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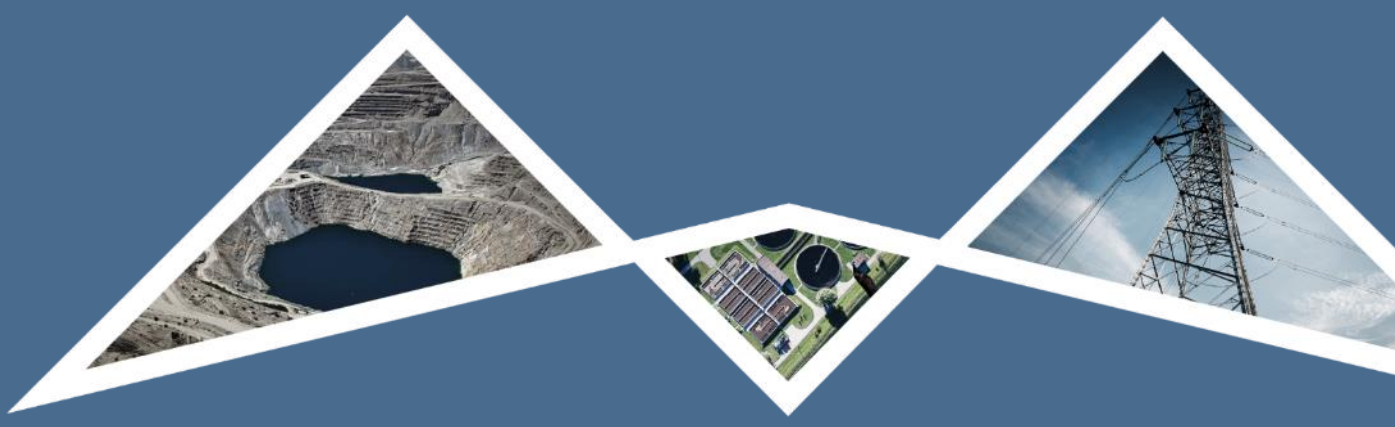
FINANCIAL PROVISION REPORT FOR TETRA4 (PTY) LTD – FEBRUARY 2024

TETRA4 VIRGINIA PRODUCTION RIGHT

PASA REFERENCE: 12/4/1/07/2/2



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List of Acronyms

DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FRDCP	Final Rehabilitation, Decommissioning and Closure Plan
I&AP	Interested and Affected Party
IWUL	Integrated Water Use Licence
LOM	Life of Mine- reflective of the current planned extent of the mining operations.
MWP	Mine works programme
NEMA	National Environmental Management Act (Act 107 of 1998)
PASA	Petroleum Agency South Africa

List of Definitions

Abandoned well	If the well is not deemed to be a viable producer, it will be abandoned as per Tetra4's Plug and Abonnement Policy and in line with the requirements of the rehabilitation plan and associated regulations. This policy requires wells to have isolation in place to prevent potential flow of fluids, either sub-surface or to surface. The well plug and abonnement process will involve the placement of cement plugs across the open hole in order to isolate zones using the pump/squeeze technique[1].
Care and maintenance	This involves the maintaining and corrective action as requires as well as conducting the required inspection and monitoring to demonstrate achievement of success of the implemented measures.

[1] Virginia Production Right; PASA Ref: 12/4/1/07/2/2 PR; Basis of design MDR1B, May 2022

Closure	This involves the application for closure certificate and initiation of transfer of on-going care and maintenance to third parties.
Contingencies	This allows for making reasonable allowance for possible oversights/omissions and possible work not foreseen at the time of compilation of the closure costs. Allowance of between 10 percent and 20 percent would usually be made based on the accuracy of the estimations. The South African Department of Mineral Resources Guideline (January 2005) requires an allowance of 10 percent.
Decommissioning	This relates to the situation after cessation of operations involving the deconstruction/removal and/or transfer of surface infrastructure and the initiation of general site rehabilitation.
Operational well	Operational well is a 'blower' that has, or will be connected to the gas gathering network for production purposes. It invariably transects more than 1 distinct flow zone.
Post-closure	The period of on-going care and maintenance, as per arrangement with third parties.
Preliminary and General (P&G)	This is a key cost item which is causally related to whether third party contractors are applied for site rehabilitation. This cost item comprises both fixed and time-related charges. The former makes allowance for establishment (and de-establishment) of contractors on-site, as well as covering their operational requirements for their offices (electricity/water/communications), latrines, etc. Time-related items make allowance for the running costs of the fixed charged items for the contract period.
Rehabilitation:	The re-instatement of a disturbed area into a usable state (not necessarily its pre-mining state) as defined by broad land use and related performance objectives.
Remediation	To assist in the rehabilitation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions.
Scheduled closure	Closure that happens at the planned date and/or time horizon.
Site relinquishment	Receipt of closure certificate and handover to third parties for on-going care and maintenance, if required.
Suspension well	Should the well not be required for immediate production it will be suspended. In simplified terms for the purposes of this Financial Provision report a suspension well refers to an exploration borehole which does not provide clear results on whether the borehole will be able to successfully extract gas over a duration of time, it is classified as "suspended" and further studies and/or drilling would be required to determine whether the exploration borehole is feasible for extraction.
Unscheduled closure	Immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state.

EXECUTIVE SUMMARY

Tetra4 (Pty) Ltd (herein referred to as Tetra or the Holder) is the holder of a Production Right for natural gas issued by the Department of Mineral Resources and Energy (DMRE) in association with the Petroleum Agency South Africa (PASA). The Production Right spans an area of approximately 187 000ha in the Free State Province, stretching from Welkom in the north, to Theunissen in the south. The Production Right was issued for a duration of 30 years commencing in 2010. The Holder is continuing with further exploratory drilling activities and has commenced with production from some initial wells. The completion of construction of the Cluster 1 phase of the production is due shortly, and initial production of helium and Liquid Natural Gas (LNG) is due to commence in the near future.

According to the National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Financial Provision Regulations (2015) (NEMA GNR 1147), every mine[2] must make financial provision for annual rehabilitation, final rehabilitation, decommissioning and closure activities at the end of mining; and remediation and management of latent or residual environmental impacts which may become known in the future. GNR1147 also requires that every holder must annually-

a) Assess his or her environmental liability in a prescribed manner and must increase his or her financial provision to the satisfaction of the Minister responsible for mineral resources; and

b) Submit an audit report to the Minister responsible for mineral resources on the adequacy of the financial provision from an independent auditor.

This report includes the following sections which aims to comply with the requirements of the Financial Provision Regulations (2015):

- Section A: Final Rehabilitation, Decommissioning and Closure Plan (FRDCP) aligned with the requirements outlined in Appendix 4 of GNR 1147 including the closure cost estimate calculated by a third party;
- Section B: Annual Rehabilitation Plan (ARP) aligned with the requirements outlined in Appendix 3 of GNR 1147; and
- Section C: An Environmental Risk Assessment Report aligned with the requirements outlined in Appendix 5 of GNR 1147.

The closure vision for the operation is to conduct the rehabilitation, decommissioning and closure operations and manage the environmental impacts in such a manner to ensure that the landscape is safe, stable and non-polluting over the long term, and that the post closure land use aligns with the surrounding land-use and/or agreed upon end use and does not affect the sustained utilisation thereof.

The GNR1147 financial provision is expected to represent a realistic estimation of the required cost for effective decommissioning, rehabilitation, closure, and management of ongoing residual, and reasonably foreseeable potential future latent, impacts. The financial provision estimation has been calculated using the GNR1147 method (i.e. real contractor rates).

The **Scheduled closure cost** estimated for the Tetra4 Virginia Production Right is **R 48 806 526.32 (excl. VAT)** and the **Unscheduled closure cost** are **R 45 501 931.29 (excl. VAT).** The summarised costs as determined using the NEMA GNR1147 methodology, is summarised in Table 1.

[2] In accordance with the MPRDA, reference of a mine would apply to a petroleum production operation.

Table 1: Summarised consolidated financial provision costs

Closure Cost Item	Scheduled Closure3			Unscheduled Closure4		
	2021	2022	2023	2021	2022	2023
Final Decommissioning and Closure Cost	R 40 789 084.27	R 37 716 144.77	R 43 785 220.20	R 26 408 438.45	R 34 149 254.23	R 35 840 744.58
Infrastructural Areas	R 15 393 064.07	R 12 994 324.22	R 12 688 314.35	R 9 444 931.83	R 12 846 905.70	R 12 505 464.0
Well closure	R 16 437 049.21	R 16 757 092.06	R 21 688 314.35	R 11 075 354.48	R 14 025 158.01	R 14 428 213.30
General Surface Rehabilitation	R 1 603 562.35	R 1 008 220.42	R 1 067 806.25	R 1 021 043.02	R 913 892.72	R 1 067 806.25
P&Gs and Contingencies	R 7 355 408.64	R 7 006 507.46	R 8 463 734.17	R 4 867 109.12	R 6 363 297.80	R 7 839 260.53
Annual Rehabilitation Cost	R 0.00	R 0.00	R 0.00	R 581 893.93	R 855 805.29	R 4 639 880.59
Post Closure Phase- Residual and Latent Cost	R 3 767 674.34	R 4 931 972.64	R 5 021 306.12	R 3 767 674.34	R 4 931 972.64	R 5 021 306.12
Monitoring	R 3 235 093.86	R 3 793 848.16	R 4 018 064.58	R 3 235 093.86	R 3 793 848.16	R 4 018 064.58
Latent and residual risk provision	R 532 580.48	R 1 138 124.49	R 1 003 241.54	R 532 580.48	R 1 138 124.49	R 1 003 241.54
Total Quantum of Financial Provision (Excl. VAT)	R 44 556 758.61	R 42 648 116.81	R 48 806 526.32	R 30 758 006.72	R 39 937 032.15	R 45 501 931.29

[3] Scheduled closure refers to the process of decommissioning, rehabilitation, and closure of the production operations as at the planned cessation of production activities. This is also referred to as planned closure.

[4] Unscheduled closure refers to the process of decommissioning, rehabilitation, and closure of the production activities, assuming all production activities cease as at the date of this report. This is also referred to as unplanned closure.

As can be seen from Table 1 above, there has been an ~14% increase in the unscheduled closure cost. This can be attributed to the following:

- Annual rates escalation;
- Additional wells drilled - 2022 quantum provides for 43 production wells, whereas the 2023 quantum provides for 51 production wells.
- The construction (and hence the environmental footprint) of the production plant has increased substantially since the 2021 and 2022 assessments.
- A thorough site visit with detailed measurements enabled specialists to generate significantly more accurate cost projections for infrastructure rehabilitation

1 INTRODUCTION

Tetra4 (Pty) Ltd (herein referred to as Tetra or the Holder) is the holder of a Production Right for natural gas issued by the Department of Mineral Resources and Energy (DMRE) in association with the Petroleum Agency South Africa (PASA). The Production Right spans an area of approximately 187 000ha in the Free State Province, stretching from Welkom in the north to Theunissen in the south.

In 2017, following an Environmental Impact Assessment (EIA), Environmental Authorisation (EA) was issued to Tetra4 to extend gas production operations within the existing Production Right, to amend the existing EMPr, and include the combined helium and LNG plant and any activities not previously authorised to the gas production development. As part of this EIA process a Final Rehabilitation, Decommissioning and Closure Plan (FRDCP) was prepared in accordance with the requirements of the NEMA Financial Provisioning Regulations (2015) (NEMA GNR 1147). The GNR1147 also requires that every holder must annually-

a) Assess his or her environmental liability in a prescribed manner and must increase his or her financial provision to the satisfaction of the Minister responsible for mineral resources; and

b) Submit an audit report to the Minister responsible for mineral resources on the adequacy of the financial provision from an independent auditor.

2 REPORT STRUCTURE AND GNR 1147 ALIGNMENT

According to the regulations, financial provision must be made for annual rehabilitation, final rehabilitation, decommissioning and closure activities at the end of prospecting, exploration, mining or production operations; and remediation and management of latent or residual environmental impacts which may become known in the future. This report includes the following sections which aims to comply with the requirements of the Financial Provision Regulations (2015):

- Section A: Final Rehabilitation, Decommissioning and Closure Plan (FRDCP) aligned with the requirements outlined in Appendix 4 of GNR 1147 including the closure cost estimate calculated by a third party;
- Section B Annual Rehabilitation Plan (ARP) aligned with the requirements outlined in Appendix 3 of GNR 1147; and
- Section C: An Environmental Risk Assessment Report aligned with the requirements outlined in Appendix 5 of GNR 1147.

Table 2 below lists the specific requirements that must be contained in each of the three plans as per the NEMA GNR 1147 Appendices 3, 4 and 5, as well as the associated section in the report where each requirement is addressed.

Table 2: NEMA GNR1147 requirements.

NEMA GNR 1147 Appendix 4 - Final Rehabilitation, Decommissioning and Closure Plan (FRDCP)		
No.	**Requirements**	**Section**
3 (a)	Details of the person or persons that prepared the plan.	Section 3
3 (b)	The context of the project, including material information and issues that have guided the development of the plan, an overview of the environmental context, the social context regarding closure activities and post-mining land use, stakeholder issues and comments, and the mine plan and schedule for operations.	Section 4.1

NEMA GNR 1147 Appendix 4 - Final Rehabilitation, Decommissioning and Closure Plan (FRDCP)		
No.	**Requirements**	**Section**
3 (c)	Findings of an environmental risk assessment leading to the most appropriate closure strategy.	Sections 4.3 and 4.4
3 (d)	Design principles, including the legal and governance framework, the closure vision, objectives and targets, alternative closure and post closure options, a motivation for the preferred closure action, details of the closure and post closure period, details associated with any on-going research on closure options, and details of assumptions made to develop closure actions.	Section 4.4
3 (e)	A proposed final post-mining land use.	Section 4.6
3 (f)	Closure actions required.	Section 4.7
3 (g)	A schedule of actions for final rehabilitation, decommissioning and closure.	Section 4.8
3 (h)	An indication of the organisational capacity that will be put in place to implement the plan, including the organisational structure.	Section 4.9
3 (i)	An indication of gaps in the plan.	Section 4.10
3 (j)	Relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators.	Section 4.11
3 (k)	The closure cost estimation procedure.	Section 4.12
3 (l)	Monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps.	Section 4.13
3 (m)	Motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps as per 2(i).	n/a

NEMA GNR 1147 Appendix 3 - **Annual Rehabilitation Plan (ARP)**		
No.	**Requirements**	**Section**
3 (a)	Details of the person/s that prepared the plan.	Section 3
3 (b)	the pertinent environmental and project context relating directly to the planned annual rehabilitation and remediation activity.	Section 5

NEMA GNR 1147 Appendix 3 - **Annual Rehabilitation Plan (ARP)**		
No.	**Requirements**	**Section**
3 (c)	results of monitoring of risks identified in the final rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities.	Section 5.1
3 (d)	an identification of shortcomings experienced in the preceding 12 months.	Section 5.2
3 (e)	details of the planned annual rehabilitation and remediation activities or measures for the forthcoming 12 months, including those which will address the shortcomings contemplated in 3 (d) above or which were identified from monitoring in the preceding 12 months.	Section 5.3
3 (f)	a review of the previous year's annual rehabilitation and remediation activities, indicating a comparison between activities planned in the previous year's annual rehabilitation and remediation plan and actual rehabilitation and remediation implemented.	Section 5.3
3 (g)	Costing, including an explanation of the closure cost methodology, auditable calculations of costs per activity or infrastructure, cost assumptions and monitoring and maintenance costs likely to be incurred both during the period of the annual rehabilitation plan and those that will extend past the period of the final rehabilitation, decommissioning and mine closure plan.	Section 5.4

NEMA GNR 1147 Appendix 5 - **An Environmental Risk Assessment Report**		
No.	**Requirements**	**Section**
3 (a)	Details of the person or persons that prepared the plan.	Section 3
3 (b)	Details of the assessment process used to identify and quantify the latent risks.	Section 6.1
3 (c)	Management activities.	Section 6.2
3 (d)	Costing, calculated using the current value of money and no discounting or net present value calculations included in the determination of the quantum of the liability.	Section 6.2
3 (e)	monitoring, auditing and reporting requirements.	Section 6.2

3 DETAILS OF THE REPORT SPECIALISTS

EIMS was appointed by Tetra4 to develop the Financial Provision report inclusive of the annual rehabilitation plan (ARP), final rehabilitation, decommissioning and mine closure plan (FRDCP) and environmental risk assessment (ERA). The details of the professionals who contributed to the preparation of this report is provided in Table 3.

Table 3: Details of Technical Specialist[5]

Name	Role	Qualifications/ Experience	Professional registrations
Liam Whitlow	Environmental Scientist	BSc Hons Environmental Management. ~20 years environmental consulting experience.	South African Council for Natural Scientific Professions- Registered Professional Natural Scientist (Environmental Science). Registered Environmental Assessment Practitioner. Member of Land Rehabilitation Society of Southern Africa.
Jessica Jordaan	Environmental Scientist	BSc in Geology and BSc Hons in Soil Science.	3 years environmental soil science experience and environmental science. Member of Land Rehabilitation Society of Southern Africa.
Douglas Richards	Environmental Engineer	BEng Tech Civil Engineering	15 years environmental engineering experience Member of South African Institution of Civil Engineering (SAICE) Member of Land Rehabilitation Society of Southern Africa.
Mariesa Le Roux	Environmental Engineer	BEng Civil Engineering	2 years environmental engineering experience, Member of South African Institution of Civil Engineering (SAICE) (Membership number 201700381), Member of Engineering Council of South Africa (ECSA) (Candidate Engineer number 2021204307), Member of Geosynthetic Interest Group of South Africa (GIGSA)

4 SECTION A: FINAL REHABILITATION, DECOMMISSIONING AND MINE CLOSURE PLAN (FRDCP)

The objective of the final rehabilitation, decommissioning, and closure plan is to identify a post-production land use that is feasible through the identification and provision of various components as outlined in Appendix 4 2(a) – (h) of GNR 1147. The FRDCP provides the vision, objectives and targets through detailing closure actions and measures. The required resources such as costs; time and personnel, including roles and responsibilities is detailed in the FRDCP in order to be able to monitor, measure and audit the committed closure actions. It is critical that the objectives included in the FRDCP must be measurable and auditable. Knowledge gaps and how these will be addressed need to be identified to improve level of cost accuracy.

This section of the report aims to achieve the GNR 1147 Appendix 4 Section 2(a) – (h) objectives and to discuss and align to the Appendix 4 Section 3 (a) – (m) requirements.

[5] According to GNR1147, "specialist" means an independent person or persons who is qualified by virtue of his or her demonstrable knowledge, qualifications, skills or expertise in the mining, environmental, resource economy and financial fields.

4.1 PROJECT CONTEXT

This section aims to provide context and focus attention on the material information and issues that have guided the development of this FRDCP. Further details on the project and environmental context can be obtained from the Environmental Impact Assessment (EIA) Report and associated Environmental Management Programme (EMPr).

The description and definition of the environmental context is critical to ensure that the ultimate closure objectives and associated end land-use are achieved. The content of this section is sourced primarily and summarised from the available EIA Reports, and the previous FRDCP.

The key environmental aspects related to the project area and specifically the closure and rehabilitation strategies are summarised in the remainder of this Section. The production activities, which would require inclusion in the FRDCP are presented herein and are derived from the available information on the historic operations and the current conditions on-site.

4.1.1 LOCATION

The granted Production Right spans approximately 187 000 ha and was awarded to Tetra4 (then Molopo South Africa) in 2012 to develop gas fields around the town of Virginia in the Free State Province (refer to Figure 1). Whilst the application for Production Right has been issued for the entire conceptual full field development area (refer to blue area in Figure 1), the environmental approvals granted, only apply to the areas with certified reserves (refer to the white shaded area in Figure 1). The entire certified reserves area spans a total area of approximately 104 659 ha, as presented by the red area in Figure 1.

For the purposes of this FRDCP the following infrastructure and operations were considered as part of the calculations and is considered as the battery limits for the cost estimates:

- The existing infrastructure constructed on-site at the time of the report – including the processing plant; office building; etc.
- All exploration and production wells (regardless of their status) at the time of the report; and
- Planned exploration activities for the next 12 months (these are accounted for under the scheduled and unscheduled closure scenarios).

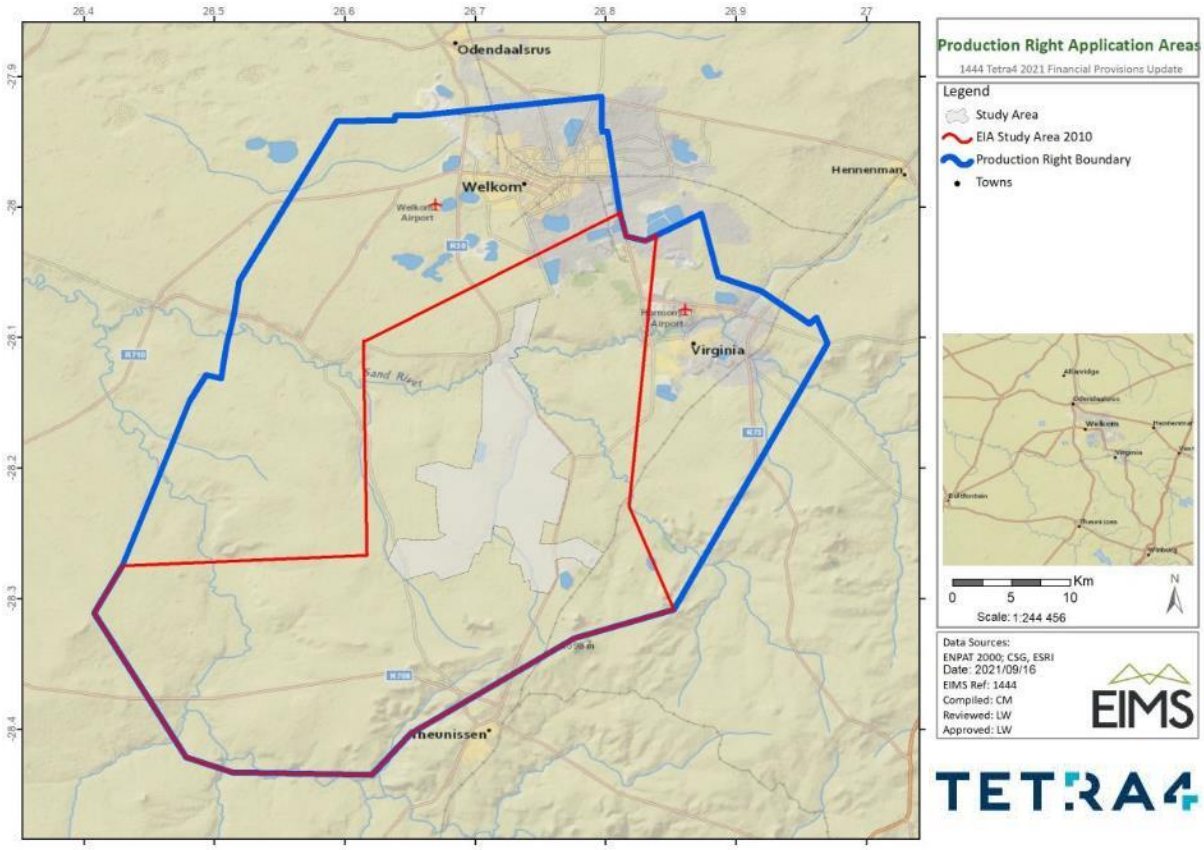


Figure 1: Locality map.

4.1.2 GAS PRODUCTION

The Tetra4 Production Right is located within the Sand River Play or Virginia Gas Field. Despite not being clearly defined, the field is composed predominantly of Karoo, Ventersdorp and Witwatersrand Supergroup lithologies complete with younger dolerite intrusions. Major fault systems associated with closely spaced zones of fractures and joints provide for preferential pathways for a combination of abiogenic and biogenic gas to reach the surface. As such, the resulting gas at the surface is a direct emission from the major fault or from minor secondary faults linked to a major fault. In this regard, it is thought that the primary source of gas originates from the Witwatersrand Supergroup or shallower Karoo. As an unconventional resource, the gas is presumed to be a mantle mix of both abiogenic and biogenic hydrocarbons originating from ancient fissure waters, coal beds of the Ecca Group of the Karoo Supergroup as well as ancient algal mats within the shallow marine/lacustrine Witwatersrand Supergroup deposits. The feed gas will be available at a pressure of ~0.4 barg (gauge pressure) and with a temperature in the range between 10º and 30ºC. The feed gas will be compressed upstream of the helium process units by a compressor station. A gas pre-treatment will remove condensate as well as traces of sulphur, mercury and C3+ gas components (e.g. propane, butane, pentane), which could cause possible damage to the downstream process equipment.

4.1.3 GAS PRODUCTION METHOD

The gas field production method to be employed entails the extraction of gas at individual well sites identified through ongoing exploration activities within the Production Right area. Gas extracted from the wells is sent via pipeline to infield compressors and then piped through to the combined helium and liquid natural gas (LNG) plant for processing. The final product includes helium and LNG, both of which are temporarily stored and trucked away via trailer to be sold to end users. Each component, namely well sites, pipelines, infield centralised compressors and the processing plant is described below in more detail.

4.1.3.1 **Exploration Drilling**

Exploration drilling entails the use of a truck, trailer or skid mounted drill rig to drill to varying depths in order to strike the gas reserve. Percussion and diamond drills typically require clearance of an area of 50 m x 50 m in order to set up the rig and begin drilling activities. All exploration boreholes to be drilled in accordance best industry best practice and Tetra4 internal procedures and will be sealed with a combination of casing and grouting to ensure vertical isolation of the gas from both the surrounding geology and hydrological regime. In addition to the drill rig, lined sumps will be required to store and recirculate water for the drilling process. The drilling of exploration boreholes is a temporary and short-duration activity and the equipment to be used during drilling activities includes a truck/trailer or skid mounted diamond/percussion drill rig, excavator, dozer, grader water cart, light motor vehicle for transport of personnel and chemical toilets.

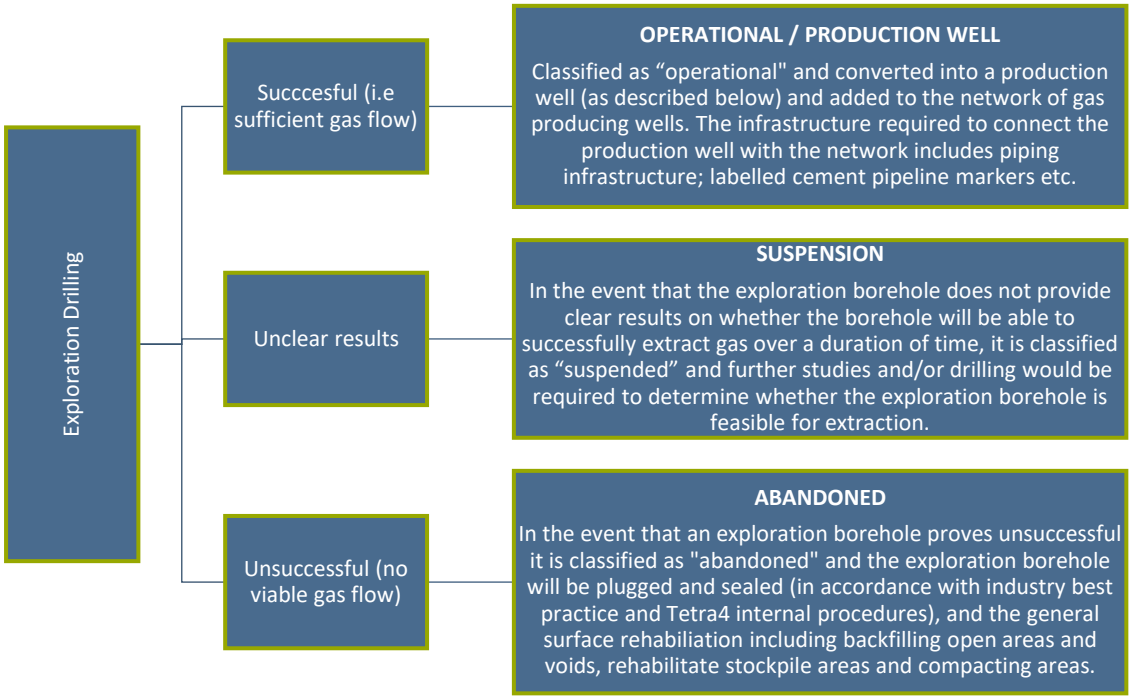


Figure 2: Classification of exploration borehole

Tetra4 has been conducting both exploration and production activities. The existing exploration and operational production wells at the end of February 2023 is listed in Table 4 and illustrated spatially in Figure 3. Table 4: Status and number of wells (February 2023).

Table 5: Existing exploration and production wells as of February 2024.

OPERATIONAL PRODUCTION WELLS (22)	SUSPENSION WELLS (20)	ABANDONED (12)
SPG03 New	SPG03	2057
T4MD0002 (R2D2)	NEA02HT4	P0010
P25	T4MD0001 (P2V2)	SWM06IT4 (P1V1)
MDR1 Re-Entry	P016b	T4WHM1
P007	P024c2	T4MD0006 (P015)

OPERATIONAL PRODUCTION WELLS (22)	SUSPENSION WELLS (20)	ABANDONED (12)
P0012	P027d	SST11
T4MD0003 (C3P0)	P023 Rev1	SST12
1307	P024b	P30b
1400	P024b_Rev1	P26C
DBE1	MDR1(b)	P027e
DW54403	HADV01	P027d
EX01	T4MD0004 (P13)	P024C
HDR01	T4MD0006b (P015b)	
HZON1	P022	
BEI02	2057N	
ST23	P025	
T4MD0005 (R2D2b)	2033	
MDR5	1629	
EC4 (T4KK010)	MDR1C (T4MD014)	
EC3 (T4KK009)	C1KK004	
P29C (T4AGR006)		
T4KK012		
SPG03 New		

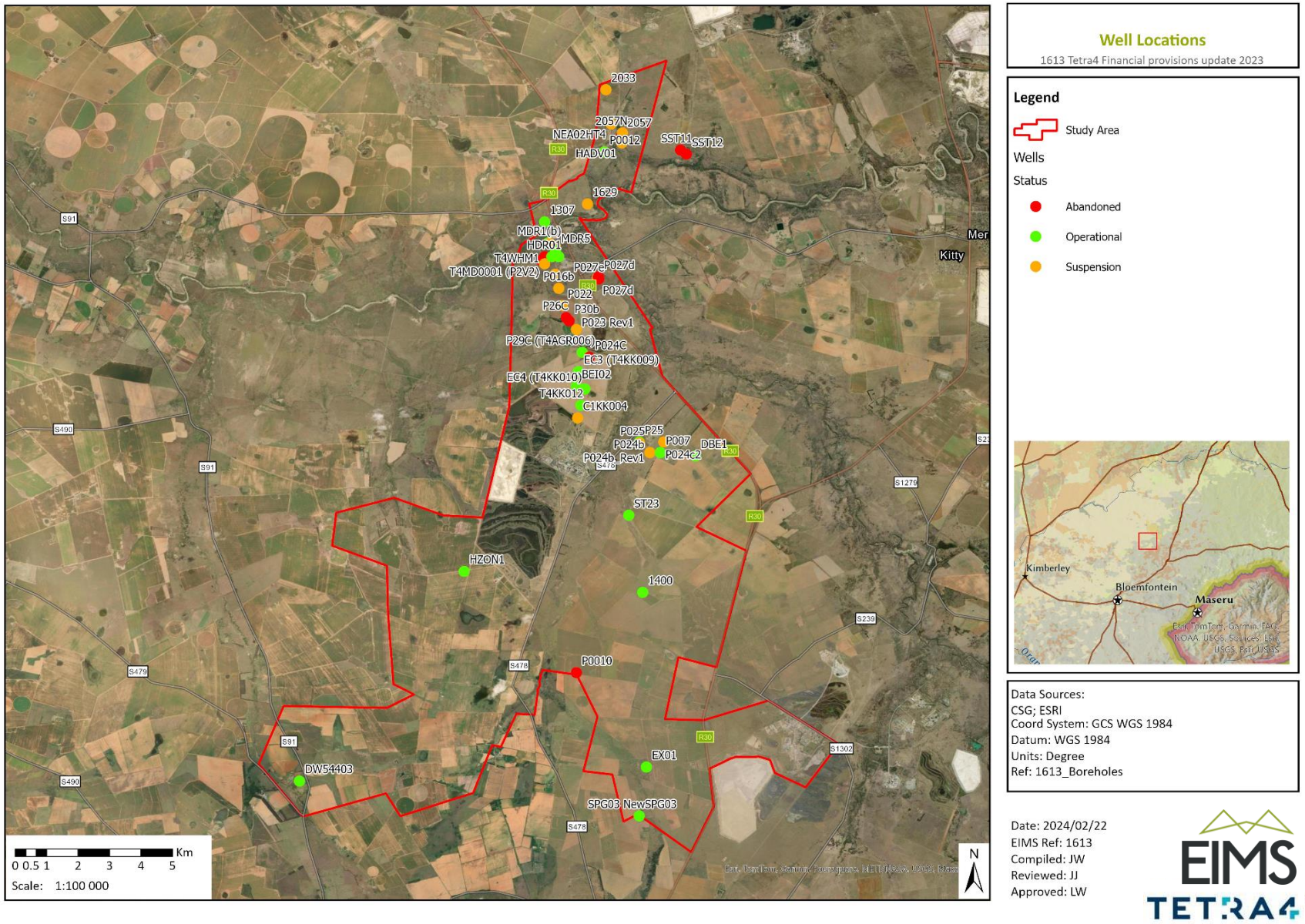


Figure 3: Spatial distribution of existing wells.

