Impact Significance

Same as for Section 9.1.1.1.6.

9.3.1.1.7 Identified Mitigation Measures

See Section 9.1.1.1.7.

9.3.1.1.8 Residual Impact Assessment

Same as for Section 9.1.1.1.8.

9.3.1.1.9 Additional Assessment Criteria

Refer to Section 9.1.1.1.9. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.1.2 Impacts on GHG Emissions and Climate Change Aspects

9.3.1.2.1 Source of Impact

The estimated GHG emissions from construction activities will result from possible well flow testing (non-routine flaring), and the mobile GHG emissions associated with the drill unit, helicopters, supply / fast supply vessels and tug boats. The key GHGs for the Project include CO_2, CH_4 and N_2O.

9.3.1.2.2 Project Controls

The following Project controls will be in place:

- TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18–- Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass).
- Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities.
- A maintenance plan will be implemented to ensure all diesel equipment receives adequate maintenance to minimise GHGs released to the atmosphere and maximise the energy efficiency.
- The drill unit, pipelaying vessel, support vessels and survey vessel will be required to prepare a Ship Energy Efficiency Management Plan (SEEMP) that complies with the IMO 2022 guidelines.

9.3.1.2.3 Potential Impact Description

GHG emissions will contribute to global climate change (indirect **negative impact**). The effect of climate change as a result of increased emissions of heat-trapping GHG's is related to increased temperatures, changing weather patterns and sea level rise.

9.3.1.2.4 Sensitivity of Receptors

Due to the international scale and infrequent occurrence of the impact, receptors are considered to be of **low sensitivity**.

9.3.1.2.5 Impact Magnitude (or Consequence)

Total GHG emissions for the construction phase are calculated as 949 057TCO_2e, taking place at three points in time (Yr 0, 1 and 10). Within the context of the national GHG inventory and targets, this contribution of GHG emissions is considered to be **low intensity**. The impact will however have an **international** impact and will most likely be **permanent**. Based on the above, the magnitude of the negative impact is considered to be **high**.

9.3.1.2.6 Impact Significance

Taking into account the **high** magnitude of the impact and the **low sensitivity** of receptors, the impact significance is considered to be **medium**, prior to mitigation.

9.3.1.2.7 Identified Mitigation Measures

Over and above the Project controls listed above, in order to mitigate the negative impact on climate change during the construction phase, the following mitigation measures are proposed:

- Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes.
- Implement effective programmes for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs.
- Optimise helicopter flight paths.
- Optimise well test and monitor the efficiency of the flare programme to reduce burning as much as possible during the test.
- Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons in order to minimise emissions and hydrocarbon ‘drop-out’ during well testing.

9.3.1.2.8 Residual Impact Assessment

With the Project controls and mitigation measures mentioned above, the residual impact could be decreased to **negligible significance**.

9.3.1.2.9 Additional Assessment Criteria

The negative impact on climate change during the construction phase is **definite** and considered to be **irreversible**. Cumulative potential is **likely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.2 UNDERWATER NOISE

9.3.2.1 Noise from Drill Rig and Support Vessels

9.3.2.1.1 Source of Impact

Drilling of up to six development wells be undertaken in the Project Development Area using a drilling unit, supported by one or two tugboats and supply vessels. The source of noise related

impacts associated with this activity include operation of the drill unit itself, as well as support tugs and supply vessels.

9.3.2.1.2 Project Controls

Refer to Section 9.1.2.1.2.

9.3.2.1.3 Potential Impact Description

Anthropogenic noise can have both direct and indirect negative impacts on marine fauna, by causing direct physical injury to hearing or other organs, (including permanent or temporary threshold shifts), causing disturbance resulting in behavioural changes or displacement from important feeding, breeding or spawning areas, and through masking or interfering with other biologically important sounds (e.g. communication, echolocation, signals and sounds produced by predators or prey).

To address these impacts, an underwater noise modelling study was undertaken (see Appendix 8). Two scenarios were modelled: 1) a worst-case scenario, where an animal would be exposed to drilling noise for the entire 24 hours, and 2) an exposure to drilling noise of 30-minute period, assuming the likelihood that an animal would move away from the source of the noise. The study considered these scenarios at two sites, both close to the coast and sensitive areas.

The model results indicate that the peak pressure levels generated by the drilling unit are sufficient to cause permanent (permanent threshold shifts) and temporary direct physical injury (temporary threshold shifts) to hearing in marine mammals and sea turtles, as well as death or injury to fish.

Based on the worst-case 24-hour exposure noise modelling results, baleen whales (southern right whale Eubalaena australis, humpback whale Megaptera novaeangliae) and other Very High-Frequency Cetaceans (pygmy sperm whale Kogia breviceps, dwarf sperm whale K. sima) are likely to be impacted the most with temporary impacts modelled to occur at 9 km and 8.6 km respectively, and permanent injury thresholds predicted to occur at distances of about 250 m and 50 m respectively. The impacts on High Frequency Cetaceans (common dolphin *Delphinus delphis*, killer whale *Orcinus orca*, Atlantic bottlenose dolphin *Tursiops350ispel350n350s*, short-finned pilot whale *Globicephala macrorhynchus*) is much smaller, with temporary impacts anticipated at distances of less than 400 m, and permanent injury thresholds predicted to occur at distances of about 10 m.

For turtles, permanent injury is predicted to occur at 10 m from the source of noise, while temporary impacts are expected within 330 m. For fish with a swim bladder, TTS impacts (i.e., a temporary loss of hearing sensitivity) is predicted to occur only very close to the drilling activity (within 160 m). Temporary effects (TTS) and permanent effects (PTS) are much smaller for the 30-minute exposure scenarios. The maximum 30-minute exposure TTS distance was modelled as 790 m for very high-frequency cetaceans, and 380 m for frequency cetaceans, while the maximum 30-minute exposure PTS distance was modelled as 20 m for low frequency cetaceans and very high-frequency cetaceans.

It is considered likely that most of these highly mobile pelagic species would move away once noise activities commence, with species likely leaving the area. However, this has a cost, and as such, behavioural effects of noise were also considered as part of the modelling study, which includes impacts on individual health and fitness, foraging efficiency, avoidance of predation, swimming energetics and reproductive behaviour (Popper & Hawkins 2016, in Anchor Environmental, 2023).

The maximum thresholds of behavioural disturbance from the drilling source were shown to be 66 km for marine mammals in all hearing groups, 11.8 km for penguins / diving birds, and 10 m for turtles.

The implications thereof are described below:

- The maximum impacted area for behavioural disturbance at any point in time will equate to some 13 684 km^2 for whales (Figure 9-13).. Assuming drilling occurs at the closet landward boundary of the Block 11B/12B Project Development Area, there is an overlap of impact of some 3 582 km^2 with the Southern Coastal and Shelf Waters IMMA, representing an overlap of <3% of the IMMA. Based on occurrence probability data (refer to Chapter 7), the species at highest risk of behavioural impacts include humpback whales in the summer (slightly less so in the winter), sperm whales year around, killer whales and Risso's dolphin.
- MMO observational data indicates that species likely to be impacted include killer whale, striped dolphin, sperm whale (Vulnerable), long-beaked common dolphin, common bottlenose dolphin, pilot whale, False killer whale (Near Threatened) and Risso's dolphin along with humpback whales and Sei whales (Endangered) (CapMarine 2020a, b, BSL & CapMarine 2023, in Anchor Environmental, 2023). While Southern right whales are the most abundant baleen whales off the coast of South Africa, they were not recorded in the Block during the 2019-2020, or 2022 MMO surveys (CapMarine 2020a, b, BSL & CapMarine 2023, in Anchor Environmental, 2023).
- The maximum impacted area for behavioural disturbance at any point in time will equate to some 437 km^2 for penguins / diving birds. While Algoa Bay penguins have been recorded as far as 60 km offshore following pelagic shoaling fish species within the 200 m isobath, the closet landward boundary of the Block 11B/12B Project Development Area lies more than 140 km offshore below the 200 m contour, and more than 190 km from the De Hoop penguin colony. As such, penguin behaviour is unlikely to be directly impacted by drilling activities within the Project Development Area.
- Cape gannets have been reported 100 km offshore in Block 11B/12B, and Cape cormorants have been reported up to 80 km from their colonies. Other bird species of concern that may occur in the Block which may be affected behaviourally by underwater noise impacts include the Shy albatross (Near Threatened, regular surface diving species), the Indian yellow-nosed albatross and Atlantic yellow-nosed albatross (both Endangered surface diving and occasional surface plunging species), the White chinned petrel and Spectacled petrel (both Vulnerable, surface diving, species) and the Sooty shearwater (a Near Threatened surface diving, pursuit-diving, surface plunging species).
- These birds may be impacted when submerged during feeding. However, most birds are submerged for a very short period of time and given relatively small area of predicted behavioural impact compared to the total habitat availability (Figure 9-14), these species are unlikely to be impacted behaviourally by drilling activities within the Project Development Area to a degree that impacts broader population dynamics especially if sufficient mitigation is implemented.

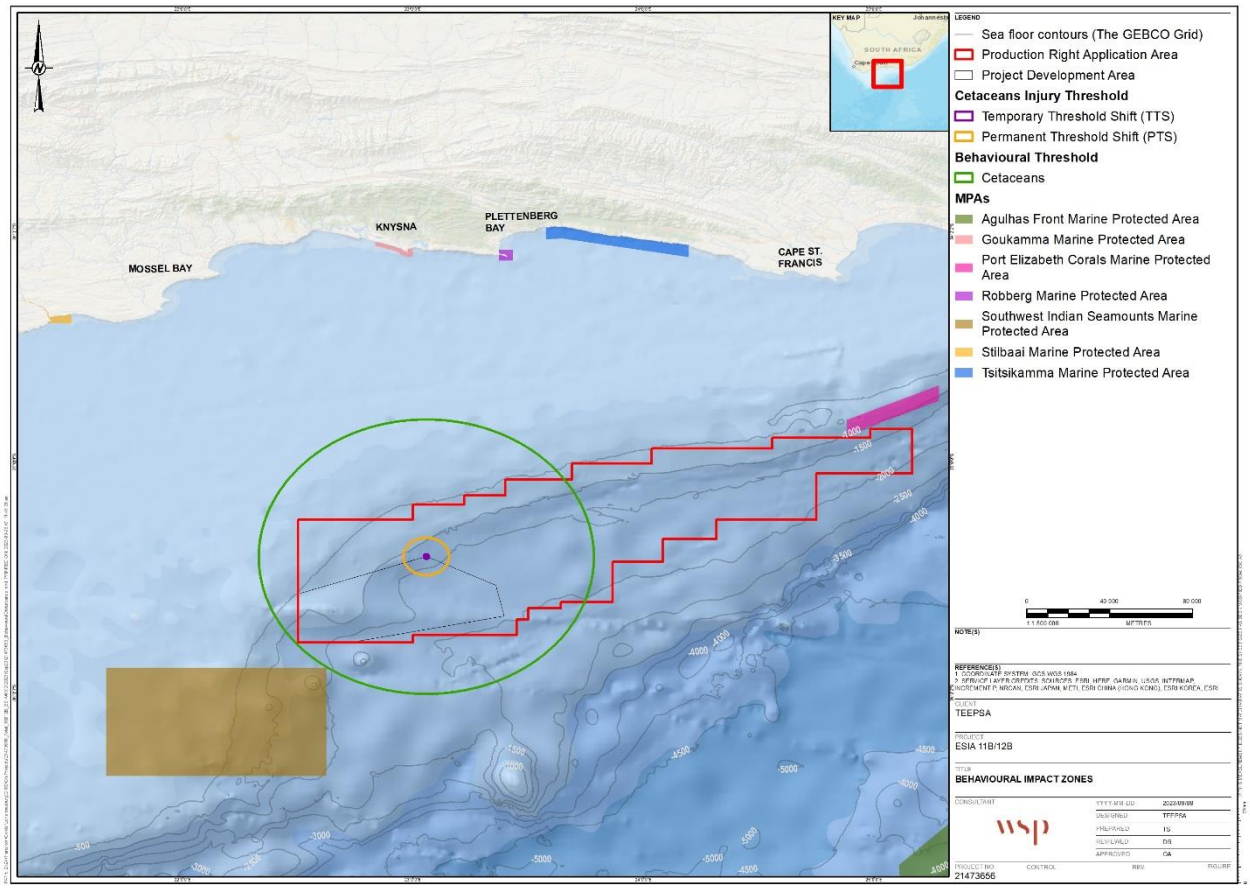

Figure 9-13–- Noise modelling study predicted zone impact on cetaceans by proposed drilling activities (worst-case, 24-hour exposure)

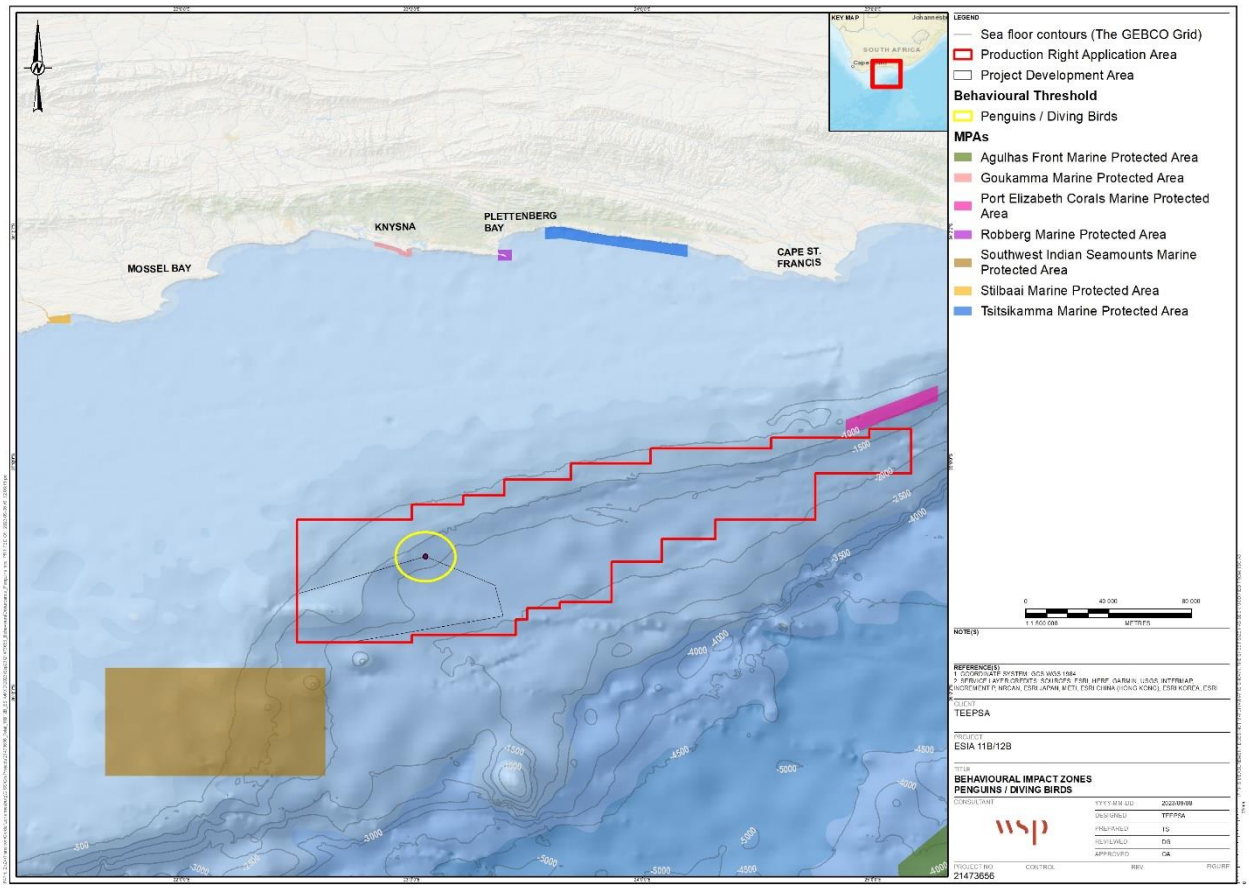

Figure 9-14–- Noise modelling study predicted zone impact of proposed drilling activities on penguins / diving birds

9.3.2.1.4 Sensitivity of Receptors

While the area impacted is small relative to the available habitat, it does intersect with major cetacean migratory routes, and while drilling activities are unlikely to cause a significant, irreversible change in habitat use of these species, receptor sensitivity is assessed as **high**. It is expected that the type of noise pollution resulting from proposed drilling activities will affect species that may be present/migrating through Block 11/12B that includes Endangered and Critically Endangered species of turtles, seabirds, cetaceans, large fish, and sharks, which have the potential to be directly harmed by the drilling noise sources.

9.3.2.1.5 Impact Magnitude (or Consequence)

The impact duration is assessed to be of short-term duration. While impacts have the potential to be permanent (in the case of PTS), model results show that species have to be within 10 to 400 m of the noise source (for 24-hour exposure) and within <10 to 20 m (for 30-minute exposure) for permanent threshold shifts/injury to occur.

This is considered to be highly improbable, considering the greater size of the area of behavioural impacts and because most pelagic species likely to be encountered within the Block are highly mobile, and would be expected to move away from the sound source before trauma could occur.

Given the sensitivity of the area, the recorded occurrence of a number of sensitive species within the site, and the uncertainty surrounding the implication of behavioural impacts over the long term, the intensity of the impact is assessed as medium over 24-hours. The magnitude of the impact on marine fauna as result of drilling noise is therefore considered to be **low** (for 24-hour exposure) and **very low** (for 30-minute exposure).

9.3.2.1.6 Impact Significance

The impact for both the 24-hour and 30-minute exposures is assessed to be of **low** significance prior to mitigation.

9.3.2.1.7 Identified Mitigation Measures

Refer to Section 9.1.2.1.7.

9.3.2.1.8 Residual Impact Assessment

Given the absence of suitable mitigation measures, the intensity, extent and duration of the impact remains unchanged, and therefore the potential impact remains of **low** significance.

9.3.2.1.9 Additional Assessment Criteria

The negative impact of noise from drilling is **definite** and considered to be **fully reversible**. Cumulative potential is possible and mitigation potential is **none**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.2.2 Noise from Vertical Seismic Profiling

Refer to 9.1.2.2.

9.3.3 AMBIENT AIR NOISE LEVELS

9.3.3.1 Noise from Helicopters

9.3.3.1.1 Source of Impact

Sound will be produced by helicopters. These elevated noise levels may disturb faunal species resulting in behavioural changes or displacement from important feeding or breeding areas.

9.3.3.1.2 Project Controls

Refer to Section 9.1.3.1.2.

9.3.3.1.3 Potential Impact Description

Transportation of personnel to and from drilling units by helicopter is the preferred method of transfer, with an estimated two trips per day, (60 round trips per month for 6 months = total 360 trips). The helicopters can also be used for medical evacuations from the drilling unit to shore (at day- or night-time), if required. While the area of construction is lies 80 to 100 km offshore, the closest commercial airport is in George, and the aircraft will therefore cross over offshore and coastal MPAs, including some sensitive coastal receptors (such as key faunal breeding/feeding areas, bird or seal colonies and nursery areas for commercial fish stocks). In addition, migratory pelagic species transiting through the drill area may also be directly affected.

9.3.3.1.4 Sensitivity of Receptors

Offshore taxa most vulnerable to disturbance by helicopter noise are pelagic seabirds, turtles and cetaceans. Although species listed as globally Endangered or Critically Endangered may potentially occur within the proposed area of construction and the helicopter flight path (see Section 3), their numbers are expected to be low. Onshore, roosting and nesting seabirds and seals are most likely to be impacted by routine helicopter operations across the coastal zone during the construction phase. Some of the seabirds roosting and nesting along the coast are listed by the IUCN as Endangered and include the African Penguin, Bank Cormorant, Cape Cormorant and Cape Gannet.

Low altitude flights over bird breeding colonies could result in temporary abandonment of nests and exposure of eggs and chicks leading to increased predation risk. However, sensitivity of birds to aircraft disturbance is species specific, and is generally lessened with increasing distance or if the flight path is off to the side and downwind. Seals may also experience both visual and acoustic disturbance from low flying aircraft, given that the frequency of aircraft engine noise emissions also overlaps with the hearing ranges of seals (Croft and Li, 2017, in Anchor Environmental, 2023).

Although any observed response is usually short-lived, disturbance of breeding seals can lead to pup mortalities through abandonment or injury by fleeing, frightened adults. However, there are no seabird or seal colonies directly below or within 5 km of the potential flight paths between the George airport and the area of offshore construction activities (Figure 9-15). The nearest seabird colonies to George airport are on the Robberg Peninsula at Plettenberg Bay (some 85 km away), with further colonies to the east on the Algoa Bay Islands off Gqeberha, (some 100 km from the closest direct flight path). Breeding and non-breeding sites for seals on the mainland include Seal Island in Mossel Bay (25 km to the west of the direct flight path), on the northern shore of the Robberg Peninsula in Plettenberg Bay and at Black Rocks (Bird Island group) in Algoa Bay (Huisamen et al. 2011, in Anchor Environmental, 2023).

Available data indicate that the expected frequency range and dominant tones of sound produced by helicopters overlap with the hearing capabilities of most cetaceans, both odontocetes and mysticetes (Richardson et al. 1995; Ketten 1998). Low altitude flights (especially near the coast) can have a significant disturbance impact on cetaceans during their breeding and mating season (Pisces 2020). The level of disturbance will depend on the distance and altitude of the aircraft from the animals (particularly the angle of incidence to the water surface) and the prevailing sea conditions. Of particular concern are the potential overlaps in flight paths with migrating Humpback whales and Southern Right whales inshore of the Block (the former April to December, with calving season from July to October, peaking in early August, and the latter June and November) (Best 2007).

Southern Right whales utilise the sheltered bays of the South Coast to breed and calve, with winter concentrations recorded all along the southern and eastern coasts of South Africa, with the most significant concentration currently on the South Coast between Cape Town and Gqeberha. It is highly likely that several hundred right whales can be expected to pass directly through the Block between May and June and then again November to January. Southern Right calving and nursing activities off the Mossel Bay coast would thus fall within the direct flight path.

Smaller cetaceans in the area include the Indo-Pacific Humpback dolphin, which occurs as a localised population concentrated around shallow reefs in the Plettenberg Bay- Algoa Bay region. Other species of concern that are likely to be encountered frequently in the Block include the Vulnerable Bryde's whales (throughout the year, with peak encounter rates occurring in late summer and autumn), the Endangered Sei whale (peaking in abundance on the East Coast in June and September), and the Vulnerable Sperm whale (high probability throughout the year, increasing in winter).

Based on the above, receptor sensitivity is considered to be **high**.

