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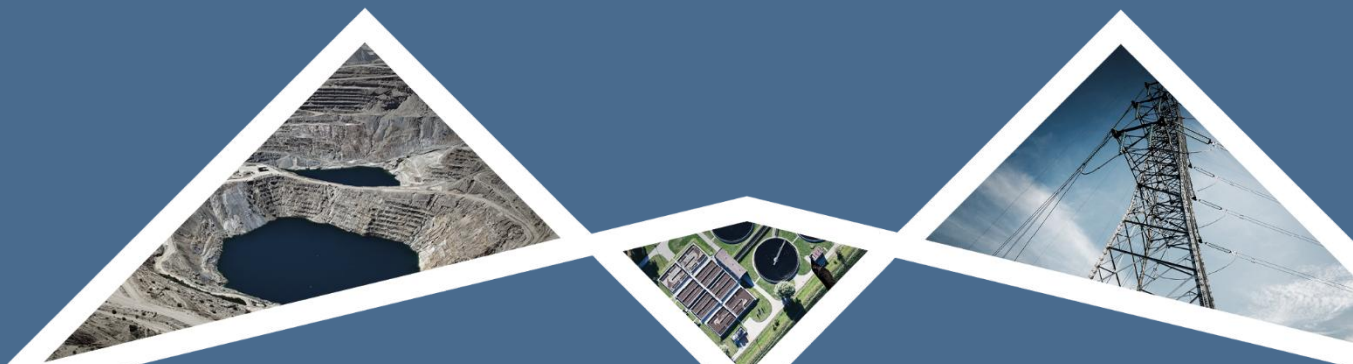
ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

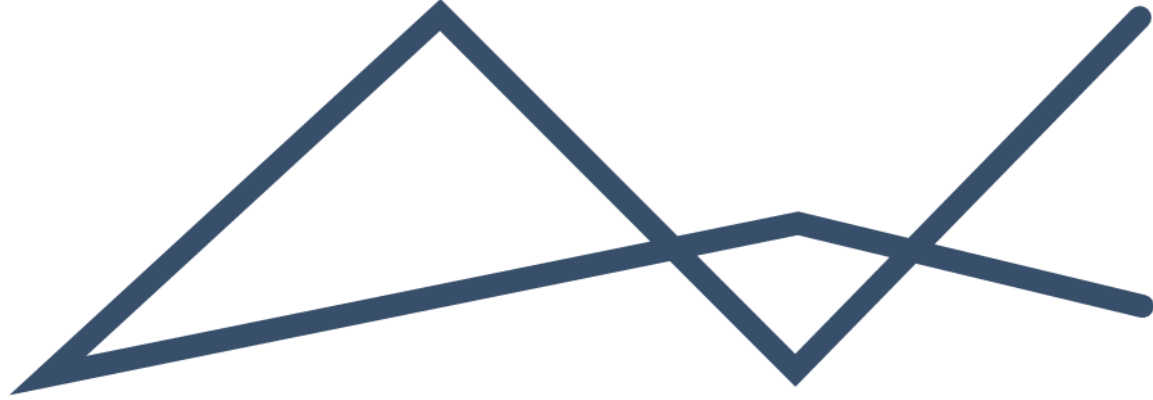
FOR D3 ENERGY SOUTH AFRICA (PTY) LTD (PREVIOUSLY MOTUOANE ENERGY (PTY) LTD.) PRODUCTION RIGHT 16 APPLICATION ON VARIOUS FARMS IN MATJHABENG AND MASILONYANA LOCAL MUNICIPALITIES, LEJWELEPUTSWA DISTRICT MUNICIPALITY IN FREE STATE PROVINCE, SOUTH AFRICA

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Appendix A: EAPs Details and Curriculum Vitae



List of Abbreviations

2D	Two-dimensional
AA	Administrative Authority
AQIA	Air Quality Impact Assessment
AWD	Accelerated Weight Drop
BID	Background Information Document
CA	Competent Authority
CBA	Critical Biodiversity Area
CBL	Cement Bond Log
CH ₄	Methane
CMA	Catchment Management Agency
CO	Carbon Monoxide
CO ₂ e	Carbon dioxide equivalent
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
dBA	A-weighted decibels
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries, and the Environment
DMRE	Department of Mineral Resources and Energy
DMPR	Department of Mineral and Petroleum Resources
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECA	Environmental Conservation Act
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EIMS	Environmental Impact Management Services (Pty) Ltd.
ELWU	Existing Lawful Water Use
EMPR	Environmental Management Programme



EMS	Environmental Management System
EN	Endangered
EPF	Exploration and Production Forum
ER	Exploration Right
ESA	Ecological Support Area
ESO	Environmental Site Officer
FEPA	Freshwater Ecosystem Priority Area
FIT	Formation Integrity Test
FSBP	Free State Biodiversity Plan
GA	General authorisation
GHG	Greenhouse Gases
GIS	Geographic Information Systems
GNR	Government Notice Regulation
GPS	Global Positioning System
Ha	Hectare
HGM	Hydrogeomorphic
HIA	Heritage Impact Assessment
Hz	Hertz
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEP	Integrated Energy Plan
IUCN	International Union for Conservation of Nature
LC	Least Concern
MAE	Mean Annual Evaporation
mamsl	meters above mean sea level
MAP	Mean Annual Precipitation
mg/l	Milligrams per litre
mm/a	Millimetre per annum
MP	Marginally Protected
MPRDA:	Mineral and Petroleum Resources Development Act
MT	Magnetotellurics Survey
NAAQS	National Ambient Air Quality Standards
NEMA	National Environmental Management Act



NEMAQA:	National Environmental Management: Air Quality Act
NEMBA	National Environmental Management: Biodiversity Act
NEMWA:	National Environmental Management: Waste Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGDB	National Groundwater Database
NHRA	National Heritage Resources Act
NO ₂	Nitrogen Dioxide
NPAES	National Protected Area Expansion Strategy
NT	Near threatened
PASA	Petroleum Agency South Africa
PEG	Propelled Energy Generator
PES	Present Ecological State
PM	Particulate Matter
PM ₁₀	Particles with a diameter of 10 micrometers or less
PM _{2.5}	Particles with a diameter of 2.5 micrometers or less.
PPP	Public Participation Process
Ptn	Portion
RE	Remaining Extent
SAHRA	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SAPAD	South African Protected Areas Database
SCC	Species of conservation concern
SEI	Site Ecological Importance
SO ₂	Sulphur Dioxide
t	Tonne
TA	Target Area
TC	Total concentration
TCP	Technical Cooperation Permit
TDS	Total Dissolved Solids
TOPS	Threatened and Protected Species
TVD	True Vertical Depth



VOC	Volatile Organic Compounds
VU	Vulnerable
WMA	Water Management Area
WUL	Water Use Licence



Definitions

Aspect - Element of an organisation's activities, products or services that can interact with the environment.

Auditing - A systematic, documented, periodic and objective evaluation of how well the Environmental Management Programme (EMPr) is being implemented and is performing with the aim of helping to safeguard the environment by facilitating management control which would include meeting regulatory requirements. Results of the audit help the organisation to improve its environmental policies and management systems, while keeping track of their compliance with the Environmental Authorization.

Clearing of vegetation - Clearing refers to the removal of vegetation through permanent eradication and in turn no likelihood of regrowth. 'Burning of vegetation (e.g. fire-breaks), mowing grass or pruning does not constitute vegetation clearance, unless such burning, mowing or pruning would result in the vegetation being permanently eliminated, removed or eradicated.

Contractor - The Contractor has overall responsibility for ensuring that all work, activities, and actions linked to the delivery of the contract, are in line with the Environmental Management Programme and that Method Statements are implemented as described.

Corrective (or remedial) action - Response required in addressing an environmental problem that is in conflict with the requirements of the EMPr. The need for corrective action may be determined through monitoring, audits or management review.

Construction - According to the regulations this term is defined as – the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint'. In this application, construction refers to the site establishment, seismic surveys and drilling activities.

Degradation - The lowering of the quality of the environment through human activities, e.g. river degradation, soil degradation.

Developer – Entity which applies for environmental approval and is ultimately accountable for compliance to conditions stipulated in the EA (Environmental Authorisation) and EMPr.

Environment - The surroundings within which humans exist and that are made up of land, water and atmosphere of the earth, micro-organisms, plant and animal life: or any part or combination of the two and the interrelationships among them, the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact Assessment (EIA) - An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of a proposed development. The EIA includes an evaluation of alternatives; recommendations for appropriate management actions for minimising or avoiding negative impacts and for enhancing positive impacts; as well as proposed monitoring measures.

Environmental Management System (EMS) - Environmental Management Systems (EMS) provide guidance on how to manage the environmental impacts of activities, products and services. They detail the organisational structure, responsibilities, practices, procedures, processes and resources for environmental management. The ISO14001 EMS standard has been developed by the International Organisation for Standardisation.

Environmental Policy – A statement of intent and principles in relation to overall environmental performance, providing a framework for the setting of objectives and targets.

Habitat - A habitat is an ecological or environmental area that is inhabited by a particular species of animal, plant, or other type of organism. It is the natural environment in which an organism lives, or the physical environment that surrounds a species population.

Hazardous substance - is a substance governed by the Hazardous Substances Act, 1973 (Act No. 15 of 1973) as well as the Hazardous Chemical and Substances Regulations, 1995.



Impact - A description of the potential effect or consequence of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time, space, magnitude and intensity.

Indigenous species - Flora and Fauna species that are naturally found in an area.

Infrastructure - The network of facilities and services that are needed for economic activities, e.g. roads, electricity, water, sewerage, etc.

Integrated Environmental Management- This is a philosophy used in the assessment of and management of the environment, during all actions, plans, activities, etc. that could affect the environment. Its aim is to ensure sustainability.

Method statement - means a written submission by the Contractor to the Project Manager in response to this EMPr or a request by the Project Manager and ECO. The method statement must set out the equipment, materials, labour and method(s) the Contractor proposes using to carry out an activity identified by the Project Manager when requesting the Method Statement. This must be done in such detail that the Project Manager and ECO is able to assess whether the Contractor's proposal is in accordance with this specification and/or will produce results in accordance with this specification.

The method statement must cover as a minimum, applicable details regarding:

- (i) Construction procedures;
- (ii) Plant, materials and equipment to be used;
- (iii) Transporting the equipment to and from site;
- (iv) (iv) How the plant/ material/ equipment will be moved while on site;
- (v) How and where the plant/ material/ equipment will be stored;
- (vi) The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur;
- (vii) Timing and location of activities;
- (viii) Compliance/ non-compliance; and
- (ix) Any other information deemed necessary by the Project Manager.

Mitigation - Measures designed to avoid, reduce or remedy adverse impacts. Actions that limit, stop or reverse the magnitude and/or rate of long-term effect on the environment.

Natural environment - Encompasses all living and non-living things occurring naturally on Earth or some region thereof. It is an environment that encompasses the interaction of all living species. Climate, weather, and natural resources that affect human survival and economic activity.

Policy - A set of aims, guidelines and procedures to help you make decisions and manage an organisation or structure. Policies are based on people or an organisation's values and goals.

Process - Development usually happens through a process - a number of planned steps or stages.

Resources - Parts of our natural environment that we use and protect, e.g. land, forests, water, wildlife, and minerals.

Slope- means the inclination of a surface expressed as one unit of rise or fall for so many horizontal units.

Solid waste- means all solid waste, including construction debris, hazardous waste, excess cement/ concrete, wrapping materials, timber, cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Spoil- means excavated material which is unsuitable for use as material in the construction works or is material which is surplus to the requirements of the construction works.