4.1.3.2 **WELL SITE CONNECTION**

All wells that are drilled and used for production purposes are strengthened with a combination of casing and grouting to average depths of 300m. The casing and grouting ensure that the gas and other fluids are isolated from surrounding geology and promotes the preferential flow of gas from the formation through the well and up to the surface. As the gas is naturally lighter than air, it rises naturally to the surface and no well stimulation is required. The combination of casing and grouting also serves to ensure that gas is isolated and prevented from interacting with the geohydrological regime.

Figure 4: View of existing production well.

Due to low gas pressures, groups of ~10-12 wells will be included as an inlet to a booster station to provide vacuum suction each. The booster stations will be connected via pipelines to centralised infield gas compressor stations. Each well will likely be equipped with an electrical or gas driven wellhead which boosts gas recovery by creating necessary pressure differentials through vacuum suction. From the wellhead, the blower will be connected via pipeline to an inline gas booster or a centralised infield reciprocating gas compressor. Pipelines will be a combination of high-pressure steel as well as low-pressure high-density polyethylene (HDPE) and is installed at a minimum depth of 1.5 m or below the plough line. Where piping (e.g. for the compressors and driers) will be brought to surface, steel piping will be utilised instead. Each production well site is approximately 10 m x 10 m and includes the installed wellhead. The well site infrastructure will include a plinth, fencing, an alarm system, and short length of piping from the wellhead with monitoring and emergency features (e.g. pressure release and check valves, etc.) prior to going underground (Figure 4). It is noted that the most recent well infrastructure is housed in a subterranean concrete bunker. For illustrative purposes please refer to Figure 5 for an example of a typical well head plan. In most instances a similar layout is implemented at other production well sites.

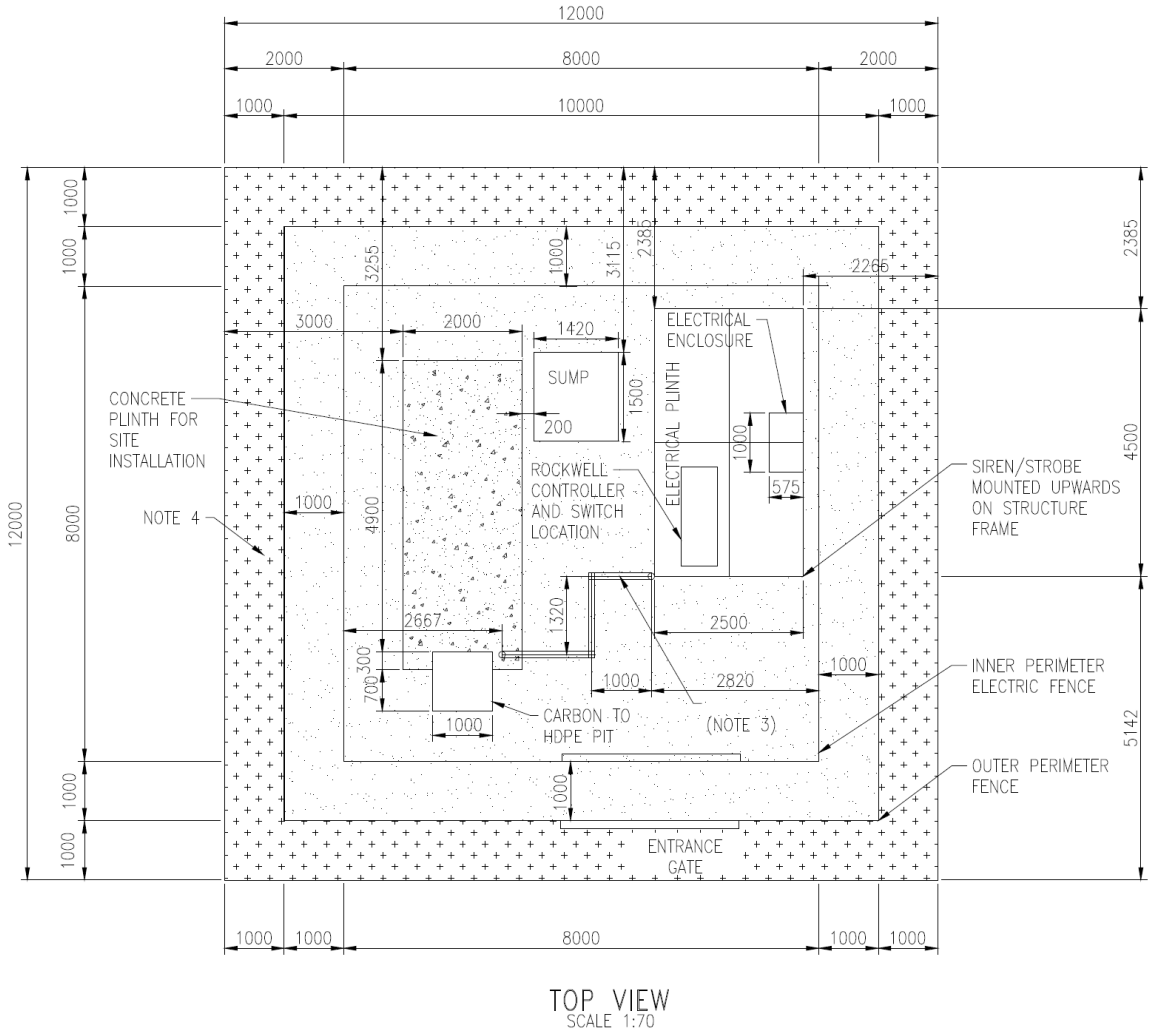


Figure 5: Typical layout of production well head.

4.1.3.3 **GAS BOOSTER AND RECIPROCATING INFIELD COMPRESSORS**

Once the feed gas exits the wellheads the gas is transported via pipeline either directly to the processing plant or via the centralised infield reciprocating compressors (see Figure 6). In certain circumstances localised in-line booster compressors and are used.

Figure 6: View of existing in-field compressor site.

The footprint of the wellhead is 10 m x 10 m but should a localised booster compressor be required at any future well with low pressure, the combined footprint will be approximately 30 m x 20 m per well site with booster pump. The footprint for a centralised reciprocating infield compressor including the gas drier will be approximately 60 m x 60 m.

4.1.3.4 **COMBINED HELIUM AND LNG PLANT**

Feed gas from either the booster compressors located at each of the well sites or from the centralised reciprocating infield compressors which will have driers in their vicinity, will be discharged into the prefabricated combined helium and LNG plant. In order to achieve the required volumes of purified helium, the compressed feed gas is fed into a further installed gas pre-treatment unit which removes any additional condensate, traces of sulphur, mercury and hydrocarbons before entering the helium separating membranes and pressure swing adsorption (PSA) unit.

Once separated by the combination of membranes and the PSA unit, the plant will separate feed gas to a minimum of 99.999 Vol% helium. Purified helium is then liquefied and placed into dispensing units for transport off-site via trailer.

Natural gas removed of helium content is then re-circulated back into the plant where it is processed to form LNG. The LNG is then also placed into dispensing units for transport off-site also via trailer.

4.1.4 SURFACE INFRASTRUCTURE

The project requires other surface infrastructure not specifically described in the preceding sections. Such additional infrastructure includes:

- Access roads;
- Coalescer filter or knockout drum at each well;

- Pipe markers (approximately every 100 m of the pipeline, where feasible);
- Lowpoint drains and pigging stations where required along the pipeline routes;
- Gas driers;
- Fencing;
- Chemical storage;
- Temporary hazardous waste storage;
- Temporary general waste storage; and
- Mobile offices and ablutions facilities.

Figure 7 to Figure 18, provides a recent visual representation of the status of the site.

Figure 7: P7 Exploration well.

Figure 8: Production well.

Figure 9: Bunker well design option.

Figure 10: P22 Suspended well.

Figure 11: Centralised Compressor station.

Figure 12: Low point drain.

Figure 13: Pigging Station.

Figure 14: Rehabilitated pipeline route.

Figure 15: Culvert on access road.

Figure 16: Flume pipe on access road.

Figure 17: Helium / LNG Plant construction area as of 22nd February 2024.

Figure 18: HDR1 Production well and associated facility.

4.2 ENVIRONMENTAL AND SOCIAL CONTEXT

The description and definition of the pre-exploration/production environmental context is critical to ensure that the ultimate closure objectives and associated end land-use are achieved. In this regard please refer to Section

6 of the EIA report (Environmental Impact Management Services (Pty) Ltd, 2017) for a detailed description of the receiving environment applicable to the current operational area (red area in Figure 1). An overview of the broader environmental context is summarised in this section.

4.2.1 CULTURAL AND HERITAGE

The Free State has a rich archaeological and historical history going back millions of years and includes significant aspects such as Later Stone Age rock art, Battlefields and Iron Age stonewalled enclosures. The Heritage Studies highlighted a number of heritage sensitivities and features including the Battle of Zand River (7 – 10 May 1900), an historic diamond mine on the farm Welgegund, archaeological sites, historic buildings and structures, cemeteries, palaeontology as well as unmarked graves from within the study area. Additional desktop study observations made include Sacred Natural Sites.

Numerous heritage sites were identified during the relevant site visits. These identified sites comprise eleven cemeteries (TET 1, TET 6, TET 7, TET 8, TET 11, TET 15, TET 16, TET 19, TET 20, TET 21 and TET 22), two Stone Age sites (TET 23 and TET 24), two historic to recent sites where the risk was identified for stillborn baby graves to be located (TET 25 and TET 26), two historic structures believed to be older than 100 years (TET 2 and TET 3), four historic structures believed to be older than 60 years (TET 9, TET 10, TET 18, and TET 27), five sites where graves may be located (TET 4, TET 5, TET 12, TET 13 and TET 14) as well as one site comprising a single lower grinder (TET 17).

A specialist Palaeontological assessment was undertaken. It was found that proposed well sites are underlain by paleontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. The paleontologically sensitive Adelaide Subgroup and underlying Ecca Group Volksrust Formation will be impacted by the exploration/production and well drilling process but given the average diameter of the proposed boreholes, impact on potential fossil material is considered moderate to low if it is assumed that fossil remains are not uniformly distributed in fossil-bearing rock units. All proposed pipeline route options are underlain by paleontologically significant Adelaide Subgroup rocks and well-developed superficial overburden (farmland) considered to be of very low palaeontological significance. Two areas have been identified where a pipeline route will traverse potentially sensitive alluvial deposits ranging in thicknesses between 4 m and 15 m at the Bosluispruit and the Sand River. The site selected for the combined helium and LNG gas conditioning plant is underlain by paleontologically significant Adelaide Subgroup rocks capped by well-developed superficial overburden considered to be of very low palaeontological significance.

4.2.2 SOCIO-ECONOMIC

The project area covers a large part of the Free State gold fields, and hence an understanding of its economic baseline is important to scope the Economic Impact Assessment (ECIA)[6]. The immediate receptor area is the population of Matjhabeng Municipality, which is one of five local municipalities in Lejweleputswa District in the Free State. The major towns located in Matjhabeng are Allanridge, Hennenman, Odendaalsrus, Ventersburg, Virginia and Welkom. The Cluster 1 project is located in Wards 23 and 24 of the Matjhabeng Local Municipality and Ward 6 of the Masilonyana Local Municipality that forms part of the Lejweleputswa District Municipality in the Free State Province.

The main towns in the Matjhabeng Local Municipality are Welkom, Odendaalsrus, Virginia, Hennenman, Allanridge and Ventersburg (www.matjhabeng.fs.gov.za). The municipality has a combined population of more than 500 000 people. The economy of the municipality is centred on mining activities in, and around Welkom, Allanridge, Odendaalsrus and Virginia. Manufacturing aimed at the mining sector exists to a limited extent in the above towns, with other activities being limited. Agriculture is a primary economic activity in the region, and ranges from farming, to hunting and fishing. The unemployment rate within this municipality is around 37.0% (Matjhabeng LM IDP 2023/2024).

[6] Economic Impact Assessment

The main towns in the Masilonyana Local Municipality are Theunissen, Brandfort, Winburg, Verkeerdevlei and Soutpan (www.masilonyana.fs.gov.za). The economy of the municipality is largely dependent on agriculture with predominantly livestock farming in the southern and western parts and crop production combined with livestock farming predominantly in the northern and eastern parts. Mining activities are situated north of Theunissen and secondary mining activities (salt and diamonds) are also found in the area. The unemployment rate in the Masilonyana Local Municipality is around 38.8% (Masilonyana LM Draft IDP 2017-2022).

The Lejweleputswa District Municipality (LDM) is situated in the north western part of the Free State and borders the North West Province to the north; the Fezile Dabi and Thabo Mofutsanyane District Municipalities to the north-east and east respectively; the Motheo and Xhariep District Municipalities to the south; and the Northern Cape Province to the west. The LDM is accessible from Johannesburg, Cape Town, Klerksdorp and Kimberley through one of South Africa's main national roads, the N1. The district covers the second largest area (24.3%) in the province and consists of the Masilonyana, Matjhabeng, Nala, Tokologo and Tswelopele Local Municipalities (www.lejweleputswa.co.za).

The main economic activities in the district are mining and agriculture (www.led.co.za). Most of the mining activity takes place in the Matjhabeng LM and the recent economic downturn in the gold mining industry led to retrenchments. Most of the retrenched labourers, who are mostly unskilled, are remaining in the region, adding to the social problems that are associated with declining conditions. Due to a number of factors including drought and market conditions, the agricultural sector is also experiencing negative growth. Furthermore, many farmers are mechanising their operations, leading to job losses and migration of workers to urban areas. The economies of the smaller towns are based on business supporting agriculture and as such this is impacting on the economy of the small towns negatively.

As is to be expected in any economic observation of Matjhabeng, gold production and the mining industry loom large. The mining industry is still the dominant sector of the local economy. The wellbeing of the Matjhabeng economy is therefore knitted together with the state of its mining industry. In the past two decades, this industry has unfortunately declined in output, affecting employment especially. However, the decline in economic value added (EVA) of the mining industry has not been as severe as that of the job losses in the industry.

Matjhabeng has a relatively large economy compared to that of other SA municipalities, but its Gross Geographic Product (GGP) has been declining for years. This means the local economy still has a measure of critical mass that could provide continued private consumption expenditure which could sustain it for quite some time. However, any economy requires new investment to grow sustainably, and based on continued mine closures and declining population in the region, it is doubtful that there will be robust economic growth for some time to come.

The Matjhabeng economy is probably a mirror of any mineral-resource based region in SA. Employment in most of these economies has declined due to a weak global economy, corresponding decline in commodity prices, and reductions in the mine workforce. Across most regions in SA the unemployment rate has increased, and many semi-urban regions are experiencing an exodus of people in search of jobs in the cities. The Matjhabeng economy is by all accounts finding a new equilibrium, one where mining employment continually declines, and its population migrates out. The increase in government expenditure and perennial agricultural activities are keeping the municipality's decline in check, but if more mines close down its GGP and formal employment is set to decline more. The prognosis for the municipality's economy is not favourable unless large-scale economic investment comes back to the region.

4.2.3 GEOLOGY AND TOPOGRAPHY

The study area is characterised by a flat surface with sparse vegetation. An analysis of topographical data indicated a slope of less than 1:10 over most of the project area. The surface geology within the study area comprises mainly Aeolian sands, with dolerite and shale outcrops. The thickness of the unconsolidated material could be inferred from the Tetra4 geological logs and suggests that the sand and alluvial material is on average 11m thick.

The unconsolidated sediments are underlain by shales and mudstones with subordinate coarse-grained sandstone of the Ecca and Beaufort Groups of the Karoo Supergroup. The Beaufort Group mudstones, shales

and fine-grained sandstones are anisotropic in nature due to their fluvial deposition. These sediments are on average 400 m thick in the study area. None of the geological logs reported fault zones in the Karoo sediments. This does not necessarily mean that fault zones do not exist, simply that they were probably not recorded during the historical drilling programme.

Dolerite sills in the Karoo formations are sheetlike intrusions that tend to follow bedding planes. A dolerite sill has intruded near the base of the Karoo sediments across the length of the study area. The sill undulates slightly but is present from an average depth of around 350 m and has an average thickness of 30 m. Dwyka tillites were not recorded in every exploration well. The regional extent of the Dwyka formation cannot be confirmed with certainty, but the borehole logs suggests that it occurs at an average depth of around 400 m below surface and reaches an average thickness of 65 m.

The Ventersdorp Supergroup volcanics that underlie the Karoo aquifers consist of felsic and mafic lavas with very low anticipated permeabilities. As such, these formations are assumed to act as aquitards or aquicludes and limit the vertical movement of groundwater. The volcanics are on average about 1 km thick over the area. It is noted that the thickness of the lavas varies over the study area. In the north, the lavas thin out to a thickness of around 250 m. The exploration logs made available by Tetra4 indicate the presence of fracture and shear zones in the Ventersdorp lavas. These zones were encountered at elevations of 1000 to 400 mamsl. No information regarding the permeability of the fracture and shear zones is available from the geological logs. The exploration logs suggest that these fracture and shear zones are overlain by unfractured lava, which is expected to have a low permeability and therefore retard the vertical movement of groundwater between the production zone and the overlying potable Karoo aquifers. The potable Karoo aquifers are also separated from the deep-seated fracture and shear zones by a 30 m thick dolerite sill that extends across the study area, as mentioned above. The sill is expected to have low permeability and to act as an aquitard or aquiclude. It is unlikely that significant vertical groundwater movement would take place naturally between the fracture and shear zones and the overlying shallow potable Karoo aquifers.

The Witwatersrand Supergroup sediments that underlie the Ventersdorp lavas comprises mainly quartzites of the Central Rand Group (CRG). The depth of the CRG quartzites was not available from the Tetra4 geological logs, as the drilling was stopped in the quartzites. Dolerite sills have also intruded the lavas and CRG quartzites. The extent to which these sills are interconnected across the study area cannot be confirmed from the exploration logs.

4.2.4 CLIMATE

The study area has warm summers and cold winters. Frost is a common phenomenon and the coldest periods (usually from June to August) are exacerbated by seasonal aridity. The daily minimum temperatures for the coldest months are below freezing, and, along with the regular occurrence of frost, are therefore a potentially limiting factor for plant growth.

The study area is situated in a summer rainfall area, with rainfall peaking in January and at its lowest during July. Rainfall data was obtained from rainfall station 0365058 (Hennenman) and the Mean Annual Precipitation (MAP) was calculated at 612 millimetres per annum (mm/a) over a 36-year period. The 95th percentile is 884 mm/a and the 5th percentile 408 mm/a. Annual rainfall is approximately 450 mm/a, which is considered to be relatively dry for an area of grassland.

4.2.5 ECOLOGY

The site is primarily within two regional vegetation types called Central Free State Grassland and Vaal-Vet Sandy Grassland, with other parts of the study area falling within Winburg Grassy Shrubland, Bloemfontein Karroid Shrubland, Highveld Alluvial Vegetation or Highveld Salt Pans. Vaal-Vet Sandy Grassland is considered in the scientific literature to be Endangered and is also listed as Endangered in the National List of Ecosystems that are Threatened and Need of Protection (GN2747 of 2022), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004). Central Free State Grassland is considered in the scientific literature to be Vulnerable but is not listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN2747 of 2022).

There are seven Red or Orange List plant species that have been recorded from the quarter degree grid in which the study site is situated. All of these were considered to have a medium to high chance of occurring in the type of habitats available on-site, one of which is listed as Vulnerable, two as Near Threatened and four as Declining. There are two plant species protected according to the National Environmental Management: Biodiversity Act that have a geographical distribution that includes the site. These are *Merwilla plumbea* and *Crinum bulbispermum*, both of which could potentially occur on-site. There is one protected tree species that could occur in the types of habitats that occur in the study area (*Acacia erioloba*). It is considered to be unlikely to occur on-site.

Significant parts of the study area are cultivated or have been previously cultivated and are therefore not considered to have high sensitivity or biodiversity value. There is also an area that is currently being mined and contains mining infrastructure. Natural habitats are considered for various reasons to have high biodiversity value and are avoided during planning phases for the proposed activities, where possible.

A total of 66 mammal species have a geographical distribution that includes the general study area in which the site is found. Of the species currently listed as threatened or protected, the following are considered to have a medium to high probability of occurring on-site, based on habitat suitability: Brown Hyaena, Spotted-necked Otter, Natal long-fingered Bat, Welwitsch's Hairy Bat, Geoffroy's Horseshoe Bat and the White-tailed Rat. Given the nature of the proposed project and the fact that many of the species of concern are relatively mobile, few threatened, near threatened or protected mammal species are likely to be significantly negatively impacted by activities on the site. The species that could potentially be affected by habitat disturbance or degradation are the Spotted-necked Otter and the African White-tailed Rat.

The site contains habitat that is suitable for various frog species, although only one protected species could potentially be affected by activities on-site, the Giant Bullfrog. A total of 48 reptile species have a geographical distribution that includes the general study area in which the site is found. Two reptile species of conservation concern could potentially occur in the study area, as follows: Giant Dragon Lizard (Vulnerable) and Striped Harlequin Snake (Near Threatened).

A total of 320 bird species have a geographical distribution that includes the general study area in which the site is found. The site contains habitat that is suitable for various bird species of conservation concern. Those that are potentially vulnerable to proposed activities in the study area are as follows: African Marsh Harrier (EN), Yellow-billed Stork (EN), Burchell's Courser (VU), African Grass Owl (VU), Secretary Bird (VU), Black Stork (VU), Maccoa Duck (NT), Red-footed Falcon (NT), Greater Painted Snipe (NT) and Black-winged Pratincole (NT). The site is not adjacent to or within any Important Bird Area for the country.

4.2.6 SOILS, LAND COVER AND LAND CAPABILITY

There are a number of land types in the study area with the most common land types in the study area being Bd, Dc and Ca (Land Type Survey Staff, 1987). The Bd and Ca, land types are found on the flat to undulating plains. The Bd land type consists of plinthic soils over more than 10% of the area, soils are eutrophic and red soils are not widespread (MacVicar et al. 1974). The Ca land type indicates land that qualifies as a plinthic catena but which has, in upland positions, margalitic and/or duplex that together cover more than 10% of the total area. The Dc landtype consists of duplex soils (sandier topsoil on clay subsoil) in which more than 10% of the land type is made up of soil forms that have one or more of vertic, melanic or red structured diagnostic horizons. These are the soils of the wide alluvial valleys of the study area. There is a large variation in the class of agricultural potential within the study area.

4.2.7 WETLANDS

There are a variety of different wetland habitats on-site, including riparian areas, stream channels, floodplains, a number of pans, open water areas and seepage areas. Aquatic systems in the study area are in a *Largely Natural to Largely Modified* state (B Category – D Category) with a *Moderate* to *High* EIS values, and reflect impacts associated with agriculture, mining and moderate rural development and associated impacts on aquatic ecosystem drivers. The most important feature to address for the health of the ecosystem and the surrounding ecosystem is the highly erosive nature of the systems, which at present makes the system highly vulnerable. Implementation of suggested mitigation measures to control further physical decline of the systems is required

to maintain the Present Ecological Status (PES) and meet the Resource Quality Objective (RQO's) for the study area. All of the delineated watercourses, along with their buffer zone, are regarded as sensitive features that should be protected from impacts.

4.2.8 SURFACE WATER

The study area is located in the Middle Vaal Water Management Area 9 (WMA 9) within the C42K and C42L quaternary catchments. The main drainage features traversing the project site include the Bosluisspruit River, Doring River and the Sand River. The Allemanskraal dam is located 21 km south of Ventersburg, however, it is outside the exploration/production area. The area surrounding the Allemanskraal Dam is also the only protected area in the vicinity, according to the Department of Water and Sanitation GIS data.

4.2.9 GROUNDWATER

Two aquifer systems were characterised with field data as part of the geohydrological study. Shallow fractured rock aquifers are formed in the upper 150 – 300 m of the Karoo sediments. These aquifers are typically low-yielding but are important to local groundwater users as they form the sole source of water supply in the region. Groundwater occurrence is associated with faults, fractures and contact zones with dolerite intrusions. A primary aquifer is associated with the alluvium deposited in the flood plains of the main rivers and streams and/or with the aeolian sands that cover a large portion of the study area. Groundwater level measurements taken during the study suggests that the unconsolidated sediments do carry groundwater. The alluvial aquifer, specifically, is vulnerable to surface sources of contamination due to its unconfined nature, expected shallow groundwater table, direct connection with rivers and streams and high permeability.

The shallow potable Karoo aquifers are separated from deep aquifer systems associated with the Ventersdorp and Witwatersrand Supergroup formations by the 30 m thick dolerite sill that extends across the study area and, by the 65 m thick Dwyka Tillite. The sill and tillite is expected to have low permeability and to act as barrier to vertical groundwater flow. Unfractured Karoo Supergroup shales found at depths greater than 300 m are also expected to act as a barrier between the deep aquifer systems and the potable Karoo aquifers. The deep aquifers are formed by fractures and shear zones in the Witwatersrand quartzites. These zones can yield large volumes of water that is associated with the underground workings of the deep gold mines. The water in the deep aquifers is naturally saline due to their marine depositional history.

In order to characterise the shallow Karoo aquifers, Tetra4 drilled five monitoring boreholes near two of the existing gas wells and three in the region of future gas well targets. These boreholes were sited using geophysical methods to ensure that preferential groundwater flow paths like fractures, faults and contact zones are targeted. Each borehole was drilled to a depth of 50 m. The available logs indicate that the boreholes intercepted unconsolidated sand and shale. One borehole intersected a dolerite contact zone. This was the only monitoring borehole that struck groundwater and Tetra4 therefor cased only this borehole. The other four boreholes intercepted seepage and were left uncased. The depth to groundwater level in the monitoring boreholes varies between 7 and 26 m below surface. The deeper groundwater level is representative of the dry boreholes where groundwater slowly seeps into the borehole. Only one pumping test and one slug test could be completed on the new monitoring boreholes due to deep groundwater levels and the fact that four of the boreholes were dry. The results confirm that the permeability of the shales is very low ($9E^{-4}$ m/d). The permeability of the dolerite contact zone intercepted is higher (0.6 m/d) and analysis of the pumping test results suggests that the sustainable yield of this borehole is around 0.35 l/s.

Groundwater quality analyses in the new monitoring boreholes and in existing boreholes monitored at Tetra4 indicate that the groundwater in the region is naturally saline, with Total Dissolved Solid (TDS) concentrations exceeding 800 mg/l on average. The main salts that contribute to elevated TDS concentrations are sodium and chloride, which is typical of the natural groundwater quality in the region. The TDS concentrations increase towards the north of the study area with highest concentrations recorded in boreholes near the Doring River. The reason for this phenomenon cannot be confirmed with certainty but is most probably related to the geology in this part of the study area. Elevated nitrate concentrations were recorded in all but one of the hydrocensus boreholes identified during the Scoping Phase of the study. This is most probably attributed to the impact of agricultural activities on groundwater quality.

The dissolved methane and ethane concentrations in the hydrocensus boreholes were all below the laboratory detection limit of 0,007 and 0,013 mg/l respectively. With reference to the ongoing regional water monitoring as well as the post-authorisation baseline monitoring undertaken by Tetra4 it is specifically noted that there are sampled boreholes which show high dissolved methane concentrations (as high as 23 mg/l) prior to any local Tetra4 activities and/or at significant distance from the Tetra4 activities.

Tetra4 has undertaken a review and update of the numerical groundwater model to incorporate newly acquired information and monitoring data (Tetra4 (Pty) Ltd, 2021). The model update included additional supplemental fieldwork, including groundwater monitoring, groundwater level monitoring, slug testing, pump testing/dewatering, incorporation of lithological data obtained from exploration drilling, and refined facility design and production-related activities. The updated groundwater model also included an update of the impacts assessments and identified and described the following specific impacts:

- "The impact of removing produced water from gas production wells during the operational phase of the project. Based on the fact that the gas producing structures which are targeted, are situated within the Ventersdorp and Witwatersrand formation, it is most likely that no water will be produced from the gas resource, as there are only a few wells which indicated water intersections at this depth. Due to extensive mining in area, the Witwatersrand basin has been dewatered for extended periods of time. However, based on the fact that one of the gas wells, well 2057, produced a large volume of water, an assessment of the impact of produced water on the overlying potable Karoo aquifers was included in the groundwater study. In order to determine the impact of all eventualities and to evaluate the worst-case scenario, a groundwater impact assessment was undertaken to establish the zone of influence of removing produced water at depth on the shallow Karoo aquifers. Simulations indicated that there is a 5% risk of impacting on the overlying Karoo aquifers at pump rates higher than 1 m^3/d. Dewatering from the deeper quartzites may also increase the risk of dewatering the Karoo aquifers if the wells are pumped at higher rates. Simulations suggest that the chance of dewatering the Karoo aquifers is also around 5% risk, but most likely lower as it is unlikely that this activity will impact the shallow aquifers.

- The drilling and operation of gas production wells could result in the migration of stray gas from the deep-seated fracture zones to formations higher up in the geological sequence. Stray gas could leak from the deep-seated fracture zones into private boreholes as a result of poorly sealed gas wells, or an overpressure event that could damage the casing and cementation or due to migration of gas along fractures and faults. In the event of gas leakage as a result of an overpressure event, with the complete failure of the casing and cementation in the well, formation water and dissolved gas will migrate preferentially along the fracture zone that is targeted during gas production and vertically up the well. Under high-pressure conditions, the migration of plumes from a well could be much faster and the radius of impact would be directly related to the strike and distance over which the fault zone prevails. The geological logs suggest that the fault zones that will be targeted are associated with the Witwatersrand quartzites and the Ventersdorp lavas. These formations are found on average deeper than 400 m below surface. Unless the fault zones extend vertically across the younger sediments to the shallow Karoo aquifers, the migration of plumes as a result of complete failure in a gas production well is expected to be restricted to the Ventersdorp and Central Rand formations. In addition, gas wells within the Virginia Production Right, produces gas as low pressures, thus reducing the likelihood that stray gas will migrate over extended distances.

- Production well dewatering will impose a stress on the surrounding aquifers, drawing water from further afield towards a well. This flow towards the well will occur preferentially from water-bearing structures that are intersected near the depth of pumping. Continued pumping from a well may therefore result in the dewatering of the water-bearing structure if it has a low storage capacity and the pumping rate is high enough. Typically, the water level in the production well will drop to below the dewatered structure in this case. In this event, the well may start to attract water either from further afield, from overlying sediments or it may pump dry. Which of these will transpire will depend on a number of factors, including the interconnected porosity and permeability of the aquifer, the permeability of the cement and the quality of the installation of the cement seal in the casing and the

pumping rate. It is unlikely that deep-seated saline water will migrate to the overlying aquifers while production wells are dewatered. This is due to the fact that the flow of water will be reversed towards the depth of pumping, not allowing saline water to migrate vertically up the well.

- The numerical model was used to assess the impact of surface spills on the underlying aquifers. An evaluation of the activities that will take place during gas production indicates that the combined Production Facility pose the largest threat in this regard. Spills associated with gas transfer pipelines, compressor stations will most probably be small and will be addressed immediately, limiting impacts on groundwater quality. It is further not possible to predict where such spills would occur, making it difficult to simulate the associated impacts. Simulations were undertaken using TDS concentrations to provide an overall groundwater quality impact assessment. Due to the fact that high porosity is assumed for the unconsolidated material, potential contamination may move at a comparatively slow rate, as larger interstitial spaces must be filled to allow contamination to migrate. It is estimated that the plume will take 55 - 96 years (20 000 – 35 000 days) to reach the Sand River north of the plant area. TDS concentrations may increase by up to 50 – 60 mg/l in the groundwater component of baseflow to the streams. This scenario represents the worst-case scenario obtained from the stochastic modelling. Modelling results also suggest that the potential pollution plume may not reach the Sand River during the 100-year simulation period, or that TDS concentrations increase by less than 10 mg/l at the river. As the baseflow component to the Doring River is expected to be a small volume, probably no more than 10 m3/d over the extent of the simulated plume, the maximum salt load to the stream is estimated to be 0,6 kg/d" (Tetra4 (Pty) Ltd, 2021).

4.2.10 AIR QUALITY

The area is dominated by winds from the north, northeast and east, with an average wind speed of 3.9 m/s. Long-term air quality impacts are therefore expected to be the most significant to the south and southwest of the project area. Ambient air pollutant levels in the project area are currently affected by the following sources of emission: agricultural activities, gold mining and ore processing, fugitive and process emissions, vehicle tailpipe emissions, household fuel combustion, biomass burning and windblown dust from exposed areas.

AQSRs within the Project area include residences, farmsteads and Holdings, as well as a mine village. The closest towns in the immediate region of the project include Welkom (located about 8 km south of the Project boundary), Virginia (located about 9 km east of the Project boundary), Bronville (located about 10 km northeast of the Project boundary), Harmony (located about 11 km south of the Project boundary) and Theunissen (located about 12 km south of the Project boundary).

4.2.11 NOISE

As per the noise study conducted in the project area, all the measurements indicated a site with a very complex sound character. Areas away from busy roads and mining activities are very quiet, with measurement locations closer to houses, busy roads and mining activities indicating higher sound levels. Vegetation growth closer to dwellings creates habitat, attracting birds and insects, which in turn make sounds that increases the ambient sound levels. The vegetation also increased wind-induced noises. The larger area, away from roads, dwellings and mining activities can be rated as Rural as per the South African National Standards: The measurement and rating of environmental noise with respect to annoyance and to speech communication criteria (SANS 10103:2008).

4.2.12 VISUAL

The sensitivity of visual receptors and views is dependent on the location and context of the viewpoint, the expectations and occupation or activity of the receptor or the importance of the view. Travellers along the roads within and through the study area, would catch glimpses of the proposed gas production infrastructure (more so the stationary surface infrastructure rather than the pipeline which will be underground) and activities when driving along the roads. These views are, however, temporary in nature and regarded as having a moderate sensitivity. People engaged in work activities within the study area are regarded as having a low sensitivity

because their attention would be focussed on their work activity. Permanent views would be those from the farmsteads and residences within the immediate area and would be classified as having a high sensitivity.

Due to the nature of the proposed gas production operations and related activities, some of the related infrastructure (e.g. well-heads, combined helium and LNG plant, etc.) may stand out from the natural setting of the study area. This could also possibly occur as a result of the construction activities such as the clearance of vegetation, which at present may be acting as a screen within the study area.