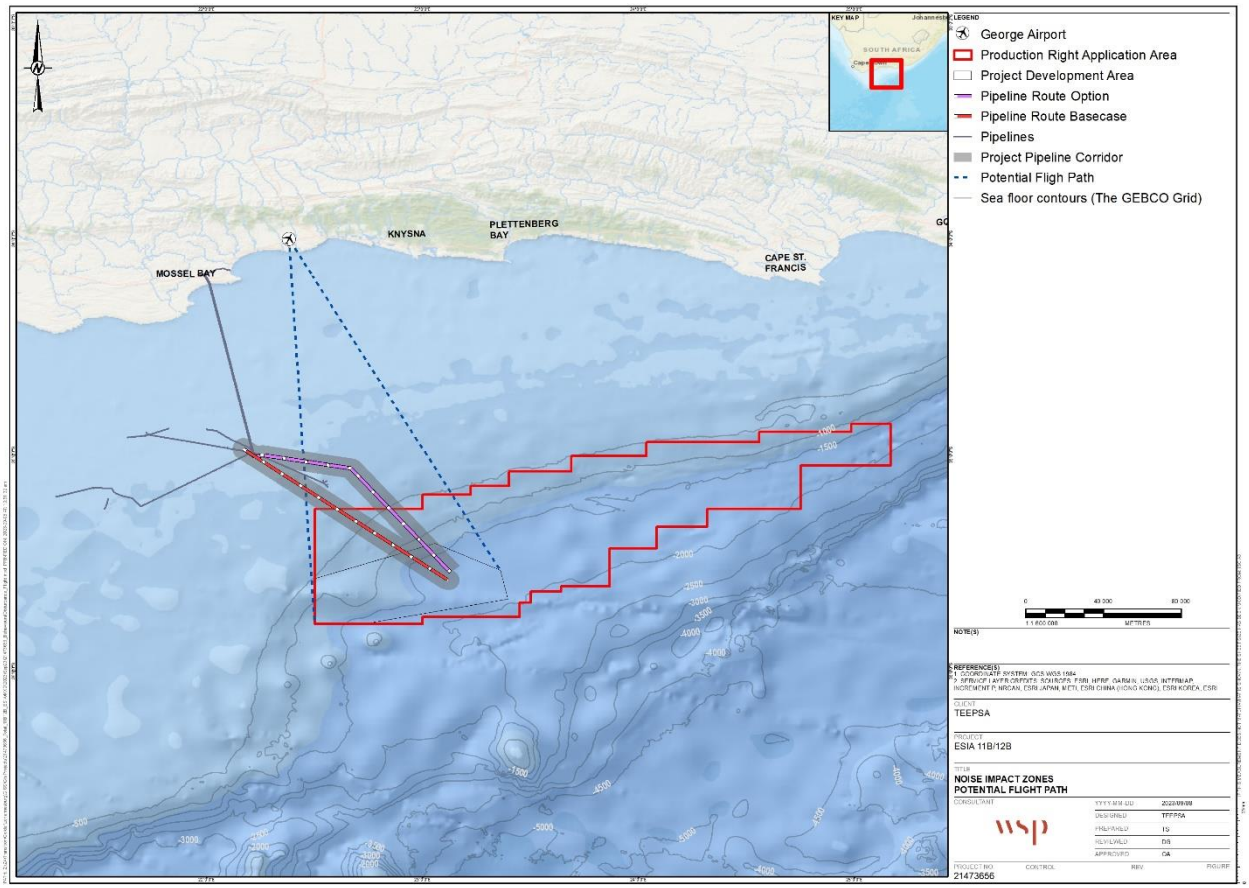

Figure 9-15–- Area of potential flight paths (within dashed white lines) from George Airport to the western Project Development Area

9.3.3.1.5 Impact Magnitude (or Consequence)

The majority of the transient noise from helicopters will be reflected by the surface of the ocean, with helicopter noise documented to be detectible for less than one minute under water (Richardson et al. 1995, WSP 2023b). Therefore, underwater noise impacts from helicopters are expected to be much less than those from other Project activities. Exposure to noise will be limited in duration (up to two trips per day over the six-months) (**short-term**) per well and will be of a temporary nature while the helicopter passes overhead (although regional in extent). Impact intensity is therefore considered to be **low** resulting in an impact magnitude of **very low**.

Indiscriminate or direct low altitude flying over seabird and seal colonies, or breeding cetaceans could impact fauna behaviour and breeding success. The level of impact will depend on the distance and altitude of the aircraft from the animals and the prevailing sea conditions at the time.

9.3.3.1.6 Impact Significance

Based on the high receptor sensitivity and very low magnitude, the significance of the impact is considered to be **low**.

9.3.3.1.7 Identified Mitigation Measures

Refer to Section 9.1.3.1.7.

9.3.3.1.8 Residual Impact Assessment

With the implementation of the Project controls and recommended mitigation measures, impact significance will be **low**.

9.3.3.1.9 Additional Assessment Criteria

Probability of the impact is **highly likely**. The loss of resources is **medium** and mitigation potential **medium**. Cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.3.2 Noise from Construction Vessels

9.3.3.2.1 Potential Impact Description

Sound will be produced by construction vessels. These elevated noise levels may disturb faunal species resulting in behavioural changes or displacement from important feeding or breeding areas. Vessel noise would primarily take place in the area of construction such as the installation of pipelines and the subsea production system, the production drill area, and along the route taken by the support vessels between the construction area/drilling unit and port.

9.3.3.2.2 Project Controls

Refer to Section 9.1.3.2.2.

9.3.3.2.3 Sensitivity of Receptors

The western Project Development Area is located approximately 80 to100 km offshore and is far removed coastal MPAs and any sensitive coastal receptors. The proposed pipeline Option route does however pass through the southwestern corner of the Kingklip Corals EBSA.

Migratory pelagic species transiting through the construction drill areas may be directly affected. The taxa most vulnerable to disturbance by underwater noise are turtles, large migratory pelagic fish and marine mammals. Some of the species potentially occurring in the drill / construction areas, are considered regionally or globally 'Critically Endangered' (e.g. Southern bluefin tuna, leatherback turtle and blue whale), 'Endangered' (e.g. Whale Shark, Shortfin Mako Shark, Fin and Sei whales), 'Vulnerable' (e.g. bigeye tuna, blue marlin, loggerhead turtle, oceanic whitetip shark, dusky shark, great white shark, longfin mako and sperm whale, Bryde's and humpback whales) or 'near threatened' (e.g. striped marlin, blue shark, longfin auna/albacore and yellowfin tuna).

Although species listed as globally Endangered or Critically Endangered may potentially occur in the area, Block 11B/12B is located in a main marine traffic route, already experiencing elevated marine traffic and vessel noise. Thus, the sensitivity of receptors to vessel noise is considered to be **medium.**

9.3.3.2.4 Impact Magnitude (or Consequence)

The sound levels radiating from vessels in transit and surveying range from 160 to 220 dB re 1 µPa at 1 m at frequencies of 5 to 500 Hz, depending on size and speed (NRC, 2003, in Anchor Environmental, 2023). As Block 11B/12B is located in a main traffic route that passes around southern Africa, the shipping noise component of the ambient noise environment is expected to be significant within and around the Block.

Previous noise modelling work has noted that the there is significant local shipping traffic and relatively strong metocean conditions in Block 11B/12B, and so the ambient noise levels are expected to be in the range 90-130 dB re 1 µPa for the frequency range 10 – 10 kHz. Note that underwater noise from vessels in transit is not considered to be of sufficient amplitude to cause direct physical injury to marine life, even at close range.

Due to their extensive distributions, the numbers of pelagic species (large pelagic fish, turtles and cetaceans) encountered during the construction phase is expected to be low and considering they are highly mobile and able to move away from the sound source before trauma could occur, the intensity of potential injury or behavioural disturbance as a result of vessel noise is rated **low**. Furthermore, the construction and drill areas are located in a main marine traffic route and thus is in an area already experiencing increased marine traffic and vessel noise.

Th359ispel359non of the impact would be limited to the short-term and extend **regionally** (behavioural disturbances would be expected up to 100 km from the drill site, as well as vessel movement between logistics base and drilling unit). The potential physiological injury or behavioural disturbance as a result of construction vessel noise would thus be of **low** magnitude.

9.3.3.2.5 Impact Significance

Based on the medium receptor sensitivity and low magnitude, the significance of the impact is considered to be **low**.

9.3.3.2.6 Identified Mitigation Measures

See Section 9.1.3.2.6.

9.3.3.2.7 Residual Impact Assessment

With the implementation of the Project controls and recommended mitigation measures, impact significance will reduce to **very low**.

9.3.3.2.8 Additional Assessment Criteria

Probability of the impact is **likely**. The loss of resources is **low** and mitigation potential **low**. Cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.4 LIGHT EMISSIONS

9.3.4.1 Light Emissions from Drill Rig and Construction Vessels

9.3.4.1.1 Source of Impact

During the construction phase, vessels associated with construction activities, such as pipe laying, are likely to be the greatest source of artificial light at night.

9.3.4.1.2 Potential Impact Description

Refer to Section 9.1.4.1.2.

9.3.4.1.3 Project Controls

Refer to Section 9.1.4.1.3.

9.3.4.1.4 Sensitivity of Receptors

Species listed as globally Endangered or Critically Endangered may potentially occur in the area, the proposed project areas are located in a main marine traffic route, already experiencing the increased marine traffic and vessel noise. Thus, the sensitivity of receptors to vessel noise is considered to be **medium**.

9.3.4.1.5 Impact Magnitude (or Consequence)

The amount of light spill that will reach the areas surrounding the vessels is unknown but will be influenced to a large degree by climate/atmospheric conditions. Artificial skyglow (direct lighting emitted or reflected upwards, scattered in the atmosphere and reflected back to the ground; Kyba et al. 2011, in Anchor Environmental, 2023) can spread light pollution hundreds of kilometres from its source (Luginbuhl et al. 2014, in Anchor Environmental, 2023).

The extent of the impact is therefore considered to be **local** (i.e., confined to within the Block and its nearby surroundings), of **medium-term** duration. Given that the Block is located along a main marine traffic route, the area is already impacted by increased anthropogenic lighting, and the intensity of the impact is therefore considered to be **low** for the construction phase, resulting in an impact magnitude of **very low**.

9.3.4.1.6 Impact Significance

Based on the medium receptor sensitivity and very low magnitude, the significance of the impact is considered to be **low**.

9.3.4.1.7 Identified Mitigation Measures

See Section 9.1.4.1.7.

9.3.4.1.8 Residual Impact Assessment

With the implementation of the Project controls and recommended mitigation measures, impact significance will reduce to **very low**.

9.3.4.1.9 Additional Assessment Criteria

Probability of the impact is **possible**. The loss of resources is **medium** and mitigation potential **low**. Cumulative potential is possible. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.4.2 Light Emissions from Well Flow Testing

Refer to Section 9.1.4.2.

9.3.5 PRODUCED WATER DISCHARGE

Refer to Section 9.1.5.

9.3.6 DISCHARGE OF DRILLING FLUIDS AND CUTTINGS

9.3.6.1 Source of Impact

Refer to Section 9.1.6.1

9.3.6.1.1 Biochemical and Toxicity Water Column and Benthic Impacts

9.3.6.1.1.1 Potential Impact Description

See Section 9.1.6.2.1.1.

9.3.6.1.1.2 Project Controls

Refer to Section 9.1.6.2.1.2.

9.3.6.1.1.3 Sensitivity of Receptors

Given the importance of the area in general for VME indicator species (both within and outside of the MPAs and EBSAs), the benthic sensitivity of the western Project Development Area is considered to be **high**.

9.3.6.1.1.4 Impact Magnitude (or Consequence)

Assuming that the WBMs to be used in drilling of the well do not contain spotting fluids or lubricating hydrocarbons, the impact intensity of discharges of these drilling fluids to both the water column and the sediments are considered of **medium** intensity. The area affected by discharged drilling fluids/cuttings would however be relatively localised depending on the site of the well. Impact duration is expected to be medium term. Based on the above, impact magnitude associated with biochemical and toxicity risks related to the discharge of drilling fluid and cuttings is considered to be **low** for WBMs.

The impact related to the discharge of the excess cement around the wellbore and leaching of the additives into the surrounding water column is considered to be extremely localised, the duration short term and the intensity very low. Impact magnitude is therefore considered to be **very low**.

9.3.6.1.1.5 Impact Significance

Taking into account the magnitude of the negative impacts identified above and receptor sensitivity (high), impact significance is expected to be **low** for discharges of WBMs and cement.

9.3.6.1.1.6 Identified Mitigation Measures

Refer to Section 9.1.6.2.1.6.

9.3.6.1.1.7 Residual Impact Assessment

With implementation of the Project controls and mitigation measures, residual impact significance will be **low**.

9.3.6.1.1.8 Additional Assessment Criteria

The probability of the impact is **definite** and **partially reversible**. Loss of resource is **low** and mitigation potential is **medium**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.6.2 Turbidity and Smothering Impacts on Marine Environment

9.3.6.2.1 Potential Impact Description

Discharge of drilling muds, fluids and cuttings have a potentially adverse impact on the environment, in that their discharge directly onto the seafloor adjacent to the wellbore where they would primarily have a smothering impact on sedentary benthic species.

The cuttings of a single well drilled is estimated to produce a maximum total cuttings weight of 694 metric tonnes discharged at the surface, and 421 tonnes discharged directly to the seafloor (as modelled by Sintef, 2023). The hypothetical dispersion and fates of cuttings following discharge to the ocean are shown in Figure 9-12.

The impacts of smothering are both direct (mortality and clogging of feeding mechanisms) and indirect (loss of benthic prey to predators, possible disturbance to spawning and/or recruitment). The cuttings form a highly localised cone-shaped spoil mound around the wellbore, which gets thinner towards the periphery. The magnitude of the impact on benthic fauna is dictated by the amount of sediment (i.e., depth of burial), the life-history derived tolerances of species to smothering (i.e., filter feeders are more sensitive that deposit feeders), the duration of impact, and the nature of the depositing sediments.

In areas where natural sedimentation rates are high (e.g., in proximity to river mouths or wave-disturbed shallow waters), the ability of taxa to migrate through deposited sediments is likely to be high. On the other hand, relatively immobile species occurring in areas where sedimentation rates are naturally low would be more susceptible to smothering such as in the deeper waters of Block 11B/12B below the 200 m isobath (Blood, 2015, in Anchor Environmental, 2023).

It is noted that turbidity plumes arising from the drilling of wells and discharge of cuttings would cease to exist on completion of drilling activities. No further increased turbidity would be expected during extraction of the resource. Increased turbidity of near-bottom waters through disposal of cuttings at the wellbore and sea surface may place transient stress on sessile and mobile benthic organisms, by negatively affecting filter-feeding efficiency of suspension feeders or through disorientation due to reduced visibility (Blood, 2015). However, in most cases, sub-lethal or lethal

responses occur only at concentrations well in excess of those anticipated at the wellbore. Increased turbidity can impact light penetration, particularly in shallow marine waters.

Dispersion modelling results show the primary environmental impacts of drill discharge and cuttings release on sediments is linked to burial and grain size change. Modelled drilling impacts on sediment deposition thickness after 10 years (assuming no simulation of sediment redistribution) shows that sediment deposition will either occur predominately in a southwest pattern, or in a more uniform pattern closer to the drill site, depending on site selection.

Sediment deposition is modelled to cover a relatively small area of seabed for each drilled well; for Discharge Point 4 and Discharge Point 5, under the worst-case scenario, deposition of 30 mm thick will be present in an area of ~ 0.005 km^2 around the drilling site after 10-years, with a deposition of 6.5 mm (i.e., the defined PNEC for burial) covering an area of ~0.175 km^2.

9.3.6.2.2 Project Controls

Refer to Section 9.1.6.2.1.2.

9.3.6.2.3 Sensitivity of Receptors

The sensitivity of receptors ranges from **medium** (infauna and pelagic marine biota) to **high** (epifauna).

9.3.6.2.4 Impact Magnitude (or Consequence)

The impact of smothering as a result of drilling discharges is highly dependent on the community composition of the site. Changes in abundance and diversity of infaunal, benthic communities in response to deposited cuttings are typically detected within a few hundred metres of the discharge, with recovery of the benthos observed to take from several months to several years after drilling operations had ceased (Thiel & Schriever 1990, Bluhm et al. 1995, Jennings & Kaiser 1998, Atkinson 2010, Biccard et al. 2018, in Anchor Environmental, 2023).

The impact is **localised**, and recovery is expected within a few years (within five years). Therefore, given the relatively small impact footprint, it is expected that the benthic macrofaunal community would recover to a point within the range of natural variability (i.e., where the effects of the impact(s) are no longer discernible) relatively quickly after the cessation of drilling. The smothering effects resulting from the discharge of drilling solids at the wellbore is therefore assessed to have an impact of **medium** intensity on the infauna of unconsolidated sediments in the cuttings footprint, whereas discharges from the drill unit would have a **low** intensity impact.

The relatively short duration of the turbidity plumes and their small spatial extent is expected to have negligible potential negative impacts on the pelagic system communities (namely on phytoplankton and ichthyoplankton production, fish, cetacean and turtle migration routes and spawning areas). The impact of increased turbidity in the water column and elevated suspended sediment concentrations on pelagic communities are considered to be **localised**, **short term** (days) and of **very low** consequence.

Considering the depth of the proposed drilling activities (approximately 200 m) these is rarely any significant light penetration at these depths (NOAA, 2023, in Anchor Environmental) and therefore impacts of turbidity increases on light availability at this depth are considered **negligible**.

However, the impacts of the by-products of oil exploitation, including drill cuttings, drill mud, and wastewater discharge, can smother and ultimately negatively impact sensitive deep water epifaunal communities, including cold water coral (Roberts & Cairns 2014, in Anchor Environmental, 2023). Modelling results indicate that environmental effects in the lower water column are expected to ensure for a very short duration, up to 2.5 days maximum. However, benthic effects are modelled to endure for up to five years. Therefore, should the cuttings footprint overlap with vulnerable communities on hard ground, the smothering effects could potentially have an impact of substantial consequence, and recovery would only be expected over the medium to long-term (>10 years) due to their long generation times. This impact is considered to be of **high** magnitude.

9.3.6.2.5 Impact Significance

The impact significance, without mitigation, of increased turbidity in the water column and elevated suspended sediment concentrations on infaunal communities is assessed as **low**, on pelagic communities as **very low** and on epifaunal communities as **high**. Impacts of turbidity increases on light availability are considered **negligible**.

9.3.6.2.6 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

- Pre-construction baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to inform placement of wells, with the aim of preventing disturbances to sensitive species and habitats.
- If complete avoidance mitigation is not possible, an out-of-kind offset/compensatory mechanism needs to be developed as part of a Biodiversity Action Plan (BAP), if required (see Section 9.2.1 of the marine ecology and fisheries impact assessment report for details).
- Consider implementing innovative technologies and operational procedures for drilling solids discharges to minimise turbidity and smothering impacts.

9.3.6.2.7 Residual Impact Assessment

With the implementation of the identified mitigation measures, residual impact significance will be **very low** for pelagic fauna, **low** for benthic infauna and **medium** for benthic epifauna.

9.3.6.2.8 Additional Assessment Criteria

Impact probability ranges from **highly likely** (pelagic fauna) to **definite** (infauna and epifauna communities). Reversibility ranges from **partially reversible** (infauna and epifauna communities) to **fully reversible** (pelagic fauna). The mitigation potential is **low**. The loss of resource is **low** for infauna and pelagic fauna, but **high** for epifauna. Cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.7 PHYSICAL DISTURBANCE OF SEAFLOOR SEDIMENTS

9.3.7.1 Loss of Benthic Habitat and Impact on Benthic Infauna[45]

9.3.7.1.1 Potential Impact Description

The various construction activities, including the installation of the production and appraisal wells and anchoring of the production pipeline and subsea production system, will physically disturb the seabed and will result in direct mortality of some benthic epifauna and infauna. Furthermore, the physical presence of a pipeline on the seabed is expected to reduce the area of unconsolidated seabed habitat available for colonisation by infaunal communities but will provide alternative hard substratum for colonising by benthic communities (including alien species), fish and mobile invertebrates.

Changes in benthic community structure are likely to occur with the loss of immobile, sedentary soft-bodied species and survival of more robust taxa such as molluscs and crustaceans (Savage et al. 2001, Sciberras et al. 2018, Biccard et al. 2018, in Anchor Environmental, 2023).

9.3.7.1.2 Project Controls

- TEEPSA will ensure that the contractors undertake the drilling and construction activities in a manner consistent with good international industry practice and BAT.
- Based on pre-drilling ROV survey(s), the well(s) will specifically be sited to avoid sensitive hardgrounds, as the preference will be to have a level surface area to facilitate spudding and installation of the wellhead.

9.3.7.1.3 Sensitivity of Receptors

Receptor sensitivity for benthic infauna is regarded as **low**, given that the affected area be virtually negligible in extent in comparison to similar available habitat in the area.

9.3.7.1.4 Impact Magnitude (or Consequence)

The impact will be **local** and is expected to occur over the **long-term**, given that previous studies have shown that the disturbance from anchor scars and mounds can last up to ten years (Jennings & Kaiser 1998, in Anchor Environmental, 2023). Impact intensity is expected to be **medium**, given the anticipated extent of the affected area in relation to the similar available habitat in the area. Based on the above, impact magnitude is expected to be **medium**.

9.3.7.1.5 Impact Significance

Taking into account the magnitude of the negative impact on benthic infauna (**medium**) and the **low sensitivity** of receptors, the impact significance is considered to be **low**.

9.3.7.1.6 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

[45] Benthic fauna living in the substrate and especially in a soft sea bottom.

- Conduct technical studies on techniques that can be used to minimise the impact on sensitive benthic components, specifically regarding method of laying of vessel / rig anchors and chains, choice of pipe material selection and pipe laying method.
- Consideration should be given to the feasibility of bolting the pipeline directly to the rocky substratum or to concrete bases would minimise the area impacted.
- Post-construction/drilling ROV should be undertaken to scan seafloor for any dropped equipment and other removable features (e.g. excess cement) around the well and construction sites. These must be retrieved/removed, where practicable, after assessing the safety and metocean conditions.

9.3.7.1.7 Residual Impact Assessment

The Project controls and recommended mitigation measure in place, impact significance can be reduced to **very low**.

9.3.7.1.8 Additional Assessment Criteria

The probability of the impact is **definite** and **partially reversible**. Loss of resource is **low** and mitigation potential is **low**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.7.2 Loss of Benthic Habitat and Impact on Benthic Epifauna[46]

9.3.7.2.1 Potential Impact Description

Anchoring and laying of infrastructure over hard ground or boulder fields will result in physical damage to rock outcrops or the inversion of boulders on the seabed. Construction of pipelines (for either routing option) across subtidal reefs will require permanently attaching the structure to the substratum in a manner that is sufficiently strong to resist the action of the sea. The use of concrete to cement pipelines in place is the most feasible option. This would result in the direct loss of epifauna living on these hard substrata along the pipeline path or in the areas where concrete is placed.

9.3.7.2.2 Project Controls

Refer to Section 9.3.7.1.2.

9.3.7.2.3 Sensitivity of Receptors

A number of potential VMEs have been identified through the *in situ* epifauna ROV survey campaign in the vicinity of both proposed pipeline routing options. These potential VMEs were identified through the presence of VME indicator species, most of which are present in rocky habitat. The VME indicator species noted in the area of proposed construction activities (specifically pipeline construction on both route options) include right angled corals (*Cladopsammia* and *Eguchipsammia*

[46] Benthic fauna living on the substrate (such as a hard sea floor) or on other organisms.

sp.), the sabre bryozoan (*Adeonella* sp.), zigzag coral (*Enallopsammia rostrata*) and large overhanging lace coral (Stylasteridae).

