PetroSA

# MINUTES OF THE VIRTUAL CLARIFICATION MEETING

## TENDER NO: CTT26772

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| **Meeting No.:** | CTT26772/01 | **Date:** | 26/08/2026 |
| **Project** | Feasibility Study for the Proposed Development of the E-BK, E-AD and E-S Fields in Offshore Licence Block 9, South Coast, South Africa | | |
| **Present: PetroSA** | Leon Bezuidenhout (LB) ; Tommie Boucher (TB) ; Patrick Malashe (PM); Answa De Lange (ADL); Siviwe Matyeli (SM); Fikree Davids (FD); Kgabo Rapelego (KR); Siphiwe Rasmeni (SR);Themba Buda (TB); Hennie Fortuin (HF) | | |
| **Apologies:** | | | |
| **Copies to:** | All Tenderers | | |
| **Chair** | Hennie Fortuin (HF) | **Scribe:** | Hennie Fortuin (HF) |

**DISCUSSION**

**1. WELCOME & INTRODUCTION**

**HF** welcomed attendees and advised that the purpose of the meeting was to provide tenderers with an overview of the project scope and tender requirements and to allow for clarification questions from prospective bidders.

**2. PROJECT OVERVIEW**

**LB**, Project Manager, provided an overview of the proposed feasibility study for the development of the E-BK, E-AD and E-S fields in Offshore Block 9. The objective of the project is to perform a feasibility study for the development of three new gas wells and tie them back to PetroSA's existing offshore and onshore infrastructure to augment gas supply from existing wells and supply gas onshore at a rate of ~ 45 MMScf/d over a period of ~10 years. Potential markets include Gas-to-Power. The feasibility study will assess the required drilling, subsea facilities, topsides modifications, flow assurance requirements, and overall project viability.

The feasibility study scope includes the engineering design of the three new production wells, new subsea infrastructure, assessment of impacts on existing infrastructure, including the required flow assurance studies from the wells through to the onshore delivery point., The study deliverables include preparation of documentation required to tender for the future FEED phase. The consultant will also be required to develop an AACE Class 3 cost estimate for the total end-of-job costs to execute the project, a Class 2 estimate for the subsequent FEED

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| | phase. and project schedules for the FEED and execution phases.<br><br>PetroSA advised that several key information sources will be made available to the successful bidder, including the 2016 EBK feasibility study, subsurface basis of design information, reservoir data, well plans, preliminary casing designs, subsea route surveys, metocean studies, existing infrastructure information, specifications, and PetroSA's preferred contracting strategy.<br><br>Tenderers were reminded that the evaluation criteria will be applied strictly. Bidders are required to demonstrate a minimum of 10 years' relevant offshore oil and gas EPC/EPCM experience and completion of at least 10 feasibility and/or FEED studies in the areas of drilling, facilities engineering, and flow assurance. Only one of these disciplines may be subcontracted, and appropriate subcontracting agreements must be submitted.<br><br>The proposed project team must include suitably qualified key personnel with a minimum of 10 years' relevant experience and participation in at least 10 feasibility and/or FEED projects in their respective disciplines.<br><br>In addition, bidders must submit a comprehensive technical proposal, including a detailed project execution methodology, CTR-based cost estimates, resource plans, project schedules, organisational structure, company and personnel experience records, and evidence of access to the specialist software, tools, systems, and databases required to execute the scope of work successfully.<br><br>• (See presentation attached).<br><br>Scope clarification meeting (26082026) - |
| **3.** | **CLARIFICATION QUESTIONS AND RESPONSES** |
| 3.1 | **Availability of Previous Feasibility Study**<br><br>**Question:**<br>Will the feasibility study completed in 2016 be made available during the tender stage?<br><br>**Response:**<br>PetroSA confirmed that the 2016 feasibility study will only be made available to the successful bidder after contract award. The study is intended as reference information to support the execution of the current feasibility study, which will be based on updated project requirements, field configurations, production profiles, and design assumptions |
| 3.2 | **Subsurface Studies**<br><br>**Question:**<br>Will additional subsurface characterisation, reservoir evaluation, or subsurface studies form part of the feasibility study scope?<br><br>**Response:**<br>PetroSA confirmed that the required subsurface and reservoir modelling work has |

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| | already been completed internally. Relevant data, including reservoir information, production profiles, and well trajectories, will be made available to the successful bidder. No additional subsurface studies are envisaged as part of the current scope of work. |
| **4.** | **PROCUREMENT CLARIFICATIONS**<br>**a) Tender Closing Date**<br>• Current tender closing date remains **09 September 2026**.<br>**b) Additional Clarification Questions**<br>• Tenderers may submit further clarification questions in writing.<br>• Technical questions should preferably be submitted by **04 September 2026**.<br>**c) Tender Bulletins**<br>• Responses to clarification questions will be issued via formal tender bulletins and circulated to all interested parties.<br>**d) General**<br>• Tenderers must submit their tenders timeously to allow assistance if support is required.<br>• Tenderers must comply strictly with all instructions in the Tender Document to facilitate an efficient evaluation process.<br>• All companies conducting business with PetroSA must be registered on the National Treasury's Central Supplier Database (CSD).<br>• Tenderers must pay careful attention to detail. Failure to provide any information requested in the Technical Questionnaire and Returnable Schedules will result in disqualification.<br>• Tenderers must regularly check the PetroSA website for updates relating to the Tender (e.g., minutes, tender bulletins, clarifications, etc.).<br>• For all updates and additional information, visit:<br>http://www.procurement.petrosa.com/tenders/tenders/default.aspx<br>• It remains the sole responsibility of the Tenderer to monitor the website regularly. |
| **5.** | **GENERAL**<br>PetroSA encourages all participants to regularly monitor the PetroSA tender portal and their registered email addresses throughout the tender period. Any additional information, clarifications, interpretations of the tender requirements, responses to queries received, or amendments to the tender documents will be communicated through formal tender bulletins. Tenderers are responsible for ensuring that they remain informed of all bulletins issued, as such communications will form an integral part of the tender documentation and must be taken into account when preparing and submitting their tenders. |

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| **6.** | **Closure**<br>There being no further questions, the Chairperson thanked all attendees for their participation and formally adjourned the meeting. Participants were reminded to monitor the PetroSA portal and their emails for tender bulletins and further communications. |

**ATTENDEES:**

| NO | NAME | COMPANY |
|---|---|---|
| 1 | Themba Buda | PetroSA |
| 2 | Leon Bezuidenhout | PetroSA |
| 3 | Dembe Madzhiga | |
| 4 | Tommie Boucher | PetroSA |
| 5 | Russell Stimatze | Halliburton |
| 6 | Patrick (Xolile) Malashe | PetroSA |
| 7 | Conradie, Francois J (External) | Woodplc |
| 8 | Answa De Lange | PetroSA |
| 9 | Fireflies.ai Notetaker Anke (Unverified) | |
| 10 | John Richardson | Schlumberger |
| 11 | read.ai meeting notes (Unverified) | |
| 12 | van Antwerp, Tanya (External) | Woodplc |
| 13 | Siviwe Matyeli | PetroSA |
| 14 | Yousef Shoaib | Halliburton |
| 15 | MALADA, RENDANI | BakerHughes |
| 16 | Olga Podvalkova | Halliburton |
| 17 | Denis Drozdovsky (External) | CME-International |
| 18 | Ndivhuwo Nemakonde | Schlumberger |
| 19 | Ciriako Aci | Schlumberger |
| 20 | Bohmer, Carel (External) | Woodplc |
| 21 | Alejandro Primera | Schlumberger |
| 22 | Martin, Julie (External) | Woodplc |
| 23 | Paulette Mokoena (External) | EPCM |
| 24 | Fikree Davids | PetroSA |
| 25 | Inge-Marie Yssel (External) | EPCM |
| 26 | Kgabo Rapelego | PetroSA |
| 27 | Pierre Duvenage (External) | MEGCHEM |
| 28 | Mofokeng, Thomasina | WSP |
| 29 | Siphiwe Rasmeni | PetroSA |
| 30 | Osazuwa, Peckins | BakerHughes |
| 31 | Neto, Edgar Manuel | BakerHughes |
| 32 | MOFUNLEWI, SAM | BakerHughes |

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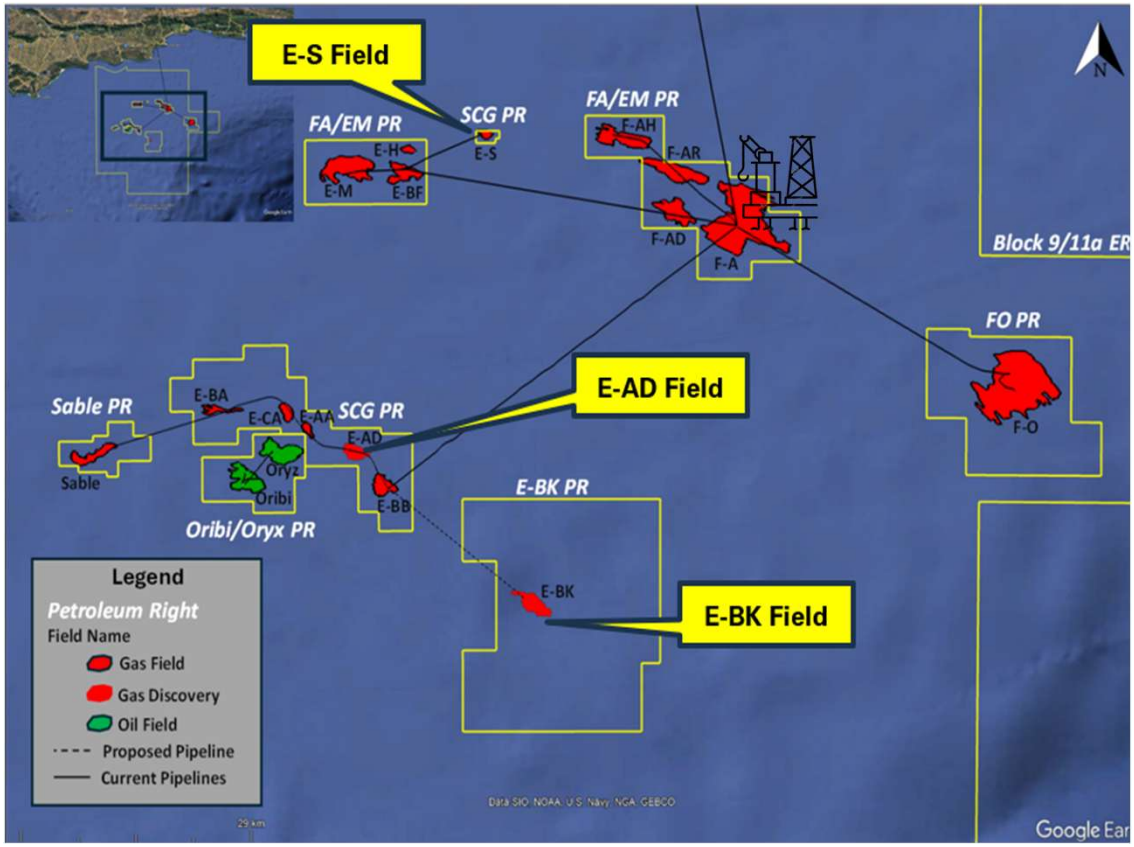
# FEASIBILITY STUDY FOR THE PROPOSED DEVELOPMENT OF THE E-BK, E-AD AND E-S OFFSHORE GAS FIELDS IN LICENCE BLOCK 9