Although the visual scoping investigation indicates that there are several visual receptors within the study area, most exposure to the gas production infrastructure and activities would be the northern and highest point of the study area. The gas production infrastructure will be visible from various parts of the study area; however this is largely in relation to the pipelines connecting the existing and proposed new gas well. It should be noted that the pipeline will be underground and the footprint of the well sites will be relatively small, and thus the visibility of these structures will be of low sensitivity. The higher visibility sensitivity will be with regards to the combined helium and LNG plant.

4.2.13 STAKEHOLDER ISSUES AND COMMENTS

The initial version of this plan was made available for public review during the Cluster 1 EIA process. The comments and issues raised through that public participation were considered and were, where applicable, informed the compilation of this FRDCP. As per the Financial Provisioning Regulations (2015) this FRDCP forms a component of the EMPR submitted in terms of section 24N of the NEMA and the Environmental Impact Assessment Regulations, 2014 and is subject to stakeholder review and comment.

Table 6 provides extracts from the individual stakeholder's submissions from the Issues and Responses Report (IRR) for the Cluster 1 EIA process which relate specifically to final rehabilitation, decommissioning and closure activities. In addition, where comments have been raised by stakeholders during the projects construction and implementation phase, these have also been presented in Table 6.

Key rehabilitation, decommissioning and closure comments raised by stakeholders included:

- Safety and security concerns.
- Long-term groundwater impacts and impacts to boreholes.
- Long-term impacts similar to mining impacts.
- Future maintenance.
- Impacts of production on the environment.
- Future benefits for landowners in terms of monitoring boreholes.
- Rehabilitation guarantee.
- Long-term impacts on ecological aspects.
- Future plans in terms of roads, infrastructure and maintenance.
- Long-term impacts on land productivity and agricultural potential.

Table 6: Key Stakeholder issues related to closure.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
Comments raised during the Cluster 1 EIA			
Mr. Frans Petrus Dawid Jacobs	Mr. Jacobs submitted his completed registration form and raised concerns regarding the following: Increased theft Security and safety risk for his family, Pollution of the environment Contamination and long-term impacts on surface and groundwater sources.	EIMS thanked Mr. Jacobs for his interest in the project and confirmed that he has been registered as an I&AP for the project and will be notified about the availability of the Scoping and EIA Reports, and any opportunity for any potential public involvement opportunity. EIMS explained that the application for Environmental Authorization following an EIA process entails 2 phases: The Scoping phase and the EIA phase. The project is currently in the Scoping Phase. The scoping phase involves a broad investigation of the study area to identify potential sensitivities and impacts applicable to the receiving environment from the proposed development; these impacts are assessed and compared in more detail during the EIA phase. Findings of the broad assessment conducted during scoping will be included in a Scoping Report, and preliminary mitigation and/or management measures recommended by the various specialists in relation to the identified impacts will be included in the accompanying Environmental Management Programme (EMPr). The scoping phase allows for the gathering of input from I&APs and other stakeholders	Safety and security concerns. Long-term groundwater impacts.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		towards ensuring that the final selection of the preferred alternatives for the proposed development is robust and informed, having taken into consideration various concerns and incorporated information from local stakeholders. The following specialist studies have been undertaken to date and findings from these assessments will be included in the Scoping Report to be made available for review to all registered Interested and Affected Parties (I&APs) such as yourself prior to submission to the Authorities: Visual Impact; Surface water; Groundwater; Wetlands and Aquatic ecology; Heritage; Air quality; Ecology; Soils and Agricultural potential; Noise; Social; and Economics.	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		With regards to the safety of the community, EIMS ensured Mr. Jacobs that the security risks will be assessed during the EIA phase. EIMS confirmed that all I&APs will be notified about the availability of the Scoping Report for public review and comment.	
Mr. Hermanus Johannes Pretorius	Mr. Pretorius submitted his completed registration form and had the following concerns: Mr. Pretorius is concerned that the project will have the same impact on him and the community as the impacts resulting from mining in terms of water, soil, noise, and safety. Mr. Pretorius also pointed out that nobody has been to his farm to inform him about the project, and wanted to know if there are final plans yet in terms of infrastructure, maintenance etc. Mr. Pretorius provided his contact number to arrange for a meeting.	EIMS thanked Mr. Jacobs for his interest in the project and confirmed that he has been registered as an I&AP for the project and will be notified about the availability of the Scoping and EIA Reports, and any opportunity for any potential public involvement opportunity. EIMS explained that the application for Environmental Authorization following an EIA process entails 2 phases: The Scoping phase and the EIA phase. The project is currently in the Scoping Phase. The scoping phase involves a broad investigation of the study area to identify potential sensitivities and impacts applicable to the receiving environment from the proposed development; these impacts are assessed and compared in more detail during the EIA phase. Findings of the broad assessment conducted during scoping will be included in a Scoping Report, and preliminary mitigation and/or management measures recommended by the various specialists in relation to the identified impacts will be included in the accompanying Environmental	Registration. Safety and security concerns. Long-term impacts similar to mining impacts. Long-term groundwater impacts. Visual and noise impacts. Future plans for development and maintenance of infrastructure.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		Management Programme (EMPr). The scoping phase allows for the gathering of input from I&APs and other stakeholders towards ensuring that the final selection of the preferred alternatives for the proposed development is robust and informed, having taken into consideration various concerns and incorporated information from local stakeholders. The following specialist studies have been undertaken to date and findings from these assessments will be included in the Scoping Report to be made available for review to all registered Interested and Affected Parties (I&APs) such as yourself prior to submission to the Authorities: Visual Impact; Surface water; Groundwater; Wetlands and Aquatic ecology; Heritage; Air quality; Ecology; Soils and Agricultural potential; Noise; Social; and Economics.	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		With regards to the safety of the community, EIMS ensured Mr. Jacobs that the security risks will be assessed during the EIA phase. EIMS confirmed that all I&APs will be notified about the availability of the Scoping Report for public review and comment.	
Mrs. Lecia Viljoen	Mrs. Viljoen submitted her registration form and had the following concerns: What are the future plans for the development, infrastructure and maintenance of the proposed infrastructure; Boreholes should not be negatively affected on the long-term; Mining is dangerous for the environment, and she does not want her farm to be neglected.	EIMS thanked Mrs. Viljoen for submitting her completed registration form, and for raising his concerns regarding the proposed project. EIMS explained to Mrs. Viljoen that the project is currently in the Scoping phase, and that a broad investigation was been conducted during this period in order to identify preliminary impacts. Findings of the broad assessments done during the Scoping phase will be made available for public review and comment. Preliminary recommended mitigation and management measures will be included in an Environmental Management Programme (EMPr). The scoping phase will allow for gathering information and input form I&APs and other stakeholder towards ensuring that the final selection of the preferred alternatives for the proposed development is robust and informed, having taken into consideration various concerns and incorporated information from local stakeholders. EIMS confirmed that the following specialist studies have been conducted and that finding from these assessments will be made	Future maintenance. Impacts of production on the environment. Long-term impacts on groundwater and boreholes.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		available in the Scoping Report for public review by I&APs: Visual impacts; Surface water; Groundwater; Wetlands and Aquatic ecology; Heritage; Air quality; Ecology; Soils and Agricultural potential; Noise; Social; and Economics. With regards to his concerns, EIMS confirmed that they have been noted and will be included in the IRR to be submitted to the decision-making authority as an appendix to the Scoping Report. EIMS informed Mrs. Viljoen, that the infrastructure alternatives presented in the map previously provided are form a desktop assessment by the applicant. These alternatives have not taken the environmental impacts into consideration yet, which is part of the EIA. During the EIA phase, detailed assessments will be conducted with regards to sensitive areas. This is likely to result in additional locations	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		and route alternatives based on the identified sensitivities and concerns. The EIA will culminate in a selection of the preferred helium plant location alternatives and associated pipeline routes; these will be presented in the EIA report and made available for I&APs for review and comment prior to submission to the decision-making authority. EIMS ensured that all I&APs will be notified about the availability of reports for review, and that consultation with I&APs will be continued throughout the EIA process, and comment timeframes will be indicated when the notifications are distributed.	
Mr. Anton van der Veen	Mr. van der Veen informed EIMS that he is the landowner of Helpmekaar 47 and would like to know what the applicant intends to do on his land. He further raised concerns regarding the long-term impact of the exploration on his groundwater and wanted to know if the applicant intends to drill on his land. Will landowners benefit from these monitoring boreholes in the future? Mr. van der Veen said he has a lot of concerns and would like to be kept up to date about the project.	EIMS thanked Mr. van der Veen for informing us that he is the landowner of the Helpmekaar 47 property, and for submitting his concerns. EIMS ensured Mr. van der Veen that his concerns have been noted by the project team and will be included in the risks/impact assessments to be conducted during the EIA phase. EIMA explained that the project entails two phases; the Scoping phase that involves a broad investigation of the study to identify potential sensitivities and impacts applicable to the receiving environment from the proposed development; these impacts are assessed and compared in more detail during the EIA. Finding of the Scoping phase and	Long-term impacts on groundwater. Future benefits for landowners in terms of monitoring boreholes.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		preliminary mitigation measures recommend by the specialists will be included in the accompanying Environmental Management Programme (EMPr). EIMS explained that the specialist studies conducted to date includes: Visual impacts; Surface water; Ground water; Wetlands and Aquatic Ecology; Heritage; Air quality; Ecology; Soils and agricultural potential; Noise; Social; and Economics. EIMS explained that the proposed infrastructure presented in the map previously provided re from a desktop assessment of the area and technical requirements by the applicant. These alternatives have not yet taken the environmental impacts in to consideration, that component is part of the EIA process. During the EIA phase, more detailed assessments with regards to environmental sensitivities will be undertaken.	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		EIMS ensured Mr. van der Veen that he will be notified of the availability of all reports, and opportunities for public involvement.	
Mr. J.P.D Botha from Wessels and Smith (Representative of Tetra 4 Cluster 1 Landowners Forum)	We have pleasure in advising that Mr. Botha's consultations scheduled for the 19th, 20th and 21st of October 2016 was cancelled and have pleasure in advising that Mr. Botha was able to respond to your letter dated 12 October 2016. Kindly find hereto attached our formal reply to your letter dated 12 October 2016 and the relevant Annexures supplied to us via Dropbox. Kindly note that a reply is requested before the 4th of November 2016. Aspects discussed in the letter included: Meeting minutes: Rehabilitation guarantee; Social and Labour plan; Organogram of the BEE structure; Confirmation of registration of Production Right; Comments on the Issues and Responses Report; MHI Risk Assessment on the Tetra 4 Compressed Natural Gas Facility; Summary of the most important recordals in the EMP of the already existing production right dated December 2010; Correspondence from PASA;	On 24/10/2016 EIMS sent Mr. Both a notification letter regarding a request to arrange one-on-one consultation with the landowners. Upon not receiving confirmation with regard to landowner consultation, EIMS sent the following on the 26/10/2016: As per the document received on 21/10/2016, page 3, point number 10: "We hereby confirm that all arrangements must be confirmed through Wessels and Smith offices and never directly with Landowners", EIMS herewith acknowledges that no arrangements with regards to consultation with the Cluster 1 Landowners Forum members can be made without further instruction from Wessels and Smith. Based on the fact that we would like to finalise the one-on-one consultation schedule in order to prevent inconvenience closer to the consultation time, and the number of other affected landowners also included in the schedule for consultation on the 2nd and 3rd November 2016, EIMS would like to inform you that we are proceeding with scheduling the consultation timeslots with the other	Rehabilitation guarantee. Social and Labour plans. Company BEE Structure. MHI Risk Assessing of proposed CNG Facility. Specialist consultation. Outcome of ecological report.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	I&AP, Consultation documentation as well as current consultation documentation and confirmation of properties; Consultation with Specialists; Comments on EIA Report of the Ecological study prepared by David Hoare. Refer to Appendix C7 of the Cluster 1 EIA Issues and Responses Report for the response from Wessels and Smith the EIMS letter dated 12 October 2016.	Cluster 1 landowners (not part of the Cluster 1 Landowners Forum). Available timeslots will be provided to Wessels and Smith once the way forward regarding consulting the Landowners Forum members is established, towards determining which timeslots will suite the members of the Landowners Forum. Refer to Appendix C9 of the Issues and Responses Report for call records with landowners regarding consultation arrangements.	
Mr. Tsui Vincent Matsepe	Mr. Matsepe requested to be registered as an I&AP for the project, in order to submit his comments. He informed EIMS that he wished to understand the development of gas fields and to what extent they will aid to the enhancement of the economy in the area as there are many inherent potential harmful effects to plant and animal life, and groundwater sources in the area.	EIMS thanked Mr. Matsepe for his interest in the project and confirmed that he has been registered as an I&AP for the project and will be notified about the availability of the Scoping and EIA Reports, and any opportunity for any potential public involvement opportunity. EIMS explained that the application for Environmental Authorization following an EIA process entails 2 phases: the Scoping phase and the EIA phase. The project is currently in the Scoping Phase. The scoping phase involves a broad investigation of the study area to identify potential sensitivities and impacts applicable to the receiving environment from the proposed development; these impacts are	Registration. Job creation. Economy upliftment. Long-term impacts on ecological aspects. Long-term impacts on groundwater.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		assessed and compared in more detail during the EIA phase. Findings of the broad assessment conducted during scoping will be included in a Scoping Report, and preliminary mitigation and/or management measures recommended by the various specialists in relation to the identified impacts will be included in the accompanying Environmental Management Programme (EMPr). The scoping phase allows for the gathering of input from I&APs and other stakeholders towards ensuring that the final selection of the preferred alternatives for the proposed development is robust and informed, having taken into consideration various concerns and incorporated information from local stakeholders. The following specialist studies have been undertaken to date and findings from these assessments will be included in the Scoping Report to be made available for review to all registered Interested and Affected Parties (I&APs) such as yourself prior to submission to the Authorities: Visual Impact; Surface water; Groundwater; Wetlands and Aquatic ecology; Heritage;	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		Air quality; Ecology; Soils and Agricultural potential; Noise; Social; and Economics. EIMS confirmed that all I&APs will be notified about the availability of the Scoping Report for public review and comment.	
Mr. Jaco Steyn	Mr. Steyn submitted his completed registration form and asked to be confirmed as an I&AP for the project. He had the following concerns: What infrastructure and future development would be required at BH 1400 (compressors, power, access boreholes); As per proposed infrastructure why do pipelines need to go all the way to Helium Plant Alternative 2 if alternative 1 is situated close by? Need to know where access roads to boreholes will be; and Will landowners and concerned parties get the opportunity to suggest alternative pipeline, road and power line routes? What will future maintenance of infrastructure include?	EIMS thanked Mr. Steyn for his interest in the project and confirmed that he is registered as an I&AP for the project. EIMS confirmed that his concerns have been noted by the project team and will be included in the risk/ impact assessments to be conducted during the Environmental Impact Assessment (EIA) phase. The application for Environmental Authorisation following an EIA process entails 2 phases: the Scoping phase and the EIA phase. The project is currently in the Scoping Phase. The scoping phase involves a broad investigation of the study area to identify potential sensitivities and impacts applicable to the receiving environment from the proposed development; these impacts are assessed and compared in more detail during	Registration. Plans for future infrastructure and development. Location of Helium Plant Alternatives. Opportunity for public/landowners to submit suggestions in terms of roads, pipeline routes and associated infrastructure. Future maintenance.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	Mr. Steyn requested a .kml file indicating the study area boundary and propose infrastructure.	the EIA phase. Findings of the broad assessment conducted during scoping will be included in a Scoping Report, and preliminary mitigation and/or management measures recommended by the various specialists in relation to the identified impacts will be included in the accompanying Environmental Management Programme (EMPr). The scoping phase allows for the gathering of input from I&APs and other stakeholders towards ensuring that the final selection of the preferred alternatives for the proposed development is robust and informed, having taken into consideration various concerns and incorporated information from local stakeholders. The following specialist studies have been undertaken to date and findings from these assessments will be included in the Scoping Report to be made available for review to all registered Interested and Affected Parties (I&APs) such as yourself prior to submission to the Authorities: Visual Impact; Surface water; Groundwater; Wetlands and Aquatic ecology; Heritage; Air quality;	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		Ecology; Soils and Agricultural potential; Noise; Social; and Economics. Specialists have undertaken preliminary impact assessments within the study area, and their findings are included in the Scoping Report. The proposed infrastructure layout (pipeline routes, helium plant location, etc.) presented in the map previously provided are from a desktop assessment of the area and technical requirements by the applicant. These alternatives have not yet taken environmental impacts into consideration, that component is part of the EIA process. During the EIA phase, more detailed assessments of the study area with regards to environmental sensitivities (as identified by the specialists, the Environmental Assessment Practitioner, and input from Interested and Affected Parties (I&APs)) will be undertaken. This is likely to result in additional location and route alternatives based on identified sensitivities and concerns. The EIA phase will culminate in a selection of the preferred helium plant location alternative and associated pipeline routes, these will be presented in the EIA Report to be made	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		available to all registered I&APs for comment prior to submission to the decision-making authorities. EIMS informed Mr. Steyn that all I&APs will be notified of the availability of reports for review. EIMS provided Mr. Steyn with the .kml files indicating the study area and proposed infrastructure.	
Mr. Andries Oosthuizen Trust	Mr. Oosthuizen called on 08/06/2016 in order to inform EIMS that he is the chairman for a board of Trustees. He wanted to register himself and his son, Mr. T.F.G. Oosthuizen as an I&AP as well. Mr. Oosthuizen requests: That EIMS send him a proper map of the designated area in a bigger format -He can see one of this properties on the map, but not the other two; What are the future plans for roads and infrastructure?	EIMS responded via email, and thanked Mr. Oosthuizen for his interest in the project, and confirmed that he has been registered as an I&AP for the project. EIMS explained the different phases of the project (Scoping and EIA) and ensured Mr. Oosthuizen that risk assessments will be conducted on various aspects and activities to take place during the EIA phase, and that the Reports will be made available for public review and comment. EIMS assured Mr. Oosthuizen that all I&APs will be notified of the availability of reports, and any opportunity for public involvement. EIMS also provided the BID.	Registration. Future plans in terms of roads, infrastructure and maintenance.
Mr. C.B. Bothma	Mr. Bothma contact EIMS via fax on 30th of June 2016 and submitted a form with his farm specific concerns. In his form, Mr. Bothma confirmed that he is the landowner of the Farm Wollie (which is a subdivision of Portion 1 of the Farm Kleinbegin 370). Mr. Bothma confirmed that his farming	EIMS confirmed receipt of Mr. Bothma's Farm Specific Concerns form, and ensured Mr. Bothma that his concerns have been noted by the project team and will be included in the IRR that will be appended to the upcoming reports. EIMS also reminded Mr. Bothma that he is registered as an I&AP for the project, and	Registration. Long-term impacts on groundwater. Graves and heritage sites. Ecological sensitivities.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	operations rely on a safe consistent supply of drinking water for watering his stock. Mr. Botha is concerns about the long-term impacts of the proposed development of groundwater supplies. Mr. Bothma pointed out that the workers on his farm have graves on the property, and that his property has environmentally sensitive animal species.	will be notified about the availability of upcoming reports and opportunities for public involvement.	
Mr. Marthinus Christie	Mr. Christie submitted his registration form on behalf of Senwes, and had the following interest in the proposed project: Senwes is an agricultural company that provides service to their clients such as: Input essentials (fuels, fertilizer; seeds etc.) which is required for planting crops; Purchase equipment; Purchase property. As security for the credit referred to above, some of the clients grant Senwes bonds over their properties, some of which are situated within the proposed exploration area. Any effect which the proposed exploration might have on the said properties, will affects Senwes's securities. Also due to its business as an agricultural company which includes dealing with producers of grain, which is situated within the proposed exploration area, Senwes' business will	EIMS thanked Mr. Christie for his interest in the project and confirmed that he has been registered as an I&AP for the project, and will be notified about the availability of the Scoping and EIA Reports, and any opportunity for any potential public involvement opportunity. EIMS explained that the application for Environmental Authorization following an EIA process entails 2 phases: the Scoping phase and the EIA phase. The project is currently in the Scoping Phase. The scoping phase involves a broad investigation of the study area to identify potential sensitivities and impacts applicable to the receiving environment from the proposed development; these impacts are assessed and compared in more detail during the EIA phase. Findings of the broad assessment conducted during scoping will be	Registration. Long-term impacts on land productivity and agricultural potential.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	be affected should the exploration affect the productivity of the land.	included in a Scoping Report, and preliminary mitigation and/or management measures recommended by the various specialists in relation to the identified impacts will be included in the accompanying Environmental Management Programme (EMPr). The scoping phase allows for the gathering of input from I&APs and other stakeholders towards ensuring that the final selection of the preferred alternatives for the proposed development is robust and informed, having taken into consideration various concerns and incorporated information from local stakeholders. The following specialist studies have been undertaken to date and findings from these assessments will be included in the Scoping Report to be made available for review to all registered Interested and Affected Parties (I&APs) such as yourself prior to submission to the Authorities: Visual Impact; Surface water; Groundwater; Wetlands and Aquatic ecology; Heritage; Air quality; Ecology;	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		Soils and Agricultural potential; Noise; Social; and Economics. EIMS confirmed that all I&APs will be notified about the availability of the Scoping Report for public review and comment.	
Cindy-Anne Oosthuizen	Mrs. Oosthuizen informed EIMS that she is a resident on Portion 4 of the Palmietkuil 328 property, and that Borehole ST23 is on the property. From the proposed plans, it seems like the proposed pipelines join up to ST23 before continuing to Helium Plant Alternative 2. She has the following concerns: She can see there is great activity at BH ST23, and that numerous pipelines joins up at this boreholes. BH ST23 is located 500 m from her house which has great security risks for her and her family. The borehole is in eyesight from their house and poses a risk for her and her small children that spend the most of the day at the house. They have workers whose houses are also located 500m from BH ST 23 – these homes also have women and small children that spend most the day alone at home, she wants to mentioned this as the activities around ST 23 will pose a risk to them. She requested information on the proposed infrastructure at the BH ST 23. She wanted to know	EIMS thanked Mr. Oosthuizen for submitting his completed registration form, and for raising his concerns regarding the proposed project. EIMS explained to Mrs. Oosthuizen that the project is currently in the Scoping phase, and that a broad investigation was been conducted during this period to identify preliminary impacts. Findings of the broad assessments done during the Scoping phase will be made available for public review and comment. Preliminary recommended mitigation and management measures will be included in an Environmental Management Programme (EMPr). The scoping phase will allow for gathering information and input form I&APs and other stakeholder towards ensuring that the final selection of the preferred alternatives for the proposed development is robust and informed, having taken into consideration various concerns and	Safety and security concerns. Visual impacts of proposed development. Future plans for the proposed development – on surface and underground.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	if the future activity at this BH will be underground or is there a plant being planned there.	incorporated information from local stakeholders. EIMS confirmed that the following specialist studies have been conducted and that finding from these assessments will be made available in the Scoping Report for public review by I&APs: Visual impacts; Surface water; Groundwater; Wetlands and Aquatic ecology; Heritage; Air quality; Ecology; Soils and Agricultural potential; Noise; Social; and Economics. With regards to her concerns, EIMS confirmed that they have been noted and will be included in the IRR to be submitted to the decision-making authority as an appendix to the Scoping Report. EIMS informed Mrs. Oosthuizen, that the infrastructure alternatives presented in the map previously provided are form a desktop assessment by the applicant. These alternatives have not	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		taken the environmental impacts into consideration yet, which is part of the EIA. During the EIA phase, detailed assessments will be conducted with regards to sensitive areas. This is likely to result in additional locations and route alternatives based on the identified sensitivities and concerns. The EIA will culminate in a selection of the preferred helium plant location alternatives and associated pipeline routes; these will be presented in the EIA report and made available for I&APs for review and comment prior to submission to the decision-making authority. EIMS ensured that all I&APs will be notified about the availability of reports for review, and that consultation with I&APs will be continued throughout the EIA process, and comment timeframes will be indicated when the notifications are distributed.	
Mr. J.P.D Botha from Wessels and Smith (Representative of Tetra 4 Cluster 1 Landowners Forum)	Wessels and Smith sent EIMS a letter via email, providing a summary of the Socio-Impact consultation held with Mr. Gert Oosthuizen. The consultation was schedules with Mr. Gert Oosthuizen in order for Dr. Aucamp to perform a Socio-Economic Impact Assessment Report after consulting affected landowners. Dr. Aucamp emphasised the importance of socio-economic impacts with regard to the project as to the installation of the pipeline and impacts when everything is in operation. Aspects discussed in	Thank you very much for the correspondence and letter dated 13 January 2017 regarding the on-site consultation by the project social specialist with Mr Oosthuizen and family on the 10th January 2017. This email serves to acknowledge receipt as well as inform you that EIMS forwarded the letter with the record of the consultation, to the social specialists for their review and they have confirmed and accepted the record of the consultation as presented in the letter.	Socio-economic impacts. Access control to properties. Safety and security risks. Compensation. Concerns regarding future development and maintenance.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	this letter includes issues Mr. Oosthuizen have in terms of the following: Access control to property; Communication through Mr. Gert and Mr. Koos Oosthuizen; Security; Compensation; and Concerns regarding future development and maintenance. Dr. Aucamp concluded that landowners feel Tetra 4 has not been playing open cards with them due to the fact that certain aspects only came to light after it was raised by landowners. Dr. Aucamp confirmed that nothing may be done on the farms of the EIA has not been approved, as the livelihood or farmers and farm workers are at stake when the pipeline will be installed. Any changes within the project that has not been discussed, must be taken into account due to the fact that the initial project changed and opened certain new issues for the landowners and farmworkers. Refer to Appendix C11 of the Issues and Responses Report for the correspondence received from Wessels and Smith.	The letter will be included as an appendix to the Issues and Responses Report to be submitted to the competent authority with the Draft and Final Environmental Impact Assessment (EIA) Reports once completed.	
Mr. J.P.D Botha from Wessels and Smith (Representative of	Wessels and Smith sent their letter dated 24 November 2016 which is a reply to EIMS's email dated 15 November 2016.	EIMS acknowledged receipt of their letter, and informed Wessels and Smith than a formal response will follow in due course.	Consultation with landowners. Rehabilitation responsibility.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
Tetra 4 Cluster 1 Landowners Forum)	The letter also contains their comments to the Scoping Report and specialist studies. Annexures A – D indicates the amended routes agreed to for all Forum members. The following aspects were discussed in the letter: Word of appreciation Constraints on perusal of the Scoping Report; Individual consultation and verbal commitments; Records of verbal agreements reached transpiring from correspondence already exchanged and personal site visits: Mr. J.H. Oosthuizen and Mandalay Trust; Mr. J.A. Smith/Anchor Family Trust; Mr. William Du Plessis; General comments referring to issues of landowners. Refer to Appendix C11 of the Issues and Responses Report for the correspondence received from Wessels and Smith.	On 6th December 2016, EIMS responded to Wessels and Smith's letter dated 24th November. Annexures A-D were included and EIMS provided itemised responses to the issues raised in their letter. General comments/issues that were addressed by EIMS include: Inclusion of all correspondence between Wessels & Smith and EIMS into Final Scoping Report; Comments regarding landowner compensation negotiations and agreements; Registration of servitudes by Tetra 4 and the responsibility of rehabilitation that will be undertaken in accordance with reasonable requests by landowners; Details regarding boosters pumps, whether they will be required and possible localities; Outcome of discussions with respective forum members; Details regarding the MHI studies for the combined helium pant, CNG plant and pipelines, as well as the engineers input on the need for MHI studies; Re-location of ST23 compressor; Specialist site visits and consultation that has been reschedule for January 2017 based on landowners request;	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		Inclusion of the latest alignment sheets with all proposed amendments of pipeline routes and surface infrastructure that will be included in the Final EIA Report; Where necessary and required, EIMS facilitation with landowner negotiation and agreement with the applicant; Mapping of Cluster 1 infrastructure and preferred alternatives selected for both the pipeline routes and location of surface infrastructure; Technical details regarding proposed infrastructure; Inclusion of water sampling results into EIR Reports with regards to the handling of condensate and discharge standards according to irrigation and livestock standards; Maintenance of infrastructure and frequency of maintenance of maintenance visits; Potential impacts that have been identified for the proposed activities; Preparation of the Closure and Rehabilitation Report during the EIA phase; Technical and maintenance detail of ESD valves; Inclusion of access related details (e.g. access roads, access to properties during	

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		construction and for maintenance etc.) in the landowner agreements; Inclusion of mitigation measures and specialist recommendations into the EMPR, in an effort to mitigate potential identified impacts; Confirmation that EIMS will forward the acknowledgement of receipt of the Final Scoping Report from PASA, and will notify Wessels and Smith of submission of Final Scoping Report and availability on the project website. Refer to Appendix C11 of the Issues and Responses Report for the correspondence received from Wessels and Smith	
Mr. J.P.D Botha from Wessels and Smith (Representative of Tetra 4 Cluster 1 Landowners Forum)	We have pleasure in advising that Mr. Botha's consultations scheduled for the 19th, 20th and 21st of October 2016 was cancelled and have pleasure in advising that Mr. Botha was able to respond to your letter dated 12 October 2016. Kindly find hereto attached our formal reply to your letter dated 12 October 2016 and the relevant Annexures supplied to us via Dropbox. Kindly note that a reply is requested before the 4th of November 2016. Aspects discussed in the letter included: Meeting minutes: Rehabilitation guarantee;	On 24/10/2016 EIMS send Mr. Both a notification letter regarding a request to arrange one-on-one consultation with the landowners. Upon not receiving confirmation with regard to landowner consultation, EIMS sent the following on the 26/10/2016: As per the document received on 21/10/2016, page 3 point number 10: "We hereby confirm that all arrangements must be confirmed through Wessels and Smith offices and never directly with Landowners", EIMS herewith acknowledges that no arrangements with regards to consultation with the Cluster 1 Landowners Forum members can be made	Rehabilitation guarantee. Social and Labour plans. Company BEE Structure. MHI Risk Assessing of proposed CNG Facility. Specialist consultation. Outcome of ecological report.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	Social and Labour plan; Organogram of the BEE structure; Confirmation of registration of Production Right; Comments on the Issues and Responses Report; MHI Risk Assessment on the Tetra 4 Compressed Natural Gas Facility; Summary of the most important recordals in the EMP of the already existing production right dated December 2010; Correspondence from PASA; I&AP, Consultation documentation as well as current consultation documentation and confirmation of properties; Consultation with Specialists; Comments on EIA Report of the Ecological study prepared by David Hoare. Refer to Appendix C7 of the Issues and Responses Report for the response from Wessels and Smith the EIMS letter dated 12 October 2016.	without further instruction from Wessels and Smith. Based on the fact that we would like to finalise the one-on-one consultation schedule in order to prevent inconvenience closer to the consultation time, and the number of other affected landowners also included in the schedule for consultation on the 2nd and 3rd November 2016, EIMS would like to inform you that we are proceeding with scheduling the consultation timeslots with the other Cluster 1 landowners (not part of the Cluster 1 Landowners Forum). Available timeslots will be provided to Wessels and Smith once the way forward regarding consulting the Landowners Forum members is established, towards determining which timeslots will suite the members of the Landowners Forum. Refer to Appendix C9 of the Issues and Responses Report for call records with landowners regarding consultation arrangements.	
Comments raised during the construction and implementation phase			
Directly affected landowners	According to feedback from the Holder, "in general, no comments in relation to final closure only three comments from different landowners	As per the feedback from the Holder it is anticipated that these concerns related to settlement of the backfilled material over the	N/A- It is anticipated that these settlement risks pertain to the construction of the pipelines and are to be resolved prior to closure and decommissioning. Where

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	on subsidence after the gas gathering rehabilitation, these have been closed out".	pipeline servitudes. According to the Holder these concerns have been rectified.	deficiencies on the constriction rehabilitation process are evident these will be reported on by the appointed Independent Auditor.
William du Plessis	Access road to well P007 deteriorated and needs to be attended to.	Management were informed and formal investigation has commenced as per Tetra4 Grievance procedure.	P007 is a production well. Concerned about adequacy of rehabilitation.
Gert Oosthuizen	Mr Oosthuizen requested a meeting to discuss the rehabilitation of the access road to ST23 and 1400 after the rainy season.	Projects team and CLO met with Mr Oosthuizen on his property, Mandalay and an agreement has been reached that after his crops have been harvested and in the dryer winter months, Tetra4 will rehabilitate the road. The CLO communicated with Mrs Cindy Oosthuizen enquiring about the state of the road and to invite Mr Oosthuizen to subit a claim if he has already fixed the road.	1400 is a production well. Concerned about adequacy of rehabilitation.
Theuns Strauss	Mr Strauss raised a concern regarding the rehabilitation of his fence where an Eskom access gate was constructed.	The CLO informed the Process Engineer about the grievance. The Process Engineer instructed the contractors to attend to the fence at their earliest convenience.	
Dirk Kotze	Mr Kotze indicated that he is not totally satisfied with a portion of the road to the well that has been rehabilitated.	Environmental Department has arranged to meet with Mr Kotze to discuss the specific area he has mentioned. Mr Kotze will let us know when he is available.	Concerned about adequacy of rehabilitation.
Frans Jacobs	Mr Jacobs enquired about the period still needed for rehabilitating wellhead P010 since it has been shown as not productive.	Environmental Department has commenced with the rehabilitation instruction to the drill	Well P010 has been abandoned and rehabilitated. Based on a site inspection if February 2023, there are minor remnants of