Some of the impacted biota may be long-lived and fragile. While recovery of disturbed deep-sea coral communities can take up to 30 years, the replacement of entire colonies is estimated to take centuries, based on estimated growth rates and polyp recruitment (Doughty et al. 2014, Schwing et al. 2020, in Anchor Environmental, 2023). Based on the above, receptor sensitivity is considered to be **medium**.

9.3.7.2.4 Impact Magnitude (or Consequence)

While recovery of disturbed deep-sea coral communities can take up to 30 years, the replacement of entire colonies is estimated to take centuries, based on estimated growth rates and polyp recruitment (Doughty et al. 2014, Schwing et al. 2020, Anchor Environmental, 2023). The impact will therefore be expected to be **permanent**. The impact will be **local**, and impact intensity is expected to be **high**, given the permanent nature of the impact. Based on the above, impact magnitude is expected to be **high**.

9.3.7.2.5 Impact Significance

Taking into account the magnitude of the negative impact benthic epifauna (high) and the medium sensitivity of receptors, the impact significance is considered to be **high**.

9.3.7.2.6 Identified Mitigation Measures

The following mitigation measures are proposed, over and above the Project controls listed above:

- Pre-construction baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to ensure that construction activities do not disturb or destroy the sensitive and significant VME indicator epifaunal communities, vulnerable habitats (e.g., hard grounds), and structural features (e.g., rocky outcrops).
- The results of these surveys must be used to inform construction plans with the aim to provide a one km radius buffer to any sensitive communities, habitats or structures. If this is not possible, an out-of-kind /compensatory mechanism needs to be developed as part of a biodiversity action plan (BAP), if required.
- Conduct technical studies on techniques that can be used to minimise the impact on sensitive benthic components e.g. method of laying of vessel / rig anchors and chains, choice of pipe material selection, pipe laying method, etc.
- Consideration should be given to the feasibility of bolting the pipeline directly to the rocky substratum or to concrete bases would minimise the area impacted.
- Implement suitable measures to minimise cement spillages to the environment.

9.3.7.2.7 Residual Impact Assessment

The mitigation measures proposed above could reduce impact significance to **low**.

9.3.7.2.8 Additional Assessment Criteria

The negative impacts on the activities of small-scale fishers during the exploration phase is considered to be **partially reversible**. The mitigation potential is considered to be **medium**. Refer to

the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.7.3 Impact on Maritime Heritage and Palaeontological Impacts

9.3.7.3.1 Source of Impact

In the construction phase, a subsea production system will connect the development wells to the F-A Platform. Subsea structures including a FLET and a production manifold at the end of the pipeline will allow the connection of the production wells. Further, the structures will also house a subsea distribution unit, jumpers to transport the production wells to the manifolds, flowmeters, isolation valves and pressure and temperature monitoring instruments. The foundations for both the new manifolds and subsea structures are gravity based, however this is to be confirmed by the planned geophysical/geotechnical and foundation structures will be optimised in future design work.

A rigid 18-inch subsea pipeline (also known as the production pipeline) will be installed from the Project Development Area to the F-A Platform. Two options have been identified:

- The base case pipeline alignment is approximately 109 km long direct route pipeline from the gas field to the F-A Platform.
- The alternative route is approximately 115 km, the longer section of which is routed to the northeast then a shorter section turning northwest to connect to the F-A Platform.

A corridor with a 10 km width along the proposed alignment of the production pipeline has been assessed as part of this ESIA.

Furthermore, up to five production and appraisal wells will also be drilled (with the option of drilling a 6th well) in the Project Development Area over a ten-year period. During well drilling activities, 36- or 42-inch holes will be drilled to depths of 90 m, thereafter further sections will then be drilled at a 26-inch diameter to a depth of approximately 500 to 600m, followed by a 14 ¾" hole section / 10 ¾" casing and 8 ½" hole up to a maximum depth of 1 790 m.

9.3.7.3.2 Project Controls

Refer to Section 9.1.7.1.2.

9.3.7.3.3 Potential Impact Description

The construction of the subsea production system and production pipeline, and drilling of production and appraisal wells, will result in disturbance to seafloor sediments and may result in direct impacts on fossilised materials, where fossiliferous bedrock underlies the seabed and intersect with the construction activities. Indirect or downstream effects of the deposition of drill cuttings on fossil material, should it occur, is unlikely to have a negative impact.

The recording and reporting of any fossil material would offset the potential impacts and would change the impact status from negative to positive because of a potential benefit to palaeontological research and knowledge that could accrue from such information.

9.3.7.3.4 Sensitivity of Receptors

The palaeosensitivity of the site has been defined in Section 9.1.7.1.4.

9.3.7.3.5 Impact Magnitude (or Consequence)

The impact intensity, extent, duration and magnitude resulting from the construction phase is the same for exploration well drilling activities (refer to Section 9.1.7.1.5).

9.3.7.3.6 Impact Significance

The impact significance on palaeontological resources resulting from the construction phase is the same for well drilling activities (refer to Section 9.1.7.1.6).

9.3.7.3.7 Identified Mitigation Measures

See Section 9.1.7.1.7.

9.3.7.3.8 Residual Impact Assessment

The residual impact on palaeontological resources resulting from the construction phase is the same for exploration well drilling activities (refer to Section 9.1.7.1.8).

9.3.7.3.9 Additional Assessment Criteria

The probability of the impact occurring, the reversibility of the impact, the loss of the resource that would result and the cumulative potential of the impact from the construction phase is the same for exploration well drilling activities (refer to Section 9.1.7.1.9). Refer also to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.8 MARITIME SAFETY ZONES

9.3.8.1 Impact on Fisheries

9.3.8.1.1 Source of Impact

During production and appraisal well drilling operations, a temporary statutory safety zone of 500 m would be required from the drilling unit. In addition, exclusion zones would be required for all subsea infrastructure construction areas.

9.3.8.1.2 Potential Impact Description

Exclusion of fishing vessels from fishing areas could have (indirect) socio-economic implications for the affected industries. If more than one vessel is active in the vicinity, the exclusion area increases accordingly (CapMarine, 2018). Fisheries might be affected by target species avoiding the construction area, and through the damage/dislocation of fishing equipment deployed in the area by construction activities.

9.3.8.1.3 Project Controls

- Prior to commencement of drilling / construction activities, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office.
- These stakeholders should again be notified at the completion of drilling / construction activities and when the support vessels are off-location. The Notice to Mariners should give notice of (1) the co-ordinates of the drill / construction areas, (2) an indication of the proposed timeframes of the drilling / construction activities, and (3) an indication of the 500 m safety zones and the proposed safe operational limits of the drilling / construction activities.
- These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.

9.3.8.1.4 Sensitivity of Receptors

Construction activities in the western Project Development Area overlaps two fisheries, namely the offshore hake demersal trawl fishery and the long-line fishery.

The offshore hake demersal trawl fishing grounds overlap with the production pipeline corridors. The pipeline exclusion zones (for either routing options) cumulatively overlap approximately 6 km^2 of offshore trawl fishing grounds which is about 0.01 % of offshore trawl fishing grounds. However, this area is only fished 20-50% of the time (relative offshore trawl fishing effort). Considering this, the sensitivity of the hake demersal trawl fishery is anticipated to be **medium**.

The long-line fishery targeting large pelagic species operates slightly within the western Project Development Area. Large pelagic fishing activity is concentrated along the shelf break to target large pelagic species. Evidence suggests that pelagic species have more sensitive hearing (thresholds at lower frequencies) than demersal species, and that catch rates could drop significantly areas affected by construction activities (CapMarine, 2017). The receptor sensitivity of the long-line fishery is rated as **high**.

9.3.8.1.5 Impact Magnitude (or Consequence)

Given the small extent of the overlap of the offshore hake demersal trawl fishery and the pipeline corridors, the fact that the area is only fished 20-50%, the intensity of the construction phase impacts on this fishery is considered to be **very low**. With a local extent and short-term duration, the magnitude of the impact is anticipated to be **very low**.

If all six production and appraisal wells and exclusion areas (4.7 km^2) were to be sited in areas of large pelagic long fishing activity, this would cover 0.002 km^2 of large pelagic fishing grounds. In the worst-case scenario overlapping grounds are only fished 60% of the time. Considering this, the intensity of the construction phase impacts on the large pelagic fishery is expected to be **medium**. With a local extent and a short-term duration, impact magnitude is therefore considered to be **low**.

9.3.8.1.6 Impact Significance

Taking into account the magnitude of the negative impacts on the activities of the offshore hake demersal trawl (very low) and large pelagic long fisheries (**low**) and the **medium** (hake demersal trawl) and **hgih** (large pelagic fishery) **sensitivity** of receptors, the impact significance is considered to be **very low** for hake demersal trawl and **low** for large pelagic fisheries.

9.3.8.1.7 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

- Avoidance of siting well infrastructure in areas of higher fishing intensity if feasible. This particularly relates to the Large Pelagic Longline sector.
- Maintain adequate safety clearance between fishing vessels and construction vessels and equipment through at-sea communications with vessels in the vicinity of the drill area.

9.3.8.1.8 Residual Impact Assessment

Through the implementation of the Project controls and proposed mitigation measures, the residual impact significance is considered to remain **very low** for hake demersal trawl and **low** for large pelagic fisheries.

9.3.8.1.9 Additional Assessment Criteria

The negative impact on the fishing sector due to safety zones during the construction phase is considered **fully reversible**, with **low mitigation potential**. Loss of resources is **medium** and the cumulative potential unlikely. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.9 SPENDING ON LOCAL GOODS, SERVICES AND LABOUR

9.3.9.1 Impact on Economic Output and GDP

9.3.9.1.1 Source of Impact

Procuring goods and services in South Africa for the construction activities will result in an increase in local economic output activities, resulting in GDP growth. This impact will occur in Year 0, Year 1, and 10.

9.3.9.1.2 Project Controls

Refer to Section 9.1.9.1.2.

9.3.9.1.3 Potential Impact Description

The procurement of goods and services will benefit suppliers directly involved in the construction period, resulting in indirect and induced benefits through backward linkages in the value chain and additional employment opportunities that will be created. The increase in economic output will have a positive impact on the GDP. The combined impact for the construction period (in 2022 prices) is indicated in **Table 9-11**. These impacts have been separated into impacts that will be directly as a result of TEEPSA activities as well as impacts that will result from the re-commissioning of the PetroSA F-A Platform.

Table 9-11 – Construction period impact on economic output and GDP

Impact	Direct	Indirect	Induced	Total
TEEPSA Construction Activities				
Economic output	R928.6 million	R674.0 million	R489.0 million	R2 billion
GDP	R353.6 million	R251.4 million	R197.5 million	R802.5 million
PetroSA F-A Platform				
Economic output	R13.0 billion	R7.5 billion	R4.6 billion	R25.1billion
GDP	R2.7 billion	R2.9 billion	R1.9 billion	R7.5 billion
Total				
Economic output	R13.9 billion	R8,1 billion	R5.0 billion	R27 billion
GDP	R3.0 billion	R3.2 billion	R2.0 billion	R8.2 billion

Source: Urban-Econ SAM modelling, 2023

The total local spend on goods and services during the Project's construction period (3 years in total, but not consecutively) will increase economic output by R27 billion, of which R13.9 billion will be direct impacts. This will increase the GDP by R8.2 billion rand. Most of these impacts will result from PetroSA activities, which it is assumed could achieve a much higher local content percentage

than the TEEPSA activities, which rely on high-tech equipment and supplies that are not always available in the local economy.

The main sectors estimated to benefit from production and GDP during construction include mining, transport and storage, real estate and business, and manufacturing.

9.3.9.1.4 Sensitivity of Receptors

Since the TEEPSA activities will contribute to the local economy, receptor sensitivity is rated **low** for the TEEPSA activities. Since the PetroSA activities will contribute more to the local economy, receptor sensitivity is rated as **medium**.

9.3.9.1.5 Impact Magnitude (or Consequence)

The table below outlines the anticipated impact on economic output and the GDP impact of the spending on goods and services during the construction phase in the various study areas. These are based on the information presented in the economic impact assessment report (Appendix 15), which indicates what activities can be localised and which areas of influence they are most prevalent. **Table 9-12** outlines the anticipated impact on production and GDP impact of the spending on goods and services during the construction period in the various areas of the study area.

Table 9-12 – Construction period impact on production and GDP distribution

Study area	Distribution	Total production impact	Total GDP impact
iZoI	18%	R378.4 million	R171.7 million
Primary/secondary study area	34%	R736.9 million	R334,5 million
Tertiary study area	48%	R1 billion	R470.5 million

Source: Urban-Econ SAM modelling, 2023

The impact is based on the assumed availability of goods and services that will be used during this phase of the Project. Based on the size of the economy of the iZoI, a very low impact on the iZoI is presumed (for TEEPSA components) as most of the goods and services will be imported; however, for the PetroSA component, a high impact is presumed as most accommodation and transport services will be sourced from the iZoI. Goods and services utilised for the pipeline, and modifications to the F-A platform must be sourced from the primary and tertiary study areas. Given the relative size of the impact to that of the study area economies, the impact will be very low (for the TEEPSA component and medium for the PetroSA components).

The positive impact on production and GDP will have **national** impact. However, this impact is considered to be a **short-term** impact, as it will only occur in Year 0, Year 1 and Year 10 of the project. Considering the total impact of capital expenditure of the Project on construction activities, the intensity of the positive impact on production is considered to be **high**, for the PetroSA activities and **low** for the TEEPSA activities. Based on the above, impact magnitude is **high**, for the PetroSA activities, and **low** for the TEEPSA activities,

9.3.9.1.6 Impact Significance

Given the low (TEEPSA activities) and medium (PetroSA activities) sensitivity of receptors and the low (TEEPSA activities) and high (PetroSA activities) impact magnitude of the potential positive

impact on production and GDP during the construction phase, impact significance is expected to be **very low** (TEEPSA activities) and **high** (PetroSA activities).

9.3.9.1.7 Identified Enhancement Measures

In order to enhance the positive impact on economic output during the construction phase, the following enhancement measure is proposed:

- Investigates options for local procurement for pipeline construction to enhance local economic benefits.
- Engage with local forums, business chambers, tourism offices, and collective organisations in order to disclose information and ascertain any issues and/ or concerns.
- Project procurement policy to prioritise supply of goods and services from local suppliers, as appropriate.
- Sub-contractor procurement policies for non-local (iZoI) suppliers.
- Preferential contracting of local (iZoI) companies for goods and services.
- Community/ stakeholder engagement on procurement/ employment/ skills development opportunities.

9.3.9.1.8 Residual Impact Assessment

The enhancement measures will positively impact economic output and GDP during the construction phase. For the TEEPSA component, the significance of the Project will increase to **medium** significance, with enhancement measures. However, impact significance will remain the same for the PetroSA component since the local content is already assumed to be very high at 98%. The residual impact assessment, therefore, remains of **high** significance, for the PetroSA activities.

9.3.9.1.9 Additional Assessment Criteria

The positive impact on economic output and GDP due to spending during the construction phase is considered **irreversible**. There could be potential during the construction phase to increase local spending. However, it is unlikely (due to the lack of local production capabilities and skill levels) that all spending during this phase can be local. The enhancement impact is therefore considered to be **medium**. There will be **no loss of resources**. Cumulative potential is **possible**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.9.2 Impact on Jobs

9.3.9.2.1 Source of Impact

Spending in South Africa on suppliers of goods and services during the Project's construction phase will generate economic activity that will sustain or generate additional employment opportunities. This impact will only occur in Year 0, Year 1, and 10.

9.3.9.2.2 Potential Impact Description

Procuring goods and services will positively impact jobs either by sustaining existing jobs or creating new jobs (on-shore and off-shore). Those employed in direct and indirect activities related to the construction phase will earn a household income, resulting in induced spending in the economy. The impact on employment for the construction period is indicated in Table 9-13.

Table 9-13 – Construction period impact on employment

Impact	Direct	Indirect	Induced	Total
TEEPSA Activities				
Employment	634 jobs	801 jobs	651 jobs	2 086 jobs
PetroSA Activities				
Employment	4 913 jobs	8 934 jobs	6 123 jobs	19 970 jobs
Total				
Employment	5 547 jobs	9 735 jobs	6 774 jobs	22 056 jobs

Source: Urban-Econ SAM modelling, 2023

The total local spend on goods and services during the construction period (total of 3 years) of the Project will support 22 056 jobs, the majority of which will be created by PetroSA for the re-commissioning of the F-A Platform (refurbishment / modifications). The TEEPSA activities will create 634 direct jobs, which can mainly be attributed to the contractors and suppliers involved in the Project and not direct jobs created by TEEPSA during the construction phase, as these are anticipated to be modest. The main sectors estimated to benefit from employment during construction include mining, manufacturing, trade and accommodation, and general government and community services.

9.3.9.2.3 Project Controls

Refer to Section 9.1.9.2.2.

9.3.9.2.4 Sensitivity of Receptors

The sensitivity of the receptors is the same as defined in Section 9.3.9.1.4.

9.3.9.2.5 Impact Magnitude (or Consequence)

The positive impact on employment will have a **national** impact. However, this impact is considered to be a **short-term** impact, as it will only occur in Year 0, Year 1 and Year 10 of the project. Considering the total impact of capital expenditure on employment and the duration of the Project, the intensity of the positive impact on economic output is considered to be **low** for TEEPSA activities but **high** for PetroSA activities. Therefore, the magnitude of the positive impact on employment is considered **low** for TEEPSA activities but **high** for PetroSA activities.

9.3.9.2.6 Impact Significance

Given the very low sensitivity of receptors and the low magnitude of the potential positive impact on employment during the construction phase of the proposed Project, it is considered to be of **very low** significance for TEEPSA activities. For PetroSA activities, however, the impact is **high** as most of the activities can be localised within South Africa.

9.3.9.2.7 Identified Enhancement Measures

In order to enhance the positive impact on employment, the following enhancement measures are proposed:

- Investigate options for local procurement for pipeline construction to enhance local economic benefits.

- Increase procurement spend in South Africa as appropriate.
- Employ local labour (iZoI) to increase benefits to the local community where feasible.
- Sub-contract to local construction companies where possible.
- Skills transfer and knowledge sharing to build local skills bases where possible.
- Community/ stakeholder engagement on procurement/ employment/ skills development opportunities.
- Engage with local forums, business chambers, tourism offices, and collective organisations in order to disclose information and ascertain any issues and/ or concerns.

9.3.9.2.8 Residual Impact Assessment

The mitigation measures will enhance the positive impact on employment during the construction phase. For the TEEPSA activities, if investigations allow the pipeline construction to become more localised, which in turn allows the enhancement of local economic benefits (for the construction of pipes within South Africa), the residual impact can be increased to **medium** significance. For the PetroSA activities, impact significance will remain the same (**high**), given the high local content percentage already applied.

9.3.9.2.9 Additional Assessment Criteria

The positive impact on employment due to spending during the construction phase is considered **irreversible**. There could be potential during the construction phase to increase local spending. However, it is unlikely (due to the lack of local production capabilities and skill levels) that all spending during this phase can be local. The enhancement impact is therefore considered to be **medium**. There will **no loss of resources**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.3.9.3 Impact on Household Income

9.3.9.3.1 Source of Impact

The positive impact on employment will generate additional household income. This impact will only occur in Year 0, Year 1, and 10.

9.3.9.3.2 Project Controls

Refer to Section 9.1.9.3.2.

9.3.9.3.3 Potential Impact Description

Procuring goods and services will positively impact jobs either by sustaining existing jobs or creating new jobs (onshore and offshore). Those employed in direct and indirect activities related to the construction phase will earn an income, resulting in induced spending in the economy. The combined impact on household income for the construction period (in 2022 prices) is indicated in Table 9-14.

Table 9-14 – Construction period impact on income

Impact	Direct	Indirect	Induced	Total
Household income- TEEPSA Component	R148.4 million	R100.3 million	R79.6 million	R328.3
Household Income PetroSA Component	R1.2 billion	R1.2 billion	R746.4 million	R3,1 billion
Household Income (TOTAL)	R1,4 billion	R1.3 billion	R826.0 million	R3.5 billion

Source: Urban-Econ SAM modelling, 2023

The positive impact on employment will increase household income by R3.2 billion for the duration of the construction period for both the TEEPSA and PetroSA components, of which R328.3 million will be a direct benefit from the construction activities for the TEEPSA component. The main sectors estimated to benefit from household income during construction include mining, manufacturing, trade and accommodation, and real estate and business services.

9.3.9.3.4 Sensitivity of Receptors

The sensitivity of the receptors is the same as defined in Section 9.3.9.1.4.

9.3.9.3.5 Impact Magnitude (or Consequence)

The positive impact on household income will have a **national** impact. However, this impact is considered to be a **short-term** impact, as it will only occur in Year 0, Year 1 and Year 10 of the project. Considering the total impact of capital expenditure on employment and, subsequently, household income and the duration of the Project, the intensity of the positive impact on economic output is considered to be **low** for the TEEPSA component but **high** for the PetroSA component. The magnitude of the proposed positive impact on employment is therefore considered to be **low** for the TEEPSA component but **high** for the PetroSA component.

9.3.9.3.6 Impact Significance

Given the very low sensitivity of receptors for the TEEPSA component and the medium and high sensitivity of receptors, and the high magnitude of the potential positive impact on employment during the construction phase for the PetroSA component of the proposed project is considered to be of **very low** significance for the TEEPSA component and **high** significance for the PetroSA component.

9.3.9.3.7 Identified Enhancement Measures

Refer to Section 9.3.9.2.7.

9.3.9.3.8 Residual Impact Assessment

The mitigation measures are anticipated to enhance the positive impact on household income during the construction phase. The significance of the impact of this phase of the Project for the PetroSA component will remain the same since the degree to which local spending can be increased for the construction phase cannot be determined with the information available at the time of report writing, and hence the residual impact significance will remain of **high** significance. For the TEEPSA component, if options for local procurement for pipeline construction to enhance local economic benefits can be secured, the residual impact significance can be enhanced to **medium**.

9.3.9.3.9 Additional Assessment Criteria

The positive impact on household income due to spending during the construction phase is considered **irreversible**. There will be **no loss of resources**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.4 PRODUCTION OPERATIONS

9.4.1 AIR EMISSIONS

9.4.1.1 Impacts on Air Quality

The emissions inventory for the various phases of the Project is provided in Section 6.11. For the production operations phase, the following emission sources have been identified:

- Combustion of marine fuel in main and auxiliary engines, on maintenance vessel; and
- Gas auto-consumption combustion in turbines and flaring which may be required during routine and unplanned maintenance at the F-A Platform.

9.4.1.1.1 Project Controls

See Section 9.1.1.1.2.

9.4.1.1.2 Potential Impact Description

See Section 9.1.1.1.3.

9.4.1.1.3 Sensitivity of Receptors

See Section 9.3.1.1.4.

9.4.1.1.4 Impact Magnitude (or Consequence)

Same as for Section 9.1.1.1.5..

9.4.1.1.5 Impact Significance

Same as for Section 9.1.1.1.6.

9.4.1.1.6 Identified Mitigation Measures

The following mitigation measures are recommended:

- Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes.
- Ensure no incineration of waste occurs within the port limits, subject to obtaining an Atmospheric Emissions Licence.
- Use of onshore power supply during vessel hotelling rather than using onboard generators/boilers, when available.
- TEEPSA will continue to engage with PetroSA regarding the use of good international industry practice in the operation and maintenance of the F-A Platform.