*Scope Clarification Meeting*

26 August 2026

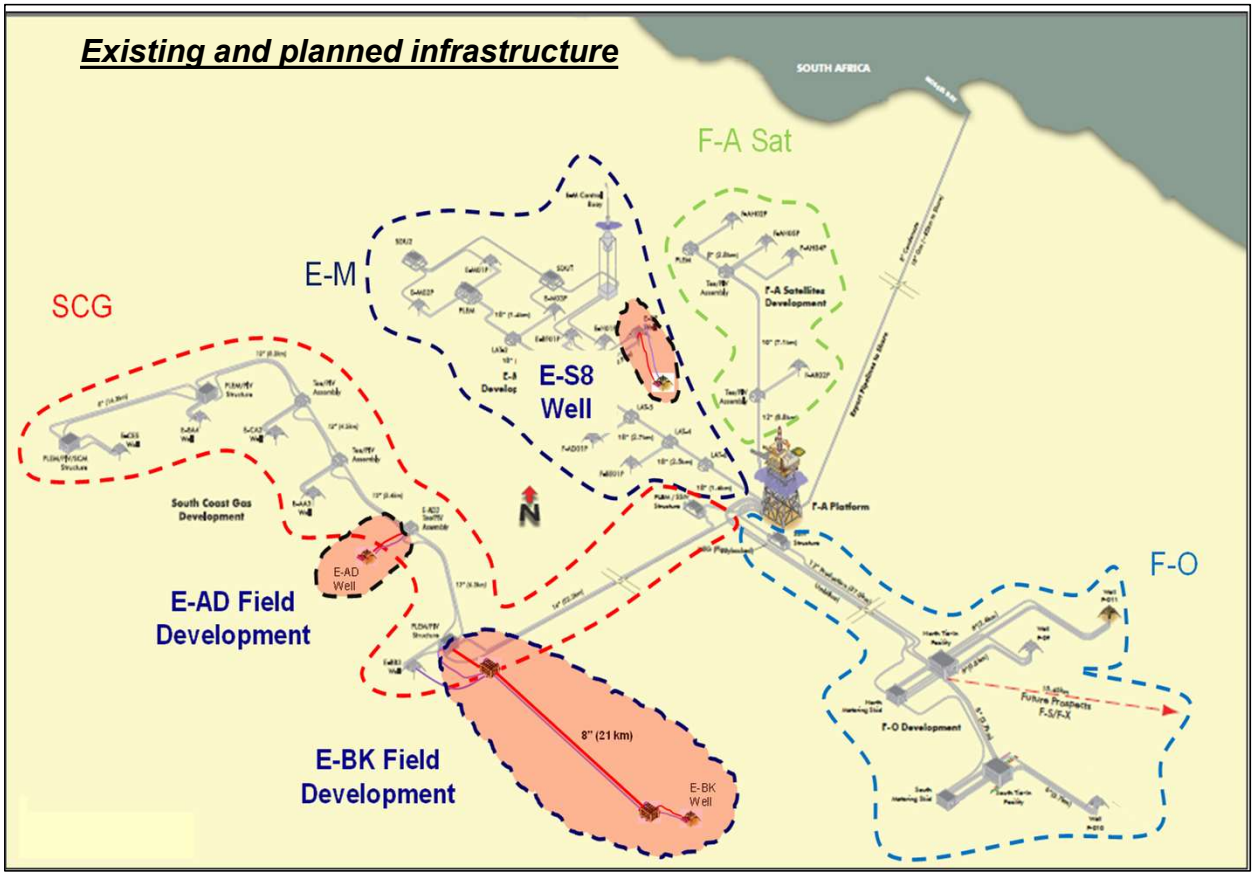
# Project Background

- PetroSA operates the F-A Platform in Block 9 (~85km offshore MB)
- Linked to the GTL Refinery in Mossel Bay by 18" gas and 8"condensate pipelines.
- Subsea developments tied back to FA platform:
  - E-M field
  - F-A satellites
  - South Coast Gas (SCG) development
  - FO field
- Block 9 has a number of small discovered gas which have remained undeveloped
- The E-BK, E-AD and E-S fields identified as candidates to be developed
  - Most mature i.t.o. subsurface tech work completed
  - Fields are near existing infrastructure
  - Existing Production Rights
- The 3 new wells will be used to augment the gas and condensate from the existing production
  - Supply gas at a rate of 45 MMscf/d over 10 years
  - Potential Gas-to-Power market



# Project Scope

- **Feasibility Study** to develop the E-BK, E-AD and E-S8 fields and tie back to existing infrastructure
  - Drilling of 3 new wells
  - New subsea infrastructure
  - Modifications on existing infrastructure to accommodate gas supply from the new fields
  - Flow assurance
- Full technical feasibility study completed in 2016 (Petrofac) to develop E-BK field.
- Feasibility study need to be updated to include E-AD and E-S8
  - Change in basis of design
  - Lower landed gas rate
  - Number of wells and contribution per well
  - Pressure profiles (Subsea, FA platform)



# Feasibility Study Scope of Work

- Consultant is required to do a **complete feasibility study** for the development of the E-BK, E-AD and E-S8 fields
- The high-level scope of work includes (refer to detail in tender documents):
  - Drilling and completions feasibility design of the 3 new production wells, including the trajectory planning, casing, tubing, wellhead, and completions selection (separate **Attachment A** in SOW)
  - Determine and design the optimum subsea system (i.e. flow lines, pipelines, manifolds, subsea production trees and control systems) layout. Determining the optimal subsea routing/s given the known seabed conditions.
  - Determine the impact of the proposed field development on the existing Subsea and FA platform topsides infrastructure, and design necessary modifications.
  - Carry out comprehensive flow assurance studies and pipeline/tubing sizing based on production profiles.
  - Perform the required Feasibility phase designs for the development plan.
  - Prepare the documentation and specifications to enable PetroSA to tender for the FEED phase
  - Develop cost estimates to complete the FEED phase (Class 2), and total end of job cost for the project (Class 3)
  - Develop project schedule for FEED and Execution phases.

# Information Supplied by PetroSA

- The E-BK Feasibility Study performed in 2016
- Subsurface Basis of Design
  - Provides key data on the E-BK, E-AD and E-S reservoirs required for the flow assurance and facilities design
- Well Plans
  - The well recommendation for the proposed E-BK production well
  - The preliminary casing design for E-AD and E-S8, based on the reservoir intersection targets as specified by the reservoir models,
- Subsea and FA platform facilities design information
- E-BK seabed route survey
  - Fugro conducted a geophysical pipeline route and site survey that covered the area between the E-BK field and the proposed tie-in point on the SCG pipeline
- Metocean Studies
- PetroSA specifications
- PetroSA preferred Contracting Strategy

# Evaluation Criteria – Company Experience

| NO | DESCRIPTION | EVALUATION SOURCE | CRITERIA (Submit supporting documents) | |
|---|---|---|---|---|
| | **COMPANY EXPERIENCE** | | | |
| 1 | The tenderer shall have a minimum of ten (10) years' Engineering, Procurement and Construction Management (EPCM) experience in the Offshore Upstream Oil & Gas sector and have completed at least ten (10) Feasibility and/or FEED studies in each of the following areas of expertise: (areas such as)<br>• Drilling (Well and Completions Engineering)<br>• Facilities Engineering (Subsea and Topsides Engineering)<br>• Flow Assurance Studies (including Transient Hydraulic Modelling)<br>Where one (1) area of expertise is subcontracted, the tenderer shall meet the requirements for at least two (2) areas of expertise, and the subcontractor shall independently meet the same minimum experience requirements for the subcontracted area. A signed subcontracting agreement must be submitted with the bid. | Tenderers shall submit a Company Information Profile and a project reference schedule detailing relevant experience, including project descriptions, scope, value, completion dates, and contactable client references.<br><br>(In compliance with the Protection of Personal Information Act (POPIA), tenderers shall obtain the necessary consent from all referenced individuals prior to submitting their contact details as part of the bid.)<br><br>**[Take note: Only one (1) out of the three (3) areas of expertise may be subcontracted]** | Minimum ten (10) years relevant experience and ten (10) or more studies for each area of expertise. | |

# Evaluation Criteria – Team Experience

| PROJECT TEAM EXPERIENCE | | | | |
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| 2. | The Bidder shall propose the following key personnel:<br>• Project Manager<br>• Drilling Lead<br>• Completions Lead<br>• Topsides Facilities Engineering Lead<br>• Subsea Facilities Engineering Lead<br>• Flow Assurance Study Lead<br>• Cost Estimation Lead<br><br>Each proposed core team member must demonstrate:<br>• A minimum of ten (10) years' relevant experience in their respective discipline; and<br>• Participation in at least ten (10) Feasibility and/or FEED projects, including experience in offshore gas field developments and brownfield projects. | Bidders shall submit:<br>• Detailed CVs for each proposed team member clearly reflecting the required experience; and<br>• A table of relevant projects, indicating the project name, client, role performed, project phase (Feasibility and/or FEED), and contactable references.<br><br>• The project table must correlate with the experience reflected in the submitted CVs. Bidders are responsible for obtaining the necessary consent from all references in compliance with POPIA. | 10 years relevant experience **and** 10 or more Feasibility and/or FEED projects. | |

# Evaluation Criteria – Technical Proposal

| | TECHNICAL PROPOSAL | | | |
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| 3. | The Tenderer must demonstrate a clear and comprehensive understanding of the project scope, deliverables, and execution requirements. | The Tenderer shall submit:<br>a. Detailed Cost, Time and Resource (CTR) estimates aligned to the scope of work and deliverables.<br>b. A Project Execution Plan clearly describing the proposed methodology, approach, key activities, and deliverables.<br>c. An organisation chart clearly defining the project management structure, reporting lines, and key personnel assigned to the project.<br>d. A detailed Gantt chart schedule aligned to the scope of work, identifying key activities, milestones, deliverables, and proposed completion dates. Preference will be given to schedules that meet PetroSA's target completion period of 12 weeks; however, reasonable deviations supported by a credible execution methodology and resource plan may be considered.<br>e. Company experience records demonstrating relevant experience as required in Section 10 of the Scope of Work.<br>f. Curricula Vitae (CVs) of the proposed project team demonstrating compliance with the personnel requirements specified in Section 10 of the Scope of Work. | The Tenderer's submission will be evaluated on the completeness, credibility, and alignment of the proposed approach, resources, schedule, and experience with the project requirements. | |