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
		contractor and the well should be rehabilitated by the end of October 2022.	the well infrastructure which should be removed. This will be listed in the Annual Rehabilitation Plan.
Andre Smith	Mr Smith informed the CLO that a contractor with a lowbed insisted to continue with work on the low point drain situated on his property. He was not informed of intended access on the day and also felt the field was too wet for heavy equipment to access.		The CLO enquired from the contractor and reminded them that non-compliance to access protocols affects our relationship negatively.
David Cairncross	Mr Cairncross raised a concern regarding the aeromagnetic survey Tetra4 is undertaking with the aircraft flying 35m above ground over his game farm. He claims the activity will unsettle his game and they will jump fences. He also indicated that he was not aware of the activity.	Tetra4 recorded the issue and responded to the party.	Exploration Management and the contractor were informed about the landowner concern. Mr Cairncross is not a landowner on our database since no drilling or exploration activity was planned on his property before. The information was however, shared on a well-known farmers group and with a farmers security group in order to inform a wider audience than just the farmers on our current database. We obtained all his information and added him to our database to keep him informed of future activity. The contractor confirmed that the survey around Mr Cairncross's property was concluded and that it would not be necessary to fly over there again. Mr Cairncross was informed of this information via WhatsApp, phone call and formal letter of apology emailed on the 27th of May 2022.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
Dirk Kotze	Live stock moved to SPG03 camps, please ensure gates are closed securely with chain and lock.	Tetra4 recorded the issue and responded to the party.	CLO bought chain and lock. Key with exploration team and with EPCM (Kevin) until handover.
	Land user informed us that access route not as per original agreement. This is not a challenge at present, but once he moves game into the camp, this will need to be addressed.	Tetra4 recorded the issue and responded to the party.	CLO reported grievance to EM and noted it in the Bi-monthly report of 20 August 2021.
	Mr Kotze indicated that he is not totally satisfied with a portion of the road to the well that has been rehabilitated.	Tetra4 recorded the issue and responded to the party.	Environmental Department has arranged to meet with Mr Kotze to discuss the specific area he has mentioned. Mr Kotze will let us know when he is available.
	His road needs urgent attention before he needs to take his product to market	Tetra4 recorded the issue and responded to the party.	Contractor appointed to scrape, fill and shape the road.
Forum from Virginia	A group of Virginia residents congregated at the Plant entrance demanding jobs and contracts.	Tetra4 recorded the issue and responded to the party.	It was suggested that the group elect a leader and that the leadership meet with Tetra4 management to raise their grievances.
Frans Jacobs	Mr Jacobs enquired about the period still needed for rehabilitating welhead P010 since it has been show as not productive.	Tetra4 recorded the issue and responded to the party.	Environmental Department has commenced with the rehabilitation instruction to the drill contractor and the well should be rehabilitated by the end of October 2022.
Frik Schoeman	Contractors arrived at site without access key and then stopped at homestead to ask for access.	Tetra4 recorded the issue and responded to the party.	Work stopped with instruction to return in the week with the key as per landowner access agreement.
Gert Oosthuizen	Increased access on wet road to wel ST23 and 1400 will cause damage to the road. Landowner	Tetra4 recorded the issue and responded to the party.	Project manager and EM have been informed of the request. Due to work deadlines the

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	indicated that a meeting should be held after the roads have dried out to discuss the issue.		road had to be accessed even in its wet condition.
	Mr Oosthuizen requested a meeting to discuss the rehabilitation of the access road to ST23 and 1400 after the rainy season.	Tetra4 recorded the issue and responded to the party.	"Projects team and CLO met with Mr Oosthuizen on his property, Mandalay and an agreement has been reached that after his crops have been harvested and in the dryer winter months, Tetra4 will rehabilitate the road.
	Tetra4 personnel driving on the wrong access road.	Tetra4 recorded the issue and responded to the party.	The CLO communicated with Mrs Cindy Oosthuizen enquiring about the state of the road and to invite Mr Oosthuizen to subit a claim if he has already fixed the road."
Gert Prinsloo	Mr Prinsloo raised a concern regarding the aeromagnetic survey Tetra4 is undertaking with the aircraft flying 35m above ground over his game farm. He claims he was not aware of the activity.	Tetra4 recorded the issue and responded to the party.	Exploration Management and the contractor were informed about the landowner concern. Communication records were investigated and both his partner (Mr Johan Prinsloo) and his wife (designated number - Marie Prinsloo) were informed of the activity three days in advance and no objections were raised. The contractor agreed to adjust his flight plan slightly since the farms are on the border of the investigation area.
Greater Virginia Youth Business Forum	Threatens operations if attention not given to enquiries about business and SMME development (Covid-19).	Tetra4 recorded the issue and responded to the party.	CLO informed management. Management arranged meetings and sent out letters. Follow-up meeting arranged.
Heibré vd Westhuizen	Access to property without following access protocols, leading to unauthorised access.	Tetra4 recorded the issue and responded to the party.	Management were informed and formal investigation has commenced as per Tetra4 Grievance procedure.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	Entering into an argument with the land user regarding the ownership of the property.		
	Mrs van der Westhuizen informed us that Telkom (national fibre supplier) has planted an anchor cable on their property without permission.	Tetra4 recorded the issue and responded to the party.	The Tetra4 contractor dealing with national suppliers informed Telkom and Telkom contacted the landowner directly.
	Mrs H vd Westhuizen inferred that the vagrant living on their portion of Mond van Doornrivier was given permission by us to stay there.	Tetra4 recorded the issue and responded to the party.	The person did not get permission from Tetra4, he is homeless and the Security Manager has reported him to Social Development to see if they can intervene and find a shelter for him.
Jack Ramohomane	Alleged not compliance with MPRDA and Constitution of SA regarding community, exploration right and SLP	Tetra4 recorded the issue and responded to the party.	Email sent to Mr Ramohomane informing him of the procedures we follow for community forum interaction, adding him to database and informing him of next planned forum (June 2022). We also sent him a link to our website to where he can find all audits and the approved SLP.
Janse De Wet	Mr De Wet raised a concern regarding the aeromagnetic survey Tetra4 is undertaking with the aircraft flying 35m above ground over his game farm. He claims the activity will unsettle his game and they will jump fences. He also indicated that he was not aware of the planned flight.	Tetra4 recorded the issue and responded to the party.	"Exploration Management and the contractor were informed about the landowner concern. Mr Janse de Wet is not a landowner on our database since no drilling or exploration activity was planned on his property before. The information was however, shared on a well-known farmers group and with a farmers security group in order to inform a wider audience than just the farmers on our current database. We obtained all his information and added him to our database to keep him informed of

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
			future activity. The contractor confirmed that the survey around Mr De Wet's property was concluded and that it would not be necessary to fly over there again. Mr De Wet was informed of this information via WhatsApp, phone call and formal letter of apology emailed on the 27th of May 2022."
Japie Nel	Rehabilitation of fence not completed to correct standard.	Tetra4 recorded the issue and responded to the party.	CLO informed Construction Manager and Contractor. Correct material was sourced to complete work on fence as requested.
	Rehabilitation of access road delayed due to excessive rain.	Tetra4 recorded the issue and responded to the party.	CLO informed Contractor. Road was fixed after the rain subsided and the road was dry.
Johan Taljaard	Mr Taljaard raised a concern regarding the aeromagnetic survey Tetra4 is undertaking with the aircraft flying 35m above ground over his game farm. He claims his son's stud animals are unsettled and a calf is missing. They allegde it was because of the aeromagnetic survey.	Tetra4 recorded the issue and responded to the party.	Exploration Management and the contractor were informed about the landowner concern. The landower were informed that his son's areas survey were concluded and a formal letter of information and apology were sent on the 27th of May 2022. The flights were cancelled on mid-day of the 27th of May.
Johan Terblanche	Fire Breaks on Mond van Doornrivier 38 RE not implemented.	Tetra4 recorded the issue and responded to the party.	CLO met with SHEQ and Environmental Departments and escalated matter to HO.
	Mr Terblanche raised a concern regarding the aeromagnetic survey Tetra4 is undertaking with the aircraft flying 35m above ground over his game farm. He claims the activity is illegal (flying too low) and invading his privacy and that he will "throw the plane with stones or shoot it down".	Tetra4 recorded the issue and responded to the party.	Exploration Management and the contractor were informed about the landowner concern. The landowner were informed of the activity three days in advance and no objections were raised. The contractor indicated that the survey around Mr Terblanche's property has already been concluded and there would be

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
	He indicated he was going to lay a complaint with Civil Aviation.		no need to fly over this property again. Mr Terblanche was notified of this and he still threatened to "shoot the airplane" if he sees it flying. Mr Terblanche was informed of the conclusion of the survey over his property via telephone call, WhatsApp and formal letter of apology sent on the 27th of May 2022. The flights were cancelled mid-day on the 27th of May 2022.
Lecia Viljoen	Alarm at Ex01 activated.	Tetra4 recorded the issue and responded to the party.	CLO informed Contractor. Contractor disconnected alarm until after Easter break.
	Alarm at EX01 has gone off.	Tetra4 recorded the issue and responded to the party.	CLO informed Contractor. Contractor reset the alarm.
	Unmarked vehicles on-site; working on Sunday without permission and guards placed at well head without prior notification.	Tetra4 recorded the issue and responded to the party.	Meeting held with Project Manager and important clauses of landowner agreement circulated to all impacted parties to ensure communication as per landowner agreement.
	Extra traffic on access road in wet conditions is a worry. A request to all users of the road to contribute gravel to the hot spots.	Tetra4 recorded the issue and responded to the party.	CLO informed project manager about the request and submitted photos of the road taken on 12 December 2021.
Mike Daly	Landowner reported contractor driver driving recklessly on the road works almost causing an accident on the R30 by disregarding landowners moving heavy agricultural implements.	Tetra4 recorded the issue and responded to the party.	The CLO reported the matter to the Health and Safety Manager for investigation and feedback.
Papiki Mwaya	Hand pump not delivering water.	Tetra4 recorded the issue and responded to the party.	Tetra4 electrician investigated and a fault was found on the pump. Further discussions with Mr Blom (land user) led to suggestions to

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
			expand the water supply to the northern dwelling, as well as the southern dwelling from the top borehole with an additional pump and jojo tank and pipeline. This proposal was accepted and Tetra4 is busy procuring as per instruction.
	Road towards brick dwellings need repair because it becomes unaccessible in the rainy season. Gravel is needed in the bend of the road.	Tetra4 recorded the issue and responded to the party.	Tetra4 investigated and a vendor has been appointed to scrape and re-inforce the road as requested.
	Solar panels installed at the four houses are not working and are not strong enough to handle many appliances.	Tetra4 recorded the issue and responded to the party.	Tetra4 electrician investigated and took photos of the current state of the connections to the batteries and inverters. House owners have created illegal connections and have overloaded the originally Tetra4 installed equiment. A decision will have to be taken with regards to the way forward since we have delivered to our original obligation.
	The community asked Tetra4 to assist them with the reseasling of their dam and the expansion of their water pipeline to their dwellings. Tetra4 agreed and commenced the work, Papiki halted the work demanding that companies he suggested should be awarded the work.	Tetra4 recorded the issue and responded to the party.	Tetra4 withdrew their assistance to this request. We have procurement processes which we adhere to and do not allow soliciting or demands regarding appointment of contractors for works.
	Mr Mwaya indicates unhappiness about temporary contracts coming to an end.	Tetra4 recorded the issue and responded to the party.	CLO explained procedure and community opportunities coming to an end and relayed message to Contractor and management.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
Pine Pienaar	Water flow through the SandVet channel was restricted because of piping used by contractor.	Tetra4 recorded the issue and responded to the party.	Contractor excavated the channel and cemented a berm as per landowner specifications.
	OHL not mapped out according to signed agreement - 1 m from boundary as agreed.	Tetra4 recorded the issue and responded to the party.	Contractor to move line as per agreement.
	OHL - various concerns regarding pegging, gates, locks planned for gates, size of pipes etc.	Tetra4 recorded the issue and responded to the party.	Management were informed and formal investigation has commenced as per Tetra4 Grievance procedure.
	OHL discussions on various points to continue. Mr Pienaar requests to escalate to his attorney until final consensus have been reached.	Tetra4 recorded the issue and responded to the party.	Management were informed, discussions held with Mr Pienaar and his legal representative.
	Mr Pienaar sent photos of water damming up at one of the crossings where pipes were installed by EPCM.	Tetra4 recorded the issue and responded to the party.	The CLO reported the matter to the Engineer and the Environmental Manager who investigated. They are currently busy with the implementation of corrective actions.
Relating Motati	Letter of demands	Tetra4 recorded the issue and responded to the party.	Written response.
Stilte Youth Representative - Thapelo	Threatens operations if attention not given to enquiries about training, job opportunities and cleaning of site (Covid-19).	Tetra4 recorded the issue and responded to the party.	CLO informed the contractor, the employment agency and Tetra4 management. Disciplinary procedure held on 7 July 2021 – outcome pending.
Theuns Strauss	Mr Strauss raised a concern regarding the rehabilitation of his fence where an Eskom access gate was constructed.	Tetra4 recorded the issue and responded to the party.	The CLO informed the Process Engineer about the grievance. The Process Engineer instructed the contractors to attend to the fence at their earliest convenience.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
William du Plessis	Gate left open and livestock escaped to neighbouring farm.	Tetra4 recorded the issue and responded to the party.	CLO informed Construction manager, contractor, and consultants about the incident with a reminder to ensure all gates are closed after they access landowner property.
	Access road to well P007 deteriorated and needs to be attended to.	Tetra4 recorded the issue and responded to the party.	Management were informed and formal investigation has commenced as per Tetra4 Grievance procedure.
	Pipeline route for Phase 1B not discussed with him or in line with solar farm meeting held earlier in the year.	Tetra4 recorded the issue and responded to the party.	"The CLO raised the issue with the Engineering team before she requested access, highlighting that drawings of final routes need to be shared with the CLO to share with landowners before access for construction is requested. Additionally access requests to landowner properties should be done timeously and not on the day the contractor needs access.
	Mr Du Plessis informed the office at 08:21 on the 11th of August that his live stock (two calves) came out of camp onto R30 during the night of the 9th of August and was hit by a Greyhound bus. Investigation needed to establish cause.	Tetra4 recorded the issue and responded to the party.	Drawings were shared with Mr Du Plessis and discussions entered with the Solar Farm owners who made adjustments to the proposed tie in. These adjustments were accepted by both Mr Du Plessis and the Tetra4 Engineering Team."
Wilma Pretorius	Mrs Prinsloo complained because the drilling continued after 18h00 on a weekday.	Tetra4 recorded the issue and responded to the party.	The CLO informed the Drilling Manager immediately after receiving the call. The Drilling Manager contacted the drilling contractor and instructed them to seize daily operations before 18h00 every week day.

Interested and Affected Party	Issue Raised	Response to Issue	Closure Aspect
Wycliff Relating	Requested evaluation of contractors at Tetra4 because there is a claim that “only white” people get business.	Tetra4 recorded the issue and responded to the party.	"Inconclusive Community meeting held on 6 October 2022 - Mr Relating did not attend."

4.3 ENVIRONMENTAL RISK ASSESSMENT

The NEMA Financial Provisioning Regulations requires that an environmental risk assessment must be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure. The findings of this risk assessment aim to guide the appropriate closure strategies. This FRDCP has been updated to include/reflect the current understanding of the project and the associated risks related to rehabilitation, decommissioning and closure. The risk assessment aims to reflect the risks associated with the current activities as well as the planned activities which have been approved by the Competent Authority (i.e. activities for which relevant EA's are in place). As such, the content of this section has been extracted from the associated EIA/s and adapted where relevant. This risk assessment will, as per the NEMA Financial Provision Regulations, be revised and amended during the future annual review process to ensure that the ongoing risk and risk ratings are relevant to the mine moving forward.

4.3.1 RISK ASSESSMENT METHODOLOGY

Environmental risks have been identified through review of the proposed and existing mining activities and the existing mine environment. The identification of risks was undertaken as follows:

- A team of specialists including an Environmental Assessment Practitioner, wetland specialist, soils and land capability specialist, a hydrogeological specialist, and a team of environmental engineers, as part of the relevant EIA process;
- If and where, risks or impacts are identified through the ongoing monitoring and stakeholder engagement process these are included and assessed.

The impact significance, or risk rating methodology as presented herein is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. The ER is determined for the pre- and post-mitigation scenario.

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\boldsymbol{C = \frac{(E + D + M + R) * N}{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 7 below.

Table 7: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary)
	3	Local (i.e. the area within 5 km of the site)
	4	Regional (i.e. extends between 5 and 50 km from the site)

	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction)
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural, and social functions and processes are not affected)
	2	Low (where the impact affects the environment in such a way that natural, cultural, and social functions and processes are slightly affected)
	3	Moderate (where the affected environment is altered but natural, cultural, and social functions and processes continue albeit in a modified way, moderate improvement for +ve impacts)
	4	High (where natural, cultural, or social functions or processes are altered to the extent that it will temporarily cease, high improvement for +ve impacts)
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts)
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact.

Once the C has been determined, the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 8.

Table 8: Probability Scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or

	5 Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \; x \; P$$

Table 9: Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of possible scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 10.

Table 10: Environmental Risk Scores

ER Score	Description
<9	Low (i.e. where this impact is unlikely to be a significant environmental risk/ reward).
≥9 ≤17	Medium (i.e. where the impact could have a significant environmental risk/ reward),
>17	High (i.e. where the impact will have a significant environmental risk/ reward).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

4.3.2 IMPACT AND RISK IDENTIFICATION

The identification of management and mitigation measures are guided by the hierarchy of mitigation. The ultimate aim being to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto. Table 11 lists the environmental impacts and risks identified which relate to final rehabilitation, decommissioning, and closure. The relevant management and mitigation measures are listed. The applicable conceptual closure strategy to avoid, manage and mitigate the impacts and risks are also included in Table 11, together with the

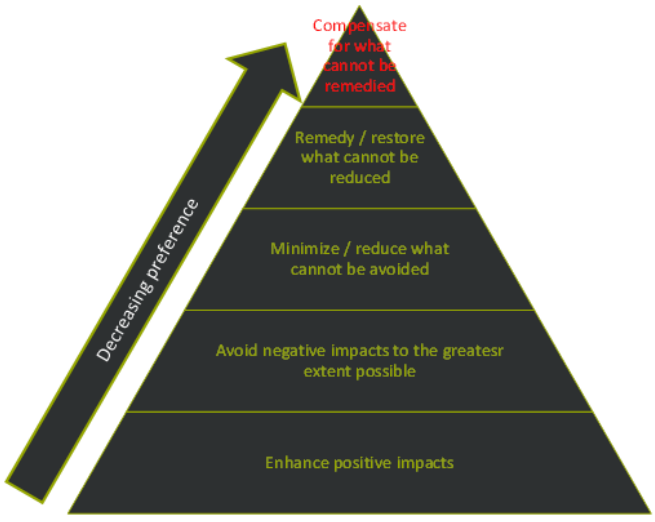


Figure 19: Hierarchy of mitigation and management.

reassessment of the environmental risk after mitigation. The environmental risk assessment of the impacts associated with final rehabilitation, decommissioning and closure has informed the most appropriate closure strategy for the project. Impacts that are classified as high-risk post-mitigation are likely to represent either latent or residual environmental impacts and financial provision will be provided to remediate these specific impacts.

The ER scores are defined as Low (<9); Medium (≥9; ≤17); and High (> 17) and are colour-coded as follows: Low – Green, Medium – Orange, and High – Red. Positive impacts have not been colour-coded. It is important to note that the environmental risk assessment will be revised and updated on an annual basis to ensure that this FRDCP remains applicable to the actual and predicted environmental impacts and risks. The EMPr addresses the management and mitigation of environmental impacts associated with the construction and operational phases whilst the three reports and plans as prescribed in the Financial Provisioning Regulations, 2015 (to be reviewed annually) will provide for the planning and financial provisioning for the concurrent rehabilitation and final closure of the production activities.

For the purpose of report, the following broad phasing definitions apply:

- Planning/Pre-construction refers to the phase in which planning takes place, namely: exploration, environmental studies, finalising designs, etc.;
- Construction refers to the phase in which the site is prepared and infrastructure is established (e.g. vegetation clearance, access road preparation, construction camp establishment, infrastructure placement, etc.);
- Operation refers to the phase in which physical production takes place – this phase will include where relevant on-going progressive rehabilitation efforts;
- Decommissioning and rehabilitation refers to the inter-linked phases in which existing infrastructure is removed and final rehabilitation efforts are applied and their success monitored;
- The closure phase commences once the gas-extracting activities have ceased, and final decommissioning and rehabilitation is being completed. This phase usually ceases 3-5 years after physical closure activities and would culminate with the issuance of a closure certificate; and
- Post-closure refers to the phase in which maintenance and rehabilitation monitoring are undertaken to ensure that the closure objectives are met. Post-closure typically commences once a closure certificate has been received. The duration of the post-closure phase is defined by the duration of the applicable residual and latent environmental impacts.

4.3.3 ENVIRONMENTAL RISK ASSESSMENT FOR REHABILITATION, DECOMISSIONING AND CLOSURE.

This risk assessment identifies and assesses the environmental risks and potential impacts associated with the current approved production activities. Where practical the mitigation hierarchy is applied to limit the post mitigation risk or impact significance. However certain impacts will perpetuate beyond the closure period and are identified described and assessed as residual and/or latent impacts in Section 6.

Table 11 provides a summary of the identified impacts, associated level of risk (or significance rating) both pre- and post- mitigation, the identified key management and mitigation actions, and finally the identified broad closure strategy. Please refer to Appendix 2 for a full breakdown of the risk ratings according to the scoring criteria defined in Section 4.3.1.

It is important to note that the risk assessment conducted as part of the initial EIA process forms the base. These risks are reviewed and supplemented in instances where additional risks or impacts are identified in subsequent updates of the FRDCP. In instances where additional impacts or risks have been added these are identified by “NEWDATE” in the impact column.

Table 11: Impact Assessment for Rehabilitation, Decommissioning and Closure[7].

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
DECOMMISSIONING PHASE					
Social	Potential to use local service providers and contribute directly to local economy.	+7.50	None.	+11.00	N/A
	Interruption in services.	-10.00	Notice of any service interruptions must be given at least a day before the interruption takes place – a SMS or e-mail system can be used for this purpose.	-5.25	Ongoing landowner and stakeholder engagement.
	Interference with existing land uses.	-13.00	Particulate matter (PM) emissions reduction along the unpaved roads, decommissioning areas, and within the proposed site boundary could include either watering or chemical suppressants, which can achieve up to 75% and 90% control efficiency respectively.	-11.00	On-going monitoring. Implement effective dust control measures. Revegetation of disturbed areas
	Impacts on existing services and infrastructure.	-13.00	If private roads are affected by project activities it is the responsibility of Tetra 4 to maintain these roads as long as they use it. Tetra 4 should engage with the relevant farmers about road maintenance, as some of them have preferential ways in which the roads must be maintained, for example if roads are only graded and not built up it turns into rivers when there is heavy rain. The road maintenance agreements must be formalised before construction commences to ensure all parties involved are protected and know their rights and	-11.00	Ongoing landowner and stakeholder engagement.

[7]The significance scores are defined as Low (<9); Medium (≥9; <17); and High (≥ 17).

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			responsibilities. It is recommended that construction[8] be planned for the dry season. Tetra 4 must provide all the affected landowners with a construction schedule to ensure that they know when construction will take place on their properties. Any changes to the construction schedule must be communicated to the farmers at least a week in advance. Before the project commences Tetra 4 should compile an asset and infrastructure baseline of any landowner infrastructure that may be affected by the project. Photographs and GPS co-ordinates of the infrastructure must be included in the baseline. A copy of the baseline affecting their property should be given to each landowner, who should sign off the document to ensure that it is accurate. Tetra 4 should keep the master document. If any damage occurs it should be reinstated to its pre-project status. If the infrastructure must move, it must be done at Tetra 4's cost. Tetra 4 must ensure that the construction team has a copy of the asset and infrastructure baseline to guarantee that no infrastructure will be damaged due to ignorance during the construction phase of the project. Notice of any service interruptions must be given at least 24 hours before the interruption takes place – a SMS or e-mail system can be used for this purpose.		

[8] Where reference is made to construction activities in this risk assessment, such mitigation and management actions must be deemed to be applicable to relevant aspects of the physical decommissioning activities.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
	Re-instatement of access routes give access to land/infrastructure that was cut off by the project.	+6.75	It may be unavoidable to change travel patterns. It is important to inform the affected stakeholders about the possibility of this impact as soon as possible. It will allow them time to get used to the idea and plan their activities accordingly. It is also important that locally affected parties give input in potential mitigation measures. Before construction commences Tetra 4 must meet individually with each applicable landowner to discuss their movement patterns and needs. Tetra 4 must provide all the affected landowners with a construction schedule to ensure that they know when construction will take place on their properties. It is recommended that construction be done outside the peak planting and harvesting seasons. Any changes to the construction schedule must be communicated to the farmers at least a week in advance. As far as possible obstruction of access routes and sensitive areas must be avoided. If it cannot be avoided both parties must agree on alternative routes, and Tetra 4 should carry the cost of implementing the alternatives. Industrial vehicles should not travel during peak traffic times. If practical and required by the landowner, access routes to land/infrastructure should be reinstated in the decommissioning phase. This must be done in conjunction with the landowners	+10.00	Ongoing landowner and stakeholder engagement.
	Increase in social license to operate due to management of nuisance impacts.	+6.00	This is a positive impact and will occur if Tetra 4 implements the suggested mitigation measures. Tetra 4 should appoint a dedicated person to communicate with the landowners. It is important for the landowners to build a relationship with this person. The person must have enough authority and access to	+9.00	Landowner consultation.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			management to ensure that he can assist with dealing with everyday issues. It is important that the landowners trust the person and have faith in their ability to address issues. In addition, Tetra 4 should establish a Community Liaison Forum that meets at least twice a year. The forum can be used to share information and give feedback on general and environmental issues. Before the project commences the construction programme must be shared with the affected parties.		
	Impacts on safety and security of local residents due to presence of unfamiliar people in the area.	-17.50	Tetra 4 should work with the existing farmers' security groups (Sector 4 Security group and AgriSec) and farmers' associations (Virginia and Theunissen) to create a farm access protocol for everybody that need to access the properties, and a safety plan. Tetra 4 should also become a member of these forums. There is an existing WhatsApp group that Tetra 4 should join. Farms that are equipped with alarms are all connected to a central point at AgriSec, and this is a good point of departure for Tetra 4 to consider security arrangements for their own assets and to link in and work with existing systems. Pictures, make and registration numbers of all vehicles used by Tetra 4 on-site should be provided to the farmer's security group and distributed to all affected landowners to ensure that they will be able to identify these vehicles if they access their properties. Tetra 4 should consider using an electronic vehicle tracking system such TeleMatrix that can identify drivers and send electronic alerts (e-mail/SMS) that will assist them with knowing the whereabouts of their drivers and informing affected	-16.25	Ongoing landowner and stakeholder engagement.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			parties when vehicles enter and exit your property (geo-fencing). In addition, for scheduled and maintenance work Tetra 4 should give a roster to the farmers stating dates and approximate times that contractors will be on the farms. Farmers emphasised that they need to know of people accessing the farm ahead of time. It is too late to inform them when entering the property. All access arrangements should be made at least 24 hours before access is required. Tetra 4 must meet with the landowners before the construction phase commence and formalise security arrangements. This should be done in writing and include the existing forums that the landowners know and trust. All contractors and employees need to wear photo identification cards. Vehicles should be marked as construction vehicles and should have Tetra 4's logo clearly exhibited. Entry and exit points of the site should be controlled. Areas where materials are stockpiled must be fenced. If a security company is used, their schedules should be communicated to the farmers, especially to those farmers that have Tetra 4 infrastructure that need to be guarded. It must be considered that guards changing shifts contribute to the impact of strangers accessing properties, and therefore a system that consider the safety of both the Tetra 4 infrastructure and the safety of the landowners must be implemented. The fact that it may be required that people spend the night on the farms is a source of discomfort for many of the landowners, especially if it is people that they do not know and trust, and have no control over. Under no circumstances should anyone		

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			be allowed to erect a dwelling for security forces on any of the farms. However, the necessary sanitation facilities must be made available, and some form of shelter from the elements.		
	Public perceptions about the impact of decommissioning on the sense of place.	+4.50	It is difficult to mitigate the impact on sense of place as it is experienced on a personal level. In general, the mitigation measures suggested in the visual, noise, ecological impact assessments and other relevant specialist studies should be adhered to. The relevant specialists will provide scientific mitigation measures for the aspects relevant to their studies. From a social perspective it is important to create a CLF that communicates the mitigation and monitoring measures to the affected parties. This forum can also act as a platform to discuss environmental issues. The CLF can meet twice a year to discuss all the concerns about the project and to share new project information. It can be an important aspect assisting Tetra 4 with obtaining a social license to operate. Sense of place is a personal experience, but successful rehabilitation will go a long way in recreating a rural sense of place. The public perception would be negative or positive depending on the successful implementation of the rehabilitation.	+5.00	Landowner consultation.
Economic	Alternative land-use.	+7.50	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised.	+7.50	Compliance with other related National Legislative Requirements.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
	Black economic transformation.	-16.00	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised.	-16.00	
	Country and industry competitiveness.	-19.00	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-19.00	
	Economic development per capita.	-7.00	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-7.00	
	Employment impacts.	-8.00	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-8.00	
	Fiscal income.	-16.25	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is	-16.25	

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised		
	Forex savings.	-13.75	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-13.75	
	GGP impact.	-10.00	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-10.00	
	Need and desirability.	-12.00	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-12.00	
Air Quality	Fugitive emissions (dust) from decommissioning/ removal of all berms, trenches and other stormwater infrastructure no longer required	-5,25	The following air quality measures are recommended during construction, operational, decommissioning and rehabilitation and closure phases of the Project: In controlling vehicle entrained particulate matter, it is recommended that water (at an application rate of 2	-5,25	Compliance with EMPR. On-going monitoring. Implement effective dust control measures.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
	Greenhouse gas emissions from decommissioning/ removal of stationary infrastructure	-4,5	litre/m2-hour), be applied on all unpaved road sections to ensure a minimum of 50% control efficiency (CE). In addition, binding agents or chemical suppressants (such as "Dust-A-Side" or "Dustex") should be considered for application on all unpaved road sections; literature reports an emissions reduction efficiency of more than 80 % (NPI, 2011; Cecala, et al., 2012; US EPA, 2006). In order to ensure lower exhaust emissions from vehicles and machinery, equipment suppliers or contractors should be required to ensure compliance with appropriate emission standards for production fleets. Also, maintenance and repair of diesel engines should be carried out as prescribed by manufacturer in order to maximize combustion and reduce gaseous emissions. Fuel efficient driving practices on-site may also help lower exhaust emissions from vehicles and machinery, such as stipulating a maximum speed on all unpaved roads and limiting unnecessary travelling of vehicles on untreated roads. In addition, other fuel efficient practices that may lower exhaust emissions include limiting idling of machinery, driving in an upper gear rather than a lower gear as much as possible, ensuring tire pressure are always adequate etc. The use of low–NOx burners in combustion systems should be considered for operation of the Helium and LNG plant.	-4,5	Revegetation of disturbed areas
	Fugitive emissions (dust) from decommissioning/ removal of stationary infrastructure	-5,25		-5,25	
	Greenhouse gas emissions from decommissioning/ removal of pipeline infrastructure	-4,5		-4,5	
	Fugitive emissions (dust) from decommissioning/ removal of pipeline infrastructure	-5,25		-5,25	
	Greenhouse gas emissions from the removal of waste and recycling of recyclable / reclaimable waste	-4,5		-4,5	
	Fugitive emissions (dust) from the removal of waste and recycling of recyclable / reclaimable waste	-5,25		-5,25	

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			Products, liquid fuels and chemicals should be stored in areas where there are provisions for containment of spills. The implementation of vapour recovery systems, for storage tanks and other applicable units, to control losses of VOCs and achieve over 90% recovery, should be considered. During construction and rehabilitation phases, stockpile of fine or erodible material (if applicable) should be treated regularly with water sprayers to reduce their potential for erosion. Infrastructure containing natural gas and associated GHG's and/or pollutants (including amongst others pipelines, processing plant, and storage vessels) must be cleared and captured, and not vented directly to the atmosphere.		
Hydrogeology	Contamination of alluvial and sand aquifers	-12	In most instances, the hydrogeological impacts associated with surface sources are linked to spills and leaks, which can be managed through the implementation of good housekeeping practices, regular inspections as well as sound environmental training. The regional extent of these impacts is not expected to be significant but would rather be restricted to the site. An emergency response protocol must be implemented at the operations that are aimed at early detection and swift reaction speed. In this regard, daily inspections of drilling pads, pipelines, compressors and the helium plant must be implemented. Specific	-4	Compliance with EMPR. Rehabilitate disturbed areas. On-going monitoring.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			emphasis must be placed on detecting leaks and spills during the inspections. An on-site communication system must be put in place to ensure that instructions are given and carried out with efficiency. In the event of a spill occurring, a method statement must be completed that describes how, where and when clean-ups will be undertaken. The on-site communication system must make provision for continual review and improvement of spill management. The necessary equipment and personal protection equipment (PPE) must be kept on-site to clean spills up and leaks. Tetra4 personnel must receive adequate training on the use of the equipment and the disposal of waste material generated during a spill. All such wastes must be treated as hazardous. The waste must be placed of to a dedicated sealed container on-site, which must be disposed of to a licensed facility. All on-site vehicle and equipment maintenance must be undertaken within an area of secondary containment, such as a bund or over a drip tray, to prevent accidental soil contamination. Oil and diesel stored on-site must be placed within a suitably sized bund. The dispensing of hydrocarbons must be undertaken with due care to prevent or contain spills. All waste generated must be contained and stored in suitably sealed, bunded and protected areas to avoid spills and leaks. Waste must be collected and disposed of off-site in a responsible manner so as to prevent groundwater contamination off-site.		