Topsoil- means a varying depth (up to 300 mm) of the soil profile irrespective of the fertility, appearance, structure, agricultural potential, fertility and composition of the soil.

Works- means the works to be executed in terms of the Contract.



1 INTRODUCTION

D3 Energy South Africa (Pty) Ltd (previously Motuoane Energy (Pty) Ltd¹ hereafter referred to as D3 Energy or the Applicant holds an Exploration Right (ER315) for hydrocarbons, granted in terms of Section 80 of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended) in September 2017. The then Department of Mineral Resources and Energy (DMRE), now the Department of Mineral and Petroleum Resources (DMPR) issued an Environmental Authorisation (EA – reference number: 12/3/315) to the Applicant in terms of the National Environmental Management Act (Act 107 of 1998 – NEMA).

The originally approved exploration area is located over an area of approximately 149 377 hectares (ha), covering various farms near the city of Welkom, within the Free State Province, extending north from approximately Theunissen, northeast towards Kroonstad, and east of Virginia and Hennenman. D3 Energy were subsequently required to relinquish part of their ER land position during their first and second renewals which reduced the ER footprint to approximately 95 483 ha, a decrease of approximately 54 000 ha less than the originally approved area. In accordance with the National Environmental Management Act (Act 107 of 1998 – NEMA) an application for amendment of the EA through a Part 2 EA Amendment process was submitted to Competent Authority in 2024 to undertake an additional ten new exploration boreholes, approximately 30 km of new onshore seismic transects, and amend the approved Environmental Management Programme (EMPr). The amended EA was granted in terms of Regulation 33 of the NEMA EIA Regulations on the 31st of October 2024. A subsequent EA Amendment was submitted to the Administrative Authority in June 2026 to amend the Holder's details from Motuoane Energy (Pty) Ltd to D3 Energy South Africa (Pty) Ltd. The EA Amendment was granted on the 24th of July 2026.

The Applicant has applied for a Production Right (PR) over a portion of their existing authorised Exploration Right (ER) 315 area. The proposed extraction and production will target helium and methane gas, and will consist of up to 43 production wells plus 5 contingent wells, gas gathering pipelines, a helium recovery and gas processing plant (CNG and/or LNG) and associated infrastructure. In addition, ongoing development activities will include drilling of up to 48 development wells, and approximately 120 km (overall) of seismic surveys. See **Figure 1** to **Figure 4** for the locality map including the proposed activities and renewable energy developments as well as existing mining rights within PR16. The proposed production right application area covers a total of ~14 440 hectares. The proposed project will involve the following activities:

- Pre-drilling seismic and/or audio magnetotelluric surveys to optimize well locations for maximum deliverability;
- Drilling and completion of wells;
- Maintenance workovers of wells;
- Construction of gas gathering pipeline systems;
- Installation of gas compression and processing facilities;
- Construction of a helium recovery facility (gas or liquid helium) and gas (methane) processing plant (CNG and/or LNG); and
- Construction of associated infrastructure including roads, communications facilities and temporary accommodation facilities, if necessary.

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) requires that an environmental management programme (EMPr) be submitted where an environmental impact assessment (EIA)

¹ It must be noted that that D3 Energy South Africa has recently changed its name from Motuoane Energy (Pty) Ltd. The EA Application / Project have been **changed from Motuoane Production Right 16 EA Application**, Within Various Farms in Matjhabeng and Masilonyana Local Municipalities, Lejweleputswa District Municipalities, Free State Province, South Africa **to D3 Energy Production Right 16 EA Application**, Within Various Farms in Matjhabeng and Masilonyana Local Municipalities, Lejweleputswa District Municipalities, Free State Province, South Africa and will be reflected accordingly in the final submission of the EIA Report and EA Application Form.



has been identified as the environmental instrument to be utilised as the basis for a decision on an application for environmental authorisation (EA). The content of an EMPr must either contain the information set out in Appendix 4 of the Environmental Impact Assessment Regulations, 2014, as amended (EIA Regulations) or must be a generic EMPr relevant to an application as identified and gazetted by the Minister in a government notice. Once the Minister has identified, through a government notice that a generic EMPr is relevant to an application for EA, that generic EMPr must be applied by all parties involved in the EA process, including but not limited to the applicant and the Competent Authority (CA).

The site sensitivity mapping approach allows for the identification of lower risk areas for positioning the project infrastructure whilst protecting identified sensitive environmental areas/ features through mitigation measures where possible would be fully excluded from any project related development regardless of the level of mitigation put forward. Furthermore, environmental sensitivity is used to aid in decision-making during consultation processes, forming a strategic part of environmental assessment processes. This sensitivity mapping approach allows for the proposed activities to be undertaken whilst protecting identified sensitive environmental areas / features. Furthermore, environmental sensitivity is used to aid in decision-making during consultation processes, forming a strategic part of Environmental Assessment processes. **Figure 5** presents the combined sensitivity map for the project. Identified sensitivities indicated in **Figure 5** and **Figure 6** include the following:

- High Heritage Sensitivity;
- 1:100-year floodline;
- Sensitive air quality receptors;
- Species of conservation concern;
- Natural habitats with high Site Ecological Importance; and
- Wetlands with high Present Ecological Status and Site Ecological Importance.

The compilation of this map has taken into consideration the individual ranking of sensitivity by all the identified specialist disciplines (e.g. Air Quality, Geohydrology, Terrestrial and Aquatic Ecology, Heritage, Social, etc.). Work within the various sensitivity rankings must be managed according to the EMPr as well as the recommendations in the individual specialist reports.

Figure 5 contains desktop sensitivity information for areas outside the assessed footprint but within the PR. These areas were generated based on latest available datasets to inform the EMPr approach of the procedure to be implemented based on environmental sensitivity of the area should the final activities fall within the PR but outside the areas assessed in detail as part of the EIA:

Should the gas plant, additional seismic surveys and/or drilling wells fall outside of the EA assessed footprint areas, but within PR16, then depending on the final location of the seismic survey / drill site with respect to the locations sensitivity as defined by the sensitivity maps, and in consultation with the ECO and relevant specialists, the following must be undertaken prior to surveying / drilling:

- In low sensitive areas, an ECO walkdown (at minimum) must be undertaken by an independent ECO to assess potential impacts and/or provide site-specific mitigation measures as well as identify any additional specialist input requirements prior the commencement of activities. The conditions of the EMPr (as a minimum) must be complied with;
- In medium sensitive areas, the respective specialists must be brought to site to assess the final seismic transect and drill site and surroundings (100m corridor for seismic transect, 100m corridor for gathering pipelines, 1km radius for drill site and 1km radius for gas plant) and develop site-specific mitigation measures. Furthermore, the conditions of the EMPr must be complied with; and
- In high sensitive areas, the respective specialists must be brought to site to assess the seismic transect and final drill sites and surroundings (100m corridor for seismic transect, 100m corridor for gathering pipelines, 1km radius for drill site and 1km radius for gas plant and develop site specific mitigation



measures. These measures (site specific EMPr conditions) must be submitted to the PASA for approval prior to commencement with the activities.

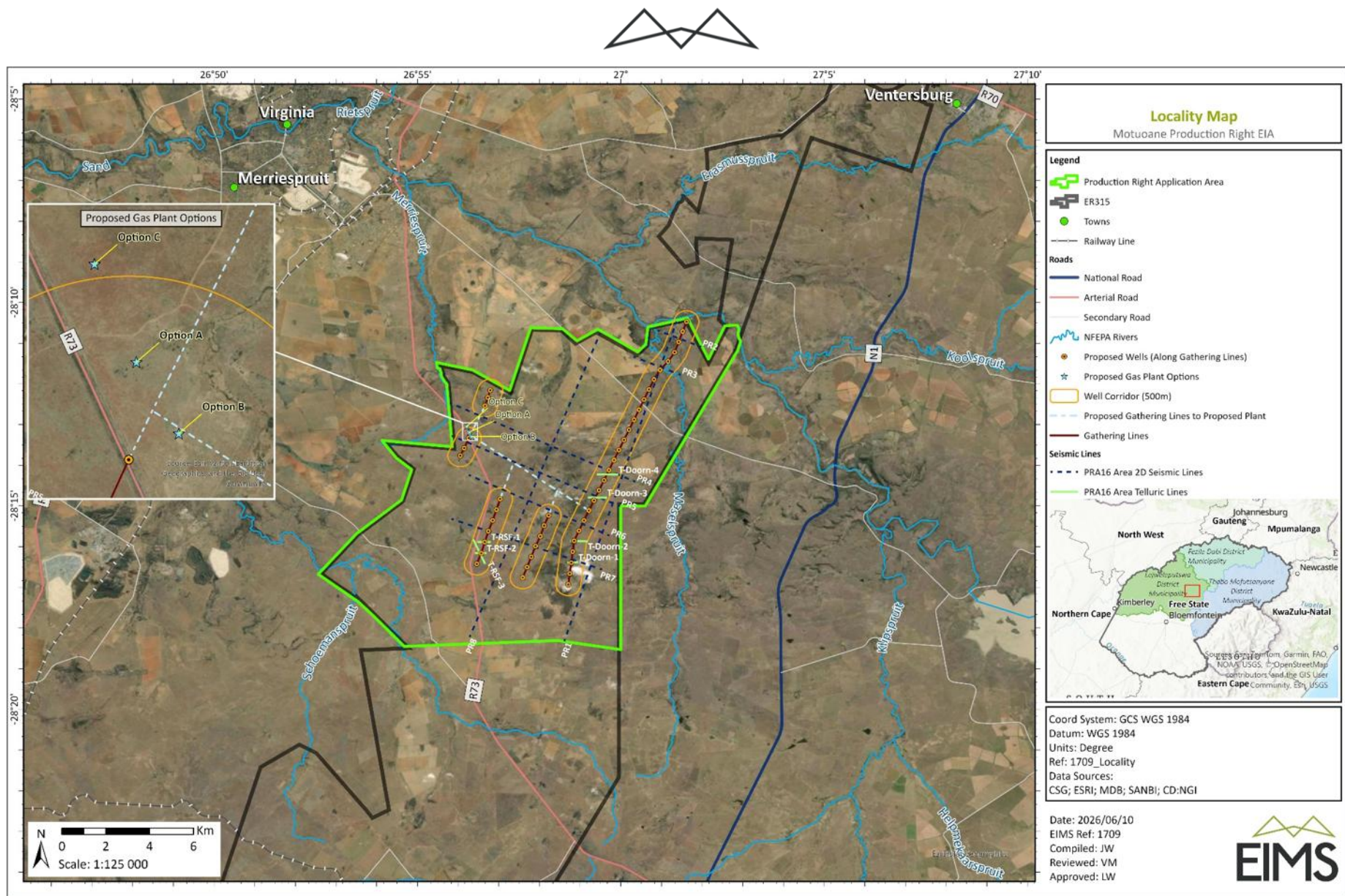


Figure 1: Aerial imagery proposed layout locality map indicating the location of the proposed D3 Energy PR16