9.4.1.1.7 Residual Impact Assessment

Refer to Section 9.1.1.1.8.

9.4.1.1.8 Additional Assessment Criteria

Refer to Section 9.1.1.1.9.

Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.4.1.2 Impacts on GHG Emissions and Climate Change Aspects

9.4.1.2.1 Source of Impact

The estimated Scope 1 GHG emissions from production activities will result from marine fuel oil consumed by the supply vessel used for subsea maintenance and monitoring. Scope 3 GHG emissions from the F-A Platform will result from gas auto-consumption combustion in turbines and flaring which may be required during routine and unplanned maintenance. The key GHGs for the Project include CO_2, CH_4 and N_2O.

9.4.1.2.2 Project Controls

See relevant controls in Section 9.1.1.1.10.2.

9.4.1.2.3 Potential Impact Description

GHG emissions will contribute to global climate change (indirect **negative impact**). The effect of climate change as a result of increased emissions of heat-trapping GHG's is related to increased temperatures, changing weather patterns and sea level rise.

9.4.1.2.4 Sensitivity of Receptors

Due to the international scale and infrequent occurrence of the impact, receptors are considered to be of **low sensitivity**.

9.4.1.2.5 Impact Magnitude (or Consequence)

The Scope 1 emissions resulting from maintenance of the well field and subsea infrastructure over the lifespan of the Project is calculated to be 256 650 TCO_2e. Within the context of the national GHG inventory and targets, this contribution of GHG emissions is considered to be **low intensity**. Since the impact of medium intensity will have an **international**, and will most likely be **permanent**, the magnitude of the negative impact is considered to be **high**.

The Scope 3 GHG emissions from the F-A platform are anticipated to be 4 049 699 TCO_2e over the Project life span with an average of 161 988 TCO_2e/annum. Within the context of the national GHG inventory and targets, this contribution of GHG emissions is considered to be **medium intensity**. Since the impact of medium intensity will have an **international**, and will most likely be **permanent**, the magnitude of the negative impact is considered to be **very high**.

9.4.1.2.6 Impact Significance

For Scope 1 emissions, taking into account the **high** magnitude of the impact and the **low sensitivity** of receptors, the impact significance is considered to be **medium**, prior to mitigation.

For Scope 3 emissions, taking into account the very **high** magnitude of the impact and the **low sensitivity** of receptors, the impact significance is considered to be **very high**, prior to mitigation.

9.4.1.2.7 Identified Mitigation Measures

Over and above the Project controls listed above, in order to mitigate the negative impact on climate change during the production operations phase, the following mitigation measure is proposed:

- TEEPSA will ensure that the contractors undertake the drilling and construction activities in a manner consistent with good international industry practice and BAT.

9.4.1.2.8 Residual Impact Assessment

For the Scope 1 emissions, with the Project controls and mitigation measures mentioned above, the residual impact could be decreased to **negligible significance**.

For the Scope 3 emissions, with the Project controls and mitigation measures mentioned above, the residual impact could be decreased to **medium significance**.

9.4.1.2.9 Additional Assessment Criteria

The negative impact on climate change during the construction phase is **definite** and considered to be **irreversible**. Cumulative potential is **likely**.Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.4.2 PRESENCE OF SEA FLOOR INFRASTRUCTURE

9.4.2.1 Impact on Local Benthic Environment

9.4.2.1.1 Source of Impact

The physical presence of subsea infrastructure during the production operations phase is likely to have a number of effects on the local ecology, depending both on the locality of the disturbance, type of structure deployed, and water depth of the disturbance. The structures predicted to remain on the seafloor include anchors of metocean buoys as well as any residual cement used during cementing, plugging, and risered drilling stages of well installation.

In particular, the presence of the production pipeline will likely have the most significant impact on the local benthic environments when compared to the other subsea structures, because of the extent of the linear infrastructure (approximately 109 to 115 km, depending on the routing option). The impacts are also dependent on whether the infrastructure remains above the sediment (i.e., as artificial rocky habitat), or if it is buried by sediments.

9.4.2.1.2 Potential Impact Description

Studies available on the impacts of subsea infrastructure at comparative depths have found changes in megabenthic structures over a short (three month) period, particularly in mid-depths, with increased faunal densities found near the pipe (Biede et al. 2022, in Anchor Environmental, 2023). This could be a result of the increased shelter provided by the pipeline and/ or due to organic matter being trapped by the structures and leading to a localised increase in food resource, which could lead to megafaunal aggregations, especially when soft sediment is replaced by hard habitat, albeit artificial (Billet et al. 2001, in Anchor Environmental, 2023). Indeed, subsea oil and gas infrastructure appears to provide a sheltering habitat for fish usually associated with complex reef habitats (such as kingklip and jacopever), and it has been proposed that infrastructure may positively affected larval production, which could subsequently result in increased recruitment success (Blood, 2015, in Anchor Environmental, 2023).

Furthermore, the ‘artificial hard substrate’ infrastructure may become fouled with benthic epifauna resulting in increased diversity and abundance of marine species and ultimate alteration of benthic community structure. While this ‘reef effect’ may have positive implications to certain fish species

that demonstrate a preference for structural seabed features, it may also enhance colonisation by non-indigenous species, thereby posing a threat to natural biodiversity. However, due to the water depths in the Block, colonisation by invasive species is unlikely to pose a significant threat to natural biodiversity in the deep-sea habitats.

Overall, should the infrastructure not become buried in sediment, the physical presence of the pipeline is expected to reduce the area of unconsolidated seabed habitat available for colonisation by infaunal communities but will provide an alternative hard substratum for colonising benthic communities (including VME species) or resulting in faunal attraction to fish and mobile invertebrates. Changes in benthic community structure are likely to occur with the loss of immobile, sedentary soft-bodied species and survival of more robust taxa such as molluscs and crustaceans (Savage et al. 2001, Sciberras et al. 2018, Biccard et al. 2018, in Anchor Environmental, 2023).

The rate of colonisation (and recolonisation) by species on these new substrates will likely vary based on water depth and temperature, with colonisation rates typically being higher in shallower, warmer waters and vice versa (Biede et al. 2022, in Anchor Environmental, 2023). Localised alterations of the local habitat linked to the pipeline are anticipated to be more exacerbated in areas with soft substrate as opposed to hard rocky areas.

The communities present in the vicinity of the pipelines are predicted to closely match the baseline condition in areas with hard substrates over time (Taormina et al. 2018, in Anchor Environmental, 2023). The converse is likely true for naturally soft substrates, where the introduction of hard surface may lead to colonisation by reef species and ultimately form reef habitat outside of its baseline context. The rate of colonisation (and recolonisation) by species on these new substrata will likely vary based on water depth and temperature, with colonisation rates expected to be higher in shallower, warmer waters and vice versa (Mercier et al. 2017, Girard et al. 2019, Biede et al. 2022, in Anchor Environmental, 2023).

9.4.2.1.3 Project Controls

None.

9.4.2.1.4 Sensitivity of Receptors

Preliminary results of the 2022 Environmental Baseline Survey for Block 11B/12B support the presence of largely mosaic habitat types along both pipeline corridor options, indicating that benthic impacts of each route will be similar. However, VME indicator species were found along both proposed pipeline corridors. The sensitivity of receptors is therefore assessed as **high**.

9.4.2.1.5 Impact Magnitude (Consequence)

The increase or modification of a sit''s biodiversity due to the presence of subsea structures would be considered a **site** specific/local impact. Due to the relatively small area which will be altered by this infrastructure and pipeline, coupled with the fact that the pipeline corridor will pass through mosaic areas of both sandy and rocky substrate, the production operations phase impact intensity is rated as being **very low**. Should the pipeline not be buried and remain on the sea floor post-decommissioning, the impact will be **permanent**. This will result in an impact of **very low** magnitude. Should the pipeline be buried, the impact will be short-term and the impact magnitude will remain very low.

9.4.2.1.6 Impact Significance

Taking into account the very low magnitude of the negative impact of the subsea pipeline on the local benthic environment, and the high sensitivity of receptors, the impact significance is considered to be **low**. Should the pipeline be buried, impact significance will be reduced to **negligible**, since receptor sensitivity will reduce to low.

9.4.2.1.7 Identified Mitigation Measures

The following mitigation measures are proposed:

- Once the pipeline is installed, it is recommended that further disturbance along the route is minimised to allow the new (novel) community to stabilise with time.

9.4.2.1.8 Residual Impact Assessment

With the implementation of the mitigation measures, specifically avoidance of marine sensitive areas in terms of pipeline placement, impact significance can be reduced to **very low**, if the pipeline is not buried and is placed on the seabed. If the pipeline is buried, impact significance will remain **negligible**.

9.4.2.1.9 Additional Assessment Criteria

The negative impact on the benthic environment due the physical presence of subsea infrastructure during the production operations phase is considered **partially reversible**, with **high** mitigation potential. Loss of resources is **low** and the cumulative potential **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.4.3 MARITIME SAFETY ZONES

9.4.3.1 Impact on Fisheries

9.4.3.1.1 Source of Impact

Taking into account the proposed subsea production system, umbilical, flowline and production wells, and the safety zones associated therewith, it is estimated at that approximately 63 km^2 of potential fishing grounds will be inaccessible to fisheries.

9.4.3.1.2 Potential Impact Description

Exclusion of fishing vessels from fishing areas could have (indirect) socio-economic implications for the affected industries. Fisheries might be affected by the loss of productive fishing grounds, and therefore may directly impact catch, or CPUE, with (indirect) socio-economic implications for the affected industries, and through the damage/dislocation of fishing equipment deployed in the area by operating activities.

9.4.3.1.3 Project Controls

TEEPSA will co-ordinate with the South African Maritime Safety Agency (SAMSA) that is responsible for maritime safety, health and environmental protection regarding safety zones. After installation of the production wells, subsea infrastructure and pipeline, the locations will be surveyed and marked on bathymetric and navigation charts as a hazard. Maritime shipping, commercial and small-scale fishing sectors will be notified of the presence of the infrastructure.

9.4.3.1.4 Sensitivity of Receptors

As described in Section 9.3.8.1.4, the western Project Development Area overlaps two fisheries, namely the offshore hake demersal trawl fishery and the long-line fishery. The sensitivity of the hake demersal trawl fishery is considered to be **medium**, and the sensitivity of the large pelagic fishery is rated as **high**.

9.4.3.1.5 Impact Magnitude (or Consequence)

Given the small extent of the overlap of the offshore hake demersal trawl fishery and the pipeline corridors, the fact that the area is only fished 20-50%, the intensity of the production phase impacts on this fishery is considered to be very low. With a local extent and long-term duration associated with the production phase, the magnitude of the impact is anticipated to be **low**.

The intensity of the production phase impacts on the large pelagic longline fishery is expected to be low. With a local extent and a long-term duration, impact magnitude is therefore considered to be **low.**

Impact Significance

Taking into account the magnitude of the negative impacts on the activities of the offshore hake demersal trawl fishery (low) and large pelagic long fisheries (low) and the medium (demersal trawl) and high (large pelagic long fishery) sensitivity of receptors, the impact significance is considered to be **very low** for the hake demersal trawl and **low** large pelagic fisheries.

9.4.3.1.6 Identified Mitigation Measures

The following mitigation measures are proposed, over and above the Project controls listed above:

- Establish a stakeholder engagement forum to facilitate ongoing engagement with indigenous people, coastal communities and fisheries associations / organisations, while carrying out its business in the IZoI. Encourage communities to document and report any adverse health effects, incidents, or concerns related to the Project operations.

9.4.3.1.7 Residual Impact Assessment

Through the implementation of the Project controls and proposed mitigation measures, the residual impact significance is considered to remain **very low** for the hake demersal trawl and **low** large pelagic fisheries.

9.4.3.1.8 Additional Assessment Criteria

The negative impact on the fishing sector due to safety zones during the production phase is considered **fully reversible**, with **low mitigation potential**. **Loss of resources is medium** and the cumulative potential **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.4.4 SPENDING ON LOCAL GOODS, SERVICES AND LABOUR

9.4.4.1 Impact on Economic Output and GDP

9.4.4.1.1 Source of Impact

The spending on the annual operation and maintenance of the pipeline and F-A platform will result in a need for goods and services, contributing to GDP growth. This impact will be for the full duration of the operational phase (25 years).

9.4.4.1.2 Project Controls

Refer to Section 9.1.14.1.2.

9.4.4.1.3 Potential Impact Description

The procurement of goods and services for the proposed Project's operational and maintenance aspects will directly benefit production activities, resulting in indirect and induced benefits through backward linkages in the value chain and additional employment opportunities that will be created. The increase in economic output will have a positive impact on the GDP. The annual impact for the operational period (in 2022 prices) is indicated in Table 9-15.

Table 9-15 – Operational period impact on production and GDP (per annum)

Impact	Direct	Indirect	Induced	Total
Economic output	R1 4 billion	R883.0 million	R790.1 million	R3.0 billion
GDP	R690.7 million	R376.5 million	R318.6 million	R1.4 billion

Source: Urban-Econ SAM modelling, 2023

The Project's operational phase will increase economic output by R3.0 billion per year, of which R1.4 billion will be directly related to the Project. The GDP impact due to the increase in economic output is an estimated R1.4 billion per annum. The main sectors estimated to benefit from production and GDP during the operation phase include mining, transport and storage, real estate and business, and manufacturing.

In conjunction with the economic benefits linked to production activities, there will be investment into local economic development initiatives through the SLP. The SLP for 2025 to 2029 allocates funds for LED initiatives. These initiatives will be identified through consultation with the local government to ensure that they meet the needs of communities. Projects that can be funded include economic development, green economy, health and safety, social upliftment and education. Spending on such projects will generate additional economic activity. In addition to spending linked to the SLP, CSI initiatives from TEEPSA will further enhance the economic benefits in the local communities.

Given that the benefits outlined above only consider the benefits of the activities related to the proposed projects, it should be highlighted that the utilisation of the gas by end users will further enhance the positive economic impacts of the Project.

While this assessment is not a cost benefit analysis, given the nature of the Project, the social cost of carbon (SCC) is an important factor to consider when reviewing the economic benefits of the Project. The social cost of carbon measures the economic damages that could result from greenhouse gas (GHG) emissions associated with the project. The total cost estimated GHG emissions of the project must be offset by the economic benefits.

Not considering the F-A platform, it is projected that the direct GHG emissions of the Project will total 1 512 751 TCO_2, and 4 049 699 TCO_2 if the GHG emissions from the F-A platform are included

in the estimations (WSP, 2023b). It is worth noting that in case the gas is earmarked to Gas To Power (Eskom or IPP), the additional power generated would help to retire coal-fired or diesel peaker power plants from the grid, which GHG emissions are much higher than those of the gas power units. The extent by which the GHG emissions of this upstream gas project and its possible Gas To Power activity would offset the saved emissions from the coal or diesel plants has not been factored here.

There are numerous estimates available for the SCC. The economics assessment utilised the findings from Azer, Martin, Johansson and Sterner (2023) and Rennert, Errikson, Prest et al. (2022) to show the combined GDP impact across all phases of the project against the SCC based on the emission estimates for the proposed project. These two research studies show that the SCC ranges between $27.0 to $1 200.0 per tonne of CO_2.

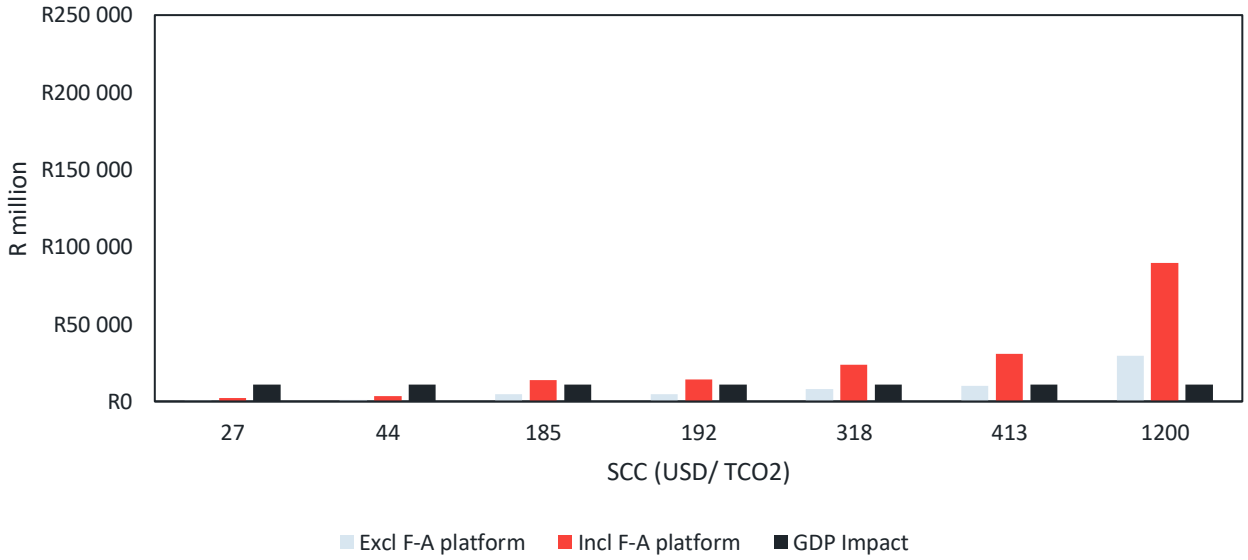

Figure 9-16–- Social Cost of Carbon

Source: Urban-Econ calculations, 2023

At the lower estimations of the SCC, the positive GDP impact of the Project is greater than the total SCC of the project, indicating a net benefit despite the increase in emissions. If the SCC is greater than $185.0/ tCO_2, the net impact will be negative.

9.4.4.1.4 Sensitivity of Receptors

It is anticipated that a large portion of the economic benefits of the operational phase will be captured in the iZoI through services such as logistics and the operations of the off-shore base and the F-A platform. The location of the end-user options is also in the iZoI, which will enhance the economic benefits for the local communities. Additional investment into the local communities through CSI and LED spending will further boost economic activities. Therefore, the positive impact on economic output and GDP during the operational phase is classified as being of **medium** sensitivity.

9.4.4.1.5 Impact Magnitude (or Consequence)

The positive impact on economic output and GDP will have a **regional** impact, given that not all goods and services for the operational phase are located in the iZoI but will also be sourced from the primary area of study. Given the anticipated duration of the production phase, these economic benefits are considered to be **long-term**. The oil and gas industry has stagnated in the iZoI due to the lack of local feedstock. The operations of the Project could, therefore, revitalise the industry. The anticipated intensity of the Project is, therefore, considered to be medium. Therefore, the magnitude of the positive impact on the economy (through economic output and GDP) of the Project's production phase is considered **medium**.

9.4.4.1.6 Impact Significance

Given the medium sensitivity of receptors and the medium magnitude of the potential positive impact on economic output and GDP during the production phase of the Project, it is considered to be of **medium** significance.

9.4.4.1.7 Identified Enhancement Measures

In order to enhance the positive impact on economic output during the productions phase, the following enhancement measure is proposed:

- Prioritise the procurement of goods and services from local suppliers, where possible.
- SLP initiatives for training and skills development to be aligned with technical skills requirements over the production period.

9.4.4.1.8 Residual Impact Assessment

The enhancement measures will positively impact economic output and GDP during the production phase. However, the residual impact significance will remain **medium**.

9.4.4.1.9 Additional Assessment Criteria

The positive impact on economic output and GDP due to spending during the production phase is considered **irreversible**. Through the SLP and the Procurement Progression Plan, enhancement measures are likely to enhance the benefit of the operational phase of the project. There will be no loss of resources. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7for the impact summary.

9.4.4.2 Impact on Jobs

9.4.4.2.1 Source of Impact

Procuring goods and services in the effort to extract gas and the operation of the F-A platform will generate economic activity that will sustain or generate additional employment opportunities. This impact will occur for the duration of the production phase.

9.4.4.2.2 Project Controls

Per Section 41 of the MPRD regulations, an SLP is required for the Project and the development of a Procurement Progression Plan. Based on the draft SLP (2025 – 2029), the following points that directly link to employment will be considered when procurement occurs:

- "Contractors will be required to maximize local content through the employment and training of HDPs.

- HDPs should be provided opportunities to be recruited and to improve their skill sets and advance their capabilities.
- For all training and employment, first priority is given to HDPs."

A Skills Development Plan forms part of the SLP. The Skills Development Plan must be submitted to the relevant Sector Education and Training Authority (SETA) as a Workplace Skills Plan/ Annual Training Report. The Skills Development Plan outlines proposed internship and bursary programmes, mentorship programmes and employment equity plans.

9.4.4.2.3 Potential Impact Description

Activities related to gas extraction and the operation of the F-A platform will have a positive impact on jobs either by sustaining existing jobs or creating new jobs (onshore and offshore) through direct employment (either TEEPSA or PetroSA) or through the procurement of goods and services required for operation. Those employed in direct and indirect activities related to the operational phase will earn an income, resulting in induced spending in the economy. The combined impact on employment for the operational period (in 2022 prices) is indicated in Table 9-16.

Table 9-16 – Operation period impact on employment

Impact	Direct	Indirect	Induced	Total
Employment	266 jobs	1 201 jobs	1 011 jobs	2 478 jobs

Source: Urban-Econ SAM modelling, 2023

The Project's production phase will benefit 2 478 jobs, of which 266 are directly related to the Project. It is anticipated that most of the direct employment will be related to the operations of the F-A platform and not direct jobs created by TEEPSA during the production phase, as these are anticipated to be minimal. The main sectors estimated to benefit from employment during the operation phase include mining, manufacturing, trade and accommodation, and general government and community services.

Through the SLP, there will be an investment in local economic development initiatives, which will support additional employment opportunities in the iZoI. These initiatives will be identified through consultation with the local government to ensure that they meet the needs of communities. Types of projects that can be funded include economic development, green economy, health and safety, social upliftment and education.

9.4.4.2.4 Sensitivity of Receptors

The sensitivity of receptors is considered to be **medium**.

9.4.4.2.5 Impact Magnitude (or Consequence)

It is anticipated that most of the employment opportunities will be in the iZoI. Furthermore, this impact is considered to be a **long-term** impact, as it will only occur for the duration of the production phase of the Project. Considering the total impact of the operational expenditure on employment and the duration of the Project, the intensity of the positive impact on economic output is considered to be **medium**. The magnitude of the positive impact on employment is therefore considered to be **medium**.

9.4.4.2.6 Impact Significance

Given the medium sensitivity of receptors and the medium magnitude of the potential positive impact on employment during the production phase, impact significance is considered to be **medium**.

9.4.4.2.7 Identified Enhancement Measures

In order to enhance the positive impact on employment during the construction phase, the following enhancement measure is proposed:

- Preferential employment of local labour to increase benefits to the local community.
- SLP initiatives for training and skills development to be aligned with Project technical skills requirements over the production period.

9.4.4.2.8 Residual Impact Assessment

The enhancement measures will enhance the positive impact on employment during the production phase by ensuring more local labour can be employed. This will not change the significance rating of the positive impact on employment and hence will remain **medium**.