# Evaluation Criteria – Technical Proposal

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| 4 | The Tenderer must demonstrate that it has access to the necessary tools, systems, specialist software, hardware, and data sources required to successfully execute the scope of work. | The Tenderer shall submit:<br>• A list of all proposed software, hardware, modelling tools, databases, and other resources to be utilised for the project; and<br>• Supporting documentation demonstrating ownership, licensing, subscription, access rights, or availability of the proposed tools and systems. | The Tenderer must demonstrate that the proposed tools and systems are appropriate, available, and sufficient to perform the required services and deliver the project outcomes. | |

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## Questions

# THANK YOU

*Working Together, Building a Better PetroSA, Again.*

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| PetroSA | **CTT26772**<br><br>**SCOPE OF WORK**<br><br>**TO CONDUCT A FEASIBILITY STUDY FOR THE PROPOSED DEVELOPMENT OF THE E-BK, E-AD AND E-S FIELDS IN OFFSHORE LICENCE BLOCK 9, SOUTH COAST, SOUTH AFRICA** |

| Revision | Issue Date | Comments |
|---|---|---|
| 01 | 24/06/2026 | Scope of Work concluded, ready for publication |

| ROLE / DISCIPLINE | INITIAL & SURNAME | SIGNATURE | DATE |
|---|---|---|---|
| ORIGINATOR:<br>Project Manager | L Bezuidenhout | | |
| REVIEWED<br>Senior Process Engineer | E Mabaso | | |
| REVIEWED<br>Subsurface Lead | A de Lange | | |
| REVIEWED<br>Drilling Lead | S Matyeli | | |
| REVIEWED<br>Subsea Lead | K Rapelego | | |
| REVIEWED<br>Topsides Lead | P Malashe | | |
| REVIEWED<br>HSEQ Lead | M Ramone | | |
| CHECKED<br>Regional Manager | S Soobader | | |
| APPROVED<br>Project Sponsor | V Godongwana | | |

# SCOPE OF SERVICES

## FEASIBILITY STUDY FOR THE PROPOSED DEVELOPMENT OF THE E-BK, E-AD and E-S FIELD IN OFFSHORE LICENCE BLOCK 9, SOUTH COAST, SOUTH AFRICA

**Compiled by:**

PetroSA

## 1. PROJECT BACKGROUND

PetroSA operates the F-A Platform in Block 9 *(Figure 1)*, approximately 85km off the southern coast of South Africa. The platform is linked to the PetroSA-operated Gas-To-Liquids Refinery onshore in Mossel Bay by 18" gas and 8" condensate pipelines. Tied back to the platform are several existing subsea developments:

- The E-M field and associated adjacent accumulations are connected through an 18" pipeline,
- The F-A satellites development is tied back through an 8"/10"/12" pipeline,
- The South Coast Gas (SCG) development ties back five gas wells, one in each of the E-CE, E-BA, E-CA, E-AA and E-BB accumulations, via an 8", 12" and 14" daisy-chain pipeline system.
- The FO field is tied back via a 40 km 12" pipeline

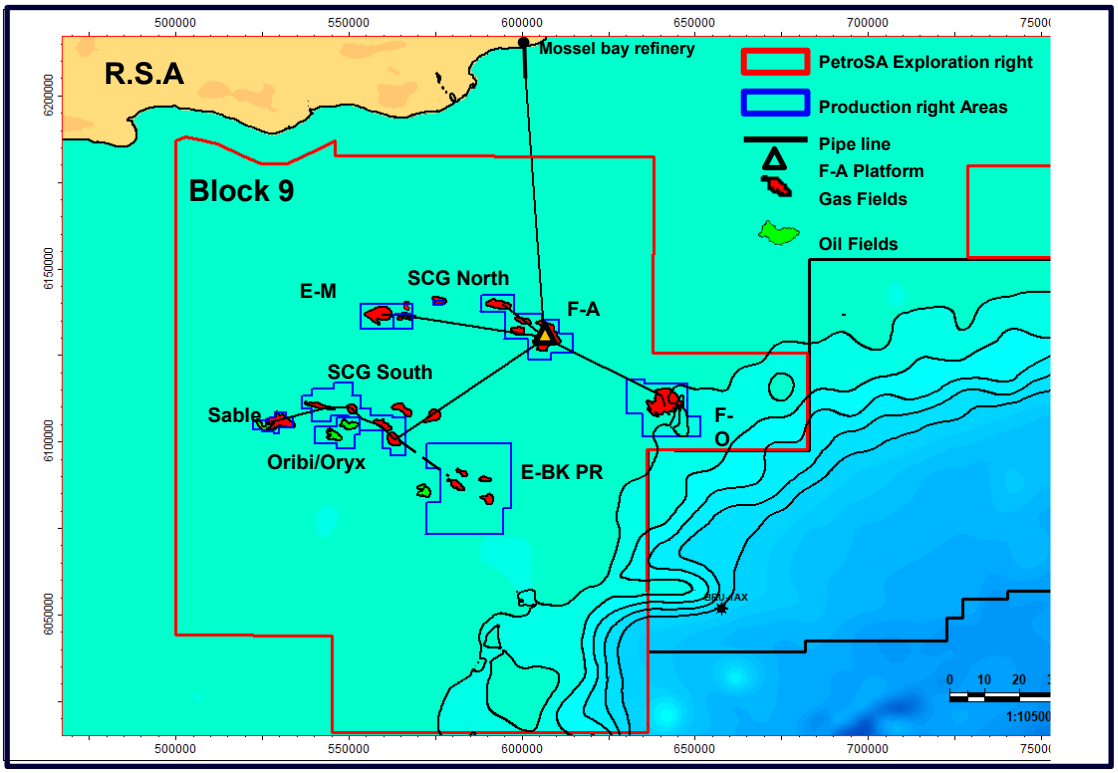


***Figure 1:*** *Location of Block 9 in the Bredasdorp Basin off the south coast of South Africa.*

PetroSA has a number of small discovered oil and gas fields in the South Central Basin in Block 9 which have remained undeveloped due to their historical marginal commerciality. The

fields are located in approximately 100m to 140m deep water and within proximity of PetroSA's existing subsea pipeline network.

PetroSA has identified the E-BK, E-AD and E-S fields as candidates to be developed and tied back to existing infrastructure. The new fields were selected based on the maturity of the technical work completed to date, the complexity of the development, and the value in terms of cost per volume of gas. The fields are near existing infrastructure in Block 9 and inside current Production Rights, which reduce development costs and allow for shorter timelines to first gas.

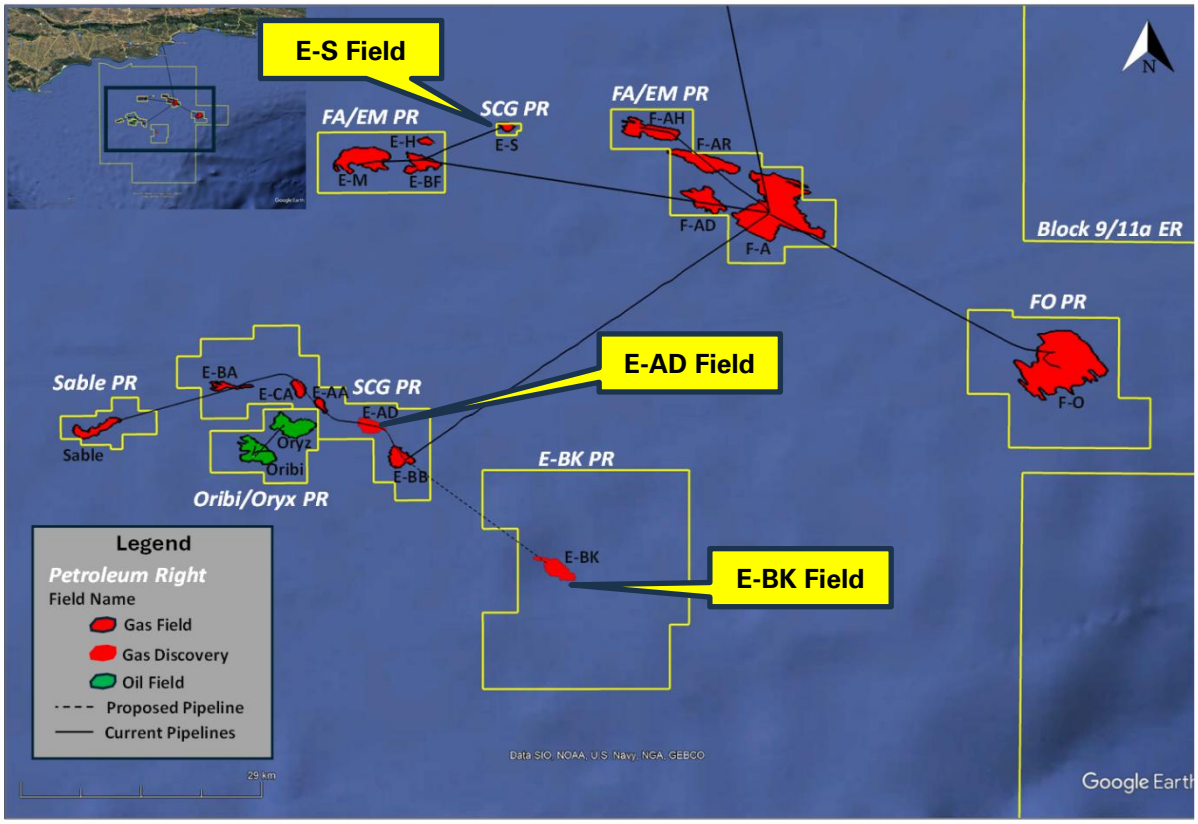


***Figure 2:*** *Location of E-BK, E-S and E-AD fields*

The new wells will be used to augment the gas and condensate from the existing production wells (already connected to the infrastructure) to supply gas at a rate of 45 MMscf/d over a 10-year period to the onshore facilities.

Additional potential gas field developments (2nd phase of development) are currently under evaluation to extend the gas supply duration to 20 years and beyond. However, it is outside of this project scope.

## 2. DEVELOPMENT OUTLINE

PetroSA performed a full technical feasibility study in 2016 to develop the E-BK field and tie the field back to existing infrastructure. The facilities (subsea and topsides) engineering study was performed by Petrofac, while the reservoir modelling and well engineering were performed in-house by PetroSA. The feasibility study now needs to be updated to include the E-AD and E-S fields, and thereby account for changes in the number of wells online, flow rates, pressure profiles, arrival pressures at the FA platform, and other affected systems.