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
	Contamination from leakage and spillage	-9	All wells should be capped and or plugged to prevent the spilling of contaminated groundwater; and The water quality monitoring plan should be implemented in this phase to monitor any deterioration of the water quality.	-3.5	Cap well. Refer to section 4.4.6. Compliance with EMPR. Ongoing Monitoring.
	Stray gas migration affecting groundwater quality	-9	The shallow potable Karoo aquifers will be protected during gas production drilling through the insertion of several well casings and cementation. Well design will be undertaken according to designs developed by a qualified well engineer. Well design will be undertaken according to designs developed by a qualified well engineer. The upper 300 – 450m of the geological succession will be cased off using a combination of telescopic drilling, steel casing and cementation between the well annulus and the casing. This configuration is aimed at isolating the shallow Karoo potable aquifer from the deep-seated gas production zone and the saline formation water associated with the production zone. It is noted that Tetra4 does not anticipate intersecting formation water during its gas production phase. In the unlikely event that produced water has to be extracted from gas production wells, this water will be stored in sealed containers, removed from site and disposed of to a suitable licenced (where necessary) environment/waste management facility. The produced water is expected to contain elevated levels of dissolved salts, hydrocarbons and trace elements	-4,5	Plug entire length of well and cap well. Refer to sections 4.4.6 and 0. Compliance with EMPR. Ongoing Monitoring.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			and would therefore be harmful to the environment. Responsible disposal thereof is therefore important. A groundwater monitoring programme will be implemented in the gas well as well as in the monitoring and hydrocensus boreholes to detect dissolved methane and ethane gas.		
Land-use	Abandoned project infrastructure creating future liability. Associated risk, or impacts include: - Settlement of the pipeline servitude allowing for preferential flows and potential erosion. - Remnant infrastructure or residual contamination.	-12	Conclude formal agreements with relevant surface rights holders (or other third parties) in respect of long-term land-use restrictions and controls, as well as the transfer of any infrastructure to landowners (where applicable). Dismantle and remove and/ or dispose all remnant infrastructure (not formally excluded due to private landowner agreement) and render safe. Removal of all services (including roads, stormwater, water and power infrastructure), structures, machinery, and infrastructure unless these are specifically required for post-closure land-use, post-closure projects or have been requested by the relevant landowner. All identified infrastructure should be broken down to natural ground level. Dismantle and dispose of all fences that do not form part of post-closure property boundaries. Areas where infrastructure was demolished should be assessed through a risk-based system to determine if there is any residual contamination or risk and appropriate remediation measures implemented.	-4.5	

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			Where contaminated material is detected, this should be removed and disposed of. Profile the area to be free draining. Confirm that pipeline servitudes do not show evidence of settlement and consequent preferential surface water flows. A waste and infrastructure hierarchical principal should be applied to all decommissioned infrastructure or wastes, as follows: Reduce, re-use, recycle, dispose. Place, assess and ameliorate topsoil's over rehabilitated areas.		
CLOSURE AND REHABILITATION					
Economics	Alternative Land-use	11,25	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	11,25	Compliance with other related National Legislative Requirements.
	Black Economic Transformation	-16	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-16	
	Country and Industry Competitiveness	-16	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No	-16	

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised		
	Economic development per capita	-12,5	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-12,5	
	Employment Impacts	-13,75	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-13,75	
	Fiscal Income	-16,25	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-16,25	
	Forex savings	-13,75	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-13,75	

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
	GGP Impact	-16,25	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-16,25	
	Need and Desirability	-15	All the significant enhancement measures are legislated and these measures are currently monitored by various responsible government departments. No enhancement measures over and above to what is prescribed by the mining charter, B-BBEE codes and the Social and Labour Plan, is advised	-15	
Hydrogeology	Contamination of alluvial and sand aquifers	-14	Implement good housekeeping practices, regular inspections as well as sound environmental training. The regional extent of these impacts is not expected to be significant but would rather be restricted to the site. An emergency response protocol must be implemented at the operations that are aimed at early detection and swift reaction speed. In this regard, daily inspections of drilling pads, pipelines, compressors and the helium plant must be implemented. Specific emphasis must be placed on detecting leaks and spills during the inspections. An on-site communication system must be put in place to ensure that instructions are given and carried out with efficiency. In the event of a spill occurring, a method statement must be completed that describes how, where and when clean-ups will be undertaken. The on-site communication	-4,5	Rehabilitate disturbed areas. Plug entire length of well and cap well in instances where gas and saline flow zones are intersected. . Refer to sections 4.4.6 and 0. Compliance with EMPR. Ongoing Monitoring.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			system must make provision for continual review and improvement of spill management. The necessary equipment and personal protection equipment (PPE) must be kept on-site to clean spills up and leaks. Tetra4 personnel must receive adequate training on the use of the equipment and the disposal of waste material generated during a spill. All such wastes must be treated as hazardous. The waste must be placed of to a dedicated sealed container on-site, which must be disposed of to a licensed facility. All on-site vehicle and equipment maintenance must be undertaken within an area of secondary containment, such as a bund or over a drip tray, to prevent accidental soil contamination. Oil and diesel stored on-site must be placed within a suitably sized bund. The dispensing of hydrocarbons must be undertaken with due care to prevent or contain spills. All waste generated must be contained and stored in suitably sealed, bunded and protected areas to avoid spills and leaks. Waste must be collected and disposed of off-site in a responsible manner so as to prevent groundwater contamination off-site.		
	Well casing and/or cementation failure affecting groundwater quality- including vertical migration of formation water and saline aquifers.	-12,75	Well abandonment and plugging to comply with industry best practice, the EMPR and Tetra4 Internal Procedures. Tetra4 will implement well-specific plugging requirements protect the shallow potable Karoo aquifers at closure. Well design will be done by a qualified well engineer and/or other suitably qualified	-7,5	Plug entire length of well and cap well. Refer to sections 4.4.6 and 0. Compliance with Well, Closure, Abandonment and Rehabilitation Guideline.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			specialist who will take corrosion, pressures, temperatures, exposure times, production life and well rehabilitation into consideration. The cement seals will be pumped as a water-cement slurry down the casing to the bottom of the well, leaving a sheath of cement to set and harden. The integrity of the seals should, where applicable, be pressure tested before the next phase of drilling commences. If the well fails the pressure test, the casing will be re-cemented before drilling continues. Testing will be implemented to ensure that the plug is placed at the proper level and provides adequate protection of permeable zones, for example the fracture zones from which gas was produced and the overlying Karoo aquifers. These tests should include tagging the top of the plug. Pressure testing should be undertaken on the seal but care should be taken not to damage the seal during pressure testing. Swabbing can be undertaken to remove fluids from the well. Upon completion of the rehabilitation of the well, a surface casing vent flow test should be considered to determine whether gas or liquid or a combination thereof is escaping from the casing. If gas is detected during this test, additional seals should be designed and implemented. A groundwater and gas monitoring programme will be implemented at each well to serve as an early detection mechanism.		Ongoing monitoring.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			Tetra4 has also prepared a Gas Well, Closure, Abandonment and Rehabilitation Guideline document which will be complied with.		
Social	Potential to use local service providers and contribute directly to local economy.	7,5	Tetra 4 must appoint a community liaison officer (CLO) that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra 4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new activities are planned for a property, Tetra 4 must consult with the landowner and obtain his consent to execute the activity on his/her land. If any interference takes place and there are actual losses, the landowner should be compensated for their losses. Tetra 4 must have a claims procedure that is communicated to all affected landowners. In order to receive compensation, the claim forms must be submitted to the Tetra 4 CLO Compensation should follow the IFC principles, which states that market related prices should be paid, and if anything is restored, it must be to the same or better standards than before. Tetra 4 should employ an environmental officer (EO) that oversees all the environmental aspects of the project. There must be a formal procedure in place on how to report incidents to ensure records of all grievances are kept. Environmental incidents must be	11	Initial assessment and consultation with landowner. Ongoing landowner and stakeholder engagement.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			reported to the CLO, who must inform the EO. If a farmer reports any invasion of alien species as a result of Tetra 4, immediate action must be taken to ensure the invasion does not spread further. If any damage was done as a result of their activities, Tetra 4 should carry the cost of rehabilitation and compensate the farmer for his losses. If needed an external mediation process should be followed. A water census should be conducted before the project commences and each affected party should be given the records affecting their property. Tetra 4 should keep records of all the properties. If any decline in the volume or quality of water occurs that can be linked to Tetra 4 activities, Tetra 4 should provide the affected parties with water of equivalent or better quality (depending on use) until such a time that the quality and availability is restored to pre-project levels. The relevant biophysical specialists will provide scientific mitigation measures for biophysical aspects that impact on the livelihoods of the affected landowners. From a social perspective it is important to create a community liaison forum (CLF) that communicate the mitigation and monitoring measures to the affected parties. This forum can also act as a platform to discuss environmental issues. It can be an important aspect assisting Tetra 4 with obtaining a social license to operate.		
	Impacts on safety and security of local residents due to presence of unfamiliar people in the area	-17,5	Tetra 4 should work with the existing farmers' security groups (Sector 4 Security group and AgriSec) and farmers' associations (Virginia and Theunissen) to	-16,25	Initial assessment and consultation with landowner.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			create a farm access protocol for everybody that need to access the properties, and a safety plan. Tetra 4 should also become a member of these forums. There is an existing WhatsApp group that Tetra 4 should join. Farms that are equipped with alarms are all connected to a central point at AgriSec, and this is a good point of departure for Tetra 4 to consider security arrangements for their own assets and to link in and work with existing systems. Pictures, make and registration numbers of all vehicles used by Tetra 4 on-site should be provided to the farmer's security group and distributed to all affected landowners to ensure that they will be able to identify these vehicles if they access their properties. Tetra 4 should consider using an electronic vehicle tracking system such TeleMatrix that can identify drivers and send electronic alerts (e-mail/SMS) that will assist them with knowing the whereabouts of their drivers and informing affected parties when vehicles enter and exit your property (geo-fencing). In addition, for scheduled and maintenance work Tetra 4 should give a roster to the farmers stating dates and approximate times that contractors will be on the farms. Farmers emphasised that they need to know of people accessing the farm ahead of time. It is too late to inform them when entering the property. All access arrangements should be made at least 24 hours before access is required. Tetra 4 must meet with the landowners before the construction phase commence and formalise security arrangements. This should be done in writing and include the existing forums that the landowners know and trust.		Ongoing landowner and stakeholder engagement.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			All contractors and employees need to wear photo identification cards. Vehicles should be marked as construction vehicles and should have Tetra 4's logo clearly exhibited. Entry and exit points of the site should be controlled. Areas where materials are stockpiled must be fenced. If a security company is used, their schedules should be communicated to the farmers, especially to those farmers that have Tetra 4 infrastructure that need to be guarded. It must be considered that guards changing shifts contribute to the impact of strangers accessing properties, and therefore a system that consider the safety of both the Tetra 4 infrastructure and the safety of the landowners must be implemented. The fact that it may be required that people spend the night on the farms is a source of discomfort for many of the landowners, especially if it is people that they do not know and trust, and have no control over. Under no circumstances should anyone be allowed to erect a dwelling for security forces on any of the farms. However, the necessary sanitation facilities must be made available, and some form of shelter from the elements.		
	Interference with existing land uses/livelihoods	-13	Tetra 4 must appoint a community liaison officer (CLO) that deals with the affected landowners throughout the life of the project. If existing activities will be affected negatively Tetra 4 must enter into negotiations with the affected parties as soon as reasonably achievable to ensure the affected parties are compensated fairly or can make additional arrangements. Interference with existing livelihoods should be avoided if possible. If any new	-11	Initial assessment and consultation with landowner. Ongoing landowner and stakeholder engagement.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			activities are planned for a property, Tetra 4 must consult with the landowner and obtain his consent to execute the activity on his/her land. If any interference takes place and there are actual losses, the landowner should be compensated for their losses. Tetra 4 must have a claims procedure that is communicated to all affected landowners. In order to receive compensation, the claim forms must be submitted to the Tetra 4 CLO Compensation should follow the IFC principles, which states that market related prices should be paid, and if anything is restored, it must be to the same or better standards than before. Tetra 4 should employ an environmental officer (EO) that oversees all the environmental aspects of the project. There must be a formal procedure in place on how to report incidents to ensure records of all grievances are kept. Environmental incidents must be reported to the CLO, who must inform the EO. If a farmer reports any invasion of alien species as a result of Tetra 4, immediate action must be taken to ensure the invasion does not spread further. If any damage was done as a result of their activities, Tetra 4 should carry the cost of rehabilitation and compensate the farmer for his losses. If needed an external mediation process should be followed. A water census should be conducted before the project commences and each affected party should be given the records affecting their property. Tetra 4 should keep records of all the properties. If any decline in the volume or quality of water occurs that can be linked to		

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
			Tetra 4 activities, Tetra 4 should provide the affected parties with water of equivalent or better quality (depending on use) until such a time that the quality and availability is restored to pre-project levels. The relevant biophysical specialists will provide scientific mitigation measures for biophysical aspects that impact on the livelihoods of the affected landowners. From a social perspective it is important to create a community liaison forum (CLF) that communicate the mitigation and monitoring measures to the affected parties. This forum can also act as a platform to discuss environmental issues. It can be an important aspect assisting Tetra 4 with obtaining a social license to operate.		
	Increase in social licence to operate due to management of nuisance impacts	6	This is a positive impact and will occur if Tetra 4 implements the suggested mitigation measures. Tetra 4 should appoint a dedicated person to communicate with the landowners. It is important for the landowners to build a relationship with this person. The person must have enough authority and access to management to ensure that he can assist with dealing with everyday issues. It is important that the landowners trust the person and have faith in their ability to address issues. In addition, Tetra 4 should establish a Community Liaison Forum that meets at least twice a year. The forum can be used to share information and give feedback on general and environmental issues. Before the project commences the construction programme must be shared with the affected parties.	9	Ongoing landowner and stakeholder engagement.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk	Closure Options/Actions
	NEW2021-Plugged wells resulting in redistribution of residual gas to underground workings.	-12.75	Continued consultation with affected mining operations in the area to advise on planned and implemented closure operations and the potential for gas ingress into underground workings to change. Depletion of reservoirs (if any) prior to closure and plugging.	-5.5	Pre-plugging consultation with other mineral rights holders.
Biodiversity	NEW2021- Degradation of natural habitat- incl erosion and alien invasives. Should rehabilitation not be successful then there is a potential for degradation of the rehabilitated surface and adjacent areas.	-9.75	Areas identified with erosion must be rectified by determining the driving causes and rectifying/ remediating. The rehabilitated areas must be assessed once a year for compaction, vegetation cover, and erosion. Deficiencies must be rectified. Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated. The areas to be rehabilitated must be accessed through the existing access routes or previously disturbed areas as far as practically possible to decrease the amount of vegetation disturbed. The Tetra4 Alien and Invasive Procedure must be implemented and complied with.	-3	Rehabilitate and monitoring.

4.4 DESIGN PRINCIPLES

There are no definitive principles guiding the design or the rehabilitation, decommissioning and closure plan for onshore gas production in the South African context.

4.4.1 GENERAL SURFACE REHABILITATION

The Land Rehabilitation Society of South Africa (LARRSA) has recently published a guideline for the surface rehabilitation of coal mines (LaRSSA, 2019). There are aspects of these guidelines which can be applied to the surface rehabilitation actions for most projects and are presented in below Table 12.

Table 12: Key principles for surface land rehabilitation.

Component	Rehabilitation principle
Regulatory compliance	- Achieving legal compliance is a minimum for appropriate rehabilitation planning. - Rehabilitation objectives and associated actions will not conflict with local legislation and will aim to complement and possibly go beyond legal compliance, where possible.
Concurrent implementation	- Concurrent, progressive rehabilitation will be undertaken throughout the operational stage of mining[9]. - A risk-based approach will be applied to ensure concurrently implemented rehabilitation actions will achieve the desired post-mining landscape and land capability aligned with end land use targets.
Stakeholder engagement and custodianship	- Relevant mining-affected stakeholders will be identified and involved in rehabilitation planning throughout the mining lifecycle, as required. - Rehabilitation planning will leverage from local stakeholder views, experiences, cultures and/or customs, on possible uses and needs of the rehabilitated landscape, to foster a land stewardship culture from potential next land users.
Landform Management	- Rehabilitation will be undertaken and aligned to a site-specific surface landform design that will be compiled during the planning stage of an operation. - The site-specific landform design will incorporate the surface profiling needs of the target post-mining land capability and land use/s, to optimize material movement throughout the operational and decommissioning periods, and to ensure the long-term sustainability of the rehabilitated landscape. - A 'management-of-change review process' will be incorporated into the mine planning process, to ensure that changes to the mine plan do not compromise either the proposed final landform or its potential use.
Land capability	- Post-mining land capability will, as far as is practically possible, be constructed to resemble the pre-mining land capability of the disturbed area. - Attention will be given to rehabilitating the site to specified land capabilities that can support a suite of mixed land uses. - Soil physical and chemical properties will be aligned to the productivity needs of the post-mining land use/s, and to support these in the long-term.

[9] Where reference is made to mining in these guidelines it can be extended to relevant and similar activities associated with production activities.

Component	Rehabilitation principle
Land use	- Post-mining land use planning will consider the needs of changing regional development and planning, over time. - The site will be left in an environmentally physically safe, stable, and non-polluting condition for the defined post-mining land uses. - The defined post-mining land use/s will provide socio-economic value to next land users, as agreed with these land users (once exact post-mining land uses can be defined).
Climate uncertainty	- Predictive modelling will form the basis for longer-term environmental impact identification and risk management.
Monitoring	- Monitoring will be initiated as soon as the first ground has been moved (at construction). - Monitoring will be continued progressively throughout the project lifecycle, in parallel with concurrent rehabilitation activities. - Data obtained through ongoing monitoring will be frequently assessed for trends that could demonstrate rehabilitation success, and where corrective action may be required. - The monitoring process must be linked to a corrective action process.
Adaptive land management	- An adaptive land management approach will be adopted on-site, allowing for implementation of alternative and improved rehabilitation strategies and corrective action, where required.

4.4.2 BOREHOLE PLUGGING AND ABANDONMENT

In respect of the rehabilitation plugging and abandonment reference has been made to the American Petroleum Institute (API) recommended Practice 65-3 (American Petroleum Institute, 2021). This document provides practical guidance for permanently and temporarily abandoning gas wells.

The primary goals of the practice document are protection of useable water sources, isolation of hydrocarbon bearing or water injection intervals, prevent any leakage to the surface, and prevention of unintended cross flows. Where applicable and relevant recommendations and actions defined in this practice document has been included in this FRDCP.

4.4.3 TETRA4 GAS WELL CLOSURE SEALING AND REHABILITATION GUIDELINES

Tetra4 has developed an internal guideline document addressing the planning and implementation of well abandonment, sealing and rehabilitation (Tetra4 (Pty) Ltd, 2021). These guidelines aim to provide guidance during the preparation for well closure, sealing and abandonment of a gas production/exploration well, focussing on the following aspects:

1. Determining the most suitable and appropriate closure, sealing and rehabilitation strategy with specific focus on:
    - Technical aspects pertaining to plugging mechanisms/techniques in order to ensure the most suitable and appropriate well specific closure, sealing and rehabilitation strategy is implemented - with specific focus on the plugging methods to ensure no vertical gas and/or fluid movements within the well;
    - Specifications of plugging material and equipment to ensure compliance with well abandonment standards (e.g., Best Practice Standards etc.);

- Ensuring the landscape is safe, stable and non-polluting over the long-term, and that the post closure land use aligns with the surrounding land use and does not affect the sustained utilization thereof;
- Mechanisms and tests that would be implemented to ensure cement bonding is structurally sound;
- Mechanisms and tests that could be implemented for future long-term monitoring to ensure well plugging and sealing is structurally sound.

2. Preparation of a consolidated site-specific closure, sealing and rehabilitation plan and project cost-breakdown.

These guidelines have been considered and where relevant incorporated into this Final Rehabilitation, Decommissioning and Closure Plan. A copy of the latest version of the Tetra4 Guidelines in attached as Appendix 1.

Tetra4 has also developed a Rehabilitation Procedure which specifies the closure and rehabilitation approach to Works to be undertaken within the Virginia Production Area. The requirements contained in this procedure are in addition to the requirements stipulated in the approved Environmental Management Programme 2017 (EMPr 2017), issued Environmental Authorisations, Licenses and Tetra4 Environmental Procedures- Referred to as T4-PP-SHERQ-047. This procedure is attached as Appendix 1.

4.4.4 LEGISLATIVE AND GOVERNANCE FRAMEWORK

The requirement for final rehabilitation, decommissioning, and closure stems primarily from the legislative requirements of the MPRDA and the NEMA. The relevant extracts from each of these is presented in this section.

4.4.4.1 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT, ACT 28 OF 2002

The following extracts relate to the principle of closure for any right issued under the MPRDA:

- Section 43(1): The holder of a prospecting right, mining right, retention permit, mining permit, or previous holder of an old order right or previous owner of works that has ceased to exist, remains responsible for any environmental liability, pollution, ecological degradation, the pumping and treatment of extraneous water, compliance to the conditions of the environmental authorisation and the management and sustainable closure thereof, until the Minister has issued a closure certificate in terms of this Act to the holder or owner concerned.
- Section 43(4): An application for a closure certificate must be made to the Regional Manager in whose region the land in question is situated within 180 days of the occurrence of the lapsing, abandonment, cancellation, cessation, relinquishment or completion contemplated in subsection (3) and must be accompanied by the required information, programmes, plans and reports prescribed in terms of this Act and the National Environmental Management Act, 1998.
- Section 43 (5): No closure certificate may be issued unless the Chief Inspector and each government department charged with the administration of any law which relates to any matter affecting the environment have confirmed in writing that the provisions pertaining to health and safety, and management pollution to water resources, the pumping and treatment of extraneous water and compliance to the conditions of the environmental authorisation have been addressed.
- Section 43 (7): The holder of a prospecting right, mining right, retention permit, mining permit, or previous holder of an old order right or previous owner of works that has ceased to exist, or the person contemplated in subsection (2), as the case may be, must plan for, manage and implement such procedures and such requirements on mine closure as may be prescribed.
- Section 43 (8): Procedures and requirements on mine closure as it relates to the compliance of the conditions of an environmental authorisation, are prescribed in terms of the National Environmental Management Act, 1998.

4.4.4.2 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT REGULATIONS, GNR527/2004

The following extracts from the MPRDA Regulations are specifically applicable to the preparation of this FRDCP:

- Regulation 56: Principles for mine closure: In accordance with applicable legislative requirements for mine closure, the holder of a prospecting right, mining right, retention permit or mining permit must ensure that -
    - the closure of a prospecting or mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation;
    - the closure of a prospecting or mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation;
    - risks pertaining to environmental impacts must be quantified and managed pro-actively, which includes the gathering of relevant information throughout the life of a prospecting or mining operation; in accordance with the provisions of the National Environmental Management Act, 1998, the Financial Provision Regulations, 2015 and the Environmental Impact Assessment Regulations, 2014;
    - the safety and health requirements in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) are complied with;
    - residual and possible latent environmental impacts are identified and quantified; in accordance with the provisions of the National Environmental Management Act, 1998, the Financial Provision Regulations, 2015 and the Environmental Impact Assessment Regulations, 2014;
    - the land is rehabilitated, as far as is practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms with the concept of sustainable development; in accordance with the provisions of the National Environmental Management Act, 1998, the Financial Provision Regulations, 2015 and the Environmental Impact Assessment Regulations, 2014; and
    - prospecting or mining operations are closed efficiently and cost effectively.
- Regulation 61: Closure Objectives: Closure objectives form part of the environmental authorisation, as the case may be, and must-
    - identify the key objectives for mine closure to guide the project design, development and management of environmental impacts in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;
    - provide broad future land use objective(s) for the site; and
    - provide proposed closure costs in accordance with the National Environmental Management Act, 1998 and the Financial Provision Regulations, 2015.
- Regulation 62: Contents of closure plan: A closure plan contemplated in section 43(3)(d) of the Act, forms part of the environmental management programme or environmental management plan, as the case may be, and must include –
    - a description of the closure objectives and how these relate to the prospecting or mine operation and its environmental and social setting;
    - a plan contemplated in regulation 2(2), showing the land or area under closure;
    - a summary of the regulatory requirements and conditions for closure negotiated and documented in the environmental authorisation, as the case may be;

- a summary of the results of the environmental risk report and details of identified residual and latent impacts; in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;
- a summary of the results of progressive rehabilitation undertaken; in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;
- a description of the methods to decommission each prospecting or mining component and the mitigation or management strategy proposed to avoid, minimize and manage residual or latent impacts;
- details of any long-term management and maintenance expected;
- details of a proposed closure cost and financial provision for monitoring, maintenance and post closure management; in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;
- a sketch plan drawn on an appropriate scale describing the final and future land use proposal and arrangements for the site;
- a record of interested and affected persons consulted; and
- technical appendices, if any.

4.4.4.3 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

Prior to 8 December 2014, the environmental aspects of mining and production activities were regulated in terms of the MPRDA. Recent legislative amendments and the drive towards a 'one environmental system' have resulted in the inclusion of the requirement for rehabilitation, decommissioning and closure planning and associated financial provisions into the NEMA. Specific sections of the Act are extracted below:

- Section 24P: Financial provision for remediation of environmental damage:

  (1) An applicant for an environmental authorisation relating to prospecting, exploration, mining, or production must, before the Minister responsible for mineral resources issues the environmental authorisation, comply with the prescribed financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.

  (2) If any holder or any holder of an old order right fails to rehabilitate or to manage any impact on the environment or is unable to undertake such rehabilitation or to manage such impact, the Minister responsible for mineral resources may, upon written notice to such holder, use all or part of the financial provision contemplated in subsection (1) to rehabilitate or manage the environmental impact in question.

  (3) Every holder must annually-

  a. assess his or her environmental liability in a prescribed manner and must increase his or her financial provision to the satisfaction of the Minister responsible for mineral resources; and

  b. submit an audit report to the Minister responsible for mineral resources on the adequacy of the financial provision from an independent auditor.

  (4) (a) If the Minister responsible for mineral resources is not satisfied with the assessment and financial provision contemplated in this section, the Minister responsible for mineral resources may appoint an independent assessor to conduct the assessment and determine the financial provision. (b) Any cost in respect of such assessment must be borne by the holder in question.

(5) The requirement to maintain and retain the financial provision contemplated in this section remains in force notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002 to the holder or owner concerned and the Minister responsible for mineral resources may retain such portion of the financial provision as may be required to rehabilitate the closed mining or prospecting operation in respect of latent, residual or any other environmental impacts, including the pumping of polluted or extraneous water, for a prescribed period.

(6) The Insolvency Act, 1936 (Act No. 24 of 1936), does not apply to any form of financial provision contemplated in subsection (1) and all amounts arising from that provision.

(7) The Minister, or an MEC in concurrence with the Minister, may in writing make subsections (1) to (6) with the changes required by the context applicable to any other application in terms of this Act.

- Section 24R: Mine closure on environmental authorisation:

(1) Every holder, holder of an old order right and owner of works remain responsible for any environmental liability, pollution or ecological degradation, the pumping and treatment of polluted or extraneous water, the management and sustainable closure thereof notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002, to the holder or owner concerned.

(2) When the Minister responsible for mineral resources issues a closure certificate, he or she must return such portion of the financial provision contemplated in section 24P as the Minister may deem appropriate to the holder concerned but may retain a portion of such financial provision referred to in subsection (1) for any latent, residual or any other environmental impact, including the pumping of polluted or extraneous water, for a prescribed period after issuing a closure certificate.

(3) Every holder, holder of an old order right or owner of works must plan, manage, and implement such procedures and requirements in respect of the closure of a mine as may be prescribed.

(4) The Minister may, in consultation with the Minister responsible for mineral resources and by notice in the Gazette, identify areas where mines are interconnected or their impacts are integrated to such an extent that the interconnection results in a cumulative impact.

(5) The Minister may, by notice in the Gazette, publish strategies in order to facilitate mine closure where mines are interconnected, have an integrated impact, or pose a cumulative impact.

4.4.4.4 FINANCIAL PROVISIONING REGULATIONS, GNR1147/2015

On 20th November 2015, the Minister promulgated the Financial Provisioning Regulations under the NEMA (GNR1147). The regulations (as amended) aim to regulate the determining and making of financial provision as contemplated in the NEMA for the costs associated with the undertaking of management, rehabilitation and remediation of environmental impacts from prospecting, exploration, mining or production operations through the lifespan of such operations and latent or residual environmental impacts that may become known in the future. These regulations provide for, inter alia:

- Determination of financial provision: An applicant or holder of a right or permit must determine and make financial provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts of prospecting, exploration, mining or production operations, as contemplated in the Act and to the satisfaction of the Minister responsible for mineral resources.

- Scope of the financial provision: Rehabilitation and remediation; decommissioning and closure activities at the end of operations; and remediation and management of latent or residual impacts.

- Regulation 6: Method for determining financial provision – An applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for:
    - Annual rehabilitation – annual rehabilitation plan;
    - Final rehabilitation, decommission and closure at end of life of operations – rehabilitation, decommissioning, and closure plan; and
    - Remediation of latent defects and residual impacts – environmental risk assessment report.
- Regulation 10: An applicant must-
    - Ensure that a determination is made of the financial provision and the plans contemplated in regulation 6 are submitted as part of the information submitted for consideration by the Minister responsible for mineral resources of an application for environmental authorisation, the associated environmental management programme and the associated right or permit in terms of the Mineral and Petroleum Resources Development Act, 2002; and
    - Provide proof of payment or arrangements to provide the financial provision prior to commencing with any prospecting, exploration, mining, or production operations.
- Regulation 11: Requires annual review, assessment, and adjustment of the financial provision. The review of the adequacy of the financial provision including the proof of payment must be independently audited (annually) and included in the audit of the EMPr as required by the EIA regulations.

Appendix 4 of the Financial Provisioning Regulations provides the minimum content of a final rehabilitation, decommissioning, and closure plan. This FRDCP has been prepared to align with these requirements. Appendices 3 and 5 of the Financial Provisioning Regulations provide content requirements for the Annual Rehabilitation Plan and Environmental Risk Assessment Report, respectively. These requirements are addressed under Section 5 and 0 respectively.

4.4.5 CLOSURE VISION, OBJECTIVE AND TARGETS

The vision, and consequent objective and targets for rehabilitation, decommissioning, and closure, aim to reflect the local environmental and socio-economic context of the project, and to represent both the corporate requirements and the stakeholder expectations as well as the legislative framework and regulations.

The receiving environment within which the exploration and production activities are being undertaken include the following key land-uses:

- Agriculture- cultivated fields;
- Natural and degraded veld primarily utilised or livestock grazing;
- Mining areas; and
- Low density rural residential.

With reference to Section 4.2.13, the stakeholders consulted during the public participation process for the EIA raised concerns regarding, amongst others, the following:

- Impacts on ground water quality and availability;
- Impacts on surface water quality;
- The proposed pipeline alignment;
- Disruption of current land use and capability;
- Sense of place;

- The quantum for rehabilitation; and
- Security and access to individual farms.

With reference to both the environmental context of the project and the feedback from the consultation process the vision for closure is to:

Ensure that the landscape is safe, stable and non-polluting over the long term, and that the post closure land use aligns with the surrounding land-use and does not affect the sustained utilisation thereof.

In support of achieving this post closure vision there are certain key rehabilitation, decommissioning, and closure objectives. 'Well-conceptualised rehabilitation objectives will allow assessment of the risks associated with achieving these objectives and guide the setting of suitable rehabilitation actions to be taken to mitigate these risks at every stage of the mine's life. Rehabilitation objectives describe 'what' needs to be achieved to reach the mine's rehabilitation goal. These objectives should be aligned to site-specific characteristics that are within the mine's control. Rehabilitation objectives should be as specific, measurable, achievable, and realistic as possible. They should also define a time period against which they can be measured' (LaRSSA, 2019). Driven by the closure vision, and with due consideration of the project context the following closure objectives and associated targets are presented in Table 13.

Table 13: Closure objectives and associated targets.

Objective	Target
Set the course for eventual ecosystem rehabilitation, including the improvement of the natural vegetation community, hydrology, and wildlife habitats for impacted areas only.	Alignment of soil condition with that required to meet the defined land capability commitments. Sustainable natural areas. Agreed upon viable land-use.
Prevent future environmental issues related to long term fluid or gas leakage or vertical movement through the well.	No migration of gas or water along the rehabilitated well bore.
Protection of water resources.	Consistent with baseline condition (specifically production indicator parameters).
Ensure that land is usable, in alignment with surrounding land uses.	Agreed upon viable land-use.

4.4.6 ALTERNATIVE CLOSURE AND POST CLOSURE OPTIONS

There are various alternative closure and post closure options available. The identification and consideration of the most suitable alternatives are driven by, inter alia the following considerations:

- The ability of the selected alternative to adequately meet the specified closure vision and objectives.
- The efficiency, viability, and practicality of the selected alternative.
- The preference, where possible, for low maintenance and sustainable options.
- The alignment with the local environmental and socio-economic context and associated opportunities and constraints.

Table 14 presents some available options and alternatives related to the rehabilitation and closure process. The options in the table below that are marked with an "☑" are considered the preferred options for the purpose of this FRDCP. It is important to note that oil and gas production closure and rehabilitation research is ongoing and consequently the available and preferred closure strategies, techniques and available technologies are developing on a continual basis which may, in the medium to long-term, lead to the identification of further closure alternatives.

Table 14: Closure alternatives

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
Exploration and production wells.	Casing	Retain casing ☑	No additional effort, time and cost to remove the casing string. The casing and associated cemented annulus may provide additional barrier and stability to the hole.	Depending on the nature of the well, corrosion of the casing over time may affect the integrity of the plug.	It is suggested that the casing is retained, and that industry standard well bore plugging and abandonment be implemented.
		Remove casing	Casing is often removed in an attempt to recover and salvage the steel.	The retention of the casing is strongly dependant on the nature of the geological strata and location of groundwater aquifer and other permeable zones. The presence of these zones may also be a hindrance to the removal of a casing string. Removal of the casing may result in collapse of the hole making controlled plugging difficult.	
	Plugging extent- The primary objective of wellbore plugging is to isolate potential flow zones (including gas and water zones).	Plugging full length of well bore. ☑	Provides longer barrier distance.	Additional design and implementation costs.	As a standard the well bore will be cemented for the full length and diameter of the wellbore to surface. There may be instances where intermittent plugging options are preferrable- in such instances these deviations must be designed and
		Partial/ intermittent	Reduced design and implementation costs.	Reduced barrier length may result in opportunity for fluid or gas migration.	