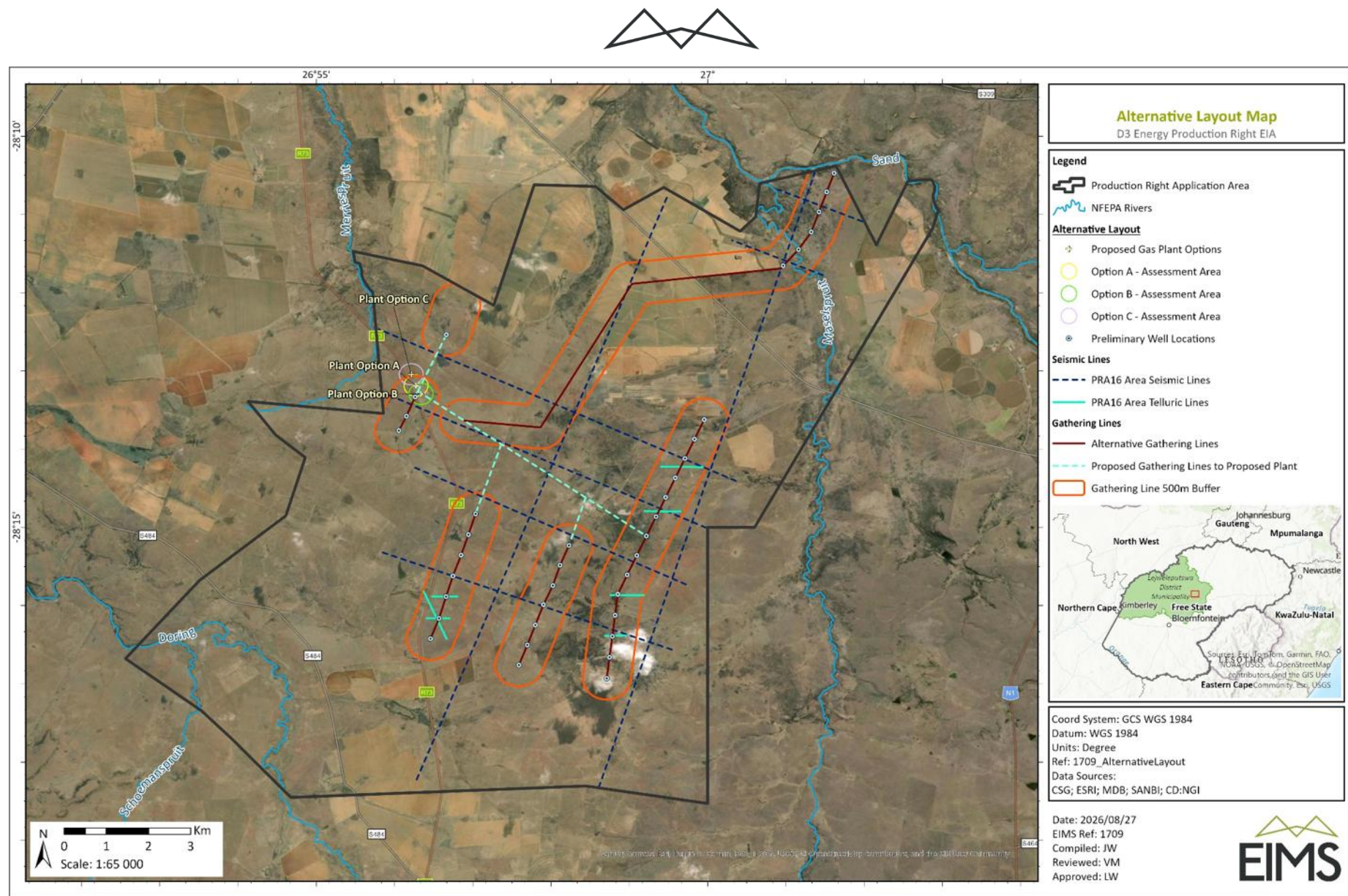


Figure 2: Aerial imagery alternative layout locality map indicating the location of the proposed D3 Energy PR16.

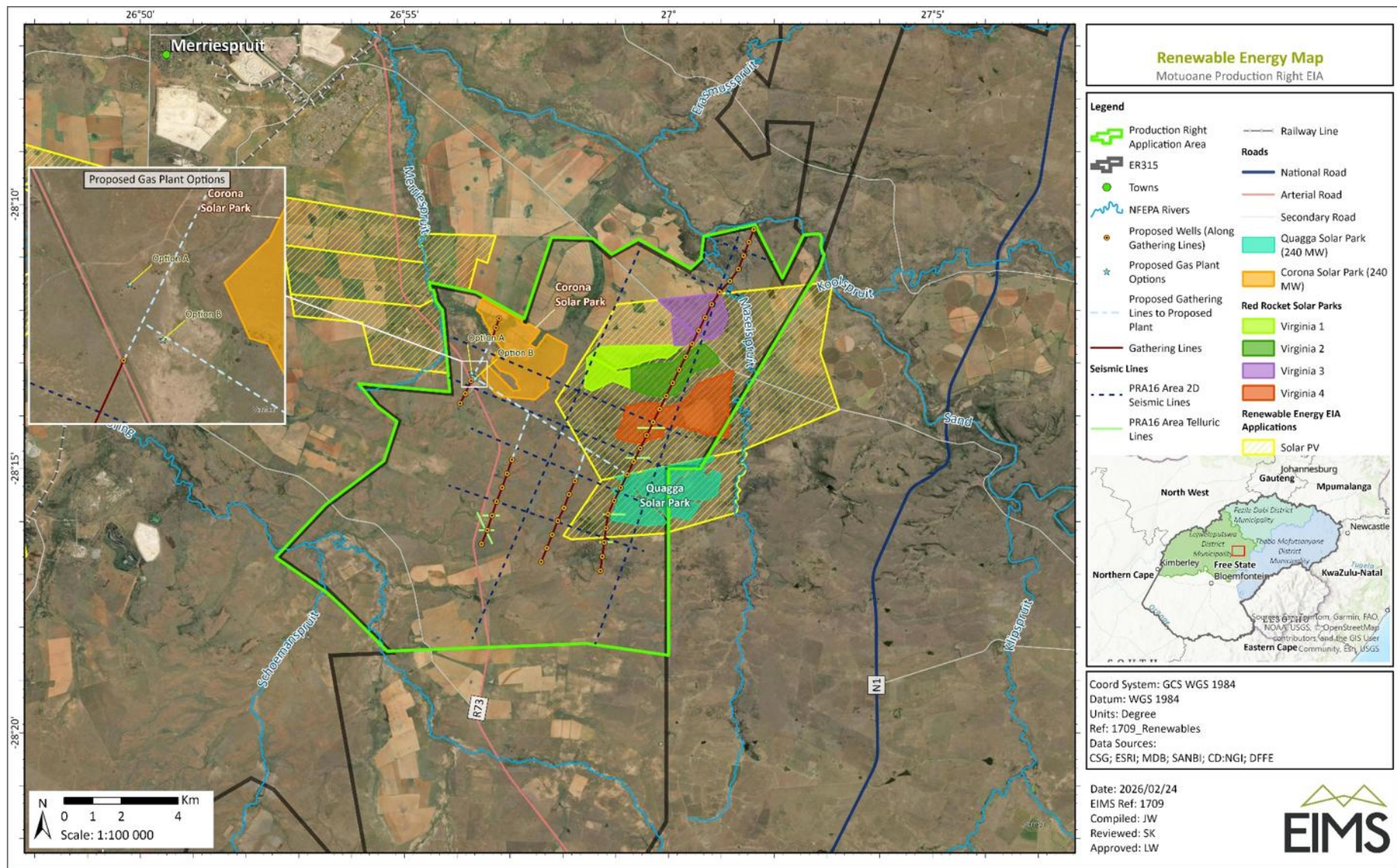


Figure 3: Locality map indicating the renewable energy developments within PR16.