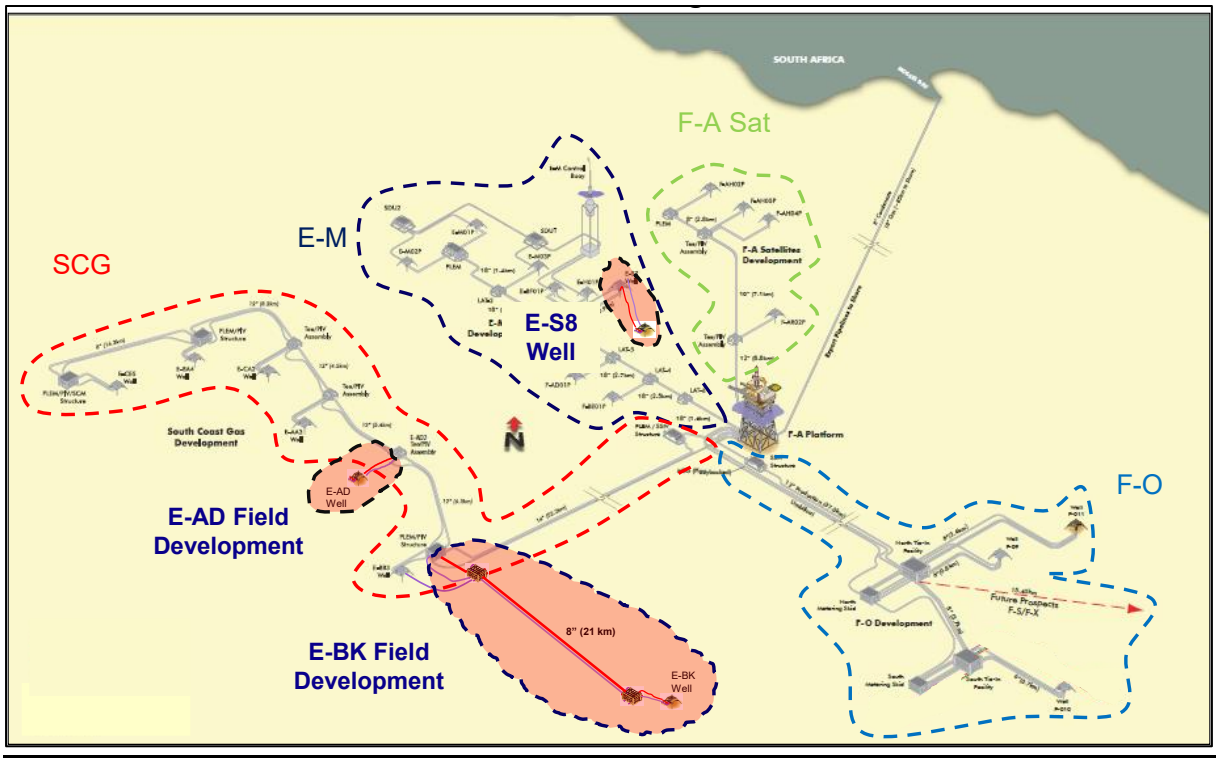


***Figure 3:*** *Existing and planned infrastructure*

### 2.1 E-BK Field

The E-BK field is a high liquid yield gas-condensate field (which only has one hydrocarbon fluid phase), located approximately 20 km southeast of the nearest subsea tie-in facility on the existing SCG pipeline.

The reservoir lithology is interpreted as deep-marine mass flow sandstones, deposited in a channel and lobe facies. The average reservoir is 125m with a Nett to Gross of 42.5%, an average porosity of 15%, an average water saturation of 56.8% and an average permeability of 60 mD.

The E-BK field is planned to be developed with a single horizontal producer with a true vertical depth of 2595m below mean sea-level and a horizontal length of 700m along the axis of the reservoir, in a water depth of ~140m. The horizontal section will be as high above the gas-water contact as possible, to ensure the intersection of good reservoir facies and to minimise early water production.

The well will be completed with a subsea wellhead and production tree located on the seabed. The approximately 20 km long new gas and condensate export pipeline will be routed to the E-BB3 tie-in point on the existing SCG pipeline 52 km southwest of the FA Platform.

The E-BK field is estimated to contain 2P recoverable reserves of 3.4 million barrels of condensate (MMbbl) and 44 billion standard cubic feet (Bscf) of gas, with peak production rates of approximately 7 000 bbl/d and 50 MMscf/d of gas are anticipated.

| | Recoverable Gas (BCF) | Recoverable Condensate (MMSTB) |
|---|---|---|
| 3P | 59 | 4.3 |
| **2P** | **44** | **3.4** |
| 1P | 33 | 2.6 |

**2.2 E-AD Field Development**

The E-AD field is an oil and gas accumulation in multiple horizon sequences (14A, 12A, 11A, 10A and 5A), located in the SCG Production Right. It was initially planned as part of the SCG field development plan, but not executed due to rig time constraints.

The sandstone reservoirs were developed as a system of deep-marine, stacked channels and lobes in a basin-floor fan setting. Most of the reservoirs indicate gas-down-to with no clear indication of where the gas-water contacts are. The reservoirs are 5 to 20m thick and are located between 2800m and 3050m below mean sea level. The reservoir porosity ranges from 10% to 14%, the water saturation from 38% to 50% and the permeability from 4 to 50 mD.

The current field development plan targets only the gas/condensate accumulations. The field development includes the drilling of one well (E-AD2), in a water depth of ~120m, and tying it back to the existing E-AD tie-in point on the SCG pipeline via a ~100 meter subsea connection.

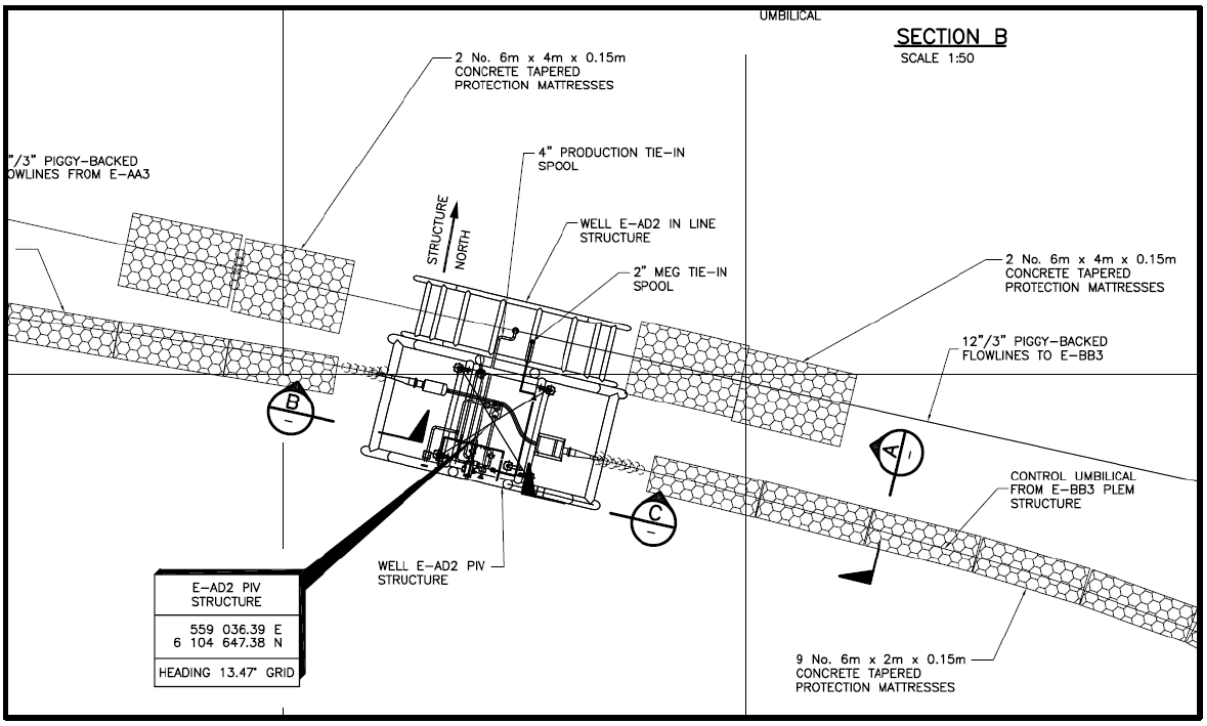


***Figure 4:*** *Existing infrastructure at E-AD2 tie-in point.*

The estimated 2P recoverable volume is 8 Bcf of gas and 0.3 MMbbls of condensate, with a peak gas rate of ~10 MMscf/d and peak condensate rate of ~ 500 bbls/d

| | Recoverable Gas (BCF) | Recoverable Condensate (MMSTB) |
|---|---|---|
| 3P | 20 | 0.7 |
| **2P** | **8** | **0.3** |
| 1P | 6 | 0.2 |

## 2.3 E-S Redevelopment (E-S8 well)

The E-S field is a gas and condensate field currently being produced from one production well (E-S7). Although it forms part of the SCG Production Right, the existing well ties into the EM subsea infrastructure.

The existing E-S7 well is not placed in an optimal position in the reservoir, and the opportunity therefore involves redeveloping the field with a new well (E-S8) targeting a separate reservoir compartment in ~100m water depth. The top hole location of the new well (E-S8) is anticipated to be within ~50 meters of the existing (E-S7) well, from where the well will be deviated towards

the target reservoir. The anticipated top hole position maximises reuse of the existing subsea infrastructure at E-S7. The new well will be tied back to the existing ES subsea manifold.