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
					reviewed by a well engineer and approved by the PASA.
	Plugging Material-	There are various materials available for a barrier including (chemical, natural, and mechanical). The barrier can be a single or multi component system and should aim to have the following properties: - Inability for well fluids to pass; - No degradation of the sealing capacity over time; - Avoidance of movement; and - Appropriate of the specific environment and application.	There are different advantages and disadvantages for the different types of barrier materials. The specific environmental circumstances and the nature of the well construction will dictate which barrier is most appropriate.		The cement to be used must comply with industry best practice and the relevant API standards, or alternative standards as agreed with the PASA, and as approved by the well engineer. It is also recommended that a well bore stress model is developed and applied to the well/s to predict the long term thermal and mechanical stresses and adapt the plug material accordingly.
	Plugging techniques and barrier placement methodology.	Dump Bailer- typically used to deliver a small volume of cement.	Allows for accurate control of plug placement depth.	Outdated. This technique has the potential to allow for contamination of the well plug and therefore may affect the plug integrity. Only allows for limited cement volume per placement.	The specific type of displacement method to be utilised is depending on the well construction and alignment as well as the prevailing hydrostatic balance.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
		Squeeze/ displacement method: This method may include: balanced plugs, pump and pull, perforation, wash and cement (PWC), inside blowout preventer (IBOP), and sacrificial workstring release tools. ☑	The displacement method minimises the contamination of the cement by being able to displace fluid within the well. Allows for a more stable well plug.		
	Well Surface Infrastructure- this includes the well head, plinth, electrical components, and fencing.	Complete removal ☑	Allows for complete site decommissioning and rehabilitation. Allows for future unhindered alternative land use.	Additional cost.	The surface area of a decommissioned well must be clear of obstructions and equipment. In order to allow unhindered land use of the well area, it is suggested that all surface infrastructure be removed. In addition, the well will be capped at +/-1m below ground level with the requirement for marking its' location and representing its' position on the Title/SG Diagram.
		Retain	Potential for landowner to retain for alternative uses.	Risk of future liability for rights holder. May hinder future land uses.	
Pipeline infrastructure	All pipelines	Complete removal	No remnant infrastructure on-site.	Removal of the pipelines would involve significant disturbance to the land. This would undo the previous post-construction rehabilitation efforts and would likely reintroduce alien invasives and destabilise the soils (erosion).	It is proposed that the pipeline remain in the ground as removing it will re-disturb consolidated rehabilitated areas. Post closure uses may be discussed with landowners at a later stage.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
		Retain ☑	Reduced closure phase disturbance of previously rehabilitated areas- no duplication of rehabilitation effort.	Remnant infrastructure on-site. Potential for long term liability- future excavations or collapse and subsidence of overlying areas causing preferential flow paths.	
Processing facility and compressor stations infrastructure	All surface infrastructure including access roads, power and water supply.	Complete removal ☑	No remnant liability associated with surface infrastructure.	Additional cost.	Allowance is made in the current FRDCP to decommission, demolish and dispose of the processing plant infrastructure and rehabilitate the area. Although no discounting can be done in terms of GNR 1147, the possibility exists to either sell off the plant infrastructure or to treat them as assets that can be dismantled, transported and reassembled where required.
		Retain	Provides opportunity for infrastructure to be reused or repurposed either in full or partially. Allows for alternative post-closure uses.		
Access roads	Access roads	Rehabilitate ☑	No remnant liability associated with maintenance or ownership of access roads. Allows for returning the area to pre-commencement land uses.	Additional cost.	The intention is to rehabilitate the area, including the access routes, to the pre-construction condition. However, in certain instances, the landowner may request the retention of the access route. The applicability of these options will need to be addressed on a case by case basis prior to closure.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
		Retain	Allows for reuse or repurposing should there be a need for such. Reduced cost.	Long term degradation of the road may result in post closure liability for holder.	

4.4.7 MOTIVATION FOR PREFERRED CLOSURE OPTIONS

With reference to Sections 4.4.5 and 4.4.6, the preferred closure option is as follows:

- Retain casing (informed by a pre-closure inspection of casing integrity) and plug using a displacement/pump/squeeze technique, the full length of the well with a suitable plugging cement, as prescribed by industry best practice, and in accordance with the applicable API guidelines and standards as signed off by a well engineer and agreed to by the PASA.
- Cut surface casing at a depth to be informed by end land-use (presumed below plough depth), remove and bury.
- Retain the pipelines in the ground to avoid the need for further ground disturbance and rehabilitation.
- Allowance is made for full decommissioning, demolition and disposal of the processing plant infrastructure after closure as well as rehabilitation of the site.
- Compressor sites will be rehabilitated and the associated infrastructure demolished and removed.
- Rehabilitate access routes or retain when requested by a landowner.

It is anticipated that the closure options presented above, together with monitoring of the post closure period, will achieve the stipulated closure objective. This closure option is in line with industry best practice and the requirements of the MPRDA Regulations.

Effective abandonment depends on knowledge of the well construction, geology, and the hydrogeology. In this regard it is recommended that prior to commencement of closure and decommissioning of any specific well the following must be undertaken:

- A detailed site-specific decommissioning plan must be prepared by an appropriately qualified specialist or specialists. This plan must take into consideration the following site-specific factors:
    - Current condition and design of the well (informed by suitable well integrity testing);
    - Records of the drilling results (geological logs), cement used and testing results for the life of each well, including the cement bond log tests immediately after grouting and prior to decommissioning as well as any periodic maintenance checks during the operational life;
    - Height of cement in annulus outside casing;
    - Considerations for the composition and placement of the plug or barriers should include:
        - Location of potential flow zones and pore pressures.
        - Location of useable water sources.
        - Formation fracture pressure of natural seals.
        - Cross flow potentials; direction and resultant equalised pressures.
        - Future field plans.
        - Compaction, subsidence, and recharged formations.
        - Corrosion risks.
        - Locations of natural faults and their ability to transmit fluids and/or pressure.
        - Ability to be able to verify the barrier.
        - Operating environment (temperature, pressures, chemical characteristics).

- Cement casing overlaps;
- The need for abandonment plugs to cover the full diameter of the hole;
- The type of fluid in annuli above cement;
- The chemical composition of the prevailing groundwater;
- The following considerations apply to determining the composition of the barrier material/s:
    - Inability for wellbore fluids to bypass in either direction.
    - No degradation of sealing capacity over time.
    - The specific host rock thermal and effective stress characteristic which may affect permanent plug integrity.
    - Avoidance of movement.
    - Appropriate for the environment (e.g. Temperature, pressure, chemical exposure) and application[10].
- Potential difficulties of injecting cement into the annulus;
- Future monitoring of the integrity of the well plug; and
- The depth below surface at which casing must be cut.

- The applicable landowner must be consulted, and input obtained regarding the current and planned land-uses applicable to the area and the need to retain surface infrastructure, well accessibility and/or access tracks.

The revised decommissioning plan and the feedback from the landowner consultation must be submitted to the PASA prior to implementation.

Table 15 provides a list of threats, opportunities and uncertainties related to the preferred closure options. Where applicable actions to address these uncertainties are presented in Section 4.10.

Table 15: Threats, opportunities, and uncertainties associated with preferred closure option.

Item:	Description:
Threats:	Insufficient financial provision to adequately implement closure plan. Insufficient management commitment to effective rehabilitation. Inadequate topsoil management during construction phases to allow for adequate topsoil cover to enable rehabilitation. Inability to identify and implement a suitable alternative land use on the defined alternative land use areas. Groundwater modelling inaccurately predicts the potential medium to long term impacts on the groundwater resources. Incorrect plug/ barrier materials used for well bore plugging could result in long term degradation of plug effectiveness.

[10] The development of an applicable well bore stress model would assist in planning the final specific barrier characteristics.

Item:	Description:
	Third party activities may affect the success of the rehabilitation and closure strategies (e.g. ongoing mining activities such as blasting and excavations may impact on the long term integrity of well barriers and casing). Movement of faults which may intersect the zone of influence of a well may compromise the long term stability of the barrier or casing.
Opportunities:	NEMA requires annual review of the rehabilitation and closure plans and associated financial provisions- this provides an ideal opportunity to ensure that the rehabilitation process is assessed for relevance on a continual basis.
Uncertainties:	There are certain closure actions and parameters which are uncertain prior to actual closure. These include the status of the well bores at the time of closure. The specific circumstances will need to be assessed at the time of closure by a qualified well engineer and a decommissioning plan prepared. The extent to which the infrastructure established for the production may be of value for reuse or repurposing by the landowners is uncertain at this stage and must be ascertained prior to final closure. The groundwater model should continue to be updated based on monitoring data and the predictions of impacts to water resources should be reviewed and revised. An adaptive land management approach will be adopted on-site, allowing for implementation of alternative and improved rehabilitation strategies and corrective action, where required.

4.4.8 CLOSURE PERIOD AND POST CLOSURE REQUIREMENTS

The closure period is defined as the period between the cessation of production, and the completion of active rehabilitation actions on the applicable site. It may become necessary to decommission and plug unsuccessful or dry wells during the operational phase. In these instances, it is suggested that closure on these specific wells is initiated as soon as possible.

Following successful completion of the active closure actions it is suggested that a further post closure period be assigned to allow for monitoring of the success of closure. This closure and post closure monitoring will involve the following actions and durations:

- Water monitoring- as informed by the water monitoring plan for 50 years after decommissioning or until a long-term trend can be determined;
- Fugitive gas emissions using either soil vapour probes, efluxes, Flir Methane Cameras, or surface methanometers, for a period of 50 years post closure;
- Well plugging and abandonment verification to confirm that there is proper and effective vertical isolation (this could include: bond log tests, cementing tests, communication tests, hydraulic pressure tests, applied weight test); and
- Biodiversity assessments mid wet season (i.e. annual) should be undertaken by a qualified ecologist / botanist to monitor the rehabilitation progress with regards to flora for a period of 3 years after rehabilitation.

There are however certain residual and latent impacts which may manifest in the post closure phase. These relate primarily to the risk of well plug integrity and associated long-term management of vertical migration of gas and/or fluids to the shallow water resources or the surface.

The management and monitoring associated with these residual and latent risks are addressed in Section 6.

4.5 ENVIRONMENTAL INDICATORS AND MONITORING

Table 16 provides a list of the environmental impacts identified for the rehabilitation, decommissioning, and closure of the project. In addition, environmental indicators are identified for each impact, together with proposed monitoring requirements. The indicators and monitoring will aim to inform ongoing rehabilitation and remediation activities. These indicators will also inform the assessment of whether the closure objectives have been adequately met.

Table 16: Environmental Indicators and Monitoring requirements

Aspect	Impact	Monitoring Requirements	Indicators	Closure Targets
Decommissioning Phase				
Social	Potential to use local service providers and contribute directly to local economy.	None.	Complaints register.	No unaddressed issues.
	Interruption in services.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Complaints register.	No unaddressed issues.
	Interference with existing land uses.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Complaints register.	No unaddressed issues.
	Impacts on existing services and infrastructure.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Complaints register.	No unaddressed issues.
	Re-instatement of access routes give access to land/infrastructure that was cut off by the project.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Complaints register.	No unaddressed issues.
	Increase in social license to operate due to management of nuisance impacts.	Community Liaison Forum held twice a year during construction and operational phases. Pre- decommissioning and closure forum with relevant affected landowners.	Complaints register.	No unaddressed issues.
	Impacts on safety and security of local residents due to presence of unfamiliar people in the area.	As part of the monthly ECO reports, the impact of safety and security must be assessed and reported on.	Complaints register.	No unaddressed issues.
	Public perceptions about the impact of decommissioning on the sense of place.	Community Liaison Forum held twice a year during construction and operational phases. Pre- decommissioning and closure forum with relevant affected landowners.	Complaints register.	No unaddressed issues.

Aspect	Impact	Monitoring Requirements	Indicators	Closure Targets
Economic	Alternative land-use.	Refer to Environmental Risk Assessment under Section 4.3.	N/A	N/A
	Black economic transformation.		N/A	N/A
	Country and industry competitiveness.		N/A	N/A
	Economic development per capita.		N/A	N/A
	Employment impacts.		N/A	N/A
	Fiscal income.		N/A	N/A
	Forex savings.		N/A	N/A
	GGP impact.		N/A	N/A
	Need and desirability.		N/A	N/A
Air Quality	Fugitive emissions (dust) from decommissioning/ removal of all berms, trenches and other stormwater infrastructure no longer required	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Evidence of excessive dust generated (complaints).	No dust nuisance complaints.
	Greenhouse gas emissions from decommissioning/ removal of stationary infrastructure.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Natural gas concentrations.	No fugitive emissions from wells.
	Fugitive emissions (dust) from decommissioning/ removal of stationary infrastructure.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Evidence of excessive dust generated (complaints).	No dust nuisance complaints.

Aspect	Impact	Monitoring Requirements	Indicators	Closure Targets
	Greenhouse gas emissions from decommissioning/ removal of pipeline and well infrastructure.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Natural gas concentrations.	No fugitive emissions from wells.
	Fugitive emissions (dust) from decommissioning/ removal of pipeline infrastructure- NOTE: at present the intention will be to abandon the subsurface pipelines on-site and therefore dust emissions from removal are not applicable.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Evidence of excessive dust generated (complaints).	No dust nuisance complaints.
	Greenhouse gas emissions from the removal of waste and recycling of recyclable / reclaimable waste.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Natural gas concentrations.	No fugitive emissions from wells.
	Fugitive emissions (dust) from the removal of waste and recycling of recyclable / reclaimable waste.	Regular monitoring and reporting (monthly ECO reports) during decommissioning.	Evidence of excessive dust generated (complaints).	No dust nuisance complaints.
Closure and Rehabilitation Phase				
Hydrogeology	Contamination of alluvial and sand aquifers.	Regular monitoring and reporting (monthly ECO reports) during decommissioning. An emergency response protocol must be implemented that is aimed at early detection and swift reaction speed relating to leaks and spills.	Groundwater quality.	Consistent with baseline condition (specifically production indicator parameters).
	Contamination from leakage and spillage.	Monitoring should take as per the EMP requirements.	Groundwater quality.	Consistent with baseline condition (specifically

Aspect	Impact	Monitoring Requirements	Indicators	Closure Targets
				production indicator parameters).
	Stray gas migration affecting groundwater quality.	Monitoring should take as per the EMP requirements.	Groundwater quality.	Consistent with baseline condition (specifically production indicator parameters).
	Contamination of alluvial and sand aquifers at HP1.	Regular monitoring and reporting (monthly ECO reports) during decommissioning. An emergency response protocol must be implemented that is aimed at early detection and swift reaction speed relating to leaks and spills.	Groundwater quality.	Consistent with baseline condition (specifically production indicator parameters).
	~~Contamination of alluvial and sand aquifers at HP2.~~	~~Regular monitoring and reporting (monthly ECO reports) during decommissioning. An emergency response protocol must be implemented that is aimed at early detection and swift reaction speed relating to leaks and spills.~~	~~Groundwater quality~~	~~Consistent with baseline condition (specifically production indicator parameters).~~
	Well casing and/or cementation failure affecting groundwater quality.	Monitoring should take place for 50 years after cessation of production activities or until a long-term acceptable trend can be determined. A groundwater and gas monitoring programme will be implemented to serve as an early detection mechanism.	Groundwater quality and natural gas concentrations.	Consistent with baseline condition (specifically production indicator parameters) and no fugitive emissions from wells.
Economic	Alternative land-use.	Refer to Environmental Risk Assessment under Section 4.3.	N/A	N/A
	Black economic transformation.		N/A	N/A

Aspect	Impact	Monitoring Requirements	Indicators	Closure Targets
	Country and industry competitiveness.		N/A	N/A
	Economic development per capita.		N/A	N/A
	Employment impacts.		N/A	N/A
	Fiscal income.		N/A	N/A
	Forex savings.		N/A	N/A
	GGP impact.		N/A	N/A
	Need and desirability.		N/A	N/A
Social	Potential to use local service providers and contribute directly to local economy.	None.	N/A	N/A
	Impacts on safety and security of local residents due to presence of unfamiliar people in the area.	Appointment of a Community Liaison Officer and regular monitoring and reporting (monthly ECO reports) during closure and rehabilitation.	Complaints register.	No unaddressed issues.
	Interference with existing land uses/livelihoods.	Appointment of a Community Liaison Officer and regular monitoring and reporting (monthly ECO reports) during closure and rehabilitation.	Complaints register.	No unaddressed issues.
	Increase in social licence to operate due to management of nuisance impacts.	Appointment of a Community Liaison Officer and regular monitoring and reporting (monthly ECO reports) during closure and rehabilitation.	Complaints register.	No unaddressed issues.

Aspect	Impact	Monitoring Requirements	Indicators	Closure Targets
	NEW2021-Plugged wells resulting in redistribution of gas to underground workings.	Records of consultation with the affected mining entities.	Minutes of meetings.	No correlated increased levels of methane on underground workings.
Biodiversity	NEW2021- Degradation of natural habitat- incl. erosion and alien invasives. Should rehabilitation not be successful then there is a potential for degradation of the rehabilitated surface and adjacent areas.	Visual inspections of rehabilitated areas.	Presence of erosion features. Presence of alien invasive species.	Alignment with adjacent reference site or pre-commencement condition.

4.6 FINAL POST CLOSURE LAND USE

The ultimate aim of most closure and land rehabilitation is to return the land to the same or similar state to what it was pre-production. In order to inform this target, it is important to have a clear understanding of what the pre-production land-use and land capability was. Land-use is the way land is used by people for a defined purpose and may comprise one or more land uses. In most instances, one landscape can support numerous land-uses within the constraints of land capability, creating a multifunctional landscape.

The main economic activities within the production right area relate to farming (livestock/ game grazing, and cultivated lands) and mining (primarily gold mining). The final post closure land use will depend on the specific site circumstances, in so far as it relates to the pre-production uses and also the prevailing uses, at the time of closure. It is proposed that, prior to initiating closure, a suitably qualified environmental scientist undertake an assessment and consult with the landowner and prepare a site-specific decommissioning plan for submission to PASA for review and approval. For the purposes of this FRDCP it is assumed that the post closure land use will be congruent with the agricultural and natural veld mix of land use and capability in the region.

4.7 CLOSURE ACTIONS

In order to align with the defined closure plan and final land use objectives, the Holder will need to implement a series of actions which addresses the mines infrastructure, facilities, and rights area, as well as ongoing maintenance and management thereof. These actions and obligations apply to all infrastructure, activities, and aspects both within the production right area and off the production right area which were associated with the production activities and over which the Holder has responsibility.

The anticipated closure actions can be summarised as follows:

- Phase 1: Preparation for closure.
- Phase 2: Making safe.
- Phase 3: Rehabilitation.
- Phase 4: Monitoring and maintenance.

The detailed closure actions are presented in Sections 4.7.1 to 4.7.3.

4.7.1 PHASE 1: PREPARATION FOR CLOSURE

4.7.1.1 **GENERAL PRODUCTION ACTIVITIES**

There are certain closure actions that are required to be initiated and, in some instances, concluded prior to finalising and implementing the eventual decommissioning, rehabilitation and closure of the activities. The preparatory actions include the following:

- Ensure that the FRDCP and Risk Assessment is up to date and approved (including where relevant the future updated numerical groundwater model including consideration of long-term climate change predictions and adaptation).
- Application for EA, WML and/or WUL (if applicable to implement closure plan) for decommissioning and closure activities (at least 18 months prior to scheduled closure).
- Pre-emptive planning for post closure land-use including development of surface infrastructure inventory and the identification of infrastructure which is available for reuse and repurposing post closure.
- Develop or continue with local stakeholder and public communication forum/mechanisms to communicate rehabilitation progress and facilitate grievances.

- Engage with local stakeholders and specifically the directly affected landowner to reaffirm the final closure strategy - for instance there may be instances where a landowner may wish to retain or repurpose certain infrastructure.
- Update material and topsoil balances to confirm availability of suitable material for rehabilitation.
- The need for, and extent of, and active revegetation will be determined during the initial site assessment as well as the pre-closure site assessment.
- Ensure that a comprehensive alien vegetation eradication, control and management plan is in place.
- Ensure that applicable sensitive areas and stockpiles are suitably identified and demarcated, and the water and waste management plans are up to date (including inventories of waste sources, storage, and eventual disposal options).

These actions apply primarily to the surface infrastructure not directly associated with the wells (Section 4.7.1.2 addressed the actions specific to the wells) including the processing plant, and gas gathering infrastructure.

4.7.1.2 PREPARATION FOR WELL DECOMMISIONING AND CLOSURE

A well that is no longer active or producing, or for which an approved suspension period has passed, must be plugged, and decommissioned in accordance with an approved decommissioning plan. The following tasks will be undertaken prior to decommissioning:

- Site inspection and assessment by a suitably qualified environmental professional with the aim to:
  - Confirm pre-closure site conditions.
  - Undertake a site-specific closure risk assessment.
  - Consult with the affected landowner to confirm closure land use.
- Site inspection by a suitably qualified specialist/s to:
  - Assess the conditions of the specific well in respect of inter alia:
    - Current condition and design of the well; and
    - The integrity of the casing and grouting;
  - Determine the most suitable and appropriate decommissioning strategy with specific focus on the plugging method (including plug dimensions and plugging materials to be used) to ensure no vertical gas and/or fluid movements within the well[11].
  - Prepare a technical decommissioning plan addressing the factors listed in Section 4.4.7.
- Preparation of a consolidated site-specific closure and decommissioning plan.

The site-specific closure and decommissioning plan will be submitted to the PASA for review and approval prior to initiating closure.

4.7.2 PHASE 2: CLOSURE AND REHABILITATION

Phase 2 closure actions will be informed, and guided, by the approved closure and decommissioning plan prepared in Phase 1. Table 17 provides an indication of typical closure and rehabilitation actions that would be followed.

[11] Internationally accepted best practice should be applied and reference should be made to the relevant British Oil and Gas (OPp71), and/or the API guidelines and standards.

Table 17: Summary of typical closure actions.

Component	Closure Action
Dismantling and removal of any on-site infrastructure (including processing plant and compressor stations).	- Pre-emptive planning for post closure land-use including development of surface infrastructure inventory and the identification of infrastructure which is available for reuse and repurposing post closure. - Removal of all services, structures, machinery, and infrastructure unless these are specifically required for post-production land-use, post-production projects or have been requested by the landowner. - Establish formal agreements for any infrastructure handed over for third party use, and management. - All identified infrastructure should be broken down to natural ground level. All waste materials to be disposed of at suitably licenced disposal facilities. - Remove all power lines unless agreed in writing to retain for beneficial end use. - Dismantle and dispose of all fences that do not form part of post-closure property boundaries. - Areas where infrastructure was demolished should be assessed through a risk-based system to determine if there is any residual contamination or risk and appropriate remediation measures implemented. Where contaminated material is detected, this should be removed and disposed of. - Profile the area to be free draining. - Remove and rehabilitate all Stormwater management infrastructure not required in the final closure plan. - Assess available topsoil stockpiles in respect of quantity and quality- the topsoil's to be placed for rehabilitation must be suitable for revegetation. - Revegetate disturbed areas with suitable local grass mix in areas where natural regrowth is not successful of anticipated. - A waste and infrastructure hierarchical principal should be applied to all decommissioned infrastructure or wastes, as follows: Reduce, re-use, recycle, dispose. - Monitor and manage dust generated from decommissioning activities to relevant standards. - Removal and safe disposal of any remnant processing waste deposits, including PCD's and evaporation ponds/ dams. - Pump and treat or dispose (at licenced facility) remnant polluted water from PCD's. - Remove liners and residue and dispose at suitably licenced facility. - Ongoing monitoring to ensure no erosion, ponding, and adequate revegetation.
Rehabilitation of access roads	- Develop transport layout plan to utilise existing access routes where possible and minimise unnecessary access roads.

Component	Closure Action
	- Restrict vehicular movements to designated access and routes to avoid unnecessary soil compaction. - Conclude final closure layout plan defining access roads required for ongoing monitoring, management, and maintenance. - Retained access roads to be designed in accordance with relevant engineering standards and specifications- including specific management of stormwater. - Closure, decommissioning, and rehabilitation of all access roads (incl. associated structures, signage, culverts, etc) unless these are specifically required for post-closure land-use, post-closure projects, or have been requested by the landowner. - Remove any contaminated soil from roads, dispose at suitably licenced facilities. - Deep rip all compacted areas prior to rehabilitation. - Topsoil rehabilitation and amelioration as is necessary. - Revegetation. - Apply dust suppression (e.g. water sprays) where necessary.
Well site	- The borehole must be cleared of obstructions prior to abandonment. This includes associated surface infrastructure. - Remove any waste materials from the well sites and dispose at a suitably licenced waste disposal facility. - Prior to placing plugs- the state and effectiveness of the applicable annular barrier must be evaluated and verified (method may include cement bond logs, calliper logging, or communication tests). Where necessary this may require remediation of this annular barrier prior to plugging. - Suitably qualified specialist or specialists to design the most suitable and appropriate closure strategy to ensure no vertical gas or fluid movements and that all potential hydrocarbon / water bearing formations by utilizing placed cement plugs. This must include determination of plug length/ location and plug material specifications. - The cement plugs are stacked along the entire length of the wellbore (both in the open hole as well as the upper casing) to ensure efficient redundancy. The extent of plugging to be confirmed during the Preparation phase. - All plugs are tagged to ensure successful placement. - Cementation technique to follow the squeeze displacement technique (or alternative as directed by the well engineer). Wiper plugs must be utilised where applicable. - Conduct cement top-ups along the annulus, and existing cemented sections showing “no bond” or “poor bond” from logging results. - The integrity and effectiveness of the plug must be evaluated and verified once completed. There are many evaluation and verification methods which can be used subject to a specific well circumstance (e.g. physical or mechanical tests, or hydraulic/ pressure tests). The most

Component	Closure Action
	suitable verification method to be determined by a suitably qualified well engineer. - A surface / shallow cement plug (+/-50 m below ground Level) is set, and the well is cut and capped +/-1 m below ground level to remove the wellhead and all casing above this point. - The collar is then collapsed and the surface reinstated and the site rehabilitated. - Rehabilitation must reflect the local environment -ecosystem rehabilitation of impacted areas, including natural fauna and flora, hydrology and hydrogeology. - Ensure that than the final landscape is safe, stable and non-polluting over the long term, and that post closure land-use does not affect the sustained utilization. - Placement of a "surface tag" in order to ensure monitoring can continue once the casing is cut and the area revegetated.
General Surface Rehabilitation	- Develop and implement an alien vegetation eradication control and management plan (AVECMP). - The removal and/or disturbance of previously unaffected topsoil's must be avoided as far as possible and limited to the existing areas of disturbance. - Develop and implement a revegetation plan. Seeding and planting to be done at, or immediately after, the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting). - Annual monitoring of the status of rehabilitation and revegetation. - No driving will be permissible on any rehabilitated areas- only on pre-defined designated routes for monitoring. - Implement soil amelioration as is necessary. - Any contamination of the topsoil on surrounding areas must be avoided by ensuring machinery is well maintained and leak free. If contamination has occurred, the area must be remediated and ameliorated immediately. - Monitoring, including review and assessment of soil balances, soil surveys (stripped, stockpiles, and placed). - Implement defoliation on established grasses and vegetation under direction of rehabilitation specialist- to allow for reintroduction of organic matter. - Ongoing rehabilitation monitoring (including soil surveys) and maintenance until relinquishment. - Ongoing rehabilitation of eroded areas through a root cause investigation and rectification approach. - Shape all channels and drains (where applicable) to smooth slopes and integrate into the natural drainage pattern. - Construct contour banks and energy dissipating structures as necessary to protect disturbed areas from erosion prior to stabilisation.

Component	Closure Action
	- Implement controlled livestock grazing once vegetation is established. Restrict access of livestock newly rehabilitated unless specifically required for defoliation as instructed by a suitably qualified rehabilitation specialist. - Ongoing rehabilitation monitoring and maintenance until relinquishment. Including but not limited to: Alien invasive monitoring and management, erosion control and remediation, vegetation growth and supplementation).
Social and economic change management.	- Public review and comment on rehabilitation, decommissioning, and closure planning. - Regular consultation with I&APs on closure planning and rehabilitation progress, and any intrusive activities. - Develop final land management and maintenance plan with relevant landowners. - Implement land management and maintenance plan.

In accordance with Regulation 132(3) of the MPRDA regulations for Petroleum Exploration and Production (GNR 257, 2015): The surface area of the decommissioning well must be clear of obstructions and equipment and the well bore must be cemented for the full length and diameter of the wellbore to surface.

Landform, erosion control and re-vegetation is an important part of the rehabilitation process. Landform and land use are closely interrelated, and the landform should be returned as closely as possible to the original landform. Community expectations, compatibility with local land use practices and regional infrastructure, or the need to replace natural ecosystems and faunal habitats all support returning the land as closely as possible to its original appearance and productive capacity.

4.7.3 PHASE 3: MONITORING, MAINTENANCE AND RELINQUISHMENT

The purpose of monitoring is to ensure that the objectives of the rehabilitation and closure plan are met. In this regard the following actions, to be adjusted based on the completion of the pre-closure site assessment, are proposed:

- **Groundwater monitoring (production and exploration wells):** The post-closure monitoring should take place for 50 years or until a long-term acceptable trend can be determined. The extent of the monitoring is to be determined in the site-specific closure and decommission plan (provision has been made for annual monitoring). The aim of this monitoring is to confirm that abandoned wells are safe and are not resulting in a pollution or contamination hazard.

- **Flora (all areas):** Biodiversity assessments mid wet season should be undertaken by a qualified ecologist/botanist to monitor the rehabilitation progress with regards to flora. Confirmation that acceptable cover has been achieved in areas where natural vegetation is being re-established. 'Acceptable cover' means re-establishment of pioneer grass communities over the disturbed areas at a density similar to surrounding areas, non-eroding and free of invasive alien plants.

- **Gas emissions (production and exploration wells):** The well site must be monitored for the release of gas from the decommissioned well site. This can be undertaken through appropriate sampling techniques, either soil vapour probes, efluxes, Flir Methane Cameras, or surface methanometers.

Annual (or as agreed with PASA) environmental reports will be submitted to the PASA and other relevant stakeholders for at least 1 year's post-decommissioning (phase 3). The monitoring reports shall include a list of any remedial action necessary to ensure that infrastructure that has not been removed remains safe and pollution free and that rehabilitation of project sites are in a stable, weed and free condition. Electronic/digital

photographs will be taken before and after rehabilitation. Please refer to Section 4.13 for further detail on the required auditing and monitoring requirements.

4.8 FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE SCHEDULE

This section presents a high-level list of rehabilitation and closure components and the key actions related to the final rehabilitation, decommissioning, and closure. The key schedule drivers for each activity are presented in Table 18. It is important to note that there are potentially permits and licences which may be required prior to initiating closure activities these may include water use licences and/or environmental authorisations. These should be initiated as soon as practically possible as the timeframes for these processes can be extensive.

Table 18: Closure schedule drivers

Activity	Closure schedule driver
Ongoing activities.	Ongoing progressive rehabilitation as production progresses (specifically post-construction rehabilitation of pipeline routes and well site laydown areas). Ongoing decommissioning and closure of abandoned exploration and production wells. The timing of this will depend on when a decision is made to abandon a specific well.
Planning and preparation for Closure.	Updated FRDCP and compliance with the Financial Provision Regulations. Obtain relevant closure related environmental authorisations, licences, and permissions (if applicable).
Dismantling and removal of any on-site infrastructure.	Progressively as infrastructure is no longer required. Final dismantling of all infrastructure not to be retained at cessation of production activities.
Rehabilitation of access roads.	Cessation of production activities and where relevant rehabilitation activities- if possible, rehabilitation of access roads should be done progressively as these roads are no longer required.
Decommissioning and closure of well sites.	Well decommissioning and plugging will be initiated once a well site is no longer yielding viable gas volumes or lapsing of the approved suspension period. The closure will commence on completion and approval of the site-specific decommissioning plan.
Removal and safe disposal of processing waste deposits, including PCD's and evaporation ponds/ dams.	PCDs to be decommissioned once dirty water areas and need for PCDs ends (i.e. once pollution source terms are removed)- most likely at the end of decommissioning and rehabilitation.
General surface rehabilitation (incl. backfilled open cast areas and voids, stockpile areas, compacted areas, etc).	Completion of decommissioning. Seeding and planting is most successful when done at or immediately after the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting).
Rehabilitation Monitoring.	Ongoing throughout rehabilitation activities and into the closure and post closure periods.
Social and economic change management.	Ongoing throughout rehabilitation activities and into the closure period.

4.9 ORGANISATIONAL CAPACITY

It is critical that roles and responsibilities for the effective planning, implementation, monitoring, and revision of the closure process are clearly defined and provided for. The Holder of the Production Right is ultimately responsible for ensuring compliance with all the provisions of the Right and associated plans, as well as other relevant legal requirements. The Holder must ensure knowledge and understanding of the applicable legislation, guidelines, and industry best practices.