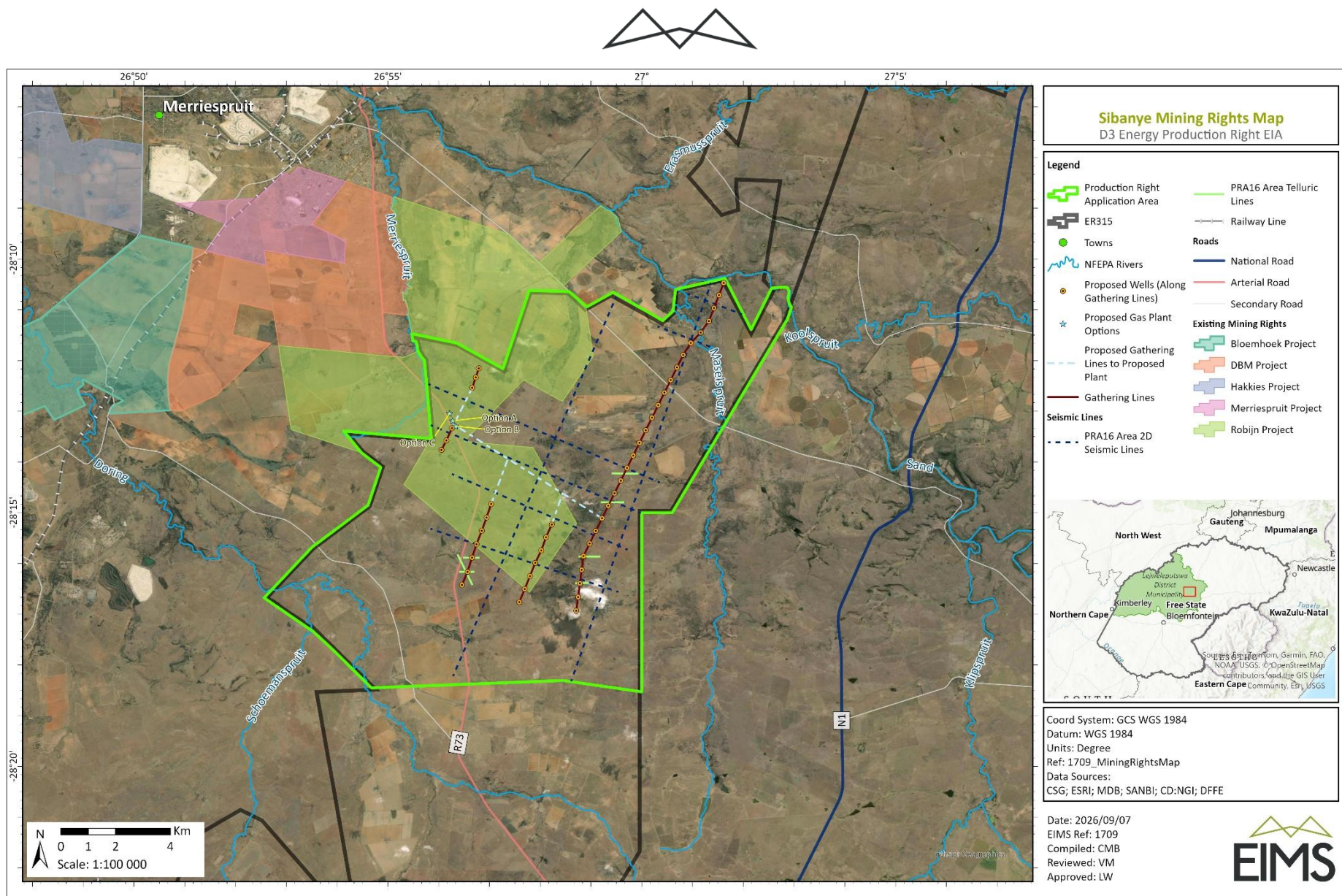


Figure 4: Existing mining rights within the proposed D3 Energy PR footprint

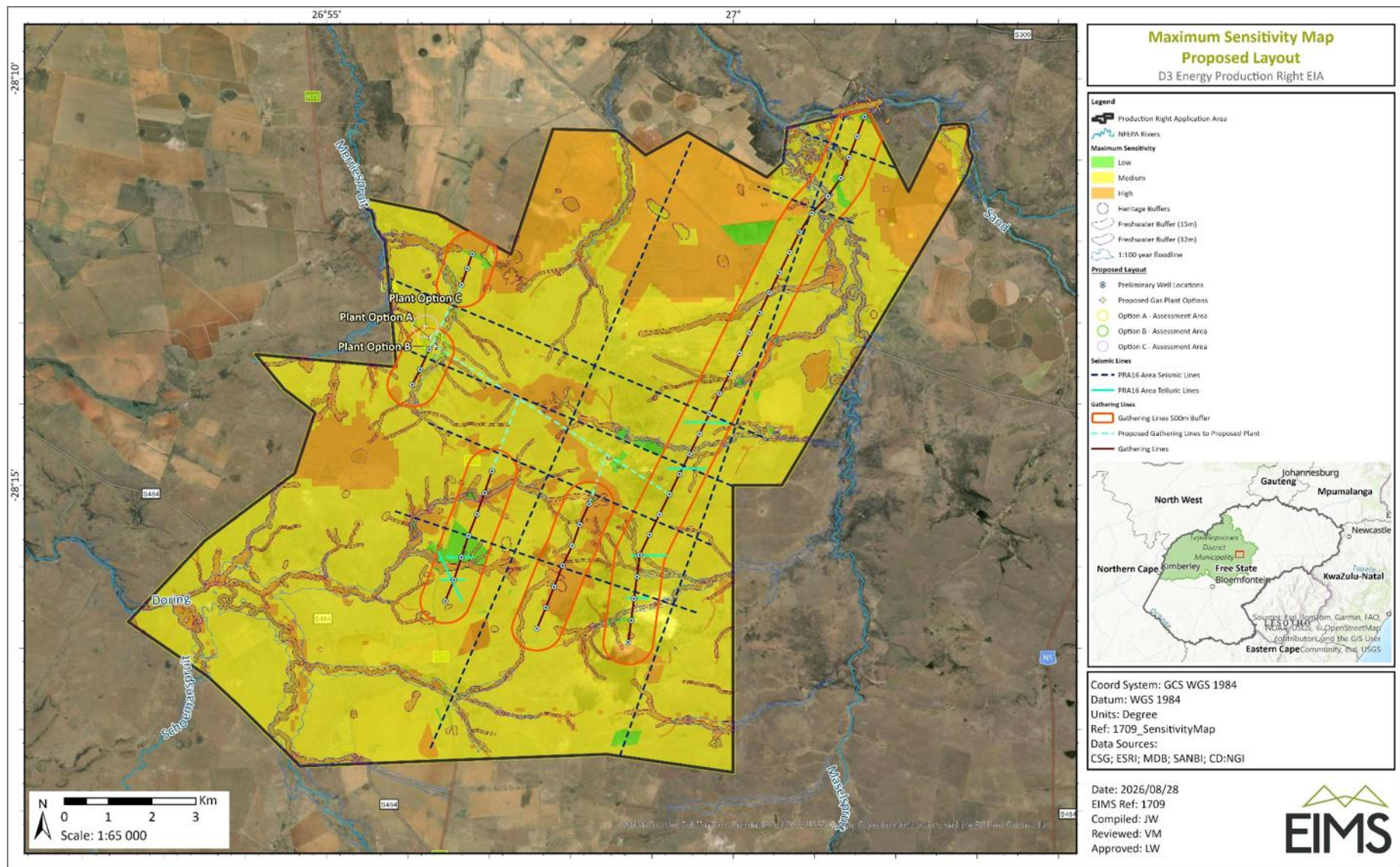


Figure 5: Site Maximum Sensitivity Map for PR16 to be used to identify EMPr process / procedure for activities outside of the assessed footprint.

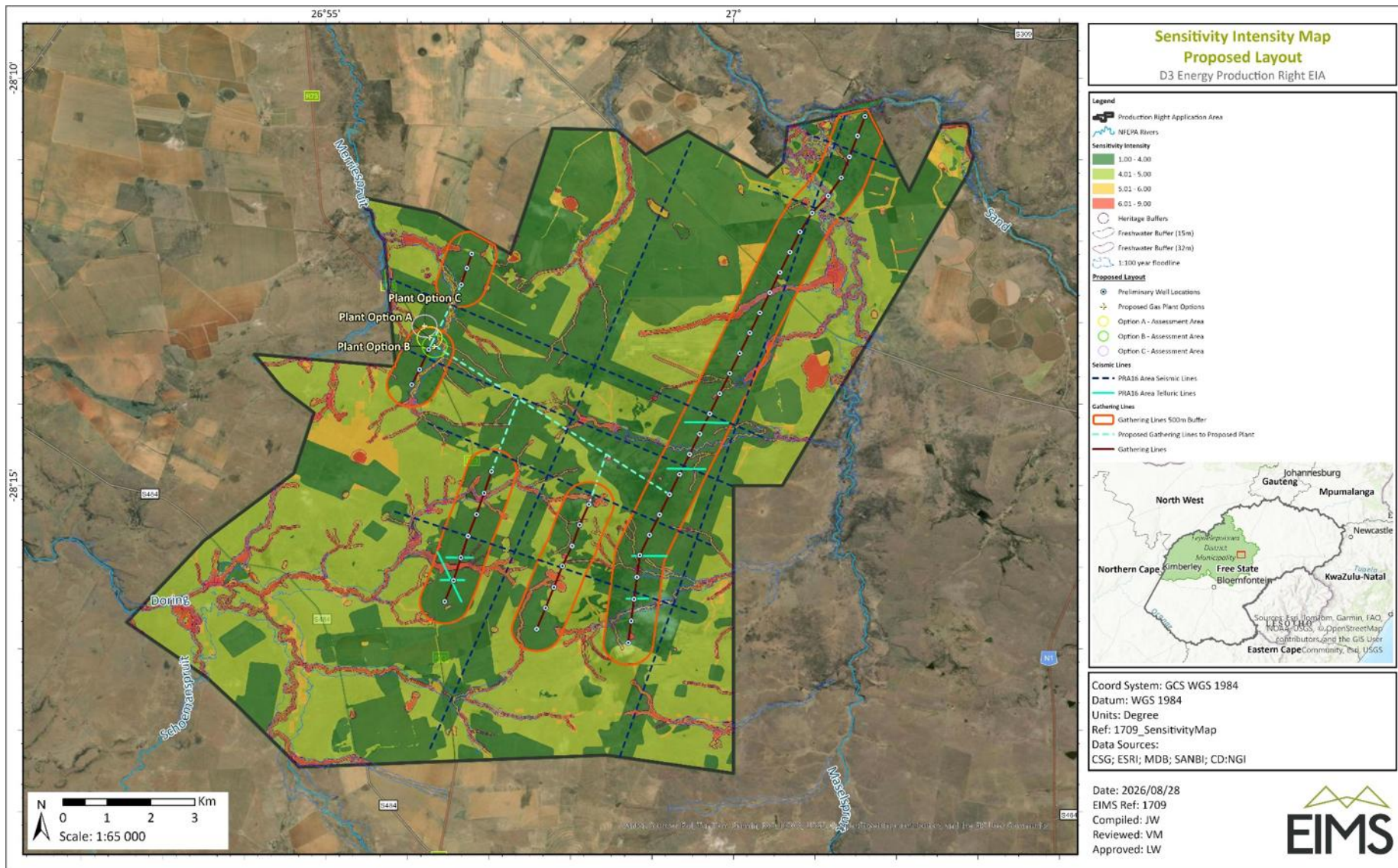


Figure 6: Site Sensitivity Map for the PR16.



2 PURPOSE OF THIS REPORT

An EMPr is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction, operation and decommissioning of a project are prevented, and that the positive benefits of the projects are enhanced. This EMPr has been compiled in accordance with the Environmental Impact Assessment Regulations (GN R982 of 2014 as amended) for the requirements of an EMPr, to establish the mitigation and management measures that need to be implemented to avoid, reduce and minimise potential environmental impacts arising out of any of the phases applicable to the proposed activities. As previously indicated, an EMPr is a working document that should be updated on a regular basis, as and when necessary. The EMPr thus supports an on-going proactive mitigation approach and duty of care to the environment. The EMPr shall allow for risk minimization and will ensure legal compliance. This EMPr will also allow the user to make minor amendments to ensure continual revision and improvement of risk mitigation through the continual re-assessment of risks associated with the proposed exploration and production activities. Any amendments need to align with the required regulatory approval processes.

This document represents the specifics and stipulated level of compliance required for the proposed D3 Energy PR activities in the Matjhabeng and Masilonyana Local Municipalities within the Lejweleputswa District Municipality, in the Free State Province. The EMPr contains the following information:

- A description of the work programme and proposed activities;
- An assessment of the potential impacts of the proposed activities; and
- An Environmental Management Plan to manage and/or mitigate potential negative impacts.

The EMPr aims to present management measures that will eliminate, offset or reduce adverse environmental impacts, as well as to provide the framework for environmental monitoring. The primary purpose of the EMPr is to ensure that negative environmental impacts of the proposed project are effectively managed within acceptable limits and that the positive impacts are enhanced. The project locality and sensitivity maps are indicated in **Figure 1** to **Figure 6**.



3 REPORT STRUCTURE

This report has been compiled in accordance with the 2014 NEMA EIA Regulations. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in **Table 1** below.

Table 1: Report Structure.

Appendix 4 Reference	Description	Section in EMPr
Appendix 4(1)(1)(a):	Details of – i. The EAP who prepared the EMPr; and ii. The expertise of that EAP to prepare an EMPr, including a curriculum vitae.	Section 4 Appendix A
Appendix 4(1)(1)(b):	A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description.	Section 5
Appendix 4(1)(1)(c):	A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers.	Section 1
Appendix 4(1)(1)(d):	A description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including – i. Planning and design; ii. Pre-construction activities; iii. Construction activities; iv. Rehabilitation of the environment after construction and where applicable post closure; and v. Where relevant, operation activities.	Section 8 Section 10
Appendix 4(1)(1)(f):	A description of proposed impact management actions, identifying the manner in which the impact management contemplated in paragraphs (d) will be achieved, and must, where applicable, include actions to – i. Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; ii. Comply with any prescribed environmental management standards or practices; and iii. Comply with any applicable provisions of the act regarding closure, where applicable.	Section 8
Appendix 4(1)(1)(g):	The method of monitoring the implementation of the impact management actions contemplated in paragraph (f).	Section 12.1



Appendix 4 Reference	Description	Section in EMPr
		Table 9 Table 10
Appendix 4(1)(1)(h):	The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f).	Section 12.1 Table 13
Appendix 4(1)(1)(i):	An indication of the persons who will be responsible for the implementation of the impact management actions.	Section 12.1 Table 14
Appendix 4(1)(1)(j):	The time periods within which the impact management actions contemplated in paragraph (f) must be implemented.	Section 12.5
Appendix 4(1)(1)(k):	The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f).	Section 12.11 Section 12.12
Appendix 4(1)(1)(l):	A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations.	Section 12.11 Section 12.12
Appendix 4(1)(1)(m):	An environmental awareness plan describing the manner in which – i. The Applicant intends to inform his or her Employees of any environmental risk which may result from their work; and ii. Risks must be dealt with in order to avoid pollution or the degradation of the environment.	Section 12.14 Section 12.15 Section 12.16
Appendix 4(1)(1)(n):	Any specific information that may be required by the competent authority.	Section 16



4 REQUIREMENTS AND DETAILS OF THE EAP

In terms of Regulation 13 of the EIA Regulations (GN R. 982) as amended, an independent Environmental Assessment Practitioner (EAP), must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

4.1 DETAILS OF THE EAP

EIMS was appointed by D3 Energy to assist in preparing and submitting the application for Environmental Authorisation (EA) and undertaking the required public participation process in support of the proposed activities for the D3 Energy PR16 project. EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS is an independent specialised environmental consulting firm offering the full spectrum of environmental management services across all sectors within the African continent. EIMS has successfully completed many hundreds of assignments over the years with an excess of 30 years' experience in conducting EIA's for both the government and private sector. Please refer to the EIMS website (www.eims.co.za) for examples of EIA documentation currently available. In terms of Regulation 13 of the NEMA EIA Regulations (GNR 982) 2014 as amended, an independent EAP, must be appointed by the applicant to manage the application for an environmental authorisation. EIMS and the compiler of this report are compliant with the definition of an EAP as defined in Regulations 1 and 13 of the NEMA EIA Regulations, as well as Section 1 of the NEMA.