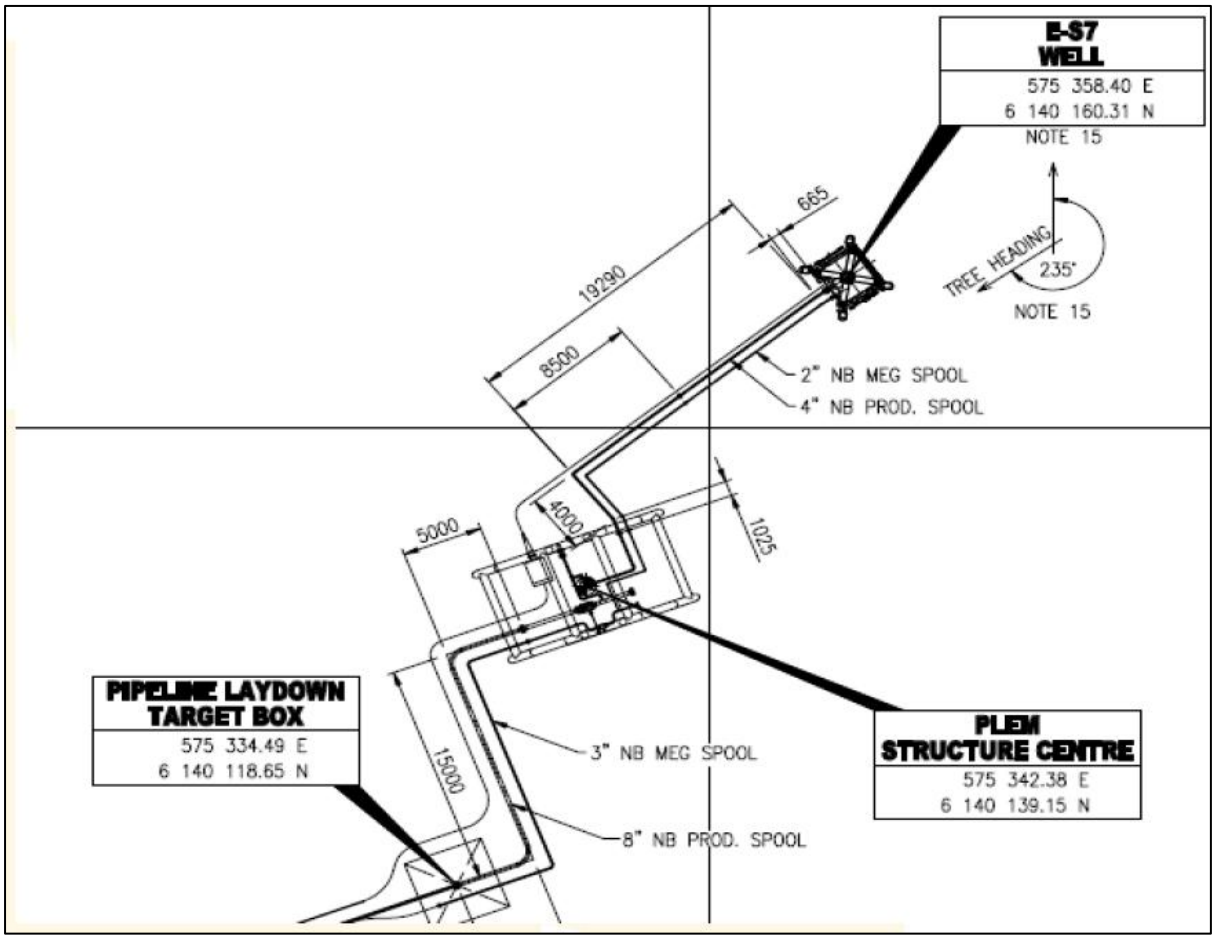


***Figure 5:*** *Existing infrastructure at E-S7 well.*

The redevelopment well will target transitional marine to fluvial sandstones which tested 38 MMscf/d of gas and 670 bbls/d of condensate over an open hole 116m gross interval. The entire fluvial section is about 289m in thickness with nett reservoir of 166m. Individual sandstones vary between 1m to 15m in thickness with average porosity of 13% and average water saturation of 47%.

The estimated 2P recoverable volume is 22 Bcf of gas and 0.84 MMbbls of condensate, with a peak gas rate of ~18 MMscf/d and peak condensate rate of ~ 300 bbls/d

| | Recoverable Gas (BCF) | Recoverable Condensate (MMSTB) |
|---|---|---|
| 3P | 27 | 0.92 |
| **2P** | **22** | **0.84** |
| 1P | 19 | 0.76 |

## 3. SCOPE OF WORK

The Consultant is required to do a complete feasibility study for the proposed development of the E-BK, E-AD and E-S field. The high-level scope of work includes:

- Drilling and completions feasibility design of the 3 new production wells, including the trajectory planning, casing-, tubing-, wellhead-, and completions selection (refer to **Attachment A** for the detailed drilling scope of work)
- Carry out comprehensive flow assurance studies and pipeline/tubing sizing based on the anticipated production profiles.
- Determine and design the optimum subsea system (i.e. flow lines, pipelines, manifolds, subsea production trees and control systems) layout. This includes determining the optimal subsea routing/s given the known seabed conditions.
- Determine the impact of the proposed field development on the existing Subsea and FA platform topsides infrastructure, and design necessary modifications.
- Perform the required Feasibility phase designs for the development plan.
- Prepare the documentation and specifications to enable PetroSA to tender for the FEED phase
- Develop cost estimates to complete the FEED phase (Class 2), and total end of job cost for the project (Class 3). This should include an estimate for decommissioning costs.
- Develop project schedule for FEED and Execution phases.

Specific consideration should be given to the following:

- Integration into the existing SCG subsea infrastructure (for E-BK and E-AD), the EM/E-S subsea infrastructure (for E-S8) and FA platform systems. The Consultant needs to familiarise themselves with the current operating conditions and operating philosophies of the existing facilities, the predicted future operating philosophies and conditions, and ensure that the proposed development option is the most optimal solution.

- Flow assurance is a key risk due to the high condensate-to-gas ratio of the fields, as well as the potential for higher water production later in field life. This will require a comprehensive dynamic flow assurance study of the new pipeline section from E-BK to E-BB3, and the impact of adding the 3 new production wells on the existing wells and pipeline system. The gas, condensate and water production profiles (Section 6: *Company Supplied Information*) are forecasts based on the subsurface models and specific assumptions regarding future operating philosophies, and could be different from the actual profiles during production, for various reasons (e.g. feedstock demand, subsurface uncertainties, etc.). The impact of changes in key variables, such as the condensate to gas ratio (CGR), water to gas ratio (WGR) and production rates, on flow assurance should be evaluated in detail to specify the technical limits and establish a safe operating envelope. The study should include the assessment of possible hydrate formation, wax deposition, inorganic scale formation and corrosion, and corresponding mitigating measures which may be adopted. The flow assurance study needs to include the flow of new and existing wells, from downhole in the wells to the reception facilities onshore.
- Slug consequence assessment: Assess the impact of predicted slug volumes and surge rates on existing process facilities, including: separators, compression systems, control systems, produced water handling systems and downstream reception facilities. Identify operational constraints and required facility modifications where applicable.
- The flow assurance study needs to evaluate the robustness of the proposed well and facilities design against low, base and high cases representing the uncertainty in gas-water contact depth and associated gas, condensate and water production profiles
- Hydrate mitigation options, and impact of hydrate mitigation on flow assurance. This should include alignment with the current hydrate mitigation philosophy (MEG and/or KHI) if deemed feasible.
- Control of the E-BK and E-AD subsea infrastructure from the FA platform via the SCG infrastructure. The SCG system is a long distance tieback and the impact of additional infrastructure on the electrical/hydraulic and the master control station (MCS) control system needs to be assessed (refer to previous electric and hydraulic impact studies in Company Supplied information).
  - The impact on the FA platform DCS (Discrete Control System) and ESD (Emergency shutdown system) interface control systems need to be assessed.

- The long hydraulic umbilicals required for the new well will increase the hydraulic fluid capacity. The impact on the hydraulic skid, supply tank and return tank needs to be assessed.

- Similarly, the control of the E-S8 well and infrastructure via the ES/EM infrastructure needs to be assessed.
  - E-S8 well will be controlled from the EM Buoy systems.
  - E-S8 is a long-distance tieback, and the impact of additional infrastructure on the electrical/hydraulic and the master control station (MCS) control system on the Buoy needs to be assessed.
  - The impact on the Buoy BCS and ESD interface control systems and the interface with the FA platform DCS and ESD system need to be assessed.
  - The potentially long hydraulic umbilical required to the new well will increase the hydraulic fluid capacity. The impact on the hydraulic skid, supply tank and return tank on the buoy need to be assessed.
- The chemical skids on the buoy and on the FA platform need to be assessed to ensure the skids comply as per capacity required for the new Wells
- The suitability of the proposed tie-in points of the new wells and associated infrastructure given the available infrastructure.
- Operability & existing facility suitability assessment: Verify the operability and suitability of the existing FA Platform process systems for the proposed development, including assessment of: liquid handling, slug handling capability, turndown performance, produced water handling requirements, chemical treatment requirements and facility modifications required.

## 4. WORK TO BE PERFORMED BY CONSULTANT

Activities required to perform the feasibility work shall include, but not be limited to, the following:

- Assimilation and review of the Company provided data, and identification of any further information required to complete the study.
- The holding of a study kick-off workshop involving both PetroSA and Consultant personnel
- Develop the Basis of Design for the Feasibility Study to be performed
- Prepare Baseline Schedule for the feasibility study
- Weekly and Monthly progress reporting, and progress meetings, including Minutes of Meetings
- Prepare Master Document Register for the feasibility study

- Execution, reporting and documentation of the well design, process design and flow assurance studies, and subsequent safety engineering
- The management of interfaces between the Consultant, the Company and Others.
- Perform the necessary system process simulations and designs.
- Process Design Cases/Operating Cases: Establish and evaluate process design cases for start-up, normal production, plateau production, declining production, end -of-field -life operation, shutdown and restart conditions. All process and flow assurance assessments shall be performed for the applicable design cases.
- Preparation of high-level operating and control philosophies for the system based on the preferred processing scheme
- Develop high-level commissioning philosophy.
- Develop high-level sparing philosophy, including the identification of maintenance spares and commission spares.
- Develop a preferred processing scheme supported and documented by process flow diagrams (PFDs), utility flow diagrams (UFDs), heat and material balance simulation results, a listing of required process utilities, and a listing of major subsea and topsides equipment.
- Identification of long lead items
- Preparation of generic functional specifications and data sheets for the main and long lead items of the subsea and topsides process and utility facilities
- Value Engineering assessments to ensure the most optimal designs are selected
- Perform a high-level risk assessment of possible alternative subsea and topsides arrangements.
- Performance of a HAZOP/HAZID study based on the preferred processing scheme.
- Develop a project-specific SHEQ philosophy to be followed during the subsequent phases of the project. The SHEQ philosophy needs to include the Codes and Standards that will be used during the different phases of the project, and should include the various technical safety philosophies to be applied (i.e. Fire and Gas, Flare & Blowdown, ESD, Fire Protection and Prevention, etc.).

## 5. WORK PERFORMED BY OTHERS

The Consultant is to document the interfaces with the Scope of Services and communicate requirements in terms of information, as well as when this information will be required. The following work will be performed by Others:

- The reservoir modelling and production profiles will be performed and supplied by PetroSA.

- The Environmental Impact Assessment.
- Integrity checks on existing subsea infrastructure and the costing of activities related to integrity reinstatement.
- The qualitative risk assessment will be managed by PetroSA, with inputs provided by the Consultant.
- Economic modelling by PetroSA.

## 6. COMPANY SUPPLIED INFORMATION

The Consultant shall review and assimilate the Company provided data, and identify any further information required. The required information is supplied as an attachment to the Scope of Services document:

### *6.1 The E-BK Development Feasibility Study*

PetroSA performed a full technical feasibility study in 2016 to develop and tie the E-BK field back to existing infrastructure. The facilities (subsea and topsides) engineering study was performed by Petrofac, while the reservoir modelling and well engineering were performed in-house by PetroSA. The full study will be made available to the Consultant. The Consultant shall made use of the completed work and revise where necessary.

### *6.2 Subsurface Basis of Design*

Provides key data on the E-BK, E-AD and E-S reservoirs required for the flow assurance and facilities design, including:

- Low (P90) / mid (P50) / high (P10) production profiles for the gas, condensate and water
- PVT data of the reservoir fluids
- Wax study

The Subsurface BOD document notes all the assumptions made to generate the production profiles, specifically assumptions on the surface network (e.g. pipeline/tubing sizes, topsides facility arrival pressures, other system constraints, etc.). The Consultant needs to confirm the actual system constraints, operating conditions and assumptions made relevant to the new development, and optimise the facility designs as part of this feasibility study. PetroSA will assess the impact of these potential changes on the E-BK, E-AD and E-S reservoir models, and provide production profile updates if required.

### *6.3 Well Plans*

The well recommendation for the proposed E-BK production well was developed during the E-BK Feasibility phase and will be made available to the Consultant. The Consultant shall review the E-BK well recommendation and confirm that the previous work is fit for purpose given that 2 additional wells will be drilled (e.g. standardisation of equipment).