Capacity in the following key roles and responsibilities must be provided for:

- Internal Closure champion: a suitably qualified person(s) who will be accountable for the following:
  - Driving the ongoing development, refinement and implementation of the closure plan;
  - Resourcing and implementing the plan;
  - Ongoing management and monitoring requirements to support the closure plan;
  - To ensure the integration of the rehabilitation and closure activities with general operational activities; and
  - Ensure legal compliance and deliver on commitments.
- Internal Social champion: a suitably qualified person(s) who will be accountable for the following:
  - Develop and implement training strategies for internal training;
  - Develop and implement effective communication with all stakeholders;
  - Develop and implement a stakeholder forum to promote information and idea sharing regarding closure related aspects and/or ensuring meaningful contributions to existing forums; and
  - Continually develop the relationship with I&APs, to promote the social licence to operate and close and decommission.
- Independent Environmental Assessment Practitioner: This individual will be appointed to ensure compliance with the requirements of the FRDCP and specifically to undertake the following tasks:
  - Undertake the required pre-closure environmental site assessment, risk assessment, and if required landowner consultations.
  - Prepare a site-specific final closure and decommissioning plan.
  - Undertake the required periodic compliance monitoring and reporting during the closure period.
- Well Engineer and or suitably qualified specialist/s: This individual must be a suitably qualified professional who must have relevant experience in petroleum exploration and production. Key attributes must include experience and qualifications related to the technologies applicable to production well closure and abandonment, as well as a thorough understanding of internationally accepted well closure and abandonment standard and guidelines. This specialist will be responsible for ensuring that the closure plan is implemented to ensure that the risks to the environment and surrounding communities are prevented or limited.

Further education, training and capacity building is critical to ensure that the production activities align with evolving internally accepted best practice and research. In this regard the Holder must ensure that regular review of international best practice is undertaken and where applicable implemented throughout the project programme. It needs to be recognised that closure planning needs to start early within the project lifecycle and continued as an integral component of the operations.

4.10 IDENTIFICATION OF CLOSURE PLAN GAPS

The key gaps applicable to this closure plan are as follows:

- The specific locations of the future production wells and associated pipeline infrastructure is unknown. These can only be defined once successful drilling has been undertaken and decision is taken to integrate the respective wells into the production network. Consequently, the scope and content of the closure plan is largely dependent on the specific environmental context associated with the activities. The closure liability estimate will need to be updated (and where necessary the closure plan amended) once the exact locations are formally determined;
- The geological stratigraphy and nature of the well profiles is unknown. The specific geological stratigraphy will be a determining factor in both the well designs and the planning for closure and decommissioning; and
- Well 2057 is an abandoned well. This well has a powerline supplying power to the site. Similarly, the powerline supplying power to the Helium Plant will, based on discussions with Tetra4, be handed over to Eskom. These powerlines will be decommissioned postproduction and handed over for alternative use.
- Access roads– at the time of this Financial Provision report, Tetra4 advised that there are no access roads currently which will require rehabilitation post closure. If all established and existing roads associated with the wells will be retained for use by the landowner/end use of the property it is required that written confirmation should be included as part of the Annual Rehabilitation Plan.

The following actions have been proposed to address these gaps:

- Complete the further exploration to determine the exact locations of the proposed new wells.
- A detailed drilling log will be prepared and maintained for each of the wells to ensure that the specific geological stratigraphy and sub-surface conditions are considering and inform the final site-specific closure and decommissioning plan;
- Annual updates to the hydrogeological model must continue;
- Tetra4 should confirm in writing whether any/all the powerlines will be retained for post closure beneficial use. If so, a formal agreement between Tetra4 and Eskom regarding the transfer of ownership of the powerlines is necessary; and
- Ensure continual review and assessment of the closure and decommissioning actions in relation to international best practice- considering ingoing research and development.

Further the financial provisioning regulations requires that the FRDCP be revisited, assessed, and revised on an annual basis. This annual review must continue to aim to ensure that the gaps identified above are addressed, as applicable, and the relevant financial provisioning updated.

4.11 RELINQUISHMENT CRITERIA

Relinquishment can be defined as the formal approval by the relevant regulating authority indicating that the completion criteria for the production activity have been met to the satisfaction of the authority. In this regard the relinquishment criteria are driven by the objectives of closure and consequently the indicators applicable to each impact associated with the closure and decommissioning. Reference is made to Table 16 which presents each identified environmental impact, the associated indicators and proposed closure targets. In summary the proposed relinquishment criteria include:

- Groundwater: the quality and quantity of the groundwater levels must be consistent with the pre-production condition - or adjusted depending on external inputs and drivers.
- Air quality: Evidence must be provided there are no gas emissions from the well sites.

- Biodiversity: The vegetation cover of the affected areas must be consistent with surrounding vegetative cover. There must be ecosystem functionality which is consistent with the surroundings.
- Social: There must be no unattended complaints. Where possible written confirmation from the affected landowner must be solicited confirming that outstanding issues have been addressed and closed out.
- Waste: There must be no waste materials remaining on-site.
- Land-use: The area must be available for ongoing land uses. The location of all historic production/exploration wells must be demarcated and where appropriate reflected on the relevant property title information.

4.12 CLOSURE COST AND FINANCIAL PROVISION- FRDCP

The closure cost estimation was determined by MineLock Consulting Engineers and was based on the requirements of GNR1147. The GNR1147 quantum is expected to represent a realistic estimation of the required cost for effective decommissioning, rehabilitation, closure, and management of ongoing residual, and potential future latent, impacts.

4.12.1 APPROACH TO FINAL CLOSURE COST DETERMINATION

Funds must be available at any time, equal to the sum of the actual costs of implementing the plans and reports for a period of 10 years (as per Section 7, Chapter 2 of the Financial Provisions Regulations). Tetra4's production right was used in 2010, with a remainder of 19 years. Therefore, NEMA Financial Regulations specify an accuracy level of 70% for operations 30 years or less (but more than 10 years). The remainder of this section provides details on the proposed closure cost. The assumptions and limitations stated in Section 4.12.2 also underpin the basis of this closure cost determination.

The closure cost has been calculated through the following steps:

- Review of available information to inform the closure battery limits for the Tetra4 operation;
- Verify unit rates for infrastructure dismantling and demolition as well as associated rehabilitation of disturbed areas, taking into account the latest demolition equipment available;
- Develop layout plans indicating existing and proposed infrastructure to be included in the rehabilitation and closure cost estimation;
- Unit rates were sourced from available precedents, inputs from specialists in the field, and experience;
- Rates are based on third-party contractor rates and not mining rates; and
- Apply the verified unit rates and associated quantities measured from the layout plans in spreadsheets to determine the closure costs.

The battery limits for this closure provision assessment are limited to:

- Access roads;
- Above surface pipelines;
- Pigging stations and low drains;
- Coalescer filter/ knockout drum at each well;
- Pipe markers;
- Well heads;
- Operational, abandoned and suspension wells;

- Inline booster compressor or infield reciprocating compressor;
- Powerlines associated with facilities;
- Fencing and firebreak;
- CNG plant and Helium plant;
- Helium storage and dispenser unit;
- CNG gas storage and dispenser unit;
- Chemical storage area;
- Temporary Hazardous waste storage;
- Temporary General waste storage;
- Mobile offices and ablution facilities;
- Guard house;
- Warehouse, workshop and laboratory;
- Control room (MCC Buildings);
- Fire water tanks and pump building;
- Substation;
- Pipe racks;
- Flare and switch yard;
- Transformer bay;
- Storm water channels;
- Attenuation dam;
- Sewerage plant;
- Compressor Station A (HDR1); and
- Compressor Station B (ST23).

4.12.2 COST ASSUMPTIONS AND QUALIFICATIONS

Closure cost estimations were determined using the following general and site-specific assumptions and qualifications:

- General:
    - Only decommissioning and rehabilitation costs equating to an outside contractor establishing on-site and conducting decommissioning and rehabilitation-related work. Based on the above, dedicated contractors would be commissioned to conduct the demolition and work over the plant site. This would require establishment costs for the demolition and rehabilitation contractors and hence, the allowance of preliminary and general (P&Gs) in the cost estimate. Allowance has also been made for third party contractors and consultants to conduct post closure care and maintenance work, as well as compliance monitoring.

- Costs pertaining to workforce management, re-training/re-skilling are outside the scope of this costing.
- Concrete footings and bases would be demolished to a maximum of 1 000 mm below the final surface topography.
- All infrastructure, other than the pipelines which will remain will be completely dismantled, regardless of whether it is foreseen that certain components would be sold off/transferred to third parties post closure. Hence, no allowance was made for the beneficial re use of any of the infrastructure. Until such agreements have been put in place, the assumption remains that total demolition would be required.
- Movable assets will be removed from site for sale and/or re used by the owners of Tetra 4, and the cost associated with dismantling and transport of these items are not included in the cost determination.
- Fixed ratios for P&Gs, contingencies and socio-economic mitigation measures have been applied.
- Income from the sale of salvage steel does not offset closure cost allowances.
- Closure costs have been determined for the scheduled and unscheduled closure scenario only. Scheduled closure takes place at a planned date and/or time horizon in accordance with overall production planning and unscheduled takes place should the production close with the infrastructure as is at present.
- The costs have been reported in present day costs. Closure cost estimations were determined using the following general and site-specific assumptions and qualifications:
- It is assumed that the management and mitigation measures suggested in the EIA Report relating to ongoing environmental management are complied with. This includes postproduction clean-up and rehabilitation.
- It is assumed that that the plugging of the wells will be able to apply an economies of scale factor which will enable a 25% reduction in the plugging of wells rate due to the number of wells (bulk rate vs rate per one well).

- Site-specific
  - It was assumed that 22 Operational, 20 Suspension and 9 new planned wells (total of 51 wells) be sealed off by pumping grout/cement into the well as part of the closure and rehabilitation phase[12]. The pressure grouting/cementing of the wells will be undertaken from near the base of the well to surface, commonly known as the Halliburton Method. In addition, it is assumed that all drilling, including casing and grouting, is carried out in accordance with industry best practice and the applicable guidelines and that permeable zones are adequately isolated (including the usable ground water aquifers) as part of the well closure;
  - It is assumed that the well engineer or other suitably qualified specialist will provide a statement, based on the well bond log and other integrity tests carried out during the operational phase, to inform the closure methodology of each well during the construction phase. In the event of unplanned closure, the latest statement will be used to inform the decommissioning plan;
  - General waste generated during the demolition and remediation phase will be disposed of at Welkom general landfill site;

[12] There are 12 existing abandoned wells, of which seven (7) are rehabilitated and five (5) still require rehabilitation. The five (5) abandoned wells are accounted for financially in the ARP.

- Hazardous waste generated during demolition will be disposed of at a registered hazardous landfill site;
- A dedicated salvage yard and de-contamination bay will be established to de-contaminate demolition waste and screen recyclables;
- The above ground sections, of the pipeline will be dismantled and sealed off;
- As confirmed by Tetra4, none of the pipe markers will remain intact post closure;
- No allowance was made for post closure water treatment after rehabilitation has been completed;
- It was assumed that constructed power lines (if any) will be transferred to post-closure landowner (to be confirmed by Tetra4) or Eskom;
- It was assumed that water required for demolition and remediation purposes will be available from licenced farm owners within a 50 km radius. No allowance was made for bulk water supply during closure phase;
- Socio-economic mitigation: Allowance of 3% of sub-total A (rehabilitation and closure actions);
- Additional studies: nominal allowances for technical and specialist studies required to adequately plan for and implement closure activities;
- Preliminaries and general: allowance of 13% of sub-total A (rehabilitation and closure actions); and
- Contingencies: Allowance for 11% of sub-total A (rehabilitation and closure actions).
- It is assumed that hydroseeding will be sufficient for rehabilitation purposes.
- Only one steel tank was visible on the site aerial photograph received February 2023 and used for calculation purposes.
- Utilities canopy area 997 m^2, assumed from 2021 plans, however confirmed by the aerial photograph received Feb 2023 the area is only 600 m^2 and 30 % of the area are covered.
- No rehabilitation of roads associated with the wells were allowed for. Additional roads at the plant (1358,4 m) were used for rehabilitation of roads calculations.
- The following assumptions were implemented for the Down Hole surveys and Unblocking of collapsed wells:
    - Wells < 5 years old = 1% : 50 wells
    - Wells > 5 years old = 3% : 50 wells
- The following assumptions were implemented for the Bond log testing:
    - Wells < 5 years old = No bond log testing will be required as these would have been tested at the completion stage.
    - Wells > 5 years old = Bond log test will be required for all operational wells.

4.12.3 DESCRIPTION OF UNIT RATES

Unit rates that were applied during the closure determination were obtained from MineLock's existing database. The database is updated in consultation with demolition practitioners and/or civil contractors. The post-closure unit rates that are included in the applied rates are summarised in the subsections below.

4.12.3.1 **GENERAL SURFACE REHABILITATION**

4.12.3.1.1 GENERAL SURFACE SHAPING

It was assumed that general surface shaping would be required over most of the areas where surface infrastructure has been removed, as part of the overall surface rehabilitation. This includes the stockpiling of building/demolition rubble to be removed for disposal, as well as the subsequent shaping and profiling of these surfaces. It has been assumed that shaping and profiling would involve the dozing of material at a 500 mm average thickness. With an adopted dozing rate of R 24.90 /m^3, this equates to about R 124 497.00 /ha.

4.12.3.1.2 GRAVEL ROADS

It was assumed that the gravel access roads are approximately 6 m wide. Gravel roads will be ripped at a rate of R1.57 /m2 and vegetated at a rate of R 6.35 /m^2. Gravel roads amount to R 7.92 /m^2. No allowance was made for any well roads to be rehabilitated, as provided by the client.

4.12.3.1.3 RIPPING

About compaction alleviation, allowance has been made for a mid-sized dozer equipped with 3 ripper tines, ripping to a depth of approximately 500 mm for compaction alleviation. An average unit rate of R 6 633.50 /ha.

4.12.3.1.4 VEGETATION

In terms of vegetation establishment, if vegetation must be established on uncompact growth medium/topsoil, soil amelioration will most likely be required. This will depend on the nature of the soil. To determine a unit rate for re-vegetation, allowance has been made to apply 0.5 ton/ha fertiliser, 5 ton/ha lime and 15 ton/ha organic material such as well-cured cattle manure. If cultivation and seeding are also included, but ripping to alleviate compaction excluded, this rate equates to R 68 080,84 /ha.

4.12.3.1.5 SURFACE WATER MONITORING

Allowance has been made to conduct the surface water monitoring at three monitoring points. If assumed that it would take at least one man-day of an independent specialist (including the preparation of the sampling equipment) to conduct the sampling at these points, this would equate to about R16 635.23 per sampling event for professional fees and associated disbursements. If an additional allowance is made for sample analysis of R 1 131.65 per sample, this equates to an additional amount of R 4 413.43, totalling to R 19 917.01 per event. It has been assumed that surface water monitoring should continue 5 years' post-closure at a bi-annual frequency (R 42 097.32/year).

4.12.3.1.6 GROUNDWATER MONITORING

It has been assumed that 35[13] groundwater monitoring boreholes would be required to reflect post closure groundwater quality.

It is assumed that the analysis cost is R 1 797.86 /borehole, which equates to a total of R 62 925.23 for 35 boreholes. Allowance has also been made for a travelling cost of R 2000.00 and one labourer at a cost of R 200 /hr. It was assumed that two man-days will be required to complete the analysis which equates to R 3 200.00. Hence, these costs amount to R 68 125.23 per event. It has been assumed that groundwater monitoring should continue for 50 years post-closure at an annual frequency.

4.12.3.1.7 REHABILITATION MONITORING

Biodiversity and soils (Landscape Function analysis) assessments (including mid-wet season) should be undertaken by a suitably qualified ecologist / botanist / soil scientist to monitor the rehabilitation progress. The monitoring should take place annually (mid-wet season), three years after rehabilitation. There should be confirmation that acceptable cover has been achieved in areas where natural vegetation is being re-established. 'Acceptable cover' means re-establishment of pioneer grass communities over the disturbed areas at a density similar to the surrounding undisturbed areas, non-eroding and free of invasive alien plants.

[13] 35 boreholes are currently being monitored by Tetra4 as part of their routine monitoring.

It was assumed that two man-days would be required to conduct the rehabilitation monitoring over the disturbed area. Assuming a consultant rate of R 1 287.25 /hr, this would equate to R 10 298,00 per event for professional fees and associated disbursements. Hence, these costs amount to about R 20 596.00 per event. It has been assumed that rehabilitation monitoring should continue for 3 years post-closure at an annual frequency (R 20 596.00 /year).

4.12.3.1.8 REHABILITATION CARE AND MAINTENANCE

It is assumed that this would require one week per year of a team of five workers and one TLB as supporting equipment to conduct the corrective measures over 5 ha. It is assumed that the hourly rate of the workers is R 53.75 /hr and the equipment R 3 394.95 /d (per machine). Care and maintenance should continue for three years post-closure. The overall rate is R 27 725.38 /year.

It has been assumed that the workers and equipment could be sourced locally.

4.12.3.2 **SITE-SPECIFIC**

Site-specific unit rates were calculated based on experience and rates obtained from contractors. The site-specific unit rate includes the following:

4.12.3.2.1 DOWN HOLE SURVEYS

Allowance was made to survey the existing and proposed wells to determine the pre-decommissioning conditions (e.g. blockages to ensure the wells are plugged/rehabilitated to the ultimate depth).

Unit rate composition:

- Setup of drill machine @ R 3 330 /h, assuming it will take 10 hours, totalling to R 33 300.00 per well;
- Conduct Calliper logging to identify and investigate potential blockages/cavities within the well:
    - Tagging of well. Lower tools down hole to ensure equipment can reach bottom of the well at R 3 330 /h, assuming it will take 10 hours, totalling to R 33 300.00 per well;
    - Lower camera down hole if blockage is detected to determine the blockage and next steps at R 1 665/h, assuming it will take 5 hours, totalling to R 8 325.00 per well.

Total cost for conducting pre-closure down hole survey per hole is R 74 925.00. A 7.5% saving for more than 30 holes were assumed, reducing the cost per hole to R 69 305.63.

4.12.3.2.2 BOND LOG TESTING

Allowance was made to test the integrity of the grouting in the wells to ensure there are no poor grouting bonds or inconsistent densities. All gas well locations will require CBL test work to be done prior to final closure. Based on the geographical location of each well, three wells can be tested per day at a daily cost of R 10 343.27. Future associated costs include:

- Logging unit preparation and mobilization/demobilization, @ R 8 652.58;
- Logging calliper/gamma ray sonde per m, @ R 12.84. 850 m assumed per well;
- Logging CBL sonde per m, @ R 27.73. 850 m assumed per well;
- Log processing, analysis and formal reporting per m, @ R 43.00. 850 m assumed per well.

Total cost per well amounts to R 83 136.73. A 20% saving for more than 30 holes were assumed, reducing the cost per hole to R 66 519.89.

4.12.3.2.3 UNBLOCKED COLLAPSED WELLS

Allowance was made for the unblocking of collapsed wells to ensure isolation/sealing to depth. This is key in preventing future preferential pathways for potential groundwater contamination.

Unit rate composition:

- Munching out of blockage, flushing of well and/or retrieval of other obstacles at R 3 330 /h, assuming it will take 50 hours, totalling to R 166 500.00 per well.

4.12.3.2.4 BOREHOLE GROUTING

Allowance was made for the grouting/cementing of the wells to a depth of 850 m. An additional 30% grouting volume was allowed, resulting in a total volume of 26.10 m^3 per well.

Unit rate composition:

- Supply and install cement plug within well via squeezing technique (Develop cement formulation for cementing the entire well annulus. Develop cement formulation to top-up "no bond" or "poor bond" cemented sections between casing and formation walls – ensure cement seals and does not disperse into porous formations. Cement formulations and volumetric calculations to be approved by well engineer/cement specialist). Total cost of cement @ R 5 625.00/cube, totalling to R 146 835.00 per well;
- Operational Time - Preparing grouting equipment @ R 3 330/h, assuming it will take 5 hours, totalling to R 16 650.00 per well;
- Operational Time - Grouting of well @ R 3 330/h, assuming it will take 3 hours, totalling to R 9 990.00 per well;
- Operational Time - Cleaning of grouting equipment @ R 3 330/h, assuming it will take 7 hours, totalling to R 23 310.00 per well;
- Top up grouting - if required @ R 5 625.00/cube, assuming 1 cube required, totalling to R 5 625.00 per well.

Total cost for well cement plug is R 202 410.00 per well. A 7.5% saving for more than 30 holes were assumed, reducing the cost per hole to R 187 229.25.

4.12.3.2.5 GAS TRANSPORTATION PIPELINE

All above ground pipeline infrastructure will be dismantled/demolished and sealed off. The in-situ gas transportation pipeline will remain as is.

4.12.4 FINAL REHABILITATION DECOMMISSIONING AND CLOSURE COST ESTIMATE

The closure cost for the proposed production activities is estimated to be R 43 653 889.19 at the end of the project life cycle. This is based on the current liabilities and the planned additional drilling to be undertaken in the forthcoming 12 months. This closure cost is based on 2023 values and will require annual reassessment, revision, and escalation. Table 19 provides a summary of the determined closure cost estimate. Please refer Appendix 2 for the detailed breakdown of the items, quantities and costs.

Table 19: Scheduled and unscheduled closure liability assessment for Tetra4.

Final Decommissioning and Closure Cost	Scheduled Closure	Unscheduled Closure
Total	R 48 806 526.32	R 45 501 931.29
Well Closure	R 21 688 314.35	R 14 428 213.30
Infrastructural Areas	R 12 565 365.43	R 12 505 464.50
General Surface Rehabilitation	R 1 067 806.25	R 1 067 806.25
P&Gs and Contingencies	R 8 463 734.17	R 7 839 260.53

4.13 MONITORING, AUDITING AND REPORTING

The requirement for monitoring and auditing should be carried through all phases of the project lifecycle. The financial provision regulations require that monitoring, auditing and reporting which relate to the risk assessment (see section 4.3), legal requirements (see section 4.4.2) and knowledge gaps (see section 4.10) as a minimum and must include-

(i) a schedule outlining internal, external, and legislated audits of the plan for the year, including-

   a. The person responsible for undertaking the audit(s);

   b. The planned date of audit and frequency of audit;

   c. An explanation of the approach that will be taken to address and close out audit results and schedule;

(ii) A schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders;

(iii) A monitoring plan which outlines-

   a. Parameters to be monitored, frequency of monitoring and period of monitoring; and

   b. An explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities.

This section aims to present the monitoring plan which will need to be implemented in the rehabilitation and decommissioning, and closure phases. For detail on the monitoring requirements during the production and progressive rehabilitation phase, and the post-closure phase, please refer to Sections 5 and 0 respectively.

For the purposes of this closure plan the monitoring and auditing is separated into two distinct categories namely, compliance monitoring and environmental monitoring. The compliance monitoring will typically align with, and be a continuation of, the requirements of compliance monitoring and reporting as specified in the EMPr. Table 20 and Table 21 provide the compliance monitoring and reporting plan and the environmental monitoring and reporting plan respectively, applicable to the decommissioning, rehabilitation, and closure phase.

In accordance with Regulation 11 of the NEMA Financial Provisioning Regulations the Holder must ensure annual review of the annual rehabilitation plan, the final rehabilitation decommissioning and closure plan, as well as the environmental risk assessment. This annual review must be audited by an independent auditor.

All monitoring and auditing must be accompanied by applicable records and evidence (e.g. delivery slips, photographic records, etc). All reports must be retained and made available for inspection by the ECO, the Holder and /or the Relevant Competent Authorities. Copies of all documentation, permits, licences, and authorisations (incl. copy of EA and relevant amendments to the EMPr and EA, waste disposal certificates, disposal licences, water use licences, etc.) must be obtained and kept in a site environmental file.

An environmental compliance register must be prepared and maintained throughout construction, operation, and decommissioning in order to monitor environmental concerns, incidents, and non-conformances. This register should be utilised to measure overall environmental performance.

The applicant must use the audit report findings to continually ensure that environmental protection measures are working effectively on-site through a system of self-checking. The EMPr should be viewed as a dynamic document aimed at continual environmental performance improvement. In this regard the provisions of Regulation 34-37 of GNR 982 apply to the process of amending the EMPr.

Table 20: Compliance monitoring and reporting plan.

Type	Functional Requirement	Responsibility	Frequency	Reporting Mechanism
Daily site inspections	- Undertake site inspections. - Photographic record of site activities. - Data capturing for record and compliance verification purposes. - Daily site inspection diary.	Environmental Officer (EO)	Daily	No routine reporting. Ad hoc as necessary.
Monthly Compliance Report	- Monitor and report on compliance with the requirements of the EA, EMPr, and closure plan and general environmental performance. - Include the results of all relevant environmental monitoring. - Include status of rehabilitation activities. - Include records of: - Waste manifests. - Incident registers. - Complaints registers. - Relevant corrective action reports.	Environmental Manager/ EO	Monthly	Monthly compliance report
Monthly ECO Audits (Decommissioning Phase)	- Site inspection and photographic record. - Audit and report on compliance with EA, EMPr and FRDCP. - Monitoring compliance with Annual rehabilitation Plan. Alignment with requirements of Appendix 7 of GNR982 (as amended), NEMA.	Independent ECO/Environmental Auditor	Monthly	Monthly Audit Report
Annual Independent Audit	- Site inspection and photographic record. - Audit and report on compliance with EA, EMPr and FRDCP. - Monitoring compliance with Annual rehabilitation Plan	Independent ECO/Environmental Auditor	Annual	Annual Environmental Compliance Audit Report

Type	Functional Requirement	Responsibility	Frequency	Reporting Mechanism
	- Alignment with requirements of Appendix 7 of GNR982 (as amended), NEMA.			
Annual review of financial provisioning reports in accordance with the requirements of Regulation 11 of the Financial Provision Regulations.	- Review, assess and adjust: • Annual Rehabilitation Plan; • FRDCP; and • Environmental Risk Assessment. - Ensure on-going compliance with the requirements of the Annual Rehabilitation Plan and the FRDCP.	Independent Specialist.	Annual	Annual Financial Provision Assessment and update.

Table 21: Monitoring plan- FRDCP

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
Surface Water	- Decommissioning. - Closure. - Post-closure (5 years post closure).	Standards: - Aquatic Water Quality Standards as published in the Department of Environmental Affairs (DEA) (2014): Framework for the Management of Contaminated Land; - South African National Standards (SANS) 241 1:2011 drinking water standards (SABS, 2015) which sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is deemed to present an acceptable health risk for lifetime consumption. Locations: Downstream of proposed pipeline river crossings (Doring River, Sand River, Bosluisspruit) Bosluisspruit). Parameters: Full monitoring set[14].	Target: < 10% variation in upstream and downstream if exceeded then review and institute additional monitoring and investigation.	- Bi-annual when active construction/ decommissioning activities within applicable catchment.	- Monitoring report. - Annual Environmental Audit Reports.

[14] pH, Electrical conductivity (EC), Total Hardness, Total Dissolved Solids (TDS), Alkalinity, Ammonia (NH3), Bromide (Br), Ni trite (NO2), Total Nitrogen, Bicarbonate (HCO3), Fluoride, Chloride, Nitrate (NO3), Sulphate (SO4), Calcium (Ca), Potassium (K), Magnesium (Mg), Sodium (Na), Silver (Ag), Aluminium (Al), Arsenic (As)Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Cobalt (Co), Chromium (Cr), Copper (Cu), Iron (Fe), Lithium (Li), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Lead (Pb), Antimony (Sb), Selenium (Se), Silicon (Si), Strontium (Sr), Thalium (Tl), Titanium (Ti), Vanadium (V), Zinc (Zn), MTBE, Benzene, TAME, Toluene, Ethyl Benzene, m+p Xylene, o Xylene, 1, 3, 5 Trimethyl benzene, 1, 2, 4 Trimethyl benzene, Naphthalene, TPH GRO C6 C10, TPH GRO C10 C40, Polycyclic aromatic compounds, Total oil and grease.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
Groundwater	- Decommissioning. - Closure. - Post-closure (50 years post closure)	Standards: as per the prevailing routine monitoring requirements or alternatively: - Guidance on Sampling Techniques (SABS ISO 5667:2:1991), Guidance on Sampling of Groundwater (SABS ISO 5667:11:2009) and Guidance on the Preservation and Handling of Samples (SABS ISO 566 7:3:1994). Laboratory analysis undertaken at a SANAS Accredited Laboratory. Locations: Existing Tetra4 routine monitoring points. Monitoring parameters (minimum): - Full monitoring set. - Physical parameters: Groundwater levels.	- Alignment with background and baseline values. - An increase in any of the indicator elements by more than 25% from baseline conditions will trigger a response from Tetra4. - The lowering in groundwater level by more than 10m will trigger a response from Tetra4. - No water supply (quality and quantity) complaints.	- Decommissioning and Closure: Bi-monthly as per the production/ operational phase monitoring requirements. - Post-closure: Annually	- Annual Monitoring Report. - Annual Environmental Audit Reports
Biodiversity	- Decommissioning. - Rehabilitation. - Closure.	Standards: - Conservation of Agricultural Resources Act, Act No. 43 of 1983 ; National Environmental Management: Biodiversity Act, Act No. 10 of 2004 alien and invasive species list (2014). - Timed random meander method.	- Target: Confirmation that acceptable cover has been achieved in areas where natural vegetation is being re-established. "Acceptable cover" means re-establishment of pioneer grass communities over the disturbed areas at a density similar to	- Biodiversity assessments mid wet season should be undertaken by a qualified ecologist / botanist to monitor the rehabilitation progress. Annual survey for a period of 3 years after rehabilitation.	- Annual Monitoring Report. - Annual Environmental Audit Reports

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		Parameters: - Flora and Fauna Surveys: Plant community composition. Alien and invasive plant abundance (numbers, density, cover, frequency); Condition measures of vigour, performance, fecundity); Structure size or age class information). Locations: All production areas and adjacent area (~20m). Random meanders within all defined rehabilitated natural areas.	surrounding undisturbed areas, non-eroding and free of invasive alien plants. - Indicators : New species appearing on-site, alien species list (including density information), change in composition/ structure of native plant communities, extent of invasive species populations, record of clearing activities, decline in abundance of alien plant species over time.		
Wells	- Decommissioning. - Rehabilitation. - Closure. Post-closure.	Standards: - Plug / barrier evaluation and verification: Well plugging and abandonment verification to confirm that there is proper and effective vertical isolation (this could include: bond log tests, cementing tests, communication tests, hydraulic pressure tests, applied weight test). This should be informed by a well engineer and the applicable API standards. - Gas emissions: Passive diffusive sampling, National Ambient Air Quality Standards (GN1210/20	- Pass barrier evaluation and verification test. - No stray gas or fluid migration. - VOCs GLCs should comply with the TCEQ guideline. Soil gas measurements should not exceed relevant reference site values. No temporal increase in the soil gas.	- Plug evaluation/ verification: Once off post plugging. - Soil and surface gas levels monitoring every 5 years for 50 years.	- Annual Monitoring Report. - Annual Environmental Audit Reports

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		09). The well site must be monitored for the release of gas from the decommissioned well site. This may be done by soil vapour testing or efluxes and/or surface methanometer or alternative method approved by a qualified well Engineer or Independent Environmental Specialist. Locations: At all closed/ abandoned wells.			

5 SECTION B: ANNUAL REHABILITATION PLAN

The annual rehabilitation plan (ARP) aims to:

- Review concurrent rehabilitation and remediation activities already implemented;
- Establish rehabilitation and remediation goals and outcomes for the forthcoming 12 months, which contribute to the gradual achievement of the post-production land use, closure vision and objectives identified in the holder's final rehabilitation, decommissioning, and mine closure plan;
- Establish a plan, schedule, and budget for rehabilitation for the forthcoming 12 months;
- Identify and address shortcomings experienced in the preceding 12 months of rehabilitation; and
- Evaluate and update the cost of rehabilitation for the 12-month period and for closure, for purposes of supplementing the financial provision guarantee or other financial provision instrument.

The purpose of an ARP report is to provide a record containing the relevant information regarding concurrent rehabilitation and remediation activities for the site for the forthcoming 12 months and how these relate to the operation's closure vision, as detailed in the final rehabilitation, decommissioning and mine/production closure plan. The ARP also indicates what closure objectives and criteria are being achieved through the implementation of the plan.

5.1 STATUS OF ENVIRONMENTAL MONITORING

This section presents the key findings of the environmental monitoring carried out on the site. The monitoring is done in accordance with the current obligations and requirements as specified in the EMPR. Table 22 presents the summary of the most recent monitoring reports. Detailed description of monitoring undertaken, and consequent findings are available in the associated source monitoring reports.

Tetra4 has other monitoring obligations which relate to the construction or operational phase specifically. These include dust, air quality, and localised surface waters monitoring. The findings for these studies are not presented herein as they do not have a bearing on the identified rehabilitation, decommissioning, and closure risks.

Table 22: Status of environmental monitoring.