The contact details of the EIMS consultant (EAP) who compiled this Report are presented in **Table 2** and the detailed CV is provided in **Appendix A**.

Table 2: Details of the Environmental Assessment Practitioner.

Aspect	Details
EAP:	Mr. Vukosi Mabunda
Tel No:	+27 11 789 7170
Fax No:	+27 86 571 9047
E-mail:	vukosi@eims.co.za
Qualifications	• MSc Geography (University of Johannesburg, 2021). • BSc Honours in Geography (University of Johannesburg, 2017). • BSc Life & Environmental Sciences (University of Johannesburg, 2016). • Environmental Law – Short Course (North-West University, 2025). • ISO14001:2015 – Short Course (North-West University, 2025).



Aspect	Details
	Environmental Management Systems – Lead Auditor Short Course, North-West University, 2025
Professional Registrations:	- Registered Environmental Assessment Practitioner with Environmental Assessment Practitioner Association of South Africa – EAPASA (Reg. No: 2019/867). - Professional Natural Scientist with the South African Council for Natural Scientific Professions – SACNASP (Reg. No: 134178). - Registered Provisional Auditor (SAATCA: #LC5544) ISO 37301:2021 Legal Compliance Management Systems. - Registered Provisional Auditor (SAATCA: #LC5544) ISO 14001:2015 Environmental Management Systems

4.2 EXPERTISE OF THE EAP

In terms of Regulation 13 of the EIA Regulations (GN R. 982) as amended, an independent EAP, must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

This EMPr was prepared by Vukosi Mabunda, a Registered EAP employed by EIMS. His CV is included in **Appendix A**. Vukosi Mabunda is currently a Senior Environmental Assessment Practitioner (EAP) & Geographic Information Systems (GIS) Consultant with over eight (8) years' working experience. Vukosi is a Registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA). He is one of the few dual registered professionals with the South African Council for Natural Scientific Professions (SACNASP) as a Professional Environmental Scientist and Geospatial Scientist. Vukosi is also one of the few dual registered auditors, currently registered with the South African Auditor & Training Certification Authority (SAATCA) as a Registered Provisional Auditor for ISO 37301:2021 Legal Compliance Management Systems (one of four registered auditors) and Registered Provisional Auditor for ISO 14001:2015 Environmental Management Systems (one of forty-four registered auditors). Vukosi has dual professional background in Geographic and Environmental Sciences having academic qualifications which focused on these disciplines as well as relevant work experience. Vukosi's highest qualification is a Master of Science Degree in Geography obtained from the University of Johannesburg in 2021. Vukosi has recently completed short courses on Environmental Law, ISO 14001:2015 Environmental Management Systems and ISO 14001:2015 Environmental Management Systems Lead Auditor from the North-West University in March 2025 and October 2025 respectively.

Vukosi has experience in various environmental assessment projects ranging from Environmental Screening, Basic Assessments, Section 102 Amendments and Scoping & Environmental Impact Assessments processes. Vukosi has also undertaken Water Use Authorisations applications through both the General Authorisation and Water Use Authorisation processes. Vukosi is also an Environmental Auditor and Environmental Control Officer who has experience in various environmental and legal compliance audits assessing compliance against the requirements of Environmental Authorisations, Environmental Management Programmes, Operational Environmental Management Plan, Waste Management License, Atmospheric Emission Licenses, Water Use Authorisations, General Authorisations as well as Legal & Environmental Performance Audits. Vukosi's career



highlights include the crucial role in the City of Johannesburg's Revised Bioregional Plan, where he was the lead GIS personnel as well as successfully completing the first Environmental Registration under the Standard for the Development and Expansion of Power Lines and Substations within Identified Geographical Areas Revision 2 in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended in Mpumalanga Province in 2024 in which he also assisted the Provincial Department Officials to understand the Standard, their roles and process of reviewing and making decisions on such applications.

5 DESCRIPTION AND SCOPE OF THE PROPOSED PROJECT

5.1 PRODUCTION RIGHT LOCALITY

Table 3 provides a description of the property details of the proposed D3 Energy PR site as well as the distance to the nearest towns. The proposed project will be located within the Matjhabeng Local Municipality and Masilonyana Local Municipalities. See **Figure 1** to **Figure 3** for the locality map including the proposed activities and renewable energy developments with the PR. Details of the properties which make up D3 Energy PR16 application area indicated in **Table 3** below.

Table 3: Locality details.

Property Area	The proposed project area is located southeast of the town of Welkom in the Free State Province of South Africa.				
Property Name, 21-digit Surveyor General Code	Farm Name	Farm Number	Portion	LPI Code	Parcel
	Azeka Farm 1019	1019	0	F04200000000101900000	RE/1019
	Azeka Farm 1019	1019	1	F04200000000101900001	1/1019
	Beginzel 75	75	0	F03500000000007500000	RE/75
	Blomskraal 216	216	0	F03500000000021600000	RE/216
	Delaporte Farm 887	887	0	F04200000000088700000	RE/887
	Detente Farm 744	744	0	F03500000000074400000	RE/744
	Detente Farm 744	744	1	F03500000000074400001	1/744
	Detente Farm 744	744	2	F03500000000074400002	2/744
	Detente Farm 744	744	2	F03500000000074400002	2/744
	Detente Farm 744	744	3	F03500000000074400003	3/744
	Doornnek Farm 905	905	0	F04200000000090500000	RE/905
	Doornnek Farm 905	905	1	F04200000000090500001	1/905
	Doornnek Farm 905	905	2	F04200000000090500002	2/905
	Doornnek Farm 905	905	3	F04200000000090500003	3/905
	Duikerbos 246	246	0	F03500000000024600000	RE/246
	Eureka 2101	2101	0	F04200000000210100000	RE/2101
	Gooi Die Hoed Farm 5	5	1	F0420000000000500001	1/5
	Grootspruit No. 943	943	0	F04200000000094300000	RE/943
	Hazor Farm 381	381	0	F04200000000038100000	RE/381
	Hazor Farm 381	381	1	F04200000000038100001	1/381
	Junctiondrift 217	217	0	F03500000000021700000	RE/217
	Junctiondrift 217	217	1	F03500000000021700001	1/217
	Junctiondrift 217	217	2	F03500000000021700002	2/217
	Junctiondrift 217	217	3	F03500000000021700003	3/217
	Kriegers Kraal 708	708	0	F03500000000070800000	RE/708
	Kriegers Kraal 708	708	1	F03500000000070800001	1/708
	Le Roux 717	717	1	F03500000000071700001	1/717



	Le Roux 766	766	0	F03500000000076600000	RE/766
	Le Roux 766	766	1	F03500000000076600001	1/766
	Leeuwkuil 428	428	0	F03500000000042800000	RE/428
	Lelievlei 407	407	0	F03500000000040700000	RE/407
	Mazelspruit Farm 1	1	0	F0420000000000100000	RE/1
	Mazelspruit Farm 1	1	1	F0420000000000100001	1/1
	Mazelspruit Farm 1	1	2	F0420000000000100002	2/1
	Mazelspruit Farm 1	1	4	F0420000000000100004	4/1
	Paardekuil Farm 228	228	0	F03300000000022800000	RE/228
	Paardekuil Farm 228	228	0	F04200000000022800000	RE/228
	Palmiet Fontein 229	229	0	F04200000000022900000	RE/229
	Palmiet Fontein 229	229	0	F04200000000022900000	RE/229
	Palmiet Fontein 229	229	1	F04200000000022900001	1/229
	Palmiet Fontein 229	229	2	F04200000000022900002	2/229
	Palmiet Fontein 229	229	3	F04200000000022900003	3/229
	Palmiet Fontein 229	229	3	F04200000000022900003	3/229
	Palmiet Fontein 229	229	4	F04200000000022900004	4/229
	Palmiet Fontein 229	229	5	F04200000000022900005	5/229
	Palmiet Fontein 229	229	6	F04200000000022900006	6/229
	Palmiet Fontein 229	229	7	F04200000000022900007	7/229
	Palmiet Fontein 229	229	8	F04200000000022900008	8/229
	Palmiet Fontein 229	229	9	F04200000000022900009	9/229
	Pieter's Gift Farm 1890	1890	0	F04200000000189000000	RE/1890
	Pieter's Gift Farm 1890	1890	1	F04200000000189000001	1/1890
	Pieter's Gift Farm 1890	1890	2	F04200000000189000002	2/1890
	Pieter's Gift Farm 1890	1890	3	F04200000000189000003	3/1890
	Quaggafontein Farm 3	3	0	F0420000000000300000	RE/3
	Randjesfontein Farm 297	297	0	F03500000000029700000	RE/297
	Rietvallei Farm 4	4	9	F0420000000000400009	9/4
	Rooiheuvel Farm 57	57	0	F03500000000005700000	RE/57
	Schoemanskop Farm 654	654	0	F04200000000065400000	RE/654
	Siberiasfontein 605	605	0	F04200000000060500000	RE/605
	Siberiasfontein 605	605	1	F04200000000060500001	1/605
	Uithoek Farm 847	847	5	F04200000000084700005	5/847
	Venters Paalmyn Farm 298	298	0	F03500000000029800000	RE/298
	Vruchtenfontein Farm 942	942	0	F04200000000094200000	RE/942
	Zanddraai Farm 58	58	0	F03500000000005800000	RE/58
	Zanddraai Farm 58	58	1	F03500000000005800001	1/58
	Zoutfontein 841	841	0	F04200000000084100000	RE/841
	Zoutfontein 841	841	1	F04200000000084100001	1/841
	Zoutfontein 841	841	2	F04200000000084100002	2/841
Application Area (Ha)	The D3 Energy PR is approximately 14 440 ha.				



Magisterial District	The project area falls within the Matjhabeng and Masilonyana Local Municipalities, Lejweleputswa District Municipalities.
Distance and direction from nearest towns	The site boundary is ~15km southeast of the town of Virginia, ~28km southeast of the town of Welkom, ~13km southwest of the town of Ventersburg and ~21km northeast of the town of Theunissen. The geographic coordinates at the approximate centre of the application area are 28°14'38.37"S and 26°57'54.97"E
Surrounding land uses	Neighbouring land-use in the surrounding of the proposed project comprises predominantly of agriculture activities with mining activities to the southwest.

The proposed activities will not take place across the entire PR. The total area to be disturbed by the invasive activities will be minimal and will be guided by the relatively non-invasive exploration techniques to be initially undertaken. It was necessary to apply for a large area in order to secure the right to assess the existence of petroleum resources and to gain access to existing data.

5.2 DESCRIPTION OF LISTED ACTIVITIES TRIGGERED

In terms of Section 24(2) of NEMA, the Minister and/or any Member of the Executive Council (MEC) in concurrence with the Minister may identify activities which require authorisation as these activities may negatively affect the environment. The NEMA EIA Regulations were promulgated in 2014 and amended in 2021 in terms of Section 24(5) and Section 44 of the National Environmental Management Act (NEMA), Act 107 of 1998 and consist of the following:

- *Regulation 982* provide details on the processes and procedures to be followed when undertaking an Environmental Authorisation process (also referred to as the EIA Regulations);
- *Listing Notice 1* (Regulation 983, as amended) defines activities which will trigger the need for a Basic Assessment process;
- *Listing Notice 2* (Regulation 984, as amended) defines activities which trigger an Environmental Impact Assessment (EIA) process. If activities from both R 983 and R 984 are triggered, then an EIA process will be required; and
- *Listing Notice 3* (Regulations 985, as amended) defines certain additional listed activities for which a Basic Assessment process would be required within identified geographical areas.