The preliminary casing design for E-AD and E-S8, based on the reservoir intersection targets as specified by the reservoir models, will be made available.

### *6.4 Subsea and FA platform facilities design information*

The project has a significant interface with the existing SCG development, the ES/EM development and the FA platform facilities. Information will be provided to enable the Consultant to manage these interfaces, and provide direction in terms of the design requirements and constraints. The following will be made available:

- Predicted future production profiles of the wells on the SCG and EM pipeline. The GAP model used to generate these profiles can be made available to the Consultant.
- SCG and EM pipeline geometry and depth profiles
- Design information on the existing SCG and EM subsea infrastructure, including subsea production trees.
- FA platform topsides facilities design information
- Previous studies on electrical and hydraulic control systems on the FA platform (SCG development and FO development)

### *6.5 Seabed survey*

Fugro was contracted by PetroSA in 2017 to conduct a geophysical pipeline route and site survey that covered the area between the E-BK field and the proposed tie-in point on the SCG pipeline  The requirements were to establish the seafloor topography, and to locate any localized obstacles, existing structures, rock outcrops or debris that could be hazardous to the anchoring of the drilling rig, and to aid in the design and installation of the proposed subsea infrastructure

The detailed scope of work for the geophysical survey was as follows:

- Measure the water depth variations and slope changes within the whole investigation area;
- Investigate the morphology, the nature of the seabed and the lithology in formations below with respect to local geology;

- Locate any natural or man-made seabed or buried obstructions such as, but not limited to: rocky outcrops, escarpments, channels, reefs, wellheads, dropped shipping containers, abandoned anchors, trawl boards, debris (natural or man-made), wrecks, existing industrial infrastructure, pipelines, cables, etc.;

### *6.6 Metocean Studies*

The Council for Scientific and Industrial Research in South Africa (CSIR) has conducted a number of metocean studies in the areas covering the project. The latest being the 2017 study in the E-BK area. All relevant reports will be made available. Limited weather data are also continuously being recorded on the FA platform and will be made available

### *6.7 PetroSA specifications*

PetroSA has a database of design specifications for equipment installed during previous offshore development projects. Relevant specifications of similar equipment used during previous PetroSA projects can be made available when required. The PetroSA supplied specifications should be used as a guideline and applied where possible. The Consultant shall ensure that the final equipment specifications conform to industry best practises, as well as the applicable codes and regulations that govern these specifications. The Consultant shall ensure that all specifications and designs conform to South African law.

### 6.8 PetroSA contracting strategy

The preferred contracting strategy, as governed by PetroSA's Procurement Policies, is to appoint a single Managing Contractor at the start of the FEED phase to manage all subsequent engineering, procurement, construction and installation deliverables for the field development. The Consultant's deliverables for the feasibility study need to be aligned with the contracting strategy, e.g. when developing the next phases scope of work and tender documentation.

## 7. DELIVERABLES FOR THE FEASIBILITY STUDY

The main deliverables from the feasibility study shall be a comprehensive report documenting all work performed, including, but not limited to, the following:

- Drilling and completion feasibility study reports, as detailed in the drilling scope of services.
- process flow diagrams for all main process systems,
- heat and material balance simulation results,

- flowline hydraulic analysis results,
- comprehensive flow assurance study to evaluate the safe and continuous transport of hydrocarbon fluids (condensate, gas, and water) from the reservoir to the processing facilities. The steady-state and transient fluid behaviour across operational scenarios needs to be evaluated, including potential blockages (wax, hydrates, scale corrosion).
- Prepare design case register
- Prepare Process design matrix: Transient operations & Sensitivity cases for P90, P50, P10. Increased water-gas ratio, increased Condensate gas ratio, reduced wellhead pressure
- hydraulic and electrical analyses of the control system
- major subsea and topsides equipment lists,
- all necessary drawings, graphs, charts, specifications, reports and other items necessary to fully document the work performed, and
- functional/generic specifications and data sheets for the main items of process and utility topsides, and subsea hardware
- Subsea and topside layouts, general arrangements and plot plans (where applicable)
- Process simulations report
- Slug impact assessment report
- Produced water handling assessment
- Operability assessment report
- Utility and chemical consumption report
- Brownfield modification register
- List of long lead items
- Detailed cost estimate for FEED (Class 2),
- Total end of job project cost estimates for the field development (Class 3).
- Project development schedule (FEED and Execution) taking relevant input from the Company.
- Quantitative Risk Assessment (Monti Carlo simulation) on Schedule & Cost estimate to ensure optimisation and determination of optimum value for project contingency taking into account variation in price and activity duration estimations.
- Preparation of a Basis of Design for the FEED
- Preparation of a detailed Scope of Work for FEED, including the Scope of Work for the managing contractor for the subsequent detailed Engineering, Procurement, Installation and Construction Management.
- Prepare the documentation and specifications to enable PetroSA to tender for the FEED, as well as the required documentation to enable PetroSA to appoint a Managing

Contractor for the subsequent detailed engineering, procurement, construction and installation management of the required facilities.

These and all other deliverables required to complete the feasibility study need to be detailed in CTRs as part of the Consultant's tender documentation to determine the full scope of deliverables.

The deliverables shall include the necessary report in a presentable form consisting of 3 hard copy sets and one electronic copy. All documents are to be provided in English.

The Consultant shall specify the software programs/packages that will be used to perform the required work. Working software copies of all models/simulations need to be supplied as part of the deliverables.

## 8. QUALITY MANAGEMENT SYSTEM

The Consultant shall have a project-specific quality management system in place to monitor, control and assure the quality of deliverables during feasibility. The Consultant needs to provide details of this quality management plan as part of the tender documentation.

## 9. REPORTING

Weekly and Monthly progress reporting, and progress meetings, including Minutes of Meetings.

## 10. TECHNICAL PROPOSAL TO BE PROVIDED AS PART OF BID

The Technical Proposal shall comprise the items as described below. The Consultant also needs to refer to the Evaluation Criteria supplied as part of the tender documentation, and ensure that sufficient information is supplied to enable PetroSA to evaluate the tender in full.

### 10.1 Overview of project

In this part of the proposal, the Consultant shall demonstrate a thorough understanding of the requirements by indicating what is considered to be the aims and the desired end-products of the Service.

### 10.2 Approach to work / Project execution plan

For clarity and complete understanding of the Services to be provided, the work items are to be broken down into a hierarchy of main and subordinate tasks, which will adequately describe the Consultant's approach to the work.

The Consultant shall supply detailed CTRs (cost/time/resource sheets) in line with the overall required scope of work. The CTRs shall describe concisely the Consultant's approach to the activity, as well as time and resources required. The detailed scope of work will be defined from these CTRs. A typical CTR format is provided in **Attachment B**.

The Consultant shall specify the software programs/packages that will be used to perform the required work.

The Consultant is expected to work closely with the technical team to ensure an aligned and iterative process, and shall closely involve PetroSA personnel in the day-to-day work.

**10.3 Schedule**

The Consultant is expected to complete the required Services, as outlined in this document, within approximately **12 weeks** from the Award date. Preference will be given to schedules that meet PetroSA's target completion period of 12 weeks; however, reasonable deviations supported by a credible execution methodology and resource plan may be considered.

The Consultant should provide a detailed schedule in line with the required deliverables and expected timelines, including sufficient allowances for data handover and review of deliverables by the Company's project team.

The Consultant shall provide a combined bar chart and tabulations (or series of charts) showing:

- Calendar time in weeks;
- Major activities and milestones;
- Consultant's programme of work, indicating main and sub tasks;
- Consultant's personnel, indicating for each one:
    - Position / designation;
    - Name (for professional personnel);
    - Duration of assignment.

**10.4 Company Information**

Concise but full information should be provided on the company designated the Controlling Company which would take overall responsibility for the Services and which would enter into a contract with the Client. If the designated company is part of a group or a consortium, the

proposal should clearly indicate the following:

- The company's relationship to the other members of the group.
- The percentage of work that will be carried out by these designated sub-contractors / partners
- The exact manner in which any other company member or members of the group would participate in the assignment and contribute to the work.
- What the fields of activity of each partner shall be.
- The Black Economic Empowerment status of these other groups or subcontractors.

The information should be presented in a tabular fashion as far as possible, with the applicable agreements between partners and any supporting descriptive material regarding these agreements, being presented in a separate addendum.
In addition, any actual or potential conflicts of interest must be declared and details provided.

**10.5 Experience Record**

The Consultant shall provide documentation of company experience in similar offshore projects, particularly in South Africa. Note that PetroSA wishes to discourage brochuremanship and unnecessary costly proposal preparation. The material presented should be prepared with maximum economy to ensure that the resources of neither Proposers nor Evaluators are wasted.

The Consultant shall list relevant projects undertaken in the last ten years. For each of the projects listed, the following information should be provided:

- Brief project description;
- Exact services performed;
- Value of the Contract of Services performed;
- Dates of commencement and completion (or projected completion) of services;
- Actual performance against work programme and budget;
- Location of Project, owner's name, address, telephone number, telefax number.

In the case where the services listed above were performed as sub-contractors, or within a consortium of joint venture, this should be clearly stated, with an indication of the proportions of the services provided by each participant.

**10.6 Organisational Chart**

The Consultant shall provide a description of the resources proposed to perform the Services, supported by an organisational chart.

The chart should include the following information:

- Interfaces between the Consultant's project team and its head office;
- Interface with PetroSA;
- Interface with relevant authorities;
- All positions proposed for the project and the relationships between them;
- Names of key professional personnel including specialists and/or specialist reviewers.

**10.7 Curricula Vitae**

In this part of its proposal, the Consultant shall supply curricula vitae (CVs) for professional staff. Each CV shall give the following information:

- Name, age, parent firm, nationality and position in project organisation;
- Educational qualifications;
- Professional qualifications (societies, honours, publications, etc.);
- Relevant experience (actual duties performed and degrees of responsibility held) including locations, dates and duration of assignments, starting with the most recent.
- Brief summary of other recent experience;
- First language and, if not English, level of proficiency in speaking, reading and writing English.

PetroSA attaches a great degree of importance to the qualifications and experience of the staff proposed. The Consultant must ensure that if selected for this work, the nominated staff is assigned as proposed. Failure to do so may result in the annulment of the award of contract.

**11. FINANCIAL PROPOSAL TO BE PROVIDED AS PART OF BID**

The Consultant shall submit a detailed Financial Proposal, including detailed CTRs (cost/time/resource sheets) for all activities and deliverables included in the Scope of Work. The CTRs shall clearly indicate the proposed methodology, resources, effort, schedule, assumptions, and associated cost. The submitted CTRs will form the basis of the commercial evaluation and, if accepted by PetroSA, shall be incorporated into and form part of the Contract. PetroSA reserves the right, at its sole discretion, to amend, defer, exclude, or discontinue any portion of the Scope of Work prior to or during contract execution. A typical CTR format is provided in Attachment B.