9.4.4.2.9 Additional Assessment Criteria

The positive impact on employment due to spending during the production phase is considered **irreversible**. Implementing the SLP and plans such as the Procurement Progression Plan can enhance the positive impact on employment. The enhancement potential is therefore considered to be **medium**. There will be **no loss of resources**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7for the impact summary.

9.4.4.3 Impact on household Income

9.4.4.3.1 Source of Impact

The positive impact on employment will generate additional household income. This impact will be for the duration of the production phase of the Project.

9.4.4.3.2 Project Controls

Refer to Section 9.1.14.3.2.

9.4.4.3.3 Potential Impact Description

The Project's operation and maintenance aspects will positively impact jobs either by sustaining existing jobs or creating new jobs (onshore and offshore) through direct job creation and the procurement of goods and services. Those employed in indirect activities related to the production phase will also earn an income, resulting in induced spending in the economy. The combined impact on household income for the operational period (in 2022 prices) is indicated in Table 9-17.

Table 9-17 – Operational period impact on income

Impact	Direct	Indirect	Induced	Total
Household income	R175.0 million	R154.8 million	R128.3 million	R458.2 million

Source: Urban-Econ SAM modelling, 2023

The positive impact on employment will have increased income by R458.2 million per annum for the operational period, of which R175.0 million will be a direct benefit from the operational activities. The main sectors estimated to benefit from household income during the operation phase include mining, manufacturing, transport and storage, and general government and community services.

9.4.4.3.4 Sensitivity of Receptors

Given the current levels household income levels in the iZoI, the proposed project can substantially boost local household income levels; the impact sensitivity is considered **medium**.

9.4.4.3.5 Impact Magnitude (or Consequence)

The positive impact on household income will have a **local** impact. Furthermore, this impact is considered to be a **long-term** impact. Considering the total impact on household income and the duration of the Project, the intensity of the positive impact on economic output is considered to be **medium**. The magnitude of the positive impact on employment is therefore considered to be **medium**.

9.4.4.3.6 Impact Significance

Given the medium sensitivity of receptors and the medium magnitude of the potential positive impact on employment during the production phase of the Project, it is considered to be of **medium** significance.

9.4.4.3.7 Identified Enhancement Measures

In order to enhance the positive impact on household income during the production phase, the following enhancement measure is proposed:

- Project procurement policy to prioritise supply of goods and services from local suppliers where possible.
- Prioritise the use of local labour, including contractors, will be prioritised where possible in line with the Project's Social and Labour Plan.

9.4.4.3.8 Residual Impact Assessment

The mitigation measures are anticipated to enhance the positive impact on household income during the production phase. However, since the degree to which local spending can be increased for the production phase cannot be determined with the information available at the time of report writing, the residual impact significance will remain as **medium**.

9.4.4.3.9 Additional Assessment Criteria

The positive impact on household income due to spending during the production phase is considered **irreversible**. There will be **no loss of resources**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.4.4.4 Impact on Government

9.4.4.4.1 Source of Impact

The positive impact on household income will positively impact the government in terms of household income (personal and corporate) tax generation. Furthermore, given the nature of the

Project, the national government will benefit from the Mineral and Petroleum Resource Royalty (MPRR) taxes as well as a carbon tax.

9.4.4.4.2 Potential Impact Description

Royalties and taxes generated through the project will accrue to the national government, which will be utilised to fund the national budget. The MPRR is levied at a rate of between 0.5% and 5% or 7%, depending on whether the product is refined or unrefined. In 2022, South Africa collected R28.5 billion in royalties.

9.4.4.4.3 Sensitivity of Receptors

Given the scale of the Project's production phase, the positive impact on the government through the increased tax revenue is deemed of **medium** sensitivity.

9.4.4.4.4 Impact Magnitude (or Consequence)

Personal Income Tax, Corporate Income Tax, MPRR and Carbon Tax accrue to the National Government of South Africa. The impact of the positive impact on the government through the Project's operation is, therefore, of national and **high** intensity. The tax benefits of the Project will be over the operational period of the project, resulting in **long-term** benefits for the government, with a **very high** magntidue.

9.4.4.4.5 Impact Significance

Given the medium sensitivity of receptors and the very high magnitude of the potential positive impact on employment during the production phase, it is considered to be of **high** significance.

9.4.4.4.6 Identified Enhancement Measures

No specific enhancement measures are proposed for this impact. If the local content spend can be increased to benefit more local businesses, the South African government will benefit from the additional income and business taxes.

9.4.4.4.7 Residual Impact Assessment

The mitigation measures are anticipated to enhance the positive impact on household income during the production phase. However, since the degree to which local spending can be increased for the production phase cannot be determined with the information available at the time of report writing, the residual impact significance will remain as **high**.

9.4.4.4.8 Additional Assessment Criteria

The positive impact on the government due to the taxes that can be earned during the production phase is considered **irreversible**. There will be **no loss of resources**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.5 DECOMMISSIONING AND CLOSURE

9.5.1 AIR EMISSIONS

9.5.1.1 Impacts on Air Quality

9.5.1.1.1.1 Source of Impact

The emissions inventory for the various phases of the Project is provided in Section 6.11. For the decommissioning phase, the following emission sources have been identified:

- Combustion of marine fuel in main and auxiliary engines, on the drill unit, supply vessels, and tugboat;
- Combustion of kerosene fuel in helicopter engines; and
- Combustion of diesel in generators on vessels.

9.5.1.1.1.2 Project Controls

See Section 9.1.1.1.2.

9.5.1.1.1.3 Potential Impact Description

See Section 9.1.1.1.3.

9.5.1.1.1.4 Sensitivity of Receptors

See Section 9.3.1.1.4.

9.5.1.1.1.5 Impact Magnitude (or Consequence)

Refer to Section 9.1.1.1.5.

9.5.1.1.1.6 Impact Significance

Refer to Section 9.1.1.1.6.

9.5.1.1.1.7 Identified Mitigation Measures

See Section 9.1.1.1.7.

9.5.1.1.1.8 Residual Impact Assessment

Same as for Section 9.1.1.1.8.

9.5.1.1.1.9 Additional Assessment Criteria

Same as for Section 9.1.1.1.9.

Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.5.1.2 Impacts on GHG Emissions and Climate Change Aspects

9.5.1.2.1 Source of Impact

The key GHGs for the Project include CO_2, CH_4 and N_2O. The emission sources associated with the decommissioning phase will result from mobile GHG emissions associated with the drill unit, helicopters, supply / fast supply vessels, and tug boats.

9.5.1.2.2 Project Controls

Refer to Section 9.1.1.1.10.2.

9.5.1.2.3 Potential Impact Description

GHG emissions will contribute to global climate change (indirect **negative impact**). The effect of climate change as a result of increased emissions of heat-trapping GHG's is related to increased temperatures, changing weather patterns and sea level rise.

9.5.1.2.4 Sensitivity of Receptors

Due to the international scale and infrequent occurrence of the impact, receptors are considered to be of **low sensitivity**.

9.5.1.2.5 Impact Magnitude (or Consequence)

GHG emissions for the decommissioning phase are calculated as 51 170 TCO_2e. Within the context of the national GHG inventory and targets, this contribution of GHG emissions is considered to be **very low intensity**. Since the impact of medium intensity will have an **international**, and will most likely be **permanent**, the magnitude of the negative impact is considered to be **very low**.

9.5.1.2.6 Impact Significance

Taking into account the very low magnitude of the impact on climate change and the **low sensitivity** of receptors, the impact significance is considered to be **negligible**.

9.5.1.2.7 Identified Mitigation Measures

Over and above the Project controls listed above, in order to mitigate the negative impact on climate change during the decommissioning phase, the following mitigation measures are proposed:

- Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes.
- Implement effective programmes for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs.
- Optimise helicopter flight paths.

9.5.1.2.8 Residual Impact Assessment

With the Project controls and mitigation measures mentioned above, the residual impact significance will remain **negligible**.

9.5.1.2.9 Additional Assessment Criteria

The negative impact on climate change during the construction phase is **definite** and considered to be **irreversible**. Cumulative potential is **likely**.Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.5.2 UNDERWATER NOISE

Underwater noise will be generated from the drill rig and support/decommissioning vessels. Refer to relevant sections of Section 9.3.2.

9.5.3 AMBIENT AIR NOISE LEVELS

Ambient air noise will be generated from the drill rig and support/decommissioning vessels Refer to Section 9.3.3.

9.5.4 LIGHT EMISSIONS

Light emissions will be generated from the drill rig and support/decommissioning vessels Refer to Section 9.3.4.

9.5.5 MARITIME SAFETY ZONES

9.5.5.1 Impact on Fisheries

9.5.5.1.1 Source of Impact

During decommissioning, a temporary statutory safety zone of 500 m would be required from the drilling. In addition, exclusion zones would be required for decommissioning areas.

9.5.5.1.2 Potential Impact Description

Exclusion of fishing vessels from fishing areas could have (indirect) socio-economic implications for the affected industries. If more than one vessel is active in the vicinity, the exclusion area increases accordingly (CapMarine, 2018). Fisheries might be affected by target species avoiding the construction area, and through the damage/dislocation of fishing equipment deployed in the area by construction activities.

9.5.5.1.3 Project Controls

- Prior to commencement of decommissioning activities, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office.
- These stakeholders should again be notified at the completion of decommissioning activities and when the support vessels are off-location. The Notice to Mariners should give notice of (1) the co-ordinates of the decommissioning areas, (2) an indication of the proposed timeframes of the activities, and (3) an indication of the 500 m safety zones and the proposed safe operational limits of the decommissioning activities.
- These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.
- Once the closure certificate for the plugged wells is issued by the Competent Authority, the requirement for a safety zone will be decided by SAMSA based on an assessment of the risk of the infrastructure as a navigational hazard. Any infrastructure deemed a navigational hazard will remain marked on the navigational charts.

9.5.5.1.4 Sensitivity of Receptors

Same as for Section 9.3.8.1.4.

9.5.5.1.5 Impact Magnitude (or Consequence)

Refer to Section 9.3.8.1.5.

9.5.5.1.6 Impact Significance

Same as for Section 9.3.8.1.6.

9.5.5.1.7 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

- Maintain adequate safety clearance between fishing vessels and decommissioning vessels and equipment through at-sea communications with vessels in the vicinity of the drill area.

9.5.5.1.8 Residual Impact Assessment

See Section 9.3.9.2.8.

9.5.5.1.9 Additional Assessment Criteria

Same as for Section 9.3.8.1.9. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.5.6 SPENDING ON LOCAL GOODS, SERVICES AND LABOUR

9.5.6.1 Impact on Economic Output and GDP

9.5.6.1.1 Source of Impact

The spending on goods and services in South Africa during this phase of the Project will positively impact the economy for the duration of the decommissioning phase (1 year). Currently, the estimates for decommissioning assume that 17% of investment could be spent locally in South Africa (for decommissioning of the wells), and 100% of local spend would be spent on decommissioning the F-A Platform. This translates into a total local spend of R1 billion.

9.5.6.1.2 Project Controls

Refer to Refer to Section 9.1.9.1.2.

9.5.6.1.3 Potential Impact Description

The increase in economic activity due to procuring goods and services during this phase will positively impact the GDP. The total impact of the spending during the decommissioning period (in 2022 prices) is indicated in **Table 9-18**. These impacts will only be for the duration of the decommissioning period (one year) and are thus short-term in nature.

Table 9-18 – Decommissioning period impact on economic output and GDP

Impact	Direct	Indirect	Induced	Total
Production	R1.0 billion	R626,7 million	R563.9 million	R2.2 billion
GDP	R463.8 million	R253.8 million	R227,5 million	R945,1 million
Employment	396 jobs	737 jobs	723 jobs	1 856 jobs

Source: Urban-Econ SAM modelling, 2023

It is estimated that during the decommissioning phase, a total of R2.2 billion will be generated in economic output and R945.1 million in GGP. The main local economic sectors that will be impacted will include transportation and logistics and the manufacturing sector (Cement and Steel).

9.5.6.1.4 Sensitivity of Receptors

It is anticipated that the majority of the positive impact during the decommissioning phase on economic output and GDP will be in the primary study area since not all goods and services are available in the iZoI. Logistics, catering and accommodation services are expected to be available. Still, specialised skills and vessels may need to be sourced from Cape Town or internationally. Taking into consideration the GDP impact of the operational activities, the positive impact is considered to be of **medium** sensitivity.

9.5.6.1.5 Impact Magnitude (or Consequence)

The positive impact on economic output and GDP is anticipated to be mainly regional. This impact is considered to be a short-term impact. The intensity of the positive impact on economic output and GDP is considered to be medium, with the magnitude of the proposed positive impact on economic output being therefore considered **low**.

9.5.6.1.6 Impact Significance

Given the medium sensitivity of receptors and the low magnitude of the positive impact on economic output and GDP due to the decommissioning of the proposed project, the impacts are considered **low** significance.

9.5.6.1.7 Identified Enhancement Measures

In order to enhance the positive impact on economic output during the decommissioning phase, the following measures are proposed:

- Maximise salvageable plant and equipment.
- Ensure that waste material brought onshore is managed by a licenced contractor and disposed of at an authorised landfill.

9.5.6.1.8 Residual Impact Assessment

The enhancement measures may increase the positive impact on economic output and GDP as a result of the decommissioning phase if increased spending in South Africa can be achieved. However, the degree to which this will be feasible is uncertain. Any positive impact will remain short-term after enhancement, and the significance, therefore, remains **low**.

9.5.6.1.9 Additional Assessment Criteria

The negative impact on production and GDP as a result of decommissioning the Project is considered to be **irreversible**. There will be **no loss of resources**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.5.6.2 Impact on Jobs

9.5.6.2.1 Source of Impact

The local spending on goods and services during this phase of the Project will positively impact employment for those directly and indirectly involved in decommissioning activities. However, these benefits will only be for the duration of the decommissioning phase (1 year).

9.5.6.2.2 Project Controls

Refer to Section 9.1.14.2.2.

9.5.6.2.3 Potential Impact Description

Local spending on goods and services required for decommissioning the Project will result in employment benefits for those directly and indirectly involved in the activities of this phase. The total impact on employment during the decommissioning period is indicated in **Table 9-19**. These impacts will only be for the duration of the decommissioning period (one year) and are thus short-term in nature.

Table 9-19 – Decommissioning period impact on employment

Impact	Direct	Indirect	Induced	Total
Employment	396 jobs	737 jobs	723 jobs	1 856 jobs

Source: Urban-Econ SAM modelling, 2023

The Projec''s decommissioning phase will positively impact employment by supporting up to 1 656 jobs for the duration of the phase, of which up to 397 jobs will be directly related to the project. The main sectors estimated to benefit from employment during the decommissioning phase include mining, trade and accommodation, transport and storage, and general government and community services.

9.5.6.2.4 Sensitivity of Receptors

It is anticipated that most of the positive impact during the decommissioning phase on economic output and GDP will be in the primary study area, given that some goods and services, such as highly skilled labour and specialised equipment and vessels, may not be available in the iZoI. Employment estimates vary substantially, and the sensitivity of the proposed positive impact on employment is therefore considered to be **medium**.

9.5.6.2.5 Impact Magnitude (or Consequence)

Employment opportunities that may arise from procuring goods and services during the decommissioning phase are only short-term benefits. Given the current variability in the possible employment opportunities, the intensity is considered medium. Goods and services may be procured from outside the iZoI (logistic support), except for the decommissioning of the FA Platform, which can be secured locally. The impact magnitude is considered to be **low**.

9.5.6.2.6 Impact Significance

Given the low sensitivity of receptors and the medium magnitude of the positive impact on employment due to the procurement activities during the decommissioning phase of the Project, the impacts are considered **low** significance.

9.5.6.2.7 Identified Enhancement Measures

Refer to Section 9.5.6.1.7.

9.5.6.2.8 Residual Impact Assessment

The enhancement measures will increase the positive impact on employment due to the procurement related to the proposed decommissioning. The extent of the residual impact will remain the same, and the effect of the decommissioning activities is considered to be short-term. The magnitude of the residual impact is, therefore, considered to be low. The residual impact assessment, therefore, remains of **low** significance.

9.5.6.2.9 Additional Assessment Criteria

The positive impact on employment as a result of decommissioning the proposed project is considered to be irreversible. There will be no loss of resources. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 7 for the impact summary.

9.5.6.3 Impact on Household Income

9.5.6.3.1 Source of Impact

The local spending on goods and services during this phase of the project will positively impact employment and, therefore, income for those directly and indirectly involved in decommissioning activities. However, these benefits will only be for the duration of the decommissioning phase (1 year).

9.5.6.3.2 Project Controls

Refer to Section 9.1.14.3.2.

9.5.6.3.3 Potential Impact Description

Local spending on goods and services required for decommissioning the proposed project will result in household income benefits for those directly and indirectly involved in the activities of this phase. The total impact on household income during the decommissioning period is indicated in **Table 9-20**. These impacts will only be for the duration of the decommissioning period (one year) and are thus short-term in nature.

Table 9-20 – Decommissioning period impact on income

Impact	Direct	Indirect	Induced	Total
Household income	R173.0 million	R104 million	R92 million	R369 million

Source: Urban-Econ SAM modelling, 2023

Given the variability in the costs related to the decommissioning phase, the estimated impact on household income is estimated to be R369 million. The main sectors estimated to benefit from household income during the decommissioning phase include mining, manufacturing, transport and storage.

9.5.6.3.4 Sensitivity of Receptors

It is anticipated that the majority of the positive impact on household income during the decommissioning phase will be in the primary study area, as goods and services will be sourced from the iZoI as well as the larger commercial hubs like Cape Town. The sensitivity of the proposed positive impact on household income is therefore considered to be **medium**.

9.5.6.3.5 Impact Magnitude (or Consequence)

The positive impact on household income is anticipated to be mainly regional. Considering the current household income levels, the intensity of the positive impact on household income is deemed medium. This impact is considered to be a short-term impact, and the impact magnitude is therefore considered **low**.

9.5.6.3.6 Impact Significance

Given the medium sensitivity of receptors and the low magnitude of the positive impact on household income due to the proposed Project's decommissioning, the impacts are considered **low** significance.

9.5.6.3.7 Identified Enhancement Measures

Refer to Section 9.5.12.1.7.

9.5.6.3.8 Residual Impact Assessment

The enhancement measures could positively impact household income during the decommissioning phase. However, the extent of the Project will remain the same. The residual impact, therefore, remains of **low** significance.

9.5.6.3.9 Additional Assessment Criteria

The negative impact on income as a result of decommissioning the Project is considered to be **irreversible**. There will be **no loss of resources**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 7 for the impact summary.

9.6 ALL PHASES

9.6.1 ROUTINE DISCHARGES TO SEA

9.6.1.1 Source of Impact

Water quality in the vicinity of operations may be impaired by various forms of waste discharged into the marine environment. Normal discharges to the sea can come from a variety of sources. The various kinds of waste produced at sea and management protocols expected for the various Project phases are outlined in Section 6.12.

Over and above discharges, large numbers of marine organisms, including fish and marine mammals, are killed or injured by becoming entangled in debris, while others, including seabirds, are at risk through the ingestion of small plastic particles (Gregory 2009, Wright et al. 2013, in Anchor Environmental, 2023). The problem of litter entering the marine environment has escalated dramatically in recent decades, with an ever-increasing proportion of litter consisting of non-biodegradable plastic materials. Objects that are particularly harmful to marine fauna include plastic bags and bottles, pieces of rope and small plastic particles (Gregory 2009, Wright et al. 2013, in Anchor Environmental, 2023).

9.6.1.2 Project Controls

- As per the applicable requirements in MARPOL 73/7817, food waste will be ground up prior to discharge (i.e., comminuted) to <25 mm diameter to meet discharge requirements. When ground to these specifications, food waste discharges are allowed if the vessel is more than 3 nautical miles (5.6 km) offshore. Food waste that is not ground may be discharged if the vessel is at least 12 nautical miles (22.2 km) offshore when sailing.
- Deck drainage on board support vessels is routinely routed directly overboard, except in areas where hydrocarbons may be released; in these latter cases, deck drainage is directed to the oil skimmers/oily water separators for treatment prior to discharge. Threshold maxima for the discharge will be 15 mg/L (parts per million, ppm) of hydrocarbons, per MARPOL requirements. Water below 15 ppm hydrocarbons content is discharged overboard with sea surface sheen monitoring. Separated oil is transferred to the waste oil tank which will be treated / disposed of onshore at an approved hazardous landfill site.
- Bilge and drain systems are monitored for hydrocarbon contamination. Oily water separators will process bilge and contaminated drain system water. Threshold maxima for the discharge will be

15 mg/L (parts per million, ppm) of hydrocarbons, per MARPOL Annex I requirements. Treated water (below 15 ppm) is discharged overboard; separated oil is transferred to the waste oil tank. The residue from the onboard oil/water separator will be treated and disposed onshore at a licenced hazardous landfill site.

- Vessels must have a Shipboard Oil Pollution Emergency Plan (SOPEP), and a valid International Oil Pollution Prevention Certificate, as required by vessel class.
- All sewage discharges will comply with MARPOL Annex IV requirements. Sewage and grey water will be treated using a marine sanitation device to produce an effluent with:
  - A Biological Oxygen Demand (BOD) of <25 mg/l (if the treatment plant was installed after 1/1/2010) or <50 mg/l (if installed before this date);
  - Minimal residual chlorine concentration of 0.5 mg/l; and
  - No visible floating solids or oil and grease.
- Vessels are required to have a valid International Sewage Pollution Prevention Certificate (ISPPC).
- Vessels must have an onboard certified sewage treatment plant providing primary settling, chlorination before discharge of treated effluent.
- Cooling waters and freshwater surplus generated by the water supply system (including brine) must be tested prior to discharge and will comply with relevant Water Quality Guidelines for residual chlorine, salinity and temperature relative to the receiving environment.
- Contractors will be required to develop a Waste and Discharge Management Plan for all wastes generated at the various sites and a Chemical Management Plan detailing the storage and handling of chemicals, as well as measures to minimise potential pollution.

9.6.1.3 Potential Impact Description

The impacts on marine life depend on the properties of the waste discharged. There may be physiological effects associated with the ingestion of hydrocarbons, detergents and other waste could have adverse effects on marine fauna and marine food chain, which could ultimately result in mortality. The discharge of galley waste and sewage may result in an additional food source for opportunistic feeders, speciality pelagic fish species, but may also lead to the attraction of predatory species, such as sharks and pelagic seabirds, to the aggregation of pelagic fish attracted by the increased food source.

Discharged produced water may contain hydrocarbons at varying concentrations and when discharged in the marine environment could, without treatment, have an immediate detrimental effect on water quality, with the toxic effects potentially resulting in mortality (e.g., suffocation and poisoning) of marine fauna or affecting faunal health (e.g., respiratory damage).

9.6.1.4 Sensitivity of Receptors

The sensitivity of the receptor is **medium**, given that the majority of discharges to sea are not unique to the Project's vessels, but common to the numerous vessels that operate in or pass through South African coastal waters on a daily basis.

9.6.1.5 Impact Magnitude (or Consequence)

Based on the small volumes, distance offshore and prevailing sea conditions, the potential impact of operational discharges from the various Project phases on the marine environment are of medium

intensity, and limited to the immediate area around the vessel, drill unit or production facility. This will result in an impact of **medium** magnitude.