The above regulations were assessed to determine whether the proposed project will trigger any of the above listed activities, and if so, which Environmental Authorisation Process would be required. The triggered listed activities presented in **Table 4** and the applicant will require an Environmental Authorisation (EA) in terms of GNR 984 Listing Notice 2 of the NEMA EIA Regulations 2014 as amended. A Scoping and EIA process is required in line with all the requirements of the NEMA EIA Regulations, 2014, as amended.



Table 4: Relevant NEMA listed activities relevant to the proposed development.

Activity No(s):	Activity	Applicability
Applicable Triggered NEMA EIA Listed Activities applied for		
NEMA GNR 983 Activity 21C	Any activity including the operation of that activity associated with an onshore seismic survey which requires an exploration right in terms of section 79 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice or in Listing Notice 3 of 2014 , required to exercise the exploration right, excluding (a) any desktop study, (b) any arial survey, and (c) a hydraulic fracturing activity which is included in activity 20A in Listing Notice 2 of 2014, in which case that activity applies	The proposed activities include the undertaking of onshore seismics with a combined length of ~120 km around known structures and possible drill locations.
NEMA GN984, Activity 20	Any activity including the operation of that activity which requires a production right in terms of section 83 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice, in Listing Notice 1 of 2014 or Listing Notice 3 of 2014 , required to exercise the production right.	The proposed activities include the establishment of up to 43 production wells (plus 5 contingent wells), which requires a production right in terms of section 83 of the MPRDA.
Other NEMA EIA Regulations, 2014 as amended applicable listed activities assessed		
NEMA GNR 983 Activity 12	The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;- excluding-	This project comprises linear activities such as pipelines and possible access roads which may impact on watercourses or within 32 m of a watercourse when in proximity to these areas.



Activity No(s):	Activity	Applicability
	(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared. This project comprises linear activities such as pipelines (with associated low point drains, pigging, booster and compressor stations) and access roads which will impact on watercourses or within 32 m of a watercourse when in proximity to these areas. NEMA GNR 983 Activity 16 The development and related operation of facilities for the desalination	
NEMA GNR 983 Activity 19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or	This project comprises linear activities such as pipelines and possible access roads which may require infilling or depositing of more than 10 m³ of material to or from a watercourse when in proximity to these areas.



Activity No(s):	Activity	Applicability
	(e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.	
NEMA GNR 983 Activity 24	The development of a road- (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road- (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.	Access roads may be required to service the various project infrastructure (~43 production wells, pipelines and processing plant) although the vast majority of these roads will not be wider than 2m and many will only be 2-spool tracks. This activity will be investigated further during the EIA process and if no access roads wider than 8m are identified, this activity will be removed during the EIA phase.
NEMA GNR 983 Activity 27	Clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan	The proposed activities will require the clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation for the processing plant (~1.5ha). Pipelines and access roads are linear activities and therefore excluded from this listed activity and the calculation of vegetation clearance.
NEMA GNR 983 Activity 28	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development:	The proposed development is on land previously used for agricultural activities (grazing and crop farming) and covers an area greater than 1 hectare (outside urban area).



Activity No(s):	Activity	Applicability
	(i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	
NEMA GNR 983 Activity 56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.	Existing roads may require lengthening by more than 1km however this is dependent on the landowner negotiations for use of existing roads. This activity will be investigated further during the EIA process and if no lengthening of existing roads is required, this activity will be removed during the EIA phase.
NEMA GNR 983 Activity 67	Phased activities for all activities- (i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices.	The proposed production project will be constructed in a phased manner which may on their own not trigger a listed activity but when combined, exceed the threshold for clearance of vegetation.
NEMA GNR 984 Activity 5	The development and related operation of facilities or infrastructure for the processing of a petroleum resource, including the beneficiation or refining of gas, oil or petroleum products with an installed capacity of 50 cubic metres or more per day, excluding activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies.	The helium recovery and gas processing plant will be constructed which serves the purpose of processing of gas of more than 50 m ³ /day.
NEMA GNR 984 Activity 7	The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods-	The proposed project will include the development and operation of gas pipelines exceeding 1 000



Activity No(s):	Activity	Applicability
	(i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day; (ii) in liquid form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 50 cubic metres per day; or (iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons per day.	metres in length, with a potential throughput capacity of more than 700 tons per day.
NEMA GNR 985 Activity 4	The development of a road wider than 4 metres with a reserve less than 13,5 metres. b. Free State i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding disturbed areas; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an international convention;	Access roads may be required to service the various project infrastructure (~43 production wells, pipelines and processing plant) which may occur within the identified CBA areas within the application area. In certain areas the width of the access roads may exceed 4m however the majority of these roads will not be wider than 2m and many may only be 2-spool tracks. This activity will be investigated further during the EIA process and if no access roads wider than 8m are identified, this activity will be removed during the EIA phase.
NEMA GNR 985 Activity 12	The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan (b). Free State: i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans; iii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; or	Sections of the proposed project footprint fall within CBA areas and watercourses where more than 300 m ² will be cleared of vegetation.



Activity No(s):	Activity	Applicability
	iv. Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland.	
NEMA GNR 985 Activity 14	The development of- (i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. Free State i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) World Heritage Sites; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ee) Sites or areas identified in terms of an international convention;	Sections of the project footprint fall within CBA areas and watercourses and infrastructure in these areas will exceed the 10 m² threshold.



Activity No(s):	Activity	Applicability
	(ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Core areas in biosphere reserves; or (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; or ii. Inside urban areas: (aa) Areas zoned for use as public open space; or (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority, zoned for a conservation purpose.	
NEMA GNR 985 Activity 18	The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. b. Free State i. Outside urban areas: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an international convention; (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve; or (hh) Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland; or	There are CBA areas overlapping with certain well and pipeline transects, and existing roads may require lengthening by more than 1 km however this is dependent on the outcome of landowner negotiations for use of existing roads. This activity will be investigated further during the EIA process and if no lengthening of existing roads is required, this activity will be removed during the EIA phase.



Activity No(s):	Activity	Applicability
	ii. Inside urban areas: (aa) Areas zoned for use as public open space; or (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose.	
NWA Section 21 Activities		
NWA Section 21 (c&i)	impeding or diverting the flow of water in a watercourse and/or altering the bed, banks, course or characteristics of a watercourse.	Gas plant, wells, pipelines and associated infrastructure (due to their linear nature) will be constructed within the regulated area of a watercourse.



5.3 PROJECT DESCRIPTION

This section provides a detailed description for the proposed D3 Energy PR16 project. Most of the key information presented in this chapter was obtained from the applicant. The aim of the project description is to describe the proposed activities planned to take place at the D3 Energy PR16. Furthermore, the project description is designed to facilitate the understanding of the proposed project related activities which are anticipated to lead to the potential impacts identified and assessed in the EIA Report, and for which management measures have been, or will be designed.

Onshore natural gas exploration is inherently progressive and iterative, comprising phased activities that are implemented in a structured and adaptive manner. Each phase generates data that informs the need for, and design of, subsequent phases, including the refinement of locations, methods, and scope of further exploration.

Initial activities establish a preliminary understanding of subsurface conditions and resource potential, while later phases are progressively defined based on the results of earlier investigations. As such, the full spatial extent and intensity of exploration activities are not fixed upfront but evolve over time in response to new information.

In this context, the EIA adopted an approach that assesses impacts associated with preliminary and reasonably foreseeable exploration activities within a defined envelope (as described herein), while remaining sufficiently flexible to accommodate changes as the exploration programme progresses. The purpose of the EIA was therefore to ensure that environmental impacts are appropriately identified, assessed, and managed on an ongoing basis, allowing environmental considerations to inform decision-making throughout the exploration lifecycle.

The Applicant has applied for a Production Right (PR) over a portion of their existing authorised Exploration Right (ER) 315 area (**Figure 1**). D3 Energy applied for a Production Right (PR 12/4/016) in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended) to the Administrative Authority (AA), the Petroleum Agency South Africa (PASA) in August 2025. The proposed extraction and production will target helium and methane gas, and will consist of up to 43 production wells, gas gathering pipelines, a helium recovery and gas processing plant (CNG and/or LNG) and associated infrastructure. In addition, ongoing development activities will include drilling of development wells, seismic and/or audio magnetotelluric surveys. The production right application area covers a total of ~14 440 hectares. The proposed project of the Production Right area will involve the following activities:

- Pre-drilling seismic and/or audio magnetotelluric surveys to optimize well locations for maximum deliverability and recovery;
- Maintenance workovers of wells;
- Drilling and completion of wells;
- Construction of gas gathering pipeline systems;
- Installation of gas compression and processing facilities;
- Construction of a helium recovery facility (gas or liquid helium) and gas (methane) processing plant (CNG and/or LNG); and
- Construction of associated infrastructure including roads, communications facilities and temporary accommodation facilities if necessary.

The D3 Energy PR proposed infrastructure layout and alternative layout footprint are presented in **Figure 2**. The locations of all proposed production wells and infrastructure have been chosen using desktop studies and available information from publicly available mapping services. All production well locations, gas gathering pipelines and processing plant infrastructure will be located in consultation with the landowners and any other stakeholders and be located to minimize damage to existing services, vegetation and land. Proposed infrastructure and production wells will be located close to existing fence lines and farm roads / tracks where practically possible and not be located within close proximity to housing and major structures. **Figure 1** and



Figure 2 depicts the proposed project locations for production wells, gas gathering pipelines and processing plant. It must be noted that although up to 43 production wells are proposed, additional wells have been plotted in the locality maps below to make allowance for areas where wells may intersect solar development projects in the PR. This will allow for the exclusion of those wells that intersect or may interfere with the solar developments in the area should it be required (Refer to Section 6.2 of the EIAr). The applicant is still in discussions with the solar companies in an attempt to pursue a coexistence arrangement.

The D3 Energy PR lies within the broader Free State Goldfields mining region, historically one of South Africa's most significant gold-producing provinces. Historic and current mining activities in the broader region include:

- Deep-level gold mining;
- Tailings storage facilities;
- Mine residue deposits; and
- Mining-related processing infrastructure.

As per the Geographic Information System (GIS) file provided by Sibanye Stillwater, the proposed D3 Energy PR overlaps with the FS 10005 MR Sibanye Stillwater Robijn Project (refer to **Figure 4**). According to Sibanye Stillwater website², in June 2017, a mining right consolidating four areas of the property (Bloemhoek, De Bron Merriespruit, Hakkies and Robijn) was approved for a 23-year period and executed. The mining right is contiguous to the north-east of the Beatrix mining right. The Robijn Project is an advanced exploration-stage gold project located in the Free State province of South Africa, forming part of Sibanye-Stillwater's broader Southern Free State (SOFs) project portfolio. However, based on available information at the time of compilation of this report, The Robijn Project does not have active shafts nor any underground tunnels because it is still an advanced exploration-stage venture. No actual shaft-sinking or underground mining infrastructure has been constructed yet. It must be noted that Sibanye Stillwater was engaged by the EAP and requested to provide information to be considered / or assessed as part of this EIAr for current and future mining activities within the proposed D3 Energy PR. The only information provided to the EAP is the MR footprint and project names as indicated on **Figure 4**, no information relating to activities and/or active mining areas within the D3 Energy PR was provided to the EAP.