The Contract shall be administered on a reimbursable basis, subject to an agreed target price derived from the approved CTRs. Payment shall be made only for work satisfactorily performed, duly supported, and accepted by PetroSA in accordance with the Contract.

No deviation from the approved scope, cost, resources, assumptions, deliverables, or schedule shall be undertaken without PetroSA's prior written approval. Any such changes shall be managed through the applicable contract change control process and shall only become effective upon written approval by PetroSA.

**12. TECHNICAL EVALUATION CRITERIA AND REQUIREMENTS**

Tenderers will be evaluated on their technical capability and capacity to perform the required services. To facilitate this assessment, tenderers shall complete and submit the attached Technical Questionnaire, together with all required supporting information.

The technical evaluation will be based on the criteria contained in the Technical Questionnaire. Only tenderers who meet all minimum technical requirements will proceed to the next stage of the evaluation process.

Failure to submit a completed Technical Questionnaire or the required supporting information may result in the tender being deemed non- responsive and excluded from further consideration.

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| PetroSA | **CTT26772**<br><br>**SCOPE OF WORK**<br><br>**TO CONDUCT A FEASIBILITY STUDY FOR THE PROPOSED DEVELOPMENT OF THE E-BK, E-AD AND E-S FIELDS IN OFFSHORE LICENCE BLOCK 9, SOUTH COAST, SOUTH AFRICA** |

| NO | DESCRIPTION | EVALUATION SOURCE | CRITERIA (Submit supporting documents) | EVALUATION SCORE YES/NO |
|---|---|---|---|---|
| | **COMPANY EXPERIENCE** | | | |
| 1 | The tenderer shall have a minimum of ten (10) years' Engineering, Procurement and Construction Management (EPCM) experience in the Offshore Upstream Oil & Gas sector and have completed at least ten (10) Feasibility and/or FEED studies in each of the following areas of expertise: (areas such as)<br>• Drilling (Well and Completions Engineering)<br>• Facilities Engineering (Subsea and Topsides Engineering)<br>• Flow Assurance Studies (including Transient Hydraulic Modelling)<br>Where one (1) area of expertise is subcontracted, the tenderer shall meet the requirements for at least two (2) areas of expertise, and the | Tenderers shall submit a Company Information Profile and a project reference schedule detailing relevant experience, including project descriptions, scope, value, completion dates, and contactable client references.<br>(In compliance with the Protection of Personal Information Act (POPIA), tenderers shall obtain the necessary consent from all referenced individuals prior to submitting their contact details as part of the bid.)<br><br>**[Take note: Only one (1) out of the three (3) areas of expertise may be subcontracted]** | Minimum ten (10) years relevant experience and ten (10) or more studies for each area of expertise. | |

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|---|---|---|---|---|
| | subcontractor shall independently meet the same minimum experience requirements for the subcontracted area. A signed subcontracting agreement must be submitted with the bid. | | | |
| | | **PROJECT TEAM EXPERIENCE** | | |
| 2. | The Bidder shall propose the following key personnel:<br>• Project Manager<br>• Drilling Lead<br>• Completions Lead<br>• Topsides Facilities Engineering Lead<br>• Subsea Facilities Engineering Lead<br>• Flow Assurance Study Lead<br>• Cost Estimation Lead<br><br>Each proposed core team member must demonstrate:<br>• A minimum of ten (10) years' relevant experience in their respective discipline; and<br>• Participation in at least ten (10) Feasibility and/or FEED projects, including experience in offshore gas field developments and brownfield projects. | Bidders shall submit:<br>• Detailed CVs for each proposed team member clearly reflecting the required experience; and<br>• A table of relevant projects, indicating the project name, client, role performed, project phase (Feasibility and/or FEED), and contactable references.<br><br>The project table must correlate with the experience reflected in the submitted CVs. Bidders are responsible for obtaining the necessary consent from all references in compliance with POPIA. | 10 years relevant experience **and** 10 or more Feasibility and/or FEED projects. | |

| | | | | |
|---|---|---|---|---|
| | **TECHNICAL PROPOSAL** | | | |
| 3. | The Tenderer must demonstrate a clear and comprehensive understanding of the project scope, deliverables, and execution requirements. | The Tenderer shall submit:<br>a. Detailed Cost, Time and Resource (CTR) estimates aligned to the scope of work and deliverables.<br>b. A Project Execution Plan clearly describing the proposed methodology, approach, key activities, and deliverables.<br>c. An organisation chart clearly defining the project management structure, reporting lines, and key personnel assigned to the project.<br>d. A detailed Gantt chart schedule aligned to the scope of work, identifying key activities, milestones, deliverables, and proposed completion dates. Preference will be given to schedules that meet PetroSA's target completion period of 12 weeks; however, reasonable deviations supported by a credible execution methodology and resource plan may be considered.<br>e. Company experience records demonstrating relevant experience as required in Section 10 of the Scope of Work.<br>f. Curricula Vitae (CVs) of the proposed project team demonstrating compliance | The Tenderer's submission will be evaluated on the completeness, credibility, and alignment of the proposed approach, resources, schedule, and experience with the project requirements. | |

| | | | | |
|---|---|---|---|---|
| | | with the personnel requirements specified in Section 10 of the Scope of Work. | | |
| 4 | The Tenderer must demonstrate that it has access to the necessary tools, systems, specialist software, hardware, and data sources required to successfully execute the scope of work. | The Tenderer shall submit:<br>• A list of all proposed software, hardware, modelling tools, databases, and other resources to be utilised for the project; and<br>• Supporting documentation demonstrating ownership, licensing, subscription, access rights, or availability of the proposed tools and systems. | The Tenderer must demonstrate that the proposed tools and systems are appropriate, available, and sufficient to perform the required services and deliver the project outcomes. | |

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|---|---|
| PetroSA | **CTT26772**<br><br>**SCOPE OF WORK**<br><br>**TO CONDUCT A FEASIBILITY STUDY FOR THE PROPOSED DEVELOPMENT OF THE E-BK, E-AD AND E-S FIELDS IN OFFSHORE LICENCE BLOCK 9, SOUTH COAST, SOUTH AFRICA** |

## Attachment A: *Detailed* Drilling and Completion Engineering Scope of Work

Attachment A - Drilling SOW for Feas

## Attachment B: Example of Typical CTR (Cost/Time/Resource) Format

CTR Format - Example.xls

**Revision Date:** 24 June 2026

***ATTACHMENT A: DETAILED*** **DRILLING AND COMPLETION ENGINEERING SCOPE OF WORK**

**FEASIBILITY STUDY FOR THE PROPOSED DEVELOPMENT OF THE E-BK, E-AD and E-S FIELD IN OFFSHORE LICENCE BLOCK 9, SOUTH COAST, SOUTH AFRICA**

## 1. INTRODUCTION

1.1 COMPANY requires Feasibility Drilling Engineering Services to be performed for its forthcoming infill development project which currently includes wells in the following fields: E-BK, E-AD, E-S in Block 9 offshore Southern South Africa. The COMPANY may revise these fields by adding and/or removing as it deems necessary.

### 1.2 E-BK Well

1.2.1 An E-BK Well is planned as a horizontal gas production well in the E-BK gas-condensate field, located approximately 130km south-south-west of Mossel Bay and ~50km south-west of the F-A Platform in a water depth of ~140m. The E-BK field was discovered by the E-BK1 well in 1991. E-BK1 proved a rich gas condensate accumulation in the 14A sandstone reservoir and tested at a maximum gas rate of 26.3 MMscf/d with a condensate rate of 4,155 stb/d. The reservoir is interpreted as a deep-marine turbidite sandstone within the 14A sand/channel-lobe complex.

1.2.2 The proposed E-BK development well is located approximately 800m north-west of the E-BK1 discovery well at surface location. The planned horizontal section passes the E-BK1 wellbore at a distance of approximately 200m. The well is designed to target the central area of the E-BK accumulation and to drill a horizontal section of approximately 700m close to the top of the 14AS reservoir while maintaining maximum stand-off above the gas-water contact.

1.2.3 The key E-BK reservoir parameters are:

- Top Reservoir : 2,590mTVDSS (T14AS horizon)
- Pressure : 3,803psia (at GWC)
- Temperature : 116 ºC (242ºF)
- Porosity (average) :15%
- Permeability (average) : 60mD
- GWC : 2,619mTVDSS
- GIIP : 60.8Bscf
- Gas formation volume factor : 0.0052rcf/scf
- Gas specific gravity : 0.81
- Initial condensate gas ratio : 180stb/MMscf

Previous dynamic reservoir simulation work evaluated alternative well types and development options and identified a single horizontal producer as the preferred development concept. The horizontal well is expected to deliver up to approximately 50 MMscf/d, subject to facilities and operating constraints. The preliminary well design, completion philosophy and detailed operating assumptions shall be confirmed during the feasibility and Basis of Design work.

## 1.3 E-AD Well

An E-AD well is planned as a vertical gas production well in the E-AD gas-condensate field, located within Block 9 of the South Coast Gas Production Right, approximately 36 m North of the discovery well E-AD1, in a water depth of ~120m. The E-AD field was discovered in 1987 when E-AD1 intersected several hydrocarbon-bearing intervals, proving gas-condensate accumulations in the 12A and 11A reservoirs. The E-AD reservoirs comprise deep-marine turbidite channel sandstones with limited well control and no appraisal drilling.

The principal development targets are the 12A, 11A Upper and 11A Lower gas-condensate reservoirs, with 11A Lower identified as the main producing interval. E-AD1 tested maximum gas rates of 10.9 MMscf/d from 12A, 13.9 MMscf/d from 11A Upper and 13.7 MMscf/d from 11A Lower, with associated condensate yields of 128, 36 and 41 stb/MMscf respectively as depicted in the Table below.

| Reservoir Interval | Maximum Qgas MMscf/d | Max Qcond stb/d | CGR stb/MMscf |
|---|---|---|---|
| **12A** | 10.9 | 1364 | 128 |
| **11A Upper** | 13.9 | 528 | 36 |
| **11A Lower** | 13.7 | 585 | 41 |

Maximum observed DST Production rates per reservoir

Dynamic reservoir simulation predicts that a single vertical development well producing commingled flow from the 12A and 11A reservoirs could produce a plateau rate of 10MMscf/d for 1 year before production is curtailed by water production.

1.3.1 The E-AD reservoir is a sandstone unit deposited as a deep-marine turbidite with a gas-condensate accumulation with the following properties:

| Parameter: | Unit: | 12A | 11AU | 11AL |
|---|---|---|---|---|
| Top of reservoir | mTVDss | 2,801 | 2,883 | 2,899 |
| Pressure | psia | 3,990 | 4,127 | 4,130 |
| Temperature | deg F | 246 | 247 | 248 |
| Porosity | % | 12 | | |
| Permeability (WTA) | mD | 6 | 4.9 | 29 |
| GWC | mTVDss | 2,822 | 2,898 | 2,914 |
| GIIP | Bscf | 3.17 | 4.05 | 15.75 |
| Gas formation factor | rcf/scf | 0.0046 | 0.0046 | 0.0046 |
| Gas density | SG | 0.703 | 0.705 | 0.707 |
| CGR | stb/MMscf | 128 | 37 | 41 |
| CO2 | Mol % | 3.9 | 3.8 | 3.82 |

E-AD Reservoir Parameters

## 1.4 E-S8 Well

An E-S Well is planned as a deviated production well targeting the Fluvial reservoir as the primary objective and the Upper Shallow Marine (USM) reservoir as a secondary objective.