9.6.1.6 Impact Significance

The potential impact of operational discharges on the marine environment is considered to be of **medium** significance with mitigation.

9.6.1.7 Identified Mitigation Measures

Over and above the Project controls, the following key mitigation measures are proposed:

- Prohibit operational discharges within (or up current from) any area that is designated as a marine sensitive area, during surveying or transit to and from the drill/construction sites.
- Low-toxicity biodegradable detergents should be used in the cleaning of deck spillages.
- Spill management training and awareness to be provided to crew members as part of the SOPEP to ensure thorough clean-up of any spillages immediately after they occur, in order to minimise the volume of contaminants washing off decks.
- All reasonable measures must be implemented to ensure that no littering takes place during the various Project phases.
- TEEPSA will continue to engage with PetroSA regarding the use of good international industry practice in the operation and maintenance of the F-A Platform.

9.6.1.8 Residual Impact Assessment

With the Project controls and mitigation measures in place, impact significance of routine discharges to sea can be reduced to **low**.

9.6.1.9 Additional Assessment Criteria

Probability of the impact is **definite**. The loss of resources is **low** and mitigation potential **high**. Cumulative potential is unlikely. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.6.2 DISCHARGE OF BALLAST WATER

9.6.2.1 Introduction of Non-indigenous Invasive Marine Species

9.6.2.1.1 Source of Impact

Ballast water and infrastructure associated with oil and gas production will, over time, develop a fouling community of marine epifauna which may consist of alien invasive species (Atkinson 2010, Biccard et al. 2018). Ballast water will be used and discharged by, for example, construction support vessels and the drilling unit (rig) with dynamic positioning system that will be used (at the well location, the pontoons are partially ballasted with seawater for stability). While this risk is present across all Project phases, the risk is highest during phases when vessels from outside the South African EEZ are first operational i.e., during the construction phase.

9.6.2.1.2 Potential Impact Description

Ballast water is either freshwater or seawater taken up at ports of departure and discharged on arrival where new water can be pumped aboard, the volume dependant on the cargo load. Ballast water is used to maintain trim and stability in ships, especially when partially loaded or empty. It is pumped on board into the holds or ballast tanks of a ship in whatever port cargo is unloaded.

Ballast water usually contains a certain amount of sediment as well as many species of living marine organism from the port of origin. Some of these species are able to survive in the ballast tanks/holds on their journey from one port to another and are then discharged with the ballast water and sediment when a new load of cargo is taken on board. After being released, some of these organisms secure a foothold in their new environment and may even flourish in the absence of their natural predators and diseases.

This applies to larger organisms as well as microscopic ones such as red tide forming phytoplankton and disease organisms such as cholera and hepatitis. These exotic organisms can therefore pose a serious risk to local marine ecosystems, to the economy of a country (e.g., by affecting local fishing or aquaculture industries), and to human health. The magnitude of this risk is exemplified by the large volumes of ballast water that are transferred around the world every year. It is estimated that on average, 3 000 to 4 000 species are transported between continents by ships each day (Carlton & Geller 1993, in Anchor Environmental; 2023).

The movement of the artificial structures and infrastructure and their associated biofouling communities from one place to another in the ocean also provides an opportunity for the translocation of alien invasive species. Introduction of alien invasive species may also take place via discharge of ballast water, containing eggs, cysts and larvae. Relocated organisms may be able to thrive and out-compete indigenous species naturally occurring in the environment, resulting in a loss of overall regional biodiversity and, in extreme cases, an invasion of the foreign species.

It is likely that drilling units, and some of the support vessels contracted for the Project would have spent time outside of South Africa's exclusive economic zone prior to drilling. Exposure to foreign water bodies and time spent in port would increase the risk of alien invasive species introduction.

9.6.2.1.3 Project Controls

- De- and re-ballasting of vessels must be undertaken only under strict adherence to International Maritime Organisation (IMO) 2004 International Convention for the Control and Management of Ship's Ballast Water and Sediments.
- Other precautionary guidelines recommended by the IMO include:
  - During the loading of ballast, every effort should be made to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms, through adequate filtration procedures;
  - Where practicable, routine cleaning of the ballast tank to remove sediments should be carried out in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the shi''s ballast water management plan; and
  - Avoidance of unnecessary discharge of ballast water.
- A ballast water management plan must be prepared and implemented for the drilling unit and support and construction vessels.

9.6.2.1.4 Sensitivity of Receptors

Due to the highly dynamic, wave-exposed coastline of South Africa, which contributes to minimising the establishment of alien invasive species (Blood, 2015, in Anchor Environmental, 2023), the sensitivity of the receptors is considered to be **low**.

9.6.2.1.5 Impact Magnitude (or Consequence)

The potential impact related to the introduction of alien invasive marine species is considered to be of high intensity, over the long-term and with an extent ranging from regional to national, resulting in a **very high** magnitude.

9.6.2.1.6 Impact Significance

Based on the low receptor sensitivity and very high magnitude, the significance of the impact is considered to be **high**.

9.6.2.1.7 Identified Mitigation Measures

The following mitigation measure is proposed:

- Infrastructure (e.g. wellheads, BOPs and guide bases) used in other locations must be thoroughly cleaned before deployment.

9.6.2.1.8 Residual Impact Assessment

With the implementation of the Project controls and recommended mitigation measures, impact significance will reduce to **medium**.

9.6.2.1.9 Additional Assessment Criteria

Probability of the impact is **unlikely**. The loss of resources is **high** and mitigation potential **high**. Cumulative potential is **possible**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.6.3 PRESENCE OF ABOVE WATER INFRASTRUCTURE

9.6.3.1 Impact on Avifauna

9.6.3.1.1 Source of Impact

Above water infrastructure associated with the various Project phases include drilling rigs, support vessels and the F-A Platform itself.

9.6.3.1.2 Potential Impact Description

Seabirds are the predominant group affected by above water infrastructure. It is well established that seabirds are attracted to offshore above water infrastructure for use as roosting sites, due to foraging opportunities (platforms tend to aggregate food availability), and due to disorientation by and attraction to light sources.

The presence of above water infrastructure can have direct lethal effects on seabirds, through direct collisions, flame from gas flares and exposure to oil. There are also documented sub-lethal effects, even when direct collisions are avoided, where migratory birds that circle platforms for long periods deplete body reserves and die especially when inclement weather limits visibility. Other sub-lethal effects include displacement from feeding habitats due to industrial activity, increased exposure to predators and increased exposure to hazardous substances discharge from the rig. These lethal and sub-lethal effects can affect both individual birds as well as resident and migratory populations.

9.6.3.1.3 Project Controls

None.

9.6.3.1.4 Sensitivity of Receptors

While species listed as globally Endangered or Critically Endangered may potentially occur in the area, Block 11B/12B is located along a main marine traffic route, and therefore receptor sensitivity is assessed as **medium**.

9.6.3.1.5 Impact Magnitude (or Consequence)

The extent of the impact is considered small, concentrated around the site i.e., just around the infrastructure itself, with a long-term duration, persisting for the entirety of the production period. Impact magnitude is therefore rated as **low**.

9.6.3.1.6 Impact Significance

Based on the to medium sensitivity of the receptors offshore and the low magnitude, impact significance without mitigation is assessed as **low**.

9.6.3.1.7 Identified Mitigation Measures

The following mitigation measures are recommended:

- Include training on how to care for downed seabirds as part of the induction and awareness training programme for the Project.
- Monitor the presence of seabirds and identify mortalities, even when birds do not land on the vessel, especially in foggy conditions and at night.
- Report ringed/banded birds to the appropriate ringing/banding scheme (details are provided on the ring).

9.6.3.1.8 Residual Impact Assessment

With the implemented mitigation measures, residual impact significance is expected to remain **low**.

9.6.3.1.9 Additional Assessment Criteria

The probability of the impact is **definite**. The loss of resources is **low** and mitigation potential **low**. Cumulative potential is **possible**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.6.4 IMPACT ON INTANGIBLE CULTURAL HERITAGE

9.6.4.1 Potential Impact Description

According to Boswell (2023), any impact on the integrity of the coastal and marine ecosystem through disturbance, pollution, noise, etc. from the various Project phases could negatively impact various aspects which make up people's intangible cultural heritage. The following key potential impacts are noted from an ICH perspective (Boswell, 2023):

- Project activities, such as helicopters, could disturb rituals which take place all year round; these impacts could however be mitigated with timely, sustained and relevant healer-diviner and First Peoples' Chief interventions.
- Project activities in Block 11B/12B, specifically maritime safety zones, may affect the livelihood of coastal communities, especially small-scale fishers. For small-scale fishers, fishing is not merely for food; it is part of culture. Other livelihood uses of the sea (i.e., seaside restaurants, sporting use of the sea, tourism) also advance cultural heritage.

- Natural and cultural heritages are interdependent; people use nature in their cultural and ritual practices. Any pollution or other form of negative impact on the sea arising from Project activities, such as air emissions, light and noise from the drill unit and supply and specialised vessels, may impact on natural phenomena (i.e., fish, shellfish, fynbos, mangroves, penguins, beach), which in turn may form part of cultural heritage practices.
- The sea is used for health purposes. Nguni and Khoi-San peoples believe in the ocean's curative and cleansing properties and collect them for spiritual and physical cleansing. The water is ingested for ritual cleansing purposes. People bathe in the seawater and kneel at the beach to revere ancestral spirits and also the sea itself (Boswell, 2023). Although Project activities will largely take place far from shore, any pollution or other form of negative impact on the sea, arising from Project activities (e.g. routine discharges to sea, drill cuttings discharges, etc.) might affect health uses of the sea. i.e., the water is no longer perceived as pristine enough for bathing, etc. or for ritual use. In an interview with a Khoi-San Chieftainess, she expressed concerns about oil and gas exploration and developments. Her concerns were about polluting endangered species within the ocean, the ecosystems and life within the ocean. She also recalled an oil spill in January 2023. There was no indication of the source of the oil spill, and no one was held accountable (Boswell, 2023).

9.6.4.2 Project Controls

- TEEPSA will ensure that contractors undertake Project activities in a manner consistent with good international industry practice and Best Available Techniques (BAT).
- TEEPSA will ensure that contractors undertake Project activities in compliance with the applicable requirements in MARPOL 73/78.

9.6.4.3 Sensitivity of Receptors

The overall sensitivity of the receptors is considered to be **medium** for all Project activities.

9.6.4.4 Impact Magnitude (or Consequence)

The extent of the impact is regional. The potential impact is considered to be of high intensity due to perceived impacts. Project activities that will take place over the short-term, such as exploration, construction and decommissioning, will result in a **medium** impact magnitude. For the longer-term activity, namely the Production Phase, impact magnitude will increase to **very high**.

9.6.4.5 Impact Significance

The significance of the impact for the exploration, construction and decommissioning phases is considered to be **medium** before mitigation. For the Production Phase, pre-mitigation impact significance will be **high**.

9.6.4.6 Identified Mitigation Measures

The following mitigation measures are proposed:

- Establish a stakeholder engagement forum to facilitate ongoing engagement with indigenous people, coastal communities and fisheries associations / organisations, while carrying out its business in the IZoI. Encourage communities to document and report any adverse health effects, incidents, or concerns related to the Project operations.
- Implement a project-specific Grievance Mechanism and ensure effective implementation through independent verification undertaken annually.

- Engage with relevant communities to undertake a ritual event/s that supports communities' engagement with ancestral spirits and with living communities/indigenous people to allow for the usage of the sea. Details to be developed as part of the Project's Stakeholder Engagement plan.
- Implement a gender-sensitive ritual event that recognises gendered coastal cultural heritage to permit all genders to articulate their cultural relation with the sea and coast. Details to be developed as part of the Project's Stakeholder Engagement plan.
- Identify appropriate cultural sites and heritage research within IZoI for consideration in the TotalEnergies Corporate Social Investment programme.

9.6.4.7 Residual Impact Assessment

Sustained consultation with relevant stakeholders and the possible implementation of ritual events that permit engagement with ancestral spirits may alleviate the potential and future negative impacts of non-consultation and poor cultural respect. The proposed mitigation would reduce the intensity to low for those community members who accept the mitigation measures (i.e., specified ritual events to engage the will of the ancestors and living communities), leading to a residual impact of **very low** significance, for the exploration, construction and decommissioning phases, and **medium** for the production operations. The intensity of the impact could however remain high and the magnitude medium to very high for those people who are categorically opposed to the Project.

9.6.4.8 Additional Assessment Criteria

The negative impact on intangible cultural heritage for all Project phases is **unlikely** and considered to be **partially irreversible**. Cumulative potential is **possible**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.6.5 IMPACT ON COMMUNITY HEALTH, SAFETY AND SECURITY

9.6.5.1 Source of Impact

The following sources of impacts on community health, safety and security have been identified:

- Potential for anti-social behaviour due to Project personnel socialising and interacting with the local community
- The potential for conflict with established community member due to a disregard for or lack of understanding of local customs and traditions by newcomers in the community
- Emissions from the drilling rig and support and supply vessels while offshore and in port

9.6.5.2 Project Controls

The following project controls have been identified:

- TEEPSA will ensure that contractors undertake Project activities in a manner consistent with good international industry practice and Best Available Techniques (BAT).

9.6.5.3 Potential Impact Description

The potential for anti-social behaviour within communities, including an increase in communicable diseases resulting from Project workers spending leisure time in local communities, even if the opportunity for interaction with the local community is limited. Local communities are aware that security and safety issues are linked to the lack of work opportunities for unskilled or low-skilled job

seekers and the anti-social behaviour of criminal activity and substance abuse are linked to the lack of constructive alternatives.

A lack of understanding of local culture and traditions may result in tensions between Project personnel who are newcomers to the community and established community members. The potential for this is limited by the low number of local personnel required for most Project phases. However, the production phase over a 25-year period has the greatest potential for community health, safety and security issues to arise as newcomers seek opportunities associated with the Project.

The emissions from support and supply vessels while they are in port and utilise diesel-powered on-board generators for power supply will potentially increase emissions in the local airshed. There is not sufficient information to confirm the anecdotal attribution of poor health to exceedances of ambient air quality limits, but communities are concerned that Project activities may result in a decrease of ambient air quality with consequent health effects.

9.6.5.4 Sensitivity of Receptors

The health, safety and security of coastal communities are considered to be of **medium** sensitivity, taking into consideration such factors as the baseline ambient air pollutants on community health and the possibility of anti-social behaviour and communicable diseases due to Project workers spending leisure time within local communities.

Local communities are small tight-knit and have specific cultural norms that, due to a lack of understanding of and respect for these traditions, can result in tensions between established community members and newcomers.

Given that the well drilling, construction, closure and survey phases of the project will rely primarily on expatriates to undertake the work, there is limited opportunity for interaction with local communities. The extended production phase is when impacts on community health, safety and security might manifest and project controls will be required to be pro-actively implemented to mitigate impacts.

9.6.5.5 Impact Magnitude (or Consequence)

For all phases of the Project, negative impacts on community health, safety and security are expected to have a **local** impact over a **long-term** duration. The intensity of the negative impacts on community health, safety and security is **medium**. The sensitivity of the communities to these impacts is considered assessed as medium. As a result, the magnitude of the potential negative impact on community health and safety is **medium**.

9.6.5.6 Impact Significance

The significance of the impacts is considered to be **medium** before mitigation.

9.6.5.7 Identified Mitigation Measures

The following mitigation measures are proposed:

- Engage with local communities, government agencies, and other stakeholders throughout the Project process to understand community concerns regarding health, safety and security issues.
- Maintain the project-specific grievance mechanisms and ensure that it is implemented effectively through independent verification on an annual basis.

- Coordinate with the MBLM emergency and rescue services and provide support (training and resources) as part of TotalEnergies Corporate Social Investment programme.
- As part of TotalEnergies Corporate Social Investment programme, invest in programmes focused on substance abuse and gender-based violence by connecting with relevant NGOs and CBOs to ascertain where assistance is needed.
- Ensure that Project personnel are made aware of local customs and traditions and the need to respect cultural norms.
- Minimise emission from vessels while in port, specifically the use of generators for power, using quayside electrical connection, where available.

9.6.5.8 Residual Impact Assessment

Given the limited opportunity for interaction with the local community for most of the Project phases and with pro-active implementation of the proposed mitigation measures, impacts to community health, safety and security should be minimised.

Implementation of mitigation measures to address any instances of tensions conflict and health impacts that arise as a result of Project activities will reduce the intensity of the impact to **low** and consequently the residual impact significance is considered to be **low**.

9.6.5.9 Additional Assessment Criteria

The probability of the impact occurring is considered **likely**; however, with implementation of Project controls, the impact is considered **partially reversible**. The mitigation potential is **medium**. The cumulative potential is **unlikely**. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.6.6 IMPACT ON HOUSEHOLD LIVELIHOOD

9.6.6.1 Source of Impact

The following impacts have been identified on household livelihoods due to Project activities in all phases of the Project:

- Adverse impacts on livelihoods of small-scale fishers resulting from to a reduction in fish catch due to a decrease in the abundance of fisheries species caused by the disturbance to or destruction of habitat.
- An increase in household livelihood resulting from direct income generation due to increased employment opportunities generated by the Project, whether these opportunities are direct, indirect or induced.

9.6.6.2 Potential Impact Description

The impact on household livelihoods will depend on the number of direct, indirect and induced employment opportunities supported by the Project activities. Where households are able to benefit from these opportunities the outcome magnitude is medium and the significance of the benefit is medium.

The need to minimise Project activities impacting on households that are dependent on fishing activities for their livelihood is to prevent a differential impact falling on those households where the

security of the livelihood is marginal and any reduction in the ability to maintain the livelihood activity will affect food security and the general wellbeing of the household.

9.6.6.3 Project Controls

- As per the SLP, TEEPSA will:
  - Develop a database to define the HDP and status of its potential suppliers, which will include elements of ownership as well as management.
  - Current and all future non-HDP suppliers will be either part of "strengthening, development" or Joint Venture programmes, depending on their level of competitiveness and importance to the Project.
  - Suppliers will be encouraged to subcontract portions of their work to HDPs, or procure goods and services from HDPs, or otherwise assist in promoting the progression of HDPs in the industry.
  - Contractors will be required to maximise local content through the employment and training of HDPs:
    - HDPs should be provided opportunities to be recruited and to improve their skill sets and advance their capabilities.
    - For all training and employment, first priority is given to HDPs.
- TEEPSA's local recruitment procedure will be used to guide the recruitment process. The procedure should be disclosed to communities through engagement undertaken as part of the corporate stakeholder engagement process.

9.6.6.4 Sensitivity of Receptors

The sensitivity of household livelihood to the during the construction phase is of **medium sensitivity**, as these receptors are likely to derive a substantial level of benefits or opportunities from the Project. The number of community members benefiting from construction phase economic activities is deemed to be high considering the number of local employment opportunities available, the size of the population in question and the extent of the primary study area.

9.6.6.5 Impact Magnitude (or Consequence)

Positive impacts on household livelihood are expected to be **local** and will be over the **long-term** given the duration of the Project lifecycle. The intensity of the positive impacts on household livelihood is **medium** and the magnitude of the potential positive impact on household livelihood is **medium**.

9.6.6.6 Impact Significance

Considering the magnitude of the potential positive impact on household livelihood (medium) and the medium sensitivity of receptors, the impact significance is **medium**.

9.6.6.7 Identified Mitigation Measures

The following mitigation measure is proposed, over and above the Project controls listed above:

The following project controls have been identified:

- Pre-screening surveys will be undertaken to identify the most appropriate location for well drilling and installation of subsea infrastructure and the pipeline to minimise disturbance to benthic habitat.
- As per the SLP, TEEPSA will:
  - Develop a database to define the HDP and status of its potential suppliers, which will include elements of ownership as well as management.
  - Current and all future non-HDP suppliers will be either part of “strengthening, development” or Joint Venture programmes, depending on their level of competitiveness and importance to the Project.
  - Suppliers will be encouraged to subcontract portions of their work to HDPs, or procure goods and services from HDPs, or otherwise assist in promoting the progression of HDPs in the industry
  - Contractors will be required to maximise local content through the employment and training of HDPs:
  - HDPs should be provided opportunities to be recruited and to improve their skill sets and advance their capabilities.
  - For all training and employment, first priority is given to HDPs

TEEPSA’s local recruitment procedure will be used to guide the recruitment process. The procedure should be disclosed to communities through engagement undertaken as part of the corporate stakeholder engagement process.

9.6.6.8 Residual Impact Assessment

The significance of the residual impact is **high**, with the implementation of the enhancement measures given the regional extent and long-term duration of the positive impact.

9.6.6.9 Additional Assessment Criteria

The positive impacts on the livelihood of communities are considered to be **likely** with a **low** enhancement potential and **possible** cumulative potential. Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.6.7 IMPACT ON LIVELIHOOD OF FISHERS

9.6.7.1 Source of Impact

The following sources of impact have been identified:

- A restriction on commercial, small-scale, recreational or mariculture activities within Block11B/12B Application Area with due to:
- The establishment of 500 m radius temporary safety zones around areas where Project vessels are undertaking exploration and production well drilling, construction, closure or survey activities, including the safety zone established around the metocean buoys that may be deployed for up to a year within Block 11B/12B.
- The establishment of a safety zone around the area where the subsea infrastructure is installed and a safety zone of 250 m to either side of the pipeline to the F- A Platform.

- A reduction in fish catch due to a decrease in the abundance of fisheries species caused by the disturbance to or destruction of habitat as a result of well drilling, construction, closure and survey activities.

9.6.7.2 Potential Impact Description

There is no overlap between Block 11B/12B and fishing grounds for inshore hake trawling, demersal longline fishing, mid-water trawl fishing, traditional/commercial line fishing, small pelagic purse seine fishing and south coast rock lobster fishing.

There is an overlap of Block 11B/12B with established fishing grounds for deep-sea hake trawling but this is outside of the Project Development Area and the overlap with the Exploratory Priority Area is limited to a small area along the northern boundary. There is an overlap with large pelagic longline fishing grounds and Block 11B/12B; however, the assessment indicated that this area is fished 38.5% of the time, on average, per annum. There is also limited overlap in the north-east corner of Block 11B/12B with squid jig fishing, and the intensity of fishing is described as 'high' in this area.

The establishment of temporary and permanent safety zones within areas of Block 11B/2B is limited to a 500 m radius around the specific locations where Project activities take place. During the exploration, construction and closure phases and while survey work is undertaken, TEESPA will notify SAMSA who will issue a Notice to Mariners regarding the establishment of temporary safety zones for the duration of activities, prior to the commencement of works.

The permanent safety zone around the production wells, subsea infrastructure installation and pipeline will possibly prevent large pelagic longline fishing and squid jig fishing in certain areas of Block 11B/12B.

The reduction in fish catch due to disruption to the abundance of valuable fish species will increase the effort required by fishers to fill quotas. This may result in fishers abandoning the fishing ground altogether or fishers having to leave the industry due to fewer fishing licenses being issued due a reduction in the total allowable catch.

9.6.7.3 Project Controls

- TEEPSA will ensure that contractors undertake Project activities in a manner consistent with good international industry practice and Best Available Techniques (BAT).

9.6.7.4 Sensitivity of Receptors

The sensitivity of the fishing sectors (commercial, small-scale, recreational or mariculture) is based on the potential resilience of the sector to disruption from activities such as those proposed in Block 11B/12B.