The proposed production wells are located along known faults (i.e. Virginia and Ventersburg faultlines) and close to either existing blowers (gas emitting wells) or exploration wells drilled by D3 Energy. The initial development will focus on the wells located on the Virginia fault where there are 13 new well locations and 3 existing wells that will be utilised in the development. There are an additional 27 well locations located on the Ventersburg fault that will be drilled as required to maintain the required sales production. The production right area has an expected life of at least 30 years.

The proposed project consists of both non-invasive and invasive exploration and production activities. Non-invasive exploration activities include desktop studies, geological mapping, geophysical surveys and environmental baseline investigations, which are expected to result in negligible physical disturbance. Invasive exploration activities, such as drilling, trenching and bulk sampling, will require localized vegetation clearance and soil disturbance. During the production phase, non-invasive activities will primarily comprise monitoring, inspection and operational control functions, while invasive activities will include infrastructure development, extraction operations, processing facilities, access roads and associated support infrastructure. These activities have the potential to result in significant biophysical and socio-economic impacts and therefore require the implementation of appropriate mitigation, management and rehabilitation measures. The proposed activities are detailed in the sub-sections below.

² <https://www.sibanyestillwater.com/business/southern-africa/gold-operations/projects/>



5.3.1 SEISMIC AND AUDIO MAGNETOTELLURIC SURVEYS

Seismic and audio magnetotelluric (MT) surveys are geophysical methods that use different physical principles to characterise the subsurface and may be used individually or in combination. Seismic methods use acoustic waves to detect variations in acoustic impedance (related to density and wave velocity), while MT survey methods use natural electromagnetic fields to map variations in electrical resistivity. Various survey techniques may be employed along pre-determined seismic transects as depicted in **Figure 7** below.

Seismic surveying along the transects through a Vibroseis technique are undertaken by a small team (approximately 5-10 personnel) by deploying an array of energy sources and receivers, such as from a small-sized Seismic Vibrator and an array of sensors or receivers (geophones) on the identified area of interest (**Figure 7**). A single Seismic Vibrator consists of a vibrating baseplate that is in contact with the ground. The vibrating plate emits a low frequency signal (4-80 Hz) into the ground, called a sweep. The vibrator vehicle progresses along the pre-determined lines (transects) using GPS for navigation. Every ~10m it stops, lowers the vibrating plate to the ground, emits a low frequency signal for 8-20seconds, retracts the plate and moves forward ~10m to the next location along the transect and so on until all the transects have been traversed. Several small geophones are used to convert the ground movements or seismic waves from the Seismic Vibrator into voltage, which is recorded at a nearby recording station. The survey team then generates and analyses the 2-D subsurface geological network and identify areas of interest for well optimisation. The outcome of the seismic survey will be used to inform preferable drilling locations.

There are also potential alternatives to the Vibroseis known as the Propelled Energy Generators (PEGs), more commonly referred to as the Accelerated Weight Drop Seismic (AWD) as well as Magnetotellurics Survey (MT) which D3 Energy may consider over the Vibroseis. AWD are light weight, highly portable seismic energy sources designed for a multitude of applications within the fields of geology, geophysics, civil engineering, and more. AWD systems utilize simple and effective elastomer band technology to propel the hammer to a high velocity. The AWD is comprised of two easily manageable components for fast and efficient installation and de-installation in the field. The AWD's lightweight, streamlined design also affords its users economy in shipping. The AWD-40Kg is designed to easily mount on trucks, bakkie, trailers, and all-terrain vehicles (**Figure 7**). AWD is a variant of seismic source of the "weight drop" type. The hammer is equipped with an inclined platform, allowing it to be installed at an angle of 45 degrees, and a special stop, adding stability in an upright position, what allows to perform survey on shear waves. The source AWD-40PS is mounted on a compact lightweight frame equipped with reliable wheel blocks. The source can be used on a rugged terrain. The total weight of the source without battery pack is less than 120 kg. The energy of a single impact reaches 1000J. Approximately 120 km (overall) of seismic surveys are proposed.

Magnetotellurics (MT) is a passive geophysical technique that uses naturally occurring electromagnetic fields to image the subsurface electrical resistivity structure by measuring the Earth's natural time-varying electric and magnetic fields. The MT method utilizes naturally occurring, broadband electromagnetic waves over the Earth's surface to image subsurface resistivity structure. The electromagnetic waves originate from regional and worldwide thunderstorm activity and from the interaction of solar wind with the Earth's magnetosphere. Due to the remote nature of the sources and the high refractive index of the Earth relative to air, the electromagnetic waves are assumed to be planar and to propagate vertically into the Earth. However, the scattering of electromagnetic waves by subsurface structure can be arbitrary in polarization, necessitating a tensor description (Wannamaker *et al.*, 2005). Accordingly, two components of electric field (E_x and E_y) and three components of magnetic field (H_x , H_y and H_z) are measured. The frequencies of the waves (signals) range from about 1 Hz to a fraction of milli Hertz, which allows to image a wide depth range. A detailed account of the MT method is given in Vozoff (1991). The audio magnetotelluric surveys will be utilised to optimize well locations for maximum deliverability.

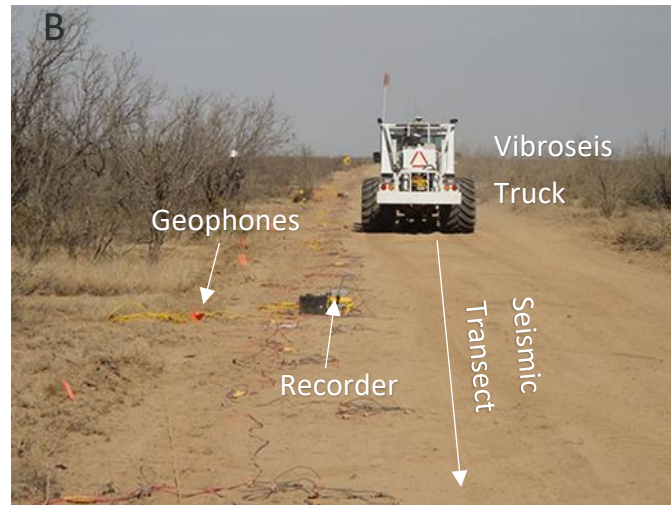
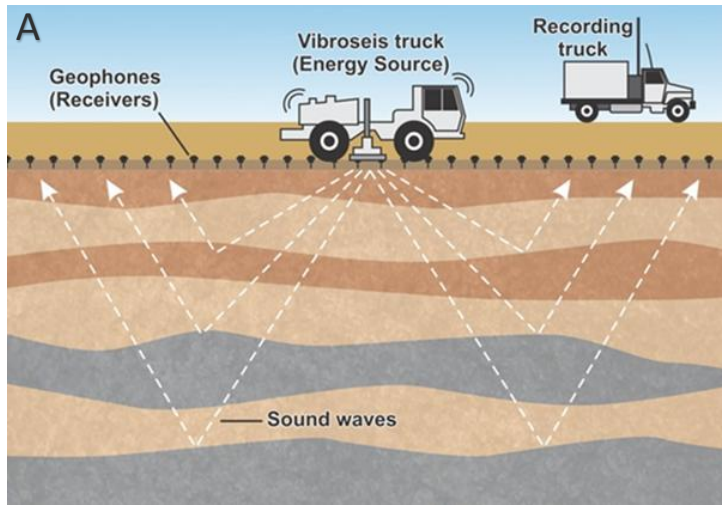


Figure 7: Seismic surveying process and potential impacts. (A) Showing an animated Vibroseis process, (B) Showing a real life Vibroseis process, (C) Showing minimal dust generated from the process, (D) Showing minimal vegetation impact associated with a new access path (transect route), (E) Showing the weight drop alternative method and (F) showing magnetotelluric survey.



5.3.2 WELL WORKOVER AND INTERVENTION

The proposed activities to be undertaken as part of the development include identifying existing blowers (pre-existing boreholes that were drilled as part of exploration programmes for gold mining) within the ER, undertaking well workover and intervention if necessary. Well intervention and workover are both remedial operations performed on gas wells to maintain or enhance production, but they differ in scope and the level of intervention required. Well intervention is a broader term encompassing any operation to access the wellbore for maintenance, repair, or production enhancement, often using tools and equipment lowered into a live well with the wellhead in place. Workover, on the other hand, typically involves more extensive operations, including removing the wellhead tree and potentially replacing the production tubing string after killing the well³.

5.3.2.1 WELL WORKOVER

Well workover stands as a comprehensive operation within the gas industry, strategically undertaken on existing wells to rejuvenate or amplify their production capabilities. This process encompasses substantial interventions and the deployment of significant equipment to address a spectrum of issues, ultimately aiming to improve the overall performance of the well. Well workovers become imperative when a well experiences a decline in production or encounters mechanical challenges that necessitate remedial action. The process of well workover will be one or a combination of the following:

a. Restoring Production:

Well workovers are often initiated with the goal of restoring or enhancing production rates. This may involve the removal of obstructions, thorough cleaning of the wellbore, or the repair of damaged equipment. By addressing these impediments, operators can optimize the well's functionality and boost production.

b. Changing Completion Design:

Modification of the well's completion design is a common facet of well workovers. This may entail actions such as replacing tubing, installing new downhole equipment, or optimizing the artificial lift system. These adjustments are geared towards improving the efficiency and effectiveness of the well's completion design.

c. Sidetracking Operations:

Some well workovers encompass sidetracking, a process that involves drilling a new borehole from an existing wellbore. This technique is employed to access additional reservoir zones, effectively bypass damaged sections, or maximize recovery from the reservoir. Sidetracking adds a layer of flexibility to well workovers, allowing operators to strategically tap into untapped resources.

5.3.2.2 WELL INTERVENTION

Well intervention in the context of gas wells refers to a set of activities aimed at diagnosing, maintaining, or enhancing the performance of a well without resorting to major interventions or workovers. These interventions are crucial for optimizing production, addressing specific issues, and ensuring the continued functionality of the well. Unlike major workovers, which involve substantial interventions, interventions are generally minor in nature and focus on improving well productivity and efficiency. The process of Well Intervention will be one or a combination of the following (but **will exclude any well stimulation techniques such as hydraulic fracturing activities associated with well intervention**):

a. Well Logging and Diagnostics:

Well logging and diagnostics involve the deployment of specialized tools and instruments downhole. These tools gather data on reservoir properties, wellbore conditions, and fluid characteristics. The collected data aids in reservoir evaluation and helps optimize production strategies by providing insights into the well's current status.

b. Maintenance and Servicing:

³ In the oil and gas industry, killing a well (often referred to as a "well kill") is a critical safety operation used to permanently or temporarily stop the flow of formation fluids (oil, gas, or water) from the reservoir into the wellbore.



Maintenance and servicing interventions encompass routine activities aimed at preserving the well's functionality. This includes cleaning the wellbore to remove debris and scale, replacing damaged or worn-out equipment, and addressing minor mechanical issues. Regular maintenance is essential to prevent larger problems and maintain the well's efficiency over time.