The E-S field was discovered by the E-S1 well in 1983. Well E-S1 was tested with a maximum gas rate of 38 MMscf/day and condensate rate of 670 bbl/day in 116m gross fluvial interval and 20 MMscf/day and condensate rate of 180bbl/day in 20m gross interval Upper Shallow Marine.

Well E-S7 was drilled several years later and flowed 6 MMscf/day and condensate rate of 16stbl/day in 34m gross interval (10m fluvial and 24m USM). The well shut in since 2016.

| Reservoir Interval | Maximum Qgas | Max Qcond | CGR |
|---|---|---|---|
| | MMscf/d | stb/d | Stb/MMscf |
| E-S1 USM | 20 | 180 | 12.8 |
| E-S1 Fluvial | 38 | 670 | 14.5 |
| E-S7 Fluvial | 6 | 16 | |

Maximum observed DST Production rates per reservoir

1.4.1 The prospect is located approximately 87–100 km south-south-west of Mossel Bay and 18 km south-west of the F-A Platform in a water depth of approximately 120 m.

1.4.2 The planned trajectory is designed to intersect three fault blocks between E-S1 and E-S7 to maximize reservoir contact and recovery potential. The proposed

well location is approximately 95 m northwest of the E-S7 production well and 695 m north of the E-S1 discovery/appraisal well.

1.4.3 The Primary E-S reservoir is a sandstone unit deposited as a fluvial wet gas accumulation, with a secondary E-S reservoir is a sandstone unit deposited as an upper shallow marine wet gas accumulation with the following properties:

| **Parameter:** | **Unit:** | **Fluvial** | **USM** |
|---|---|---|---|
| **Top of reservoir** | **mTVDss** | 2,246.22 | 2,176 |
| **Pressure** | **psia** | 3,618 | 3,190 |
| **Temperature** | **Deg F** | 231 | 213 |
| **Porosity** | **%** | 14.5 | 15.8 |
| **Permeability (WTA)** | **mD** | 21 | 213 |
| **GWC** | **mTVDss** | 2,464.3(sand2)<br>2,504.5(sand3)<br>2,540.2(sand4)<br>2,561.3(sand5) | 2,216.4 |
| **GIIP** | **Bscf** | 14.8-16.6-20.9 | 4.1-5.47-6.26 |
| **Gas formation factor** | **rcf/scf** | 0.00541 | 0.005510 |
| **Gas density** | **SG** | 0.747 | 0.659 |
| **CGR** | **stb/MMscf** | 14.5 | 12.8 |
| **CO2** | **Mol %** | 0.9 | 0.89 |

E-S Reservoir Parameters

Dynamic reservoir simulation predicts that a single slanted development well producing commingled flow from the fluvial and USM reservoirs could produce a plateau rate of 18MMscf/d for 15-20 months before production before field decline, while maximum rates from both the USM and the fluvial from E-S8 are expected to be as high as 75MMscf/d and 60MMscf/d respectively.

## 2. CONCEPTUAL STUDY

2.1 Historically COMPANY has run a four casing string; a conductor of either 36”or 30”, swaged the 20” to 17 ½” intermediate casing before running the 9 5/8” production casing and a contingency 7” Liner string to be able to run a 4 ½” production tubing and in the contingency case a 3 ½” production tubing run. These assumptions require to be firmed up with the requisite drilling engineering studies being undertaken during the feasibility phase.

2.2 Previously a semi-submersible rig and 18 ¾” well head run. However the technological developments and environmental changes in the sea states and weather requires these assumptions to be firmed up with the requisite drilling engineering studies being undertaken during the feasibility phase.

## 3. DESCRIPTION OF WORK: FEASIBILITY PHASE

3.1 CONTRACTOR shall provide and/or sub-contract the following engineering services necessary to firm up the conceptual design assumptions. These services shall include, but not be limited to (for CONTRACTOR to provide as optional any additional and/or perquisite studies):

3.1.1 Rig, Riser, Wellhead, Conductor Fatigue Analysis Study:

The ultimate focus for this study is to access the rig type to be used, taking into account the historical semi-submersible rigs usage, the technological advancement and any possible changes between the previous drilling campaign and now. The rig type study will therefore focus on the fatigue analysis and may include the following activities. The CONTRACTOR shall group activities and propose as optional any additional studies and further propose which of these studies to carry out in this feasibility phase and which to postpone to the next phase. CONTRACTOR may make proposals but COMPANY reserves the right to make final choice.

- The CONTRACTOR shall analyse weather and environmental conditions prevalent in the Block 9 area for the last 10 years and project into the next ten years.
- Specify the limits for the various rig types (semi-submersible, jack-up, dynamic positioning vessels, etc.) for these environmental conditions.
- For moored rig types undertake rig mooring assessment based on sea-bed assessment.
- Model the wait on weather for the various rig types usable in the South African Block 9 environment. Weather operating limits of different rig specifications.
- Consider the Structural Operating Capacities of the various rig types vs. what will be required (Hook Load, Setback, Deck Space, Liquid Mud Volume).
- Rig Fleet Market Availability & Commercial Assessment: Fleet supply, demand, and day rate trajectories, and possible rig upgrade/modification requirements.
- Procurement strategy & technical rig specifications shortlist
- From modelling and assessment specify different types of wellheads, conductors and casing loads.
- Produce different models of Rig/Riser/ Wellhead/Conductor load and fatigue assessments.
- Based on the above assessment derive acceptable fatigue life in days for drilling and completion activities.
- Allow access for two COMPANY personnel (drilling Engineers) exposure so as to review the software used and fine tune with CONTRACTOR the final window chosen.

- Outline the barrier philosophy for the well, during drilling and subsequent phases.
- Assessment for the different BOP types and weights to define the envelop for choice during detailed design phase.
- Assessment for the different SSXT types and weights to define the envelop for choice during detailed design phase.

3.1.2 Geo-mechanical and geo-chemical Assessment:

CONTRACTOR shall carry out studies to enable COMPANY to have an adequate description of the rock mechanics and its chemistry to enable COMPANY to assess optimal drilling trajectories, completion and production giving due regard to safety and without damaging the reservoir. The CONTRACTOR shall group activities and propose as optional any additional studies and further propose which of these studies to carry out in this feasibility phase and which to postpone to the next phase. CONTRACTOR may make proposals but COMPANY reserves the right to make final choice.

- Build a geo-mechanical model for each field
- Undertake wellbore stability studies zonal isolation assessment for each field
- Define ranges for the different mud, cement and completion fluid types and weights.
- Assess the use of the various casing string sizes and their limitations: 36”, 20”, 13 3/8”, 9 5/8”, 7”.
- Model different completion strategies and types (different ICV’s, water handling capabilities) for both initial production and future production and reservoir management.
- Trajectory constraints definition, Drilling Optimisation modelling,
- Document possible completion strategies including perforation techniques for the geo-mechanical model developed.
- Pilot hole versus geo-steering assessment requirements.
- Analyse drilling bit technology developments and performance in comparable formations as Block 9 field.
- Identify value-add technologies that have the potential to reduce well construction duration and/or cost.
- Document limitations and uncertainties of the models developed and work to be detailed during the next phase.
- Modelling of the different reservoirs and the associated fluids.

3.1.3 Drilling Engineering feasibility studies

The ultimate focus for this study is to develop preliminary design work and

where some work has been done, review the same and identify and close any gaps to enable progressing the project to the FEED stage. The CONTRACTOR shall group activities and propose as optional any additional studies and further propose which of these studies to carry out in this feasibility phase and which to postpone to the next phase. CONTRACTOR may make proposals but COMPANY reserves the right to make final choice.

- Casing, Tubing and Downhole equipment Metallurgy Screening:
  - Definition of sour and sweet gas partial pressures, and evaluation based on well lifetime temperature/pressure profiles
  - Stress corrosion cracking (SCC) risk assessment
  - Carbon Steel vs. Corrosion Resistant Alloys
  - Preliminary elastomer and seal compatibility assessment

- Preliminary Well and Completion Design:
  - Trajectory Modelling: Develop preliminary well paths to optimize reservoir drainage
  - Standardisation considerations to the extent feasible across the three fields for inventory management and to promote learning curve accumulation over the campaign duration.
  - Casing & Tubing Design: Selecting preliminary tubular sizes and materials, and associated components.
  - Evaluate different options to determine the optimal Lower Completion concept (e.g. open-hole, slotted liner, cased & perforated)
    - Consider formation damage risks & reservoir stimulation feasibility
    - Consider the need to mitigate sand production and water breakthrough
  - Preliminary upper completion design, considering reservoir management & flow assurance requirements, e.g.
    - SSSV type & depth
    - Chemical Injection Systems (Hydrate, Scale, Corrosion Inhibitors, Foamer)
    - Permanent downhole P&T gauges
    - Capability to perform gas lift via A-annulus, without the need for rig intervention.
  - Smart completions feasibility (ICVs, ICDs zonal control)

- Preliminary Drilling & Completion Fluids Selection Strategy:
  - Water-Based Muds (WBM) vs. Non-Aqueous Fluids (NAF/OBM) Screening
  - Formation Damage and Wellbore Stability Fluid Compatibility
  - Packer Fluids & Fluid Loss Control Brines Screening

- Preliminary Cementing Design Aspects:
  - Cement slurry screening, considering fluid interactions and compatibility

- Outline cementing programs to ensure zonal isolation, prevent gas migration, and provide structural integrity over the life of the well.

- Develop a list of long lead items (LLI)
  - For each LLI, specify base case quantity, procurement lead time, latest order date to protect PAGS first gas, current market availability, existing PetroSA inventory of usable LLI stock.
  - Identify batch procurement opportunities across E-BK, E-S and E-AD.

- Logistics & Infrastructure:
  - Evaluate marine support, supply vessel requirements, helicopter operations, and port availability for tubular and bulk material storage.

- Drilling & Completions Risk Register:
  - Assess technical, environmental and operational risks
  - Specify residual risks that persist after the assessed risks are mitigated to ALARP.

- Timeline Estimation:
  - Develop high-level operational schedules and drilling sequence scenarios to determine the overall project duration.
  - Estimate drilling days per well section, and for completion operations, including contingency time.
  - Estimate total pre-FID expenditure phased by calendar year.

- Cost Estimation:
  - Generate Class 3 well AFE estimates (deterministic and/or probabilistic). (incl. day-rates, fuel, casing, cementing, services, vessels, etc.).

3.2 Basis of Design (BoD):

CONTRACTOR shall compile all gathered data and engineering criteria into a finalized Drilling & Completion Basis of Design document, which acts as the foundational blueprint for COMPANY to issue into the market for the FEED phase.