While all fishing activity is subject to the seasonal weather conditions and annual catch variability, the small-scale sector is not as well established as commercial fishers, in terms of capital investment, access to markets or financial reserves to continue operations when activities are disrupted by limitations on access to established fishing grounds. For the mariculture industry, the cultivation of mariculture species for the export market is an important industry. One mariculture farm operates in the region to the east of Block 11B/12B.

Although some small-scale fishers have an allocation of the catch for commercially important species and may utilise the commercial fishing grounds through cooperative means or as crew on

commercial linefishing or squid fishing vessels, most small-scale fishers (as defined in the Marine Living Resources Amendment Act, 2014) limit their activities to within the intertidal zone, the near shore or undertake single day fishing trips.

The sensitivity of the commercial fishing industry, recreational fishing and the mariculture industry is considered **low**. The sensitivity of small-scale fishers is considered **medium** in the western Project Development Area and **high** in the eastern Exploratory Priority Area.

9.6.7.5 Impact Magnitude (or Consequence)

The magnitude of the impacts of the temporary safety zones established during the well drilling, construction, closure and survey phases on commercial, small-scale, recreational or mariculture fisheries is considered **very low** due to the short-term and localised extent of the impact that is fully reversible, once the Project activities have ceased at that location.

The magnitude of the impacts of the temporary safety zones for the above Project phases on small-scale fishers is considered **very low** due to the short-term and localised extent of the impact that is fully reversible once activities have ceased.

The magnitude of the impacts of the permanent safety zones for the production phase of the Project on commercial, small-scale, recreational or mariculture fishers is considered **medium**.

The magnitude of the impacts of the permanent safety zones for the production phase of the Project on small-scale fishers is considered **low**.

The impact of the reduction in fish catch due to disruption to the abundance of fisheries species on commercial, small-scale, recreational or mariculture is considered **high**. The same impact on small-scale fishers is considered **medium**.

9.6.7.6 Impact Significance

The significance of the impact of the temporary safety zone on commercial, small-scale, recreational or mariculture fisheries is **negligible**.

The significance of the impact of the temporary safety zone on small-scale fishers is **very low**.

The significance of the impact of a reduction in fish catch on commercial, small-scale, recreational or mariculture is **medium**.

The significance of the impact of a reduction in fish catch on small-scale fishers is **medium**.

9.6.7.7 Identified Mitigation Measures

The following mitigation measures will be instituted to minimise the impacts:

- Once the subsea infrastructure and pipeline is installed, the location will be surveyed and the coordinates sent to SAMSA. Following a risk assessment, SAMSA will establish a permanent safety zone around the area of installation and instruct the Hydrographic Office to show any areas deemed a risk to navigation as a hazard on navigation charts and bathymetric maps. This will remain on maps and charts for the duration of the production phase and possibly indefinitely, depending on the extend of removal of subsea infrastructure during the closure phase.
- No Project activities will occur in designated Marine Protected Areas and the subsea infrastructure will be placed to minimise any disturbance to ecologically or biologically sensitive

areas. If necessary, an out-of-kind offset or compensation will be included in the Biodiversity Management Plan.

- Pre-screening surveys will be undertaken to identify the most appropriate location for well drilling and installation of subsea infrastructure and the pipeline to minimise disturbance to benthic habitat.
- Establish a stakeholder engagement forum to facilitate ongoing engagement with indigenous people, coastal communities ad fisheries associations / organisations, while carrying out its business in the IZoI. Encourage communities to document and report any adverse health effects, incidents, or concerns related to the Project operations.
- Implementation of a grievance mechanism that allows the community to lodge a grievance with the Project.

9.6.7.8 Residual Impact Assessment

The residual effect of the impact of the temporary safety zones is substantially the same as for the unmitigated impact given that the temporary safety zones will be limited spatially and of a short duration and the significance of the residual impact is considered **negligible** for commercial, small-scale, recreational or mariculture fishing for all Project phases. The significance of the residual impact on small-scale fishers is **very low** for well drilling, construction, closure and survey phases and **low** for the production phase. This is due to the limited overlap of fishing grounds with the Project Development Area.

The avoidance or minimisation of impacts to benthic habitat is the most effective means of minimising the residual impact of disturbance or destruction of benthic habitat that may result in the reduction in abundance of fish species. With pre-screening surveys informing the placement of production wells and subsea infrastructure together with the pipeline alignment, disturbance to benthic habitat can be avoided entirely or, minimised. This will reduce the impact to **low** to **negligible**.

9.6.7.9 Additional Assessment Criteria

The probability of potential impacts on fishing activity for commercial and recreational fishing and mariculture activity is considered unlikely and, with implementation of Project controls, the impact is considered **fully reversible**. The mitigation potential is **high**. The loss of resource is **low**, and the cumulative potential is **unlikely**.

The additional assessment criteria for small-scale fishers during the well drilling, construction, closure and survey phase is similar to other fishery groups, with the exception that the sensitivity of the receptor is **medium.** The probability of the impact occurring is considered **possible** and, with implementation of Project controls, the impact is considered **fully reversible**. The mitigation potential is **medium**. The loss of resource is **low**, and the cumulative potential is **unlikely**.

Refer to the impact assessment tables in Appendix 4 for details pertaining to the impact ratings, and Section 9.7 for the impact summary.

9.7 IMPACT ASSESSMENT SUMMARY

The impact summary table for normal operation are provided in the table below.

Table 9-21 – Impact Summary Table: Normal operations

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
1	Exploration	Air emissions	Impacts on air quality	**Negligible** (offshore) **Very low** (offshore)	• TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 - Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass). • Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities. • Ensure that contractors make use of efficient flare tips, as appropriate. • Optimise well test programme to reduce non-routine flaring as much as possible during the test. • Commence with well testing during daylight hours where feasible due to poor dispersion potential during night-time hours. • Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons to minimise emissions and hydrocarbon 'drop-out' during well testing. • Flare inspections and maintenance, as well as performance monitoring, to ensure reduced malfunctions and interruptions. • Burning emissions from well testing or purging shall be minimised by optimising the burning system design and the testing procedures.	• Optimise rig movement and the logistics (number of trips required to and from the onshore logistics base) to reduce fuel consumption. • Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes. • Ensure no incineration of waste occurs within the port limits, subject to obtaining an Atmospheric Emissions Licence. • Use of onshore power supply during vessel hotelling rather than using onboard generators/boilers, when available.	**Negligible** (offshore) **Very Low** (onshore)
2	Exploration	Air emissions	Impacts on GHG emissions and climate change	**Medium**	• TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 - Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass). • Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities. • A maintenance plan will be implemented to ensure all diesel equipment receives adequate maintenance to minimise GHGs released to the atmosphere and maximise the energy efficiency. • The drill unit, pipelaying vessel, support vessels and survey vessel will be required to prepare a Ship Energy Efficiency Management Plan (SEEMP) that complies with the IMO 2022 guidelines.	• Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes. • Implement effective programmes for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs. • Optimise helicopter flight paths. • Optimise well test and monitor the efficiency of the flare programme to reduce burning as much as possible during the test. • Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons in order to minimise emissions and hydrocarbon 'drop-out' during well testing.	**Negligible**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
3	Exploration	Underwater noise from drill rig and support vessels	Physical injury or disturbance to marine fauna	**Low**	• No vessel may approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft. • Ensure vessel transit speed between the survey/drill area and port is a maximum of 12 knots (22 km/hr), except within 25 km of the coast where it is reduced further to 10 knots (18 km/hr). • Implement a maintenance plan to ensure all diesel motors and generators receive adequate maintenance to minimise noise emissions. • TEEPSA and its contractors will undertake Project activities in a manner consistent with good international industry practice and Best Available Techniques (BAT).	• An independent Marine Mammal Observer (MMO) must accompany the pre-drilling survey to undertake validation of cetacean migration/distribution models. • In the unlikely event of a cetacean sighting within the Permanent Threshold Shift (PTS) threshold distance for the most sensitive species (400 m) immediately prior to drilling commencement, drilling may not commence until an independent Marine Mammal Observer confirms that no cetaceans are present within this PTS radius.	**Low**

4	Exploration	Underwater noise from vertical seismic profiling	Physical injury or disturbance to marine fauna	**Low**	• TEEPSA and the drilling contractor will ensure that VSP activities are undertaken in a manner consistent with good international industry practice and BAT.	• Pre-drilling baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to inform placement of wells, with the aim of preventing disturbances to the sensitive and significant VME epifaunal communities, vulnerable habitats (e.g., hard grounds), and structural features (e.g., rocky outcrops). • A minimum of two dedicated Marine Mammal Observer (MMO), with a recognised MMO training course, must be on board for marine fauna observation (360 degrees around drilling unit), distance estimation and reporting. One MMO should also have Passive Acoustic Monitoring (PAM) training, should a risk assessment, undertaken ahead of the VSP operation, indicate that the PAM equipment can be safely deployed considering the metocean conditions (specifically current). • MMO's to arrive at ten days before drilling/VSP commences. • Ensure drilling unit vessel is fitted with PAM technology (one or more hydrophones), which detects animals through their vocalisations, should it be possible to safely deploy PAM equipment. • Undertake a one-hour (as water depths > 200 m) pre-shoot visual and possible acoustic scan (prior to soft-starts / airgun tests) within the 500 m radius mitigation zone in order to confirm there is no cetaceans, turtles, penguins and shoaling large pelagic fish activity close to the source. • Implement a "soft-start" procedure of a minimum of 20 minutes' duration when initiating the acoustic source (except if testing a single airgun on lowest power). • Maintain visual observations and possibly acoustic detections within the 500 m mitigation zone continuously during VSP operation to identify if there are any cetaceans present. • Commence VSP profiling as far as possible during daylight hours with good visibility. However, if this is not possible due to prolonged periods of low visibility (e.g. thick fog) or unforeseen technical issues, which results in a night-time start, the following mitigation measures should be implemented: • Ensure that VSP source is only used if PAM technology is in place to detect vocalisations (subject to a risk assessment indicating that the PAM equipment can be safely deployed considering the metocean conditions) or: • There have not been three or more occasions where cetaceans, penguins, shoaling large pelagic fish or turtles have been sighted within the 500 m mitigation zone during the preceding 24-hour period; and • A two-hour period of continual observation of the mitigation zone was undertaken (during a period of good visibility) prior to the period of low visibility and no cetaceans, penguins, shoaling	**Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
						large pelagic fish or turtles were sighted within the 500 m mitigation zone.	
5	Exploration	Ambient air noise from helicopters	Physical injury or disturbance to marine fauna	**Low**	• No vessel or aircraft may approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft. • TEEPSA and its contractors will undertake Project activities in a manner consistent with good international industry practice and Best Available Techniques. • The operation of helicopters aircraft will be governed by the Civil Aviation Act, 2016 (Act 6 of 2016) and associated regulations. • Maintain a flight altitude of at least 1 000 m during flight, except when taking off and landing or in a medical emergency. • Avoid extensive low altitude (<762 m or 2 500 ft) coastal flights by ensuring that the flight path is perpendicular to the coast, as far as possible.	• Ensure that all flight paths avoid the Mossel Bay (Seal Island seal colony) and Robberg Peninsula (seabird and seal colonies). • Brief of all pilots on the ecological risks associated with flying at a low altitude along the coast or above marine mammals.	**Low**
6	Exploration	Ambient air noise from support vessels	Physical injury or disturbance to marine fauna	**Low**	• No vessel or aircraft may approach closer than 300 m to any whale and a vessel should move to a minimum distance of 300 m from any whales if a whale surfaces closer than 300 m from a vessel or aircraft. • Ensure vessel transit speed between the survey/drill area and port is a maximum of 12 knots (22 km/hr), except within 25 km of the coast where it is reduced further to 10 knots (18 km/hr). • Implement a maintenance plan to ensure all diesel motors and generators receive adequate maintenance to minimise noise emissions. • TEEPSA and its contractors will undertake Project activities in a manner consistent with good international industry practice and BAT.	• Implement noise abatement measures to ensure an adequate acoustical insulation of the engines, compressors, turbines (enclose engines) and gas flow lines and valves (lagging, in-line silencers, etc.).	**Very Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
7	Exploration	Light from drill rig and support vessels	Impact on marine fauna	**Low**	• TEEPSA will ensure that the contractors undertake the drilling operation in a manner consistent with good international industry practice and BAT.	• Reduce the lighting to a minimum compatible with safe operations whenever and wherever possible to reduce nocturnal faunal attraction. • Position light sources, if possible and consistent with safe working practices, in places where emissions to the surrounding environment can be minimised i.e., aim lighting downward rather than out to sea. • Implement best practice mitigation measures for reducing lighting impacts (including the use of red filters). • Include training on how to care for downed seabirds as part of the induction and awareness training programme for the Project. • Monitor the presence of seabirds and identify mortalities, even when birds do not land on the vessel, especially in foggy conditions and at night. • Report ringed/banded birds to the appropriate ringing/banding scheme (details are provided on the ring).	**Low**
8	Exploration	Light from well flow testing	Impact on marine fauna	**Very Low**	• TEEPSA will ensure that the contractors undertake the drilling operation, including well flow testing, in a manner consistent with good international industry practice and BAT.	• Optimise well test and monitor the efficiency of the flare programme to reduce burning as much as possible during the test. • If disorientated, but otherwise unharmed seabirds are found/caught, they must be kept in a dark space and be released during daylight hours. • Include training on how to care for downed seabirds as part of the induction and awareness training programme for the Project.	**Very Low**
9	Exploration	Produced water discharge	Impact on water quality	**Very Low**	• TEEPSA will ensure that the contractors undertake the drilling operation, including well flow testing, in a manner consistent with good international industry practice and BAT. • Produced water will be treated onboard before being discharged or transported to shore. Following the onboard treatment process, if the hydrocarbon content is below 30 mg/L, the produced water may be discharged into the marine environment, if the hydrocarbon content exceeds 30 mg/L, the produced water will either be treated again or be transported to shore to be treated. • Develop and implement a Project-specific Waste and Discharge Management Plan. • All disposals at sea should strictly adhere to MARPOL 73/78 b(International Convention for the Prevention biodiversity of Pollution from Ships, 1973).	• Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons and minimise hydrocarbon ‘drop-out’ during well testing. •	**Very Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
10	Exploration	Discharge of drilling fluid and cuttings (cement and WBMs)	Biochemical and toxicity water column and benthic impacts	**Low**	• Disposal of excess cement and additives at sea should strictly adhere to MARPOL73/78 (International Convention for the Prevention of Pollution from Ships, 1973). • Ensure only low-toxicity, low bioaccumulation potential and partially biodegradable additives are used in drilling fluid and cement. • Low-toxicity biodegradable detergents should be used in the cleaning of deck spillages. • Development and implementation of a Project-specific Chemical Management Plan. • Development and implementation of a Project-specific Waste and Discharge Management Plan	• Pre-drilling baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to inform placement of wells, with the aim of preventing disturbances to declared / proclaimed sensitive areas and habitats. • If complete avoidance mitigation is not possible, an out-of-kind offset/compensatory mechanism needs to be developed as part of a Biodiversity Action Plan (BAP), if required (see Section 9.1.2 of the marine ecology and fisheries impact assessment report for details). • Implement suitable measures to minimise cement spillages to the environment.	**Low**
11	Exploration	Discharge of drilling fluid and cuttings	Turbidity and smothering impacts on marine environment	**Low** (infauna communities) **Very Low** (pelagic communities) **High** (epifauna communities)	• As for Point No. 10	• Pre-drilling baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to inform placement of wells, with the aim of preventing disturbances to declared / proclaimed sensitive areas and habitats. • If complete avoidance mitigation is not possible, an out-of-kind offset/compensatory mechanism needs to be developed as part of a Biodiversity Action Plan (BAP), if required (see Section 9.1.2 of the marine ecology and fisheries impact assessment report for details). • Consider implementing innovative technologies and operational procedures for drilling solids discharges to minimise turbidity and smothering impacts.	**Low** (infauna communities) **Very** Low (pelagic communities) **Medium** (epifauna communities)
13	Exploration	Physical disturbance of seafloor sediments	Impact on maritime heritage and palaeontology	**Low**	• As for Point No. 12	• Check for the potential for fossil and/or shipwreck-related material in or on the seabed, as part of the pre-drilling clearance surveys. • Should fossils / shipwreck-related material be identified through the pre-drilling survey or during drilling, this information must be recorded and passed on to an appropriate specialist and SAHRA must be notified through the implementation of the Chance Finds Procedure. • Implement a buffer of at least 50 m around such a site or material to ensure that it is further not impacted by the activities in Block 11B/12B. • Include training on fossil and/or shipwreck-related material as part of the induction and awareness training programme for the Project.	**Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
14	Exploration	Maritime safety zones	Impact on fisheries	**Low** (demersal trawl fishery) **Medium** (squid fishery, SSF's and large pelagic fishery)	• Prior to commencement of drilling, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office. • These stakeholders should again be notified at the completion of exploratory activities and when the support vessels are off-location. • The Notice to Mariners should give notice of (1) the co-ordinates of the exploration area, (2) an indication of the proposed timeframes of the drilling activities, and (3) an indication of the 500 m safety zones and the proposed safe operational limits of the exploratory activities. • These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.	• Maintain adequate safety clearance between fishing vessels and exploratory vessels and equipment through at-sea communications with vessels in the vicinity of the drill area.	**Very Low** (demersal trawl fishery) **Medium** (squid fishery, SSF's and large pelagic fishery)
15	Exploration	Spending on local goods, services and labour	Impact on economic output and GDP	**Very Low (+)**	• In accordance with Section 41 of the Mineral Petroleum Resources Development Plan Regulations (MPRD regulations), a Social and Labour Plan (SLP) is required for the Project as well as the development of a Procurement Progression Plan.	• Increase procurement of goods and services from South African businesses, as appropriate.	**Very Low (+)**
16	Exploration	Spending on local goods, services and labour	Impact on jobs	**Very Low (+)**	• In accordance with Section 41 of the Mineral Petroleum Resources Development Plan Regulations (MPRD regulations), a Social and Labour Plan (SLP) is required for the Project as well as the development of a Procurement Progression Plan.	• Employ local labour (IZoI) to increase benefits to the local community where feasible. • Community/ stakeholder engagement on procurement/ employment/ skills development opportunities. • Engage with local forums, business chambers, tourism offices, and collective organisations in order to disclose information and ascertain any issues and/ or concerns. • TEEPSA's local recruitment procedure will be used to guide the recruitment process. The procedure should be disclosed to communities through engagement undertaken as part of the corporate stakeholder engagement process.	**Very Low (+)**
17	Exploration	Spending on local goods, services and labour	Impact on household income	**Very Low (+)**	• As for Point No. 16	• Investigate opportunities to increase local procurement and localise expenditure. • Explore opportunities to employ as many people from the local communities as possible. • Community/ stakeholder engagement on procurement/ employment/ skills development opportunities.	**Very Low (+)**
18	Offshore surveys	Physical disturbance of seafloor sediment	Disturbance to benthic communities	**Low**	• TEEPSA will ensure that the contractors undertake survey operations in a manner consistent with good international industry practice and BAT.	• Prohibit the placement of receivers or metocean buoys in any area that is designated as a marine sensitive area.	**Very Low**
19	Offshore surveys	Noise from sonar profiling	Physical injury or disturbance to marine fauna	**Low**	• TEEPSA will ensure that the contractors undertake survey operations in a manner consistent with good international industry practice and BAT.	• Prohibit undertaking sonar surveys in any area that is designated as a marine sensitive area. • Implement relevant mitigation measures as for Point No. 4.	**Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
20	Offshore surveys	Maritime safety zones	Impact on fisheries	**Low** (demersal trawl fishery) **Medium** (squid fishery, SSF's and large pelagic fishery)	• Prior to commencement of the surveys, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office. • These stakeholders should again be notified at the completion of survey activities and when the survey vessels are off-location. • The Notice to Mariners should give notice of (1) the co-ordinates of the survey area, (2) an indication of the proposed timeframes of the survey activities, and (3) an indication of the safety zones and the proposed safe operational limits of the survey activities. • These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.	• Maintain adequate safety clearance between fishing vessels and survey vessels and equipment through at-sea communications with vessels in the vicinity of the survey area. • Appoint an on-board fisheries liaison officer (FLO) to facilitate communication with fishing vessels whilst on location. The FLO should report daily on vessel activity and respond and advise on action to be taken in the event of encountering fishing gear in the survey area.	**Low** (demersal trawl fishery) **Medium** (squid fishery, SSF's and large pelagic fishery)
21	Construction	Air emissions	Impact on air quality	**Negligible** (offshore) **Very Low** (onshore)	• As for Point No. 1	• As for Point No. 1	**Negligible** (offshore) **Very Low** (onshore)
22	Construction	Air emissions	Impact on GHG emissions and climate change	**Medium**	• TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 - Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass). • Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities. • A maintenance plan will be implemented to ensure all diesel equipment receives adequate maintenance to minimise GHGs released to the atmosphere and maximise the energy efficiency. • The drill unit, pipelaying vessel, support vessels and survey vessel will be required to prepare a Ship Energy Efficiency Management Plan (SEEMP) that complies with the IMO 2022 guidelines.	• Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes. • Implement effective programmes for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs. • Optimise helicopter flight paths. • Optimise well test and monitor the efficiency of the flare programme to reduce burning as much as possible during the test. • Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons in order to minimise emissions and hydrocarbon 'drop-out' during well testing.	**Negligible**
23	Construction	Underwater noise from drill rig and support/construction vessels	Physical injury or disturbance to marine fauna	**Low**	• As for Point No. 3	• As for Point No. 3	**Low**
24	Construction	Underwater noise from vertical seismic profiling	Physical injury or disturbance to marine fauna	**Low**	• As for Point No. 4	• As for Point No. 4	**Low**
25	Construction	Ambient air noise from helicopters	Physical injury or disturbance to marine fauna	**Low**	• As for Point No. 5	• As for Point No. 5	**Low**
26	Construction	Ambient air noise from construction vessels	Physical injury or disturbance to marine fauna	**Low**	• As for Point No. 6	• As for Point No. 6	**Very Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
27	Construction	Light from drill rig and support vessels	Impact on marine fauna	**Low**	• As for Point No. 7	• As for Point No. 7	**Very Low**
28	Construction	Light from well flow testing	Impact on marine fauna	**Very Low**	• As for Point No. 8	• As for Point No. 8	**Very Low**
29	Construction	Produced water discharge	Impact on marine fauna	**Very Low**	• As for Point No. 9	• As for Point No. 9	**Very Low**
30	Construction	Discharge of drilling fluid and cuttings (cement and WBMs)	Biochemical and toxicity water column and benthic impacts	**Low**	• As for Point No. 10	• As for Point No. 10	**Low**
31	Construction	Discharge of drilling fluid and cuttings	Turbidity and smothering impacts on marine environment	**Low** (infauna communities) **Very Low** (pelagic communities) **High** (epifauna communities)	• As for Point No. 11	• As for Point No. 11	**Low** (infauna communities) **Very Low** (pelagic communities) **Medium** (epifauna communities)
32	Construction	Physical disturbance of seafloor sediments	Loss of benthic habitat and impact on benthic infauna	**Low**	• TEEPSA will ensure that the contractors undertake the drilling and construction activities in a manner consistent with good international industry practice and BAT. • Based on pre-drilling ROV survey(s), the well(s) will specifically be sited to avoid sensitive hardgrounds, as the preference will be to have a level surface area to facilitate spudding and installation of the wellhead.	• Conduct technical studies on techniques that can be used to minimise the impact on sensitive benthic components, specifically regarding method of laying of vessel / rig anchors and chains, choice of pipe material selection and pipe laying method. • Consideration should be given to the feasibility of bolting the pipeline directly to the rocky substratum or to concrete bases would minimise the area impacted. • Post-construction/drilling ROV should be undertaken to scan seafloor for any dropped equipment and other removable features (e.g. excess cement) around the well and construction sites. These must be retrieved/removed, where practicable, after assessing the safety and metocean conditions.	**Very Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
33	Construction	Physical disturbance of seafloor sediments	Loss of benthic habitat and impact on benthic epifauna	**High**	• TEEPSA will ensure that the contractors undertake the drilling and construction activities in a manner consistent with good international industry practice and BAT.	• Pre-construction baseline surveys must be undertaken to supplement baseline information obtained in previous environmental baseline surveys for Block 11B/12B, to ensure that construction activities do not disturb or destroy the sensitive and significant VME indicator epifaunal communities, vulnerable habitats (e.g., hard grounds), and structural features (e.g., rocky outcrops). • The results of these surveys must be used to inform construction plans with the aim to provide a one km radius buffer to any sensitive communities, habitats or structures. If this is not possible, an out-of-kind offset/compensatory mechanism needs to be developed as part of a Biodiversity Action Plan (BAP), if required (see Section 9.1.2 of the marine ecology and fisheries impact assessment report for details). • Conduct technical studies on techniques that can be used to minimise the impact on sensitive benthic components, specifically regarding method of laying of vessel / rig anchors and chains, choice of pipe material selection and pipe laying method. • Consideration should be given to the feasibility of bolting the pipeline directly to the rocky substratum or to concrete bases would minimise the area impacted. • Implement suitable measures to minimise cement spillages to the environment.	**Low**
34	Construction	Physical disturbance of seafloor sediments	Impact on maritime heritage and palaeontology	**Low**	• As for Point No. 13	• As for Point No. 13	**Low**
35	Construction	Maritime Safety Zones	Impact on Fisheries	**Very Low** (hake demersal trawl) and **Low** (large pelagic fisheries)	• Prior to commencement of drilling / construction activities, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office. • These stakeholders should again be notified at the completion of drilling / construction activities and when the support vessels are off-location. • The Notice to Mariners should give notice of (1) the co-ordinates of the drill / construction areas, (2) an indication of the proposed timeframes of the drilling / construction activities, and (3) an indication of the 500 m safety zones and the proposed safe operational limits of the drilling / construction activities. • These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible.	• Avoidance of siting well infrastructure in areas of higher fishing intensity if feasible. This particularly relates to the Large Pelagic Longline sector. • Maintain adequate safety clearance between fishing vessels and drilling / construction vessels and equipment through at-sea communications with vessels in the vicinity of the drill / construction area.	**Very Low** (hake demersal trawl) and **Low** (large pelagic fisheries)