Report	Key findings	Relevant Rehabilitation, Decommissioning and Closure Considerations
Regional routine groundwater and surface water monitoring	Tetra4 has been conducting bi-monthly groundwater and surface water monitoring around the existing HDR1 production facility since mid-2017. The following conclusions are presented in the latest monitoring report (Renergen , 2023): "The chemical character of ground water can be altered due to a variety of influences. These can be natural: minerals and gases reacting with the water in its relatively slow natural passage through sediments and rocks and the interaction of lower lying and deeper aquifers, or anthropogenic causes. The possibility of surface (rivers and streams) and groundwater interactions in lower lying areas also exist. Pollution from these surface water sources could potentially pollute groundwater. This is further exacerbated by Isotope sampling and analysis that was conducted to attempt and identify if there is interconnectivity between, 1. Deeper saline aquifers and shallow potable aquifers, and 2. Shallow potable aquifers and surface water sites. Sites with similar isotope signatures are likely to have similar sources of recharge with a similar water age. Based on the Isotope analysis, rivers were concluded to likely be losing streams, contributing to the groundwater regime, where sampling is conducted. This could vary based on yearly rainfall events. It was noted that the Doring- and Sand Rivers have similar signatures to ground water sites situated close by (BH09, BH08, BH04 and BH05). The deeper saline aquifer, where sampling could be conducted, that was tested had a different isotope signature to the shallow potable water sites. This along with the much deeper water level, makes it unlikely that interconnectivity between the deeper saline and the shallow potable aquifers exist. Pump tests were also conducted along with the isotope analysis at select sites. It was concluded that slug tests conducted prior to the pumping tests yielded similar results to the pump tests. Pump testing is done to obtain valuable aquifer parameters, used to update the annual groundwater model. Additionally, the data obtained from pump tests can help identify connectivity of boreholes to the major aquifer systems. It was found that borehole Mon-F1 is poorly connected to any major fracture systems, as the borehole yield is extremely low. This means that water in the borehole is likely more stagnant, and less turbulent downhole. In previous months high methane levels were recorded at this site, likely due to build up. The water in this hole is likely also much older than that of surrounding boreholes, due to the stagnant state of water. Time-series chemistry data indicate that variations in the chemical character of the groundwater in the area exist over time and space. Some of the noted variations can be natural (geological,	Monitoring to continue to ensure reliable data for trend analysis leading towards closure.

	drought and rainfall events, natural runoff, surface water contribution to baseflow), however anthropogenic activities such as extensive historic and current gold mining and agricultural activities surrounding the monitoring sites, are expected to be major contributors. Some parameters did exceed the 25 % limit from the mean for this monitoring event at certain sites. High standard deviation values of the mean baseline (especially for HDR1 monitoring boreholes) for some of these parameters mean that there is high variability (low central tendency) of the data points around the mean. High standard deviation could possibly be attributed to the limited baseline data taken over a short period, leading to lowered reliability of the baseline mean. High standard deviation could also hint on the natural volatility of these chemical parameters as the variation is high over a short sampling period for the baseline study. The Cluster 1 baseline sampling ended in January 2019. These sites were sampled more than 3 years back, therefore major differences between the baseline and current sampling event can be expected for select parameters. Especially given the changes that occurred in the general climate and rainfall over the years. Some of the POPCs at some of the sites showed statistical significant increasing and decreasing trends since the start of the monitoring programme and over the past year as per Table 12. Some of the trends can be attributed to single events where a spike in the time-series data or a change in a parameter's detection limit caused a false trend. Water in the area is naturally brackish. Differences in water types do however occur over the study area. The major water types identified at the monitoring boreholes are Sodium-Chloride, Calcium-Chloride, Magnesium-Bicarbonate and mixed types. Previous studies showed that Sodium/ Chloride dominated water types have a strong correlation with elevated Methane concentrations. This can be seen in the dissolved Methane concentrations at unequipped wells that were identified as Sodium-Chloride types (site 21D with 6.6 mg/l and Mon-F1 with 1.6 mg/l). Alvarez et al. (2016) further highlights the above by identifying that low Nitrate and Sulphate in Sodium rich water are strong predictors in the natural occurrence of high Methane concentrations. Deverel, et al, (2011) found that certain trace elements may be present in problematically high concentrations in groundwater and soil surrounding areas of irrigation, where the groundwater has high salinity. Parameters such as Nitrates, which is elevated at a lot of sites, is also an indication of the effects of widespread agriculture on the groundwater quality. Health concerns associated with chemical determinants of drinking water differs from that of microbial contamination, as chemical determinants can cause adverse health effects after prolonged periods of exposure. Most sites included in this monitoring programme have water that is not suitable for drinking (either health or aesthetic effects exist). Additionally, most sites pose a risk to irrigation and livestock watering. Sites BH04, BH05 and BH09 pose chronic health	

	risks in terms of Manganese, site BH08 in terms of Sulphate and sites 11A, 11C, 11E, 11F, 11G, 15C, 15D, 15E, 24A, 8B, BH08, Kal2_1, Mon-F1 and BH01 pose acute health risks to domestic users in terms of Nitrate as N according to the SANS 241-1:2015 drinking water standards. It should be noted that although chronic or acute health risks did not occur at all sites during this monitoring event, they have in the past, and may in the future exceed the SANS limits due to the variability that exist in concentration of certain parameters. Certain Polycyclic Aromatic Hydrocarbons were also detected, however these were all below the US EPA's Maximum Contaminant Level. PAHs detected was likely due to sample contamination as a result of pumping equipment/ generators at some of the sites or as a result of in-filed or laboratory contamination".	
January 2023 Dust Monitoring Report	The approved Environmental Management Programme (EMPr) has the functional requirement that Tetra4 must conduct dust fallout monitoring at potential sensitive receptors which fall within the defined 200 m zone of impact of construction related activities. The majority of the pipeline network has been constructed and is no longer monitored. The dust monitoring at present focuses on the ongoing construction activities at the Plant. The following has been extracted from the latest dust monitoring report (Renergen, 2023): "Dust fallout rates at all sites fell within the slight nuisance category during the December 2022 dust fallout monitoring event. The dust fallout for this event at all sites sampled is considered permissible for residential and light commercial areas as per the four-band scale provided in the SANS 1929 (2005). The small scale of construction activities undertaken at the combined LNG/ He plant, pipeline and exploration wells are unlikely to produce dust fallout levels above the permissible levels at any of the sites being monitored. No occurrence of unusual events that may have contributed to the current reporting period's dust fallout concentrations were noted. When analysing the time-series dust fallout results, only slight changes occurred at some of the sites when compared to the previous month. There was no construction related exceedances of the National Dust Control Regulations at any of these sites for the past year. Meteorological records are important in determining possible sources of total dust fallout at the monitoring sites. The weather monitoring station located at the HDR1 Pilot Plant is used to extract wind speed and direction data monthly to assist in evaluating any possible sources of dust fallout. The wind rose plot provided in Figure 3 indicate that the dominant wind direction during this reporting period was in a westerly direction with an average wind speed of 9.95 km/h. Based on the findings of this report, no further mitigation or management measures with regards to total dust fallout are required at this time".	The dust fallout relates to active construction activities only.

Air Pollutant Passive Sampling	Two winter passive sampling campaigns were conducted at 3 locations around the Tetra4 Virginia Compression Plant between 5 July and 18 September 2023. The pollutants sampled were: SO2, NO2, HF, and VOCs. The main findings of the sampling campaigns can be summarised as follows: - SO2 concentrations were low and below the applicable NAAQS at all sampling locations; - NO2 concentrations were below the applicable NAAQS at all sampling locations; - HF concentrations were low but above the detection level at all sampling locations during all sampling periods; - Benzene and toluene concentrations were low but above detection levels. However, all other VOC concentrations were below the detection level, and the TVOC concentrations, chronic hazard risk, and increased life-time cancer risk screening were below the screening criteria and exposure risk is rated between “low” and “very low”; - The calculated equivalent annual average concentrations for benzene were below the NAAQS; - The highest sampled concentrations of SO2 and NO2 were observed at TET6 (Conduction Oil Stack) and TET3 (Background). Vehicle exhaust emissions are the most likely sources of on-site emissions, while road traffic could be a main off-site source near the background site. It is noted that, when compared with earlier sampling campaigns, the pollutant concentrations sampled during winter 2023 were: - slightly higher for SO2 - slightly higher for NO2, - higher for HF, and, - similar but slightly higher for VOCs. Based on the findings of the sampling campaign, the current sampling activities are appropriate. This includes passive sampling of SO2, NO2, HF, and TVOCs at a minimum of three locations for 1-month sampling campaigns at least twice per year. Should potential exceedances be calculated, the following additional recommendations are made: - increase the number of sampling locations and the frequency of sampling; - installation of an on-site meteorological station; and,	Emissions relate to the operations of the Plant- This is an operational phase activity and will not be a source of pollutants beyond the operational phase.

	- establishment a Complaints Register – if not already in place – where complaints can be lodged by telephone, email, or in person.	

5.2 SHORTCOMINGS IDENTIFIED DURING THE PRECEDING PERIOD

It is important to identify shortcomings in the rehabilitation activities from the preceding period, to ensure that a rehabilitation backlog does not develop. Table 23 provides a list of the outstanding rehabilitation actions identified as shortcomings during the previous ARP. Well SWM06IT4 is rehabilitated with the exception that no demarcation (surface tags) has been placed at the well location, as is required as part of the relinquishment criteria.

Table 23: Decommissioning, rehabilitation and closure shortcomings identified in previous ARP.

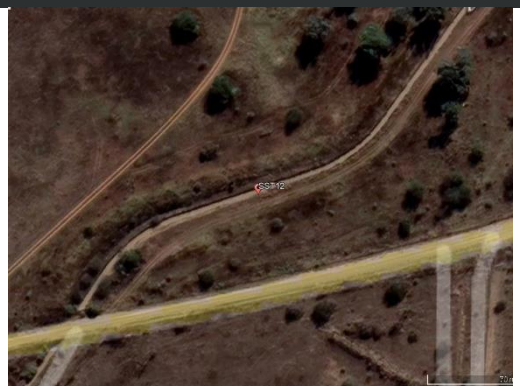
Item	Description of activity	Description of shortcomings	Required interventions	Current Status
Shortcomings identified in the previous ARP				
SWM06IT4	Status: - Well plugged, casing removed, and decommissioned. - Site rehabilitation is to be completed. 	- No site-specific decommissioning and closure plan was provided. - Site-specific project closure report to be completed. - Surface tags are not yet placed on well location.	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Continued monitoring through the growth season for re-vegetation. - Installation of surface tags required.	- Abandoned. - Site rehabilitated with the exception of surface tag placement. - Site-specific decommissioning and closure plan outstanding. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.
T4WHM1	Status: - Well not plugged, casing removed, and decommissioned. - Site rehabilitation is to be completed.	- No site-specific decommissioning and closure plan was provided. - Site-specific project closure report to be completed. - Well to be plugged.	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Seeding and planting is most successful when done at or immediately after the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting). To stimulate germination, water retention in the	- Site rehabilitated with the exception of surface tag placement. - Complete and submit site specific decommissioning and closure plan and final closure report.

Item	Description of activity	Description of shortcomings	Required interventions	Current Status
Shortcomings identified in the previous ARP				
		- Surface tags to be placed at well location.	seed zone is essential and can be aided by the application of light vegetation mulches and/or scattering of light woody debris. - Continued monitoring through the growth season for re-vegetation.	- Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.
SST11	Status: Site verification could not be completed, satellite images of the well were used. Well to be rehabilitated and relinquished.	- Well is not plugged. - Well head collar is not removed. - Surface tag has not been placed at well location. - General surface rehabilitation to be continued.	- Well to be plugged. - Well head collar to be removed. - Surace tag to be placed. - Continued monitoring through the growth season for re-vegetation.	- Site to be rehabilitated. [15]. - Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.

[15] Site not inspected by EIMS. Status determined through information provided by Renergen combined with available Google Earth Imagery.

Item	Description of activity	Description of shortcomings	Required interventions	Current Status
Shortcomings identified in the previous ARP				
				
SST12	Status: Site verification could not be completed, satellite images of the well were used. Well to be rehabilitated and relinquished.	- Well is not plugged. - Well head collar is not removed. - Surface tag has not been placed at well location. - General surface rehabilitation to be continued.	- Well to be plugged. - Well head colaar to be removed. - Surace tag to be placed. - Continued monitoring through the growth season for re-vegetation. -	- Site to be rehabilitated. [16]. - Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.

[16] Site not inspected by EIMS. Status determined through information provided by Renergen combined with available Google Earth Imagery.

Item	Description of activity	Description of shortcomings	Required interventions	Current Status
Shortcomings identified in the previous ARP				
				
Powerline ownership	Following the decommissioning of their wells, Tetra4's powerlines will be transferred to Eskom's ownership and control.	No agreement is provided to confirm transfer of ownership of the powerlines from Tetra4 to Eskom post well closures.	An agreement is required between Tetra4 and Eskom to establish the ownership acquisition.	- No agreement has been provided as of yet.

5.3 PLANNED REHABILITATION AND REMEDIATION

Planned rehabilitation is divided into two main categories, namely: Addressing accumulated rehabilitation backlog or identified shortcomings from previous periods; and progressive rehabilitation associated with ongoing operations. The following wells have been temporarily suspended pending further investigations and drilling:

- SPG03
- NEA02HT4
- T4MD0001 (P2V2)
- P016b
- P024c2
- P027d
- P023 Rev1
- P024b
- P024b_Rev1
- MDR1(b)
- HADV01
- T4MD0004 (P13)
- T4MD0006b (P015b)
- P022
- 2057N
- P025
- 2033
- 1629
- MDR1C (T4MD014)
- C1KK004

Once the additional investigative work is competed these sites will either be incorporated into the operational aspects (to be accounted for in the FRDCP and provision) or abandoned (to be added to the ARP and provision).

Operational infrastructure (including wells, pipeline infrastructure, and the processing plant) are to be retained until the end of production or where flows from production wells ceases. The decommissioning, closure and rehabilitation of these aspects are not considered eligible for progressive/concurrent rehabilitation and are therefore planned and accounted for in the FRDCP.

Surface rehabilitation of pipeline routes is considered to be a construction phase obligation and monitoring is implemented in terms of EMPr compliance. These pipelines will be retained in-situ and therefore no provision is made for further closure, and rehabilitation of the pipelines themselves. Pipeline associated infrastructure (e.g. boosters, infield compressors, low-point drains, pigging stations, etc) are accounted for under the operational infrastructure and associated FRDCP.

The ARP therefore focuses on aspects or components which pose an environmental liability, and which are no longer required for the production phases and are consequently eligible for final rehabilitation. The following well sites have been identified as abandoned by Tetra 4 and are therefore eligible for progressive closure and rehabilitation:

- 2057
- P0010
- SWM06IT4 (P1V1)
- T4WHM1
- T4MD0006 (P015)
- SST11
- SST12
- P30b
- P26C
- P027e
- P027d
- P027

A description of each site is presented in Table 24 together with the suggested annual rehabilitation obligations.

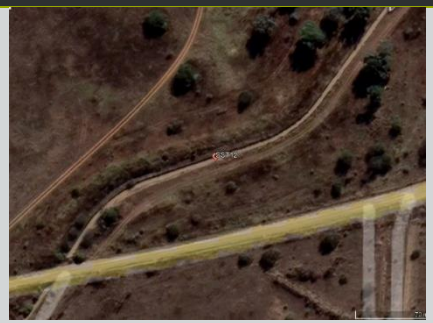
Table 24: Annual Rehabilitation Plan

Nature of activity and associated infrastructure[17] Component	Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
Well sites and associated infrastructure (incl. access)	P0010- Borehole logs not provided. 	Abandoned	~150 m^2	~150 m^2	- This site is located in a sunflower plantation and the site has been returned to cultivation. - The well has been plugged. - The well head has been removed. - No surface tag has been placed.	- Remove all remnant surface waste materials. - Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.
	SWM06IT4- Borehole logs not provided.	Abandoned - closed	~0 m^2	~0 m^2	- Shared drill site area with T4WHM1.	- Complete and submit site-

[17] Only activities or areas of disturbance which are eligible for progressive/concurrent rehabilitation are indicated.
[18] The areas were determined using available Google Earth imagery.
[19] Notes to indicate why total available or planned to be available differs from area already disturbed or planned to be disturbed. Explanation as to why concurrent rehabilitation will not be undertaken on the full available or planned to be available area.

Nature of activity and associated infrastructure[17] Component	Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
					- The site has been revegetated. - The well head collar has been removed. - The well has been plugged. - The concrete slab has been removed.	specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.
	T4WHM1/ P1V1- Borehole logs not provided.	Abandoned - closed	0 m^2	0 m^2	- Shared drill site area with SWM06IT4. - The well head collar has been removed. - The well has not yet been plugged. - No surface tag has been placed. - The site has been revegetated.	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.

Nature of activity and associated infrastructure[17] Component	Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
	T4MD0006 (P015)- Borehole logs not provided. 	Abandoned	To be confirmed.	To be confirmed.	- The well has been plugged, infrastructure removed, and rehabilitated. - No surface tags has been placed.	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.
	SST11- Borehole logs not provided. 	Abandoned	To be confirmed.	To be confirmed.	- Site not inspected by EIMS. Condition of site not verified. - According to Tetra4 the site has yet to be plugged and the collar removed.	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Plug well. - Remove collar and rehabilitate.
	SST12- Borehole logs not provided.	Abandoned	To be confirmed.	To be confirmed.	- Site not inspected by EIMS. Condition of site not verified.	- Complete and submit site-specific

Nature of activity and associated infrastructure[17] Component	Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
					- According to Tetra4 the site has yet to be plugged and the collar removed.	decommissioning and closure plan and final closure report. - Plug well. - Remove collar and rehabilitate.
	P30b- Borehole logs not provided. 	Abandoned	~4000 m^2	~0 m^2- no further surface rehabilitation required as the site is located within a cultivated field.	- Well plugged. - Surface infrastructure removed. - Site is re-incorporated into the cultivation cycle. - Waste to be removed (rubble).	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.
	P26C- Borehole logs not provided.	Abandoned	~4000m^2	~0m^2- no further surface rehabilitation required as the site is located	- Well plugged. - Surface infrastructure removed.	- Complete and submit site-specific decommissioning and closure plan

Nature of activity and associated infrastructure[17] Component	Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
				within a cultivated field.	- Site to be vegetated or re-incorporated into the cultivation cycle.	and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met.
	P027e 	Abandoned	~0 m^2	~0 m^2	- Well has yet to be plugged. - Well head collar has yet to be removed. - Fences are to be removed. - No surface tag placed. - Access road rehabilitation required. - Surface infrastructure removed. - Concrete slab to be removed. - Waste to be removed.	- Complete and submit sit-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met. - Plug well - Remove fences - Rehabilitate road - Remove remaining waste.
	P027d	Abandoned	~0 m^2	~0 m^2	- Well has yet to be plugged.	- Complete and submit site-

Nature of activity and associated infrastructure[17] Component Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
 				- Well head collar has yet to be removed. - Fences are to be removed. - No surface tag placed. - Access road rehabilitation required. - Surface infrastructure removed. - Concrete slab to be removed. - Waste to be removed. - Sumps to be backfilled and rehabilitated.	specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met. - Plug well. - Backfill sumps and rehabilitate general surface.

Nature of activity and associated infrastructure[17] Component	Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
						
	P024C 	Abandoned	~0 m^2	~0 m^2	- Well is plugged. - Well head collar is removed. - Fences are removed. - No surface tag placed. - Access road rehabilitation required. - Surface infrastructure removed. - Concrete slab has been removed. - General surface rehabilitation to be done. - Waste to be removed	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met. - Waste to be removed.

Nature of activity and associated infrastructure[17] Component	Item	Planned life of activity	Available/ Planned Area disturbed forthcoming 12 months[18]	Planned Rehabilitation Area forthcoming 12 months	Notes[19]	Planned interventions- forthcoming 12 months.
	2057 	Abandoned	~0 m^2	~0 m^2	- Well is plugged. - Well head collar to be removed. - Fences are removed. - No surface tag placed. - A formal agreement between Tetra4 and Eskom regarding the transfer of ownership of the powerlines is required. - General surface rehabilitation to be done.	- Complete and submit site-specific decommissioning and closure plan and final closure report. - Implement post rehabilitation and closure monitoring to ensure relinquishment criteria are met. - Well head collar to be removed.

5.4 ANNUAL REHABILITATION COSTING

The rehabilitation activities as listed in Table 24 and the associated costs for implementing these actions have been determined. Please refer Appendix 2 for the detailed breakdown of the items, quantities and costs. Table 25 provides a summary per site for the planned annual rehabilitation costs.

- Concrete Base (Light concrete)
- Plug of well
- Surface Capping of Well
- Dismantle of wellhead, booster compressor and coalescer filter
- Flushing & Cleaning of well
- Supply and install cement plug within well via squeezing technique (Develop cement formulation for cementing the entire well annulus. Develop cement formulation to top-up “no bond” or “poor bond” cemented sections between casing and formation walls – ensure cement seals and does not disperse into porous formations. Cement formulations and volumetric calculations to be approved by well engineer/cement specialist)
- Operational Time - Prepping grouting equipment
- Operational Time - Grouting of well
- Operational Time - Cleaning of grouting equipment
- Top up grouting - if required
- Surface Capping of well
- Cementation integrity testing (Integrity of the plugs must be confirmed by setting weight down on the upper most plug (using the drill string) as well as a differential pressure test for 4 hours at determined pressure with less than 10% bleed over the period. Pressure test data to be captured in 15-minute intervals for the entire 4-hour testing period.)
- Removal of any surface infrastructure
- Excavation of material and demolition hammer and casing
- Supply and install surface tags on each well for monitoring purposes
- Rip footprint area
- Establish vegetation

The cost for rehabilitation of the five (5) existing abandoned wells (T4WHM1, SST11, SST12, P027e and P027d) is included in the Annual Rehabilitation Cost for 2023. Table 25 provides the cost breakdown of the Annual Rehabilitation Costs. Please refer Appendix 2 for the detailed breakdown of the items, quantities and costs.

Table 25: Summary of planned Annual Rehabilitation Costs.

Item	Cost
Concrete Base (Light concrete)	R 124 780.07
Plug of well	R 2 264 479.82

Item	Cost
Surface Capping of Well	R 21 785.31
Dismantle of wellhead, booster compressor and coalescer filter	R 246 420.00
Flushing & Cleaning of well	R 123 210.00
Supply and install cement plug within well via squeezing technique (Develop cement formulation for cementing the entire well annulus. Develop cement formulation to top-up "no bond" or "poor bond" cemented sections between casing and formation walls – ensure cement seals and does not disperse into porous formations. Cement formulations and volumetric calculations to be approved by well engineer/cement specialist)	R 1 086 579.00
Operational Time - Prepping grouting equipment	R 123 210.00
Operational Time - Grouting of well	R 73 926.00
Operational Time - Cleaning of grouting equipment	R 172 494.00
Top up grouting - if required	R 41 625.00
Surface Capping of well	R 123 210.00
Cementation integrity testing (Integrity of the plugs must be confirmed by setting weight down on the upper most plug (using the drill string) as well as a differential pressure test for 4 hours at determined pressure with less than 10% bleed over the period. Pressure test data to be captured in 15-minute intervals for the entire 4-hour testing period.)	R 98 568.00
Removal of any surface infrastructure	R 0.00
Excavation of material and demolition hammer and casing	R 123 210.00
Supply and install surface tags on each well for monitoring purposes	R 10 406.25
Rip footprint area	R 530.68
Establish vegetation	R 5 446.47
Total Annual Rehabilitation Cost (Excl. VAT)	R 4 639 880.59

6 SECTION C: ENVIRONMENTAL RISK ASSESSMENT – LATENT AND RESIDUAL ENVIRONMENTAL IMPACTS

According to the Financial Provisioning Regulations (2015) the objective of the environmental risk assessment report that relates to latent and residual impacts is to:

- ensure timeous risk reduction through appropriate interventions;
- identify and quantify the potential latent environmental risks related to post closure;
- detail the approach to managing the risks;
- quantify the potential liabilities associated with the management of the risks; and
- outline monitoring, auditing, and reporting requirements.

This section of the report aims to address these objectives separately. In certain cases, these objectives have been discussed and presented in the preceding sections of this report.

6.1 THE ASSESSMENT PROCESS USED AND DESCRIPTION OF LATENT ENVIRONMENTAL RISK

Section 4.3 of this report provides a detailed description of the environmental impact/risk identification and assessment (including the methodology and findings) undertaken. Section 4.3 also includes identified mitigation measures which, once implemented successfully, will result in the avoidance or acceptable reduction of the associated impact. The primary latent and residual risks identified to potentially occur are listed below:

- Well casing and/or cementation failure affecting groundwater quality as a result of vertical migration of fluid and/or gas.

The measures considered to ensure that the risk of vertical zonal interaction (groundwater interplay between aquifers, and/or hydrocarbon movements) is mitigated, is the plugging of the entire well, as required under Regulation 132 of the MPRDA Regulations and industry best practice. In order to ensure that the closure vision, objectives and targets are met, the possibility that the integrity of the well plug may deteriorate over very long periods of time has been considered in the ERA under Section 4.3.

The drivers that could result in the manifestation of the latent risk are largely defined by the specifics of the site location and the geological profile surrounding each specific well. However, in general the drivers for this impact are summarised in the Hydrogeological study included in the original EIA report, which states the following:

> *"The steel casing and cement seals in the gas wells may undergo mechanical and/or chemical failure in the long-term. The failure could result from poor well completion practices, corrosion of steel casing and/or the deterioration of cement during and after gas production. In the event that the casing and/or cementation in a well fail, the well can become a high-permeability conduit for saline water and stray gas from deep-seated formations to the overlying shallow Karoo aquifers. Vertical pressure gradients in the subsurface can drive the movement of saline water and stray gas along the well in this instance."*
>
> *"A well's susceptibility to functional failure relates to the experience level, standards, regulations and oversight used to design, build, operate and plug the well (http://oilprice.com/Energy/Energy-General). Literature suggests that the percentage of wells that have some form of casing and/or seal failure is highly variable, varying between 2 – 75% per project (Davies, et al, 2015).*
>
> *Saline water and/or stray gas can migrate from a failed well through a number of subsurface pathways (Davies, et al, 2015). These include the development of channels in the cement, poor removal of the mud cake that forms during drilling, shrinkage of cement, the potential for high cement permeability due to poor installation methods and geological features such as bedding planes, contact zones, fault and shear zones that can act as preferential flow paths.*

A leak can be catastrophic and result in well blowout, but it can also take place at very low rates that are barely detectable. If a well isn't sealed efficiently, methane and ethane gas can migrate up it and accumulate in confined spaces, including private boreholes.

For this reason, the oil and gas industry has developed proven casing, cementing, drilling, completion and plugging requirements and regulations."

Table 26, presents the identified latent and residual risks; the assessment of the impacts; the recommended management and mitigation measures; the impact drivers, timeframes, and triggers; as well as the suggested closure options and actions.

Table 26: Latent and residual risks.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
Groundwater	Well casing and/or cementation failure affecting groundwater quality as a result of vertical migration of fluid and/or gas.	-12.5 (medium)	Well abandonment and plugging to comply with the requirements of the Petroleum Regulations and accepted best practice. Tetra4 will implement well-specific plugging requirements protect the shallow potable Karoo aquifers at closure. Well design will be done by a qualified well engineer or other suitably qualified specialist/s who will take corrosion, pressures, temperatures, exposure times, production life and well rehabilitation into consideration. The cement seals will be pumped as a water-cement slurry down the casing to the bottom of the well, leaving a sheath of cement to set and harden. The integrity of the seals should, where applicable, be pressure	-7.5 (low)	- Geological profile of closed well bore. - Well casing integrity. - Suitability and quality of the annulus barrier. - Suitability and quality of final well bore plug (mechanical factors as well as plug material factors). - Nature of the intersected flow (gas/ water) zones.	Unknown. Depending in the nature of the well and formations the impact may occur at any time in the future.	Elevations in dissolved gas and deep aquifer indicators in shallow groundwater. Gas emissions on surface.	Well closure and abandonment according to regulations and applicable international best practice.

			tested before the next phase of drilling commences. If the well fails the pressure test, the casing will be re-cemented before drilling continues. Testing will be implemented to ensure that the plug is placed at the proper level and provides adequate protection of permeable zones, for example the fracture zones from which gas was produced and the overlying Karoo aquifers. These tests should include tagging the top of the plug. Pressure testing should be undertaken on the seal but care should be taken not to damage the seal during pressure testing. Swabbing can be undertaken to remove fluids from the well. Upon completion of the rehabilitation of the well, a surface casing vent flow test should be considered to determine whether gas or liquid or a combination thereof is escaping from the casing. If gas is					

			detected during this test, additional seals should be designed and implemented. A groundwater and gas monitoring programme will be implemented at each well to serve as an early detection mechanism. Tetra4 has also prepared a Gas Well, Closure, Abandonment and Rehabilitation Guideline document which will be complied with.					

6.2 MANAGEMENT ACTIVITIES, COSTING AND MONITORING REQUIREMENTS

Prevention through accuracy of implementation is the key to addressing and reducing possible latent and residual impacts. This section aims to define the actions required during the post closure phase to manage, address, and monitor residual and latent risks.

6.2.1 MONITORING REQUIREMENTS AND CORRECTIVE MANAGEMENT

Section 4.13 provides a breakdown of the monitoring and auditing requirements for the operation, rehabilitation and decommissioning, closure, as well as post-closure phases. The post closure phase monitoring will aim primarily to monitor key drivers and parameters which causally relate to the predicted latent and residual impacts, and where applicable to trigger management and mitigation activities associated with these. The specific monitoring aspects identified include the following (refer to Table 21 for more detail):

- Surface water monitoring: five years post closure.
- Groundwater monitoring: 50 years post closure (annually)
- Surface gas: 50 years (5-year intervals)

Testing of grouting and barriers will be essential for this project and should be implemented for each well, immediately after grouting. Effective records of the drilling results, cement used, and testing results must be kept for the life of each well. A final test should be carried out during the closure phase and is to be informed by a qualified well engineer. The results and the life of well records must be made available to the well engineer, to inform the plug design.

6.2.2 MANAGEMENT AND MITIGATION ACTIVITIES

The monitoring plan described above will provide invaluable insight into the likelihood that the risk will materialise and the expected timeframes and durations of the impacts. On the basis of the current risk assessment and predictive methods, it is expected that certain post closure management activities and mitigation measures will be required. Table 27 presents the impacts and associated mitigation measures identified once the impact is manifest. The alternatives considered and the motivation for the proposed alternatives are also presented. Please refer to Table 14 for a more detailed explanation of each alternative and the associated advantages and disadvantages.

Table 27: Post closure management activities and mitigation measures.

Impact	Alternative	Selected Alternative
Well casing and/or cementation failure affecting groundwater quality as a result of vertical migration of fluid and/or gas.	Identify the specific sources of the fluid /or gas and remove pathway. This could include redrilling and plugging affected well sites.	Tetra4 should make provision for re-plugging/topping up a reasonable percentage of wells.
	Identify affected receptors and provide alternative resources (e.g. alternative water supply options).	
	Interception of contaminated water, treatment and discharge.	
	Restrict future development on affected high risk areas.	

6.2.3 COSTING ESTIMATION FOR RESIDUAL AND LATENT IMPACTS

The monitoring plan described above will provide invaluable insight into the likelihood that the risk will materialise and the expected timeframes and durations of the impacts. However, it is considered prudent that some form of financial provision is made for well integrity failure post closure at this early stage.

Patroni (2007) completed a study on the lifespan of wells-based corrosion and casing thickness and found that the lifespan of the casing tested is 75 – 110 years. In addition, the hydrogeological specialist study compiled as part of the EIA considers the post-mitigation risk as relatively low (-7.5). Furthermore, various studies carried out in Pennsylvania, USA between 2008 and 2013 have found gas well failures resulting in gas leaks to be as low as 2,5% to 3,4% (Vidic et al, 2013). For the purpose of this report, a failure rate of 3.5% is assumed.

Based on this variable information the following is proposed:

- Surface Methane Monitoring: The surface methane gas monitoring period is to be increased to 50 years at a frequency of 5 years for each well. It has been assumed that 51 locations will require monitoring post closure for a period of 50 years. This can be undertaken through appropriate sampling techniques, either soil vapour probes or surface methanometers. If it is assumed that one man-day would be required to conduct a monitoring event (including preparation, site establishment, equipment hire ex.) this would equate to R 25 635.23 per event.

- Re-drilling and Re-plugging of Wells: An allowance to re-drill and cement two of the wells during the 50-year period has been proposed. The following costs are associated with this activity:

    - Excavation of material to access plug, @ R 14 779.42 /well;
    - Removal of plug and re-drill, @ R 279 731.24 /well;
    - Supply and install cement plug with a 7.5% reduced rate @ R 187 229.25 /well;
    - Surface Capping of well with a 7.5% reduced rate @ R 3 080.25/h, assuming it will take 5 hours, totalling to R 15 401.25 /well;
    - Supply and install surface tags on each well for monitoring purposes @ R693.75 /well;
    - Backfill excavated area, @ R 473.23, assuming area of 8 m^2.

Therefore, the total cost to re-drill/plug wells amounts to R 1 003 241.54

Groundwater Monitoring: It is suggested that groundwater monitoring at each well site should continue for 50 years post closure. Monitoring is to be performed once per year during April, the month when aquifers are at their fullest.

It is assumed that the analysis cost is R 1 797.86/borehole, which equates to a total of R 62 925.23 for 35 boreholes. Allowance has also been made for a travelling cost of R 2000.00 and one labourer at a cost of R 200/hour. It was assumed that two man-days will be required to complete the analysis which equates to R 3 200.00. Hence, these costs amount to R 68 125.23 per event. It has been assumed that groundwater monitoring should continue for 50 years post-closure at an annual frequency.

Table 28 provides a summary of the determined costs for the management of the identified residual and latent impacts. Please refer Appendix 2 for the detailed breakdown of the items, quantities and costs.

Table 28: Latent and Residual Cost Estimation.

Item	Scheduled Closure[20]	Unscheduled Closure[21]
Post Closure Phase- Residual and Latent Cost	**R5 021 306.12**	**R5 021 306.12**
- Monitoring	R4 018 064.58	R4 018 064.58
- Latent and residual risk provision (Redrill and plugging of borehole)	R1 003 241.54	R1 003 241.54

The site-specific environmental assessments performed once the exact drill sites are known, as well as geological data gathered during the drilling process, will allow for a more detailed understanding of the risks related to this specific impact. This information, along with new international best practice guidelines that may be developed in the future (Section 4.4.6), will be considered in all annual updates of the financial provisions and changes to the risk assessment will be reported on. In addition, monitoring results and auditing reports, for up to 10 years after decommissioning will inform the revised risk assessment further.

[20] Scheduled closure refers to the process of decommissioning, rehabilitation, and closure of the production operations as at the planned cessation of production activities. This is also referred to as planned closure.
[21] Unscheduled closure refers to the process of decommissioning, rehabilitation, and closure of the production activities, assuming all production activities cease as at the date of this report. This is also referred to as unplanned closure.

Appendix 1: Tetra4 Gas Well Closure, Abandonment and Rehabilitation Guidelines.

Appendix 2: Cost Quantum Determination detail and supporting documentation.

Appendix 3: Environmental Risk/ Impact Assessment Detail.