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
36	Construction	Spending on local goods, services and labour	Impact on economic output and GDP	**Very Low (+)** (TEEPSA activities) **High (+)** (PetroSA F-A Platform activities)	• As for Point No. 15	• Investigates options for local procurement for pipeline construction to enhance local economic benefits. • Engage with local forums, business chambers, tourism offices, and collective organisations in order to disclose information and ascertain any issues and/ or concerns. • Project procurement policy to prioritise supply of goods and services from local suppliers, as appropriate. • Sub-contractor procurement policies for non-local (IZoI) suppliers. • Preferential contracting of local (IZoI)companies for goods and services. • Community/ stakeholder engagement on procurement/ employment/ skills development opportunities.	**Medium (+)** (TEEPSA activities) **High (+)** (PetroSA F-A Platform activities)
37	Construction	Spending on local goods, services and labour	Impact on jobs	**Very Low (+)** (TEEPSA activities) **High (+)** (PetroSA F-A Platform activities)	• As for Point No. 16	• Investigate options for local procurement for pipeline construction to enhance local economic benefits. • Increase procurement spend in South Africa as appropriate. • Employ local labour (IZoI) to increase benefits to the local community where feasible. • Sub-contract to local construction companies where possible. • Skills transfer and knowledge sharing to build local skills bases where possible. • Community/ stakeholder engagement on procurement/ employment/ skills development opportunities. • Engage with local forums, business chambers, tourism offices, and collective organisations in order to disclose information and ascertain any issues and/ or concerns.	**Medium (+)** (TEEPSA activities) **High (+)** (PetroSA F-A Platform activities)
38	Construction	Spending on local goods, services and labour	Impact on household income	**Very Low (+)** (TEEPSA activities) **High (+)** (PetroSA F-A Platform activities)	• As for Point No. 17	• As for Point No. 17	**Very Low (+)** (TEEPSA activities) **High (+)** (PetroSA F-A Platform activities)
39	Production	Air emissions	Impact on air quality	**Negligible** (TEEPSA & PetroSA F-A Platform activities, offshore) **Very Low** (TEEPSA & PetroSA F-A Platform activities, onshore)	• TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 - Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass). • Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities.	• Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes. • Ensure no incineration of waste occurs within the port limits, subject to obtaining an Atmospheric Emissions Licence. • Use of onshore power supply during vessel hotelling rather than using onboard generators/boilers, when available. • TEEPSA will continue to engage with PetroSA regarding the use of good international industry practice in the operation and maintenance of the F-A Platform.	**Negligible** (TEEPSA & PetroSA F-A Platform activities, offshore) **Very Low** (TEEPSA & PetroSA F-A Platform activities, onshore)

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
40	Production	Air emissions	Impact on GHG emissions and climate change	**Medium** (TEEPSA activities) **Very High** (PetroSA F-A Platform activities)	• TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 - Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass). • Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities. • A maintenance plan will be implemented to ensure all diesel equipment receives adequate maintenance to minimise GHGs released to the atmosphere and maximise the energy efficiency. • Support vessels will be required to prepare a Ship Energy Efficiency Management Plan (SEEMP) that complies with the IMO 2022 guidelines.	• Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes. • Implement effective programmes for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs. • TEEPSA will continue to engage with PetroSA regarding the use of good international industry practice in the operation and maintenance of the F-A Platform.	**Negligible** (TEEPSA activities) **Medium** (PetroSA F-A Platform activities)
41	Production	Presence of seafloor infrastructure	Impact on local benthic environment	**Low** (pipeline not buried) **Negligible** (pipeline buried)	-	• Once the pipeline is installed, it is recommended that further disturbance along the route is minimised to allow the new (novel) community to stabilise with time.	**Low** (pipeline not buried) **Negligible** (pipeline buried)
42	Production	Maritime safety zones	Impact on fisheries	**Very Low** (hake demersal trawl) and **Low** (large pelagic fisheries)	• TEEPSA will co-ordinate with the South African Maritime Safety Agency (SAMSA) that is responsible for maritime safety, health and environmental protection regarding safety zones. After installation of the production wells, subsea infrastructure and pipeline, the locations will be surveyed and marked on bathymetric and navigation charts as a hazard. Maritime shipping, commercial and small-scale fishing sectors will be notified of the presence of the infrastructure.	• Establish a stakeholder engagement forum to facilitate ongoing engagement with indigenous people, coastal communities and fisheries associations / organisations, while carrying out business in the IZoI. Encourage communities to document and report any adverse health effects, incidents, or concerns related to the Project operations.	**Very Low** (hake demersal trawl) and **Low** (large pelagic fisheries)
43	Production	Spending on local goods, services and labour	Impact on economic output and GDP	**Medium (+)**	• As for Point No. 15	• Prioritise the procurement of goods and services from local suppliers. • SLP initiatives for training and skills development to be aligned with technical skills requirements over the production period.	**Medium (+)**
44	Production	Spending on local goods, services and labour	Impact on jobs	**Medium (+)**	• Per Section 41 of the MPRD regulations, an SLP is required for the Project and the development of a Procurement Progression Plan. • A Skills Development Plan forms part of the SLP. The Skills Development Plan must be submitted to the relevant Sector Education and Training Authority (SETA) as a Workplace Skills Plan/ Annual Training Report. The Skills Development Plan outlines proposed internship and bursary programmes, mentorship programmes and employment equity plans.	• Preferential employment of local labour to increase benefits to the local community. • SLP initiatives for training and skills development to be aligned with Project technical skills requirements over the production period.	**Medium (+)**
45	Production	Spending on local goods, services and labour	Impact on household income	**Medium (+)**	• As for Point No. 17	• Project procurement policy to prioritise supply of goods and services from local suppliers where possible. • Prioritise the use of local labour, including contractors, will be prioritised where possible in line with the Project's Social and Labour Plan.	**Medium (+)**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
46	Production	Spending on local goods, services and labour	Impact on government	**High (+)**	• -	• -	**High (+)**
47	Decommissioning	Air emissions	Impact on air quality	**Negligible** (offshore) **Very Low** (onshore)	• TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 - Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass). • Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities. • Ensure that contractors make use of efficient flare tips, as appropriate.	• Optimise rig movement and the logistics (number of trips required to and from the onshore logistics base) to reduce fuel consumption. • Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes. • Ensure no incineration of waste occurs within the port limits, subject to obtaining an Atmospheric Emissions Licence. • Use of onshore power supply during vessel hotelling rather than using onboard generators/boilers, when available.	**Negligible** (offshore) **Very Low** (onshore)
48	Decommissioning	Air emissions	Impact on GHG emissions and climate change	**Negligible**	• TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 - Fuel Quality. Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulphur (mass). • Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities. • A maintenance plan will be implemented to ensure all diesel equipment receives adequate maintenance to minimise GHGs released to the atmosphere and maximise the energy efficiency. • The drill unit, pipelaying vessel, support vessels and survey vessel will be required to prepare a Ship Energy Efficiency Management Plan (SEEMP) that complies with the IMO 2022 guidelines.	• Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes. • Implement effective programmes for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs. • Optimise helicopter flight paths.	**Negligible**
49	Decommissioning	Underwater noise from drill rig and support/decommissioning vessels	Physical injury or disturbance to marine fauna	**Low**	• As for Point No. 3	• As for Point No. 3	**Low**
50	Decommissioning	Ambient air noise from helicopters	Physical injury or disturbance to marine fauna	**Low**	• As for Point No. 5	• As for Point No. 5	**Low**
51	Decommissioning	Ambient air noise from decommissioning vessels	Physical injury or disturbance to marine fauna	**Low**	• As for Point No. 6	• As for Point No. 6	**Very Low**
52	Decommissioning	Light emissions from drill rig and support/decommissioning vessels	Impact on marine fauna	**Low**	• As for Point No. 7	• As for Point No. 7	**Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
53	Decommissioning	Maritime safety zones	Impact on fisheries	**Very Low** (hake demersal trawl) and **Low** (large pelagic fisheries)	• Prior to commencement of decommissioning activities, stakeholders in the fishing industry and sector bodies should be notified, as well as other organs of state such as PASA, DAFF, Transnet National Ports Authority, SAMSA and the South African Navy Hydrographic office. These stakeholders should again be notified at the completion of decommissioning activities and when the support vessels are off-location. The Notice to Mariners should give notice of (1) the co-ordinates of the decommissioning areas, (2) an indication of the proposed timeframes of the activities, and (3) an indication of the 500 m safety zones and the proposed safe operational limits of the decommissioning activities. These Notices to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible. • Once the closure certificate for the plugged wells is issued by the Competent Authority, the requirement for a safety zone will be decided by SAMSA based on an assessment of the risk of the infrastructure as a navigational hazard. Any infrastructure deemed a navigational hazard will remain marked on the navigational charts.	• Maintain adequate safety clearance between fishing vessels and decommissioning vessels and equipment through at-sea communications with vessels in the vicinity of the drill area.	**Very Low** (hake demersal trawl) and **Low** (large pelagic fisheries)
54	Decommissioning	Spending on local goods, services and labour	Impact on economic output and GDP	**Low (+)**	• As for Point No. 15	• Maximise salvageable plant and equipment. • Ensure that waste material brought onshore is managed by a licenced contractor and disposed of at an authorised landfill.	**Low (+)**
55	Decommissioning	Spending on local goods, services and labour	Impact on jobs	**Low (+)**	• As for Point No. 62	• As for Point No. 62	**Low (+)**
56	Decommissioning	Spending on local goods, services and labour	Impact on household income	**Low (+)**	• As for Point No. 62	• As for Point No. 62	**Low (+)**

57	All phases	Routine discharges to sea	Impact on water quality	**Medium**	• As per the applicable requirements in MARPOL 73/7817, food waste will be ground up prior to discharge (i.e., comminuted) to <25 mm diameter to meet discharge requirements. When ground to these specifications, food waste discharges are allowed if the vessel is more than 3 nautical miles (5.6 km) offshore. Food waste that is not ground may be discharged if the vessel is at least 12 nautical miles (22.2 km) offshore when sailing. • Deck drainage on board support vessels is routinely routed directly overboard, except in areas where hydrocarbons may be released; in these latter cases, deck drainage is directed to the oil skimmers/oily water separators for treatment prior to discharge. Threshold maxima for the discharge will be 15 mg/L (parts per million, ppm) of hydrocarbons, per MARPOL requirements. Water below 15 ppm hydrocarbons content is discharged overboard with sea surface sheen monitoring. Separated oil is transferred to the waste oil tank which will be treated / disposed of onshore at an approved hazardous landfill site. • Bilge and drain systems are monitored for hydrocarbon contamination. Oily water separators will process bilge and contaminated drain system water. Threshold maxima for the discharge will be 15 mg/L (parts per million, ppm) of hydrocarbons, per MARPOL Annex I requirements. Treated water (below 15 ppm) is discharged overboard; separated oil is transferred to the waste oil tank. The residue from the onboard oil/water separator will be treated and disposed onshore at a licenced hazardous landfill site. • Vessels must have a Shipboard Oil Pollution Emergency Plan (SOPEP), and a valid International Oil Pollution Prevention Certificate, as required by vessel class. • All sewage discharges will comply with MARPOL Annex IV requirements. Sewage and grey water will be treated using a marine sanitation device to produce an effluent with: • A Biological Oxygen Demand (BOD) of <25 mg/l (if the treatment plant was installed after 1/1/2010) or <50 mg/l (if installed before this date); • Minimal residual chlorine concentration of 0.5 mg/l; and • No visible floating solids or oil and grease. • Vessels are required to have a valid International Sewage Pollution Prevention Certificate (ISPPC). • Vessels must have an onboard certified sewage treatment plant providing primary settling, chlorination before discharge of treated effluent. • Cooling waters and freshwater surplus generated by the water supply system (including brine) must be tested prior to discharge and will comply with relevant Water Quality Guidelines for residual chlorine, salinity	• Prohibit operational discharges within any area that is designated as a marine sensitive area (and up current when in close proximity) during surveying or transit to and from the drill/construction sites. • Low-toxicity biodegradable detergents should be used in the cleaning of deck spillages. • Spill management training and awareness to be provided to crew members as part of the SOPEP to ensure thorough clean-up of any spillages immediately after they occur, in order to minimise the volume of contaminants washing off decks. • All reasonable measures must be implemented to ensure that no littering takes place during the various Project phases. • TEEPSA will continue to engage with PetroSA regarding the use of good international industry practice in the operation and maintenance of the F-A Platform.	**Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
					and temperature relative to the receiving environment. • Contractors will be required to develop a Waste and Discharge Management Plan for all wastes generated at the various sites and a Chemical Management Plan detailing the storage and handling of chemicals, as well as measures to minimise potential pollution.		
58	All phases	Discharge of ballast water	Introduction of alien and invasive species	**High**	• De- and re-ballasting of vessels must be undertaken only under strict adherence to International Maritime Organisation (IMO) guidelines (Guideline A.868(20) governing discharge of ballast waters at sea). • Other precautionary guidelines recommended by the IMO include: • During the loading of ballast, every effort should be made to avoid the uptake of potentially harmful aquatic organisms, pathogens and sediment that may contain such organisms, through adequate filtration procedures; • Where practicable, routine cleaning of the ballast tank to remove sediments should be carried out in mid-ocean or under controlled arrangements in port or dry dock, in accordance with the provisions of the ship's ballast water management plan; and • Avoidance of unnecessary discharge of ballast water. • A ballast water management plan must be prepared and implemented for the drilling unit and support and construction vessels.	• Infrastructure (e.g. wellheads, BOPs and guide bases) used in other locations must be thoroughly cleaned before deployment.	**Medium**
59	All phases	Presence of Above Water Infrastructure	Impact on avifauna	**Low**	• TEEPSA will ensure that contractors undertake Project activities in a manner consistent with good international industry practice and Best Available Techniques (BAT).	• Include training on how to care for downed seabirds as part of the induction and awareness training programme for the Project. • Monitor the presence of seabirds and identify mortalities, even when birds do not land on the vessel, especially in foggy conditions and at night. • Report ringed/banded birds to the appropriate ringing/banding scheme (details are provided on the ring).	**Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
60	All phases	All Project activities	Impact on intangible cultural	**Medium** (for the exploration, construction and decommissioning phases) **High** (for the production operations phase)	• TEEPSA will ensure that contractors undertake Project activities in a manner consistent with good international industry practice and BAT. • TEEPSA will ensure that contractors undertake Project activities in compliance with the applicable requirements in MARPOL 73/78.	• Establish a stakeholder engagement forum to facilitate ongoing engagement with indigenous people, coastal communities and fisheries associations / organisations, while carrying out business in the IZoI. Encourage communities to document and report any adverse health effects, incidents, or concerns related to the Project operations. • Implement a project-specific Grievance Mechanism and ensure effective implementation through independent verification undertaken annually. • Engage with relevant communities to undertake a ritual event/s that supports communities' engagement with ancestral spirits and with living communities/indigenous people to allow for the usage of the sea. Details to be developed as part of the Project's Stakeholder Engagement plan. • Implement a gender-sensitive ritual event that recognises gendered coastal cultural heritage to permit all genders to articulate their cultural relation with the sea and coast. Details to be developed as part of the Project's Stakeholder Engagement plan. • Identify appropriate cultural sites and heritage research within IZoI for consideration in the TotalEnergies Corporate Social Investment programme.	**Very Low** (for the exploration, construction and decommissioning phases) **Medium** (for the production operations phase)
61	All phases	All Project activities	Impact on community health, safety and security	**Medium**	• TEEPSA will ensure that contractors undertake Project activities in a manner consistent with good international industry practice and BAT.	• Engage with local communities, government agencies, and other stakeholders throughout the Project process to understand community concerns regarding health, safety and security issues. • Maintain the project-specific grievance mechanisms and ensure that it is implemented effectively through independent verification on an annual basis. • Coordinate with the MBLM emergency and rescue services and provide support (training and resources) as part of TotalEnergies Corporate Social Investment programme. • As part of TotalEnergies Corporate Social Investment programme, invest in programmes focused on substance abuse and gender-based violence by connecting with relevant NGOs and CBOs to ascertain where assistance is needed. • Ensure that Project personnel are made aware of local customs and traditions and the need to respect cultural norms. • Minimise emission from vessels while in port, specifically the use of generators for power, using quayside electrical connection, where available.	**Low**

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE
62	All phases	Maritime safety zones	Impact on livelihood of fishers	**Negligible** (commercial, recreational or mariculture fisheries) **Low** (small-scale fisheries)	• TEEPSA will ensure that contractors undertake Project activities in a manner consistent with good international industry practice and BAT.	• Once the subsea infrastructure and pipeline is installed, the location will be surveyed and the coordinates sent to SAMSA. Following a risk assessment, SAMSA will establish a permanent safety zone around the area of installation and instruct the Hydrographic Office to show any areas deemed a risk to navigation as a hazard on navigation charts and bathymetric maps. This will remain on maps and charts for the duration of the production phase and possibly indefinitely, depending on the extend of removal of subsea infrastructure during the closure phase. • Establish a stakeholder engagement forum to facilitate ongoing engagement with indigenous people, coastal communities and small-scale fisheries organisations. • Develop and implement a project-specific grievance mechanism and ensure effective implementation through independent verification undertaken annually.	**Negligible** (commercial, recreational or mariculture fisheries) **Very Low** (small-scale fisheries for the well drilling, construction, closure and survey phases) **Low** (small-scale fisheries for the production phase)
63	All phases	Disturbance of marine habitat resulting in reduction of fish catch	Impact on livelihood of fishers	**Medium** (commercial, recreational, small-scale and mariculture fisheries)	• Same as for Point No. 72	• No Project activities will occur in designated Marine Protected Areas and the subsea infrastructure will be placed to minimise any disturbance to ecologically or biologically sensitive areas. If necessary, an out-of-kind offset or compensation will be included in the Biodiversity Management Plan. • Pre-screening surveys will be undertaken to identify the most appropriate location for well drilling and installation of subsea infrastructure and the pipeline to minimise disturbance to benthic habitat. • Establish a stakeholder engagement forum to facilitate ongoing engagement with indigenous people, coastal communities and small-scale fisheries organisations. • Develop and implement a project-specific grievance mechanism and ensure effective implementation through independent verification undertaken annually.	**Negligible** (commercial, recreational or mariculture fisheries) **Low** (small-scale fisheries)

NO.	PHASE	ASPECTS	IMPACTS ON MAIN RECEPTORS	PRE-MITIGATION SIGNIFICANCE	PROJECT CONTROLS	KEY MITIGATION / ENHANCEMENT MEASURE	RESIDUAL SIGNIFICANCE

64	All phases	Spending on local goods and services, potential negative impacts on fishers	Impact on household livelihood	**Medium (+)**	• As per the SLP, TEEPSA will:
					  ○ Develop a database to define the HDP and status of its potential suppliers, which will include elements of ownership as well as management.
					  ○ Current and all future non-HDP suppliers will be either part of "strengthening, development" or Joint Venture programmes, depending on their level of competitiveness and importance to the Project.
					  ○ Suppliers will be encouraged to subcontract portions of their work to HDPs, or procure goods and services from HDPs, or otherwise assist in promoting the progression of HDPs in the industry.
					  ○ Contractors will be required to maximise local content through the employment and training of HDPs:
					  ○ HDPs should be provided opportunities to be recruited and to improve their skill sets and advance their capabilities.
					• For all training and employment, first priority is given to HDPs.
						• Pre-screening surveys will be undertaken to identify the most appropriate location for well drilling and installation of subsea infrastructure and the pipeline to minimise disturbance to benthic habitat.
						• TEEPSA's local recruitment procedure will be used to guide the recruitment process. The procedure should be disclosed to communities through engagement undertaken as part of the corporate stakeholder engagement process.
							High (+)

9.8 IMPLICATIONS OF THE NO-GO ALTERNATIVE

The no-go alternative will have a significant negative impact on the local economy as well as PetroSA. In the absence of domestic gas, the GTL plant, in order to operate, would have to rely on costly imported gas, which is likely to be unaffordable. The no-go alternative means that the status quo conditions regarding the GTL facility will remain, which is affecting a substantial amount of local employment opportunities. In the case of power generation, the no-go alternative would result in importing more costly LNG, even relying more and/or longer on coal power generation, or, in the worst case, renouncing to additional power generation capacity that could contribute to end load shedding.

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