5.3.2.3 PROCESS FOR IMPLEMENTATION

Onshore well interventions and workovers can lead to various environmental, health, and safety impacts. These include water and air pollution, risks to worker health and safety, and potential impacts on surrounding communities. Mitigation strategies involve implementing best management practices, employing advanced technologies, and ensuring robust emergency response plans. The process to be followed will include:

- Assessment of existing conditions and process required: D3 Energy will first assess the conditions and issues of each existing blower (gas emitting well) with the ER. If the well is found to be suffering from significant gas flow decline, blocked completions, or severe casing damage, a workover may be undertaken (appropriate to be determined following technical assessment). However, if less critical issues like instrumentation malfunction, scale buildup, or needing to perform diagnostics, a well intervention is the more efficient, cost-effective, and likely the option to be undertaken.
- Development of an emergency response plan: an emergency response plan will be developed including spill response, fire prevention protocols, and blowout response.
- Training and personal protective equipment: providing comprehensive training on safety procedures, emergency response, and the use of personal protective equipment (PPE) will be undertaken.
- Preventing blowouts: maintaining well control through hydrostatic pressure management, utilizing robust Diverter systems, and implementing thorough planning and risk assessment, as well as implementation of early detection systems and well-defined kill procedures for mitigating potential blowouts.
- Equipment maintenance: regularly inspecting and maintaining equipment to prevent malfunctions.
- Chemical management: proper handling, storage, and disposal of chemicals.
- Casing and plugging of the wells: steel casing and cement barriers to prevent leaks as well as plugging at the end of production to prevent groundwater seepage.
- Rehabilitation: each well site will be rehabilitated to support the existing land-use.

5.3.3 WELL DRILLING

Using the data gathered during the preceding background review and surveying, up to 43 production wells and 5 contingent wells will be drilled and, if successful (gas producing), converted into production wells. All wells must be drilled and cased in accordance with applicable international standards and best practice guidelines and will be sealed with a combination of steel casing and grouting (cement) to ensure there is no mixing of gas or deep saline water with the shallower freshwater aquifers. The drilling of wells is a temporary and short-lived activity (~30 days) and the equipment to be used during drilling activities includes a truck/trailer or skid mounted drill rig, TLB, light motor vehicles for transport of personnel and chemical toilets. Drilled wells will be evaluated based on gas flow, pressure and gas composition, prior to making a decision to either complete the well as a production well or to safely decommission and rehabilitate it. Well testing may include venting and/or flaring of the gas where it is safe to do so.

Using the data gathered during the preceding background review, surveying and exploration, up to 43 production wells and 5 contingent wells will be sited. A development spacing of 500 m has been chosen for the production wells to be drilled. This spacing has been chosen following a review of geological and reservoir properties including well interference testing. The wells will be drilled to a total depth of approximately 500-650 m and open hole completed (i.e. without casing) in the reservoir zone (**Figure 8**). Production casing from the surface to the base of the Karoo geological formations will be cemented to the surface to ensure wellbore integrity. Then, the well will be drilled into the Witwatersrand formation in order to encounter gas-producing



fractures. Initially, D3 Energy will log the open hole Karoo, run and set casing, then run a Casing Bond Log (CBL). Upon reaching Total Depth (TD), D3 Energy will log the open hole beneath the casing. This logging program may evolve as drilling continues. The wells will be completed as simple open hole completions, with no tubing or pumping equipment necessary.

Each well will have an overall depth of up to 650m and a maximum diameter of 350mm, commencing with a 323mm width spud hole section drilled to 6m total vertical depth (TVD), followed by 254mm width conductor hole section drilled to 80m TVD, then an intermediate hole section of 203mm width drilled to 450m TVD and finally an open hole section of 144mm width drilled up to 650m TVD. The actual casing sizes and configurations will vary depending on the specific geological characteristics and functional requirements. Each well will be steel cased and have cement barriers to prevent leaks as well as plugged at the end of production to prevent groundwater seepage (**Figure 9**). Drilling activities are estimated to be one to two weeks per hole during which time there will be a drill rig, a service truck and an LDV on site. Intermittent use of a TLB will be used during site establishment and demobilisation.

The construction of each drill pad will disturb an area of up to 50 x 50 m (**Figure 10**). Within the disturbed area, the drill rig, drill rods, support equipment, temporary waste storage areas, chemical toilets, and any site offices required for drilling operations will be located. The proposed wells will primarily be drilled using an air-drilling method, whereby compressed air, nitrogen and/or other gases are used to cool the drill bit and transport drill cuttings to the surface. Under normal drilling conditions, conventional drilling muds and drilling chemicals will therefore not be used and no drilling fluids are anticipated to be generated during routine drilling operations. Drill cuttings generated during air drilling will be collected and managed within the designated drill pad area.

Notwithstanding the above, site-specific geological conditions may occasionally necessitate the use of limited quantities of environmentally acceptable drilling fluids or loss-circulation materials to maintain borehole stability, control downhole conditions, or address unforeseen drilling challenges. Such situations would be the exception rather than the norm. Should drilling fluids be required, only approved products will be utilized, Safety Data Sheets (SDSs) will be maintained on site, and all drilling-fluid waste will be contained and managed in accordance with this EMPr and applicable waste management requirements.

As a standard environmental protection measure, each drill pad will be equipped with impermeable, lined and fenced-off sumps (approximately 4 m × 4 m and 1.5 m deep). These sumps will primarily be used during well construction and cementing activities to contain cement returns, cement slurry overflows, equipment wash water, and any wastewater generated during drilling operations. The sumps also provide contingency containment capacity should drilling fluids be required under abnormal or unforeseen drilling conditions. The sumps will not be used for the long-term storage of waste.

Any liquids, wastewater, cement residues, drill cuttings, or drilling-fluid wastes collected within the sumps will be removed and managed by an appropriately qualified contractor and disposed of, recycled, or treated at suitably licensed facilities, as required. The integrity of the sump lining will be maintained throughout drilling operations to prevent seepage into surrounding soils and groundwater.

Upon completion of drilling and well construction, all temporary infrastructure, including lined sumps, waste storage areas and ancillary facilities, will be removed and the drill pad rehabilitated. Production wells retained for future operation will be fitted with a steel wellhead cap engraved with the borehole identification number in accordance with industry standards pending connection to the gas gathering network.

The wellhead surface facilities will be designed to minimise the footprint to ~5m x 5m. As it is anticipated that there will be no liquids produced from the wells contemplated herein, there will be no need for surface equipment such as water storage and holding tanks to be located at the wellheads. The fencing surrounding the wellsite will be able to be modified easily to maximize the land use available for the landowner. Consideration will also be given to having the wellsite facilities located below ground level in closed chambers to further reduce the visual and environmental impact- pending discussions and agreement with the respective landowner. Instrumentation at each well location will consist of gas metering and pressure monitoring only. These instruments are planned to be powered by replaceable lithium batteries, so eliminating the need for any instrumentation that requires gas to be emitted and therefore reducing fugitive emissions.



Figure 8: Typical wellhead surface infrastructure (to be connected to underground pipeline if converted to production well).



Figure 10: Drilling and potential impacts. (A) Showing the drilling process and associated infrastructure, (B) Showing the drill pad footprint at one of the active D3 Energy drilling sites, (C) Showing some of impacts associated with drilling activities including contained vegetation clearance and topsoil heaps and (D) Showing the final well, steel cased and cemented to prevent leaks with the area rehabilitated.



5.3.4 GAS GATHERING PIPELINES

The gas gathering network covers all low-pressure underground pipework from the wellhead to the gas processing plant. It is critical in this project to keep wellhead pressures low, as this maximizes gas and helium recovery from the field. The pipelines have been designed to have only one gas and helium processing plant within the project area to reduce the requirement for nodal compression. This will reduce the environmental footprint and keep noise emitting equipment to fewer locations. A provision will be made to have field nodal compression powered by the gas in the pipelines should the actual flow rates and pressures differ from the modelling, and it is found that nodal compression is required.

The preliminary conceptual gas gathering systems have been designed to minimize pipeline lengths and pressure loss, while maintaining the required distances from landowner and environmental constraints. As discussed previously all locations will be subject to review once stakeholder and landowner discussions are undertaken. Flow modelling has been conducted to ensure that the wellhead pressures at the wells are kept to a minimum. The sizing of the high-density polyethylene pipe (HDPE) pipelines will range from 110 mm diameter for up to 315 mm for main gas trunkline installed at a minimum depth of approximately 750mm for grazing land and up to 1000mm for cultivated crop land. The pipelines will be constructed from HDPE pipe and be designed to use the natural flow of the land contouring to reduce the need for low point drains.

Low point drains in gas pipelines function to remove condensed water (resulting from the gas temperature dropping) that collects at low points, preventing flow obstruction and ensuring efficient gas transport. Where drains are required, consideration will be given to installing them in underground pits to reduce visual, environmental and landowner impact. Regular pipeline leak detection surveys will be undertaken, detail of which will be included in the detailed EIA report. The total amount of underground gathering pipeline system to be installed is detailed in **Table 5** below. The pipeline routes will be marked with aboveground concrete markers. Servitude corridors (10 m wide) will be maintained free of woody plants to prevent disturbance of the pipeline by root growth and ensure access for regular inspection and maintenance when necessary.

Table 5: Expected HDPE Pipe Size and Quantity

HDPE Pipe Size	~Installed Length
110 mm OD	9,500 m
200 mm OD	6,250 m
250 mm OD	7,650 m
315 mm OD	5,400 m

There are currently two options considered for the gas gathering pipelines. The pipelines have four distinct corridors with one corridor (western corridor) split into two sections (north and south). The two central corridors are of similar size and parallel to each other while the eastern corridor is the longest corridor. Both the proposed layout and alternative layout have similar pattern with the only difference being on the eastern corridor. The proposed eastern corridor runs in a north-east to south-west direction while the alternative eastern corridor deviates in at the northern section immediately after the Maselspruit in a south-west direction then south and south-west direction again before ending just before intersecting the western corridor. The eastern corridor alternative has been developed to specifically avoid renewable energy currently existing, in progress or near commencement.

5.3.5 HELIUM RECOVERY FACILITY AND GAS PROCESSING PLANT

The proposed development comprises a helium production and processing facility designed to receive, process, separate, store, and export helium and associated gas products from upstream gas production operations. Based on the updated site layout (**Figure 11**), the facility will consist of gas treatment equipment, helium recovery systems, compression units, cryogenic processing infrastructure, produced water management facilities, loading



facilities, utility systems, and a flare system for emergency gas disposal. The facility is planned within a fenced industrial site with an approximate footprint of 1.5 – 3.0 ha including operational areas, access routes, storage facilities, and safety exclusion zones.

The helium recovery and gas processing facilities (**Figure 11**) will have the optionality of producing either gaseous or liquified helium and methane (refer to Appendix A of the EIA for a larger / clearer layout). It is planned that the plant will be fully gas-powered. One helium recovery and gas processing plant with the optionality of producing either gaseous or liquified helium and methane will be required. The location of the 3 existing wells along the Virginia fault line as well as other production wells proposed on this fault make it the best location for the plant to reduce the length of pipeline require in the initial phase of the project. A description of the helium and methane streams for gas and liquefaction processes is given below. A summary of the key project components is provided in **Section 5.3.5.1** and discussed in detail (where applicable) in the sub-sections below. A block diagram to illustrate the process and the components of the processing plant is also given below in **Figure 12**.

5.3.5.1 SUMMARY OF KEY PROJECT COMPONENTS

5.3.5.1.1 FEED GAS RECEPTION AND SEPARATION

Raw gas produced by the wells will be received at the facility and directed to an **Inlet Separation System**, where free liquids such as water and condensates are removed from the gas stream. The separation process is intended to:

- Remove entrained water and water condensate.
- Protect downstream process equipment.

The separated liquids will be managed through designated storage and treatment systems.

5.3.5.1.2 COMPRESSION SYSTEM

Following separation, the gas stream will pass through an **Inlet Compressor** and additional compression units designed to increase gas pressure to process requirements.

The compressor system will include:

- Gas compressors.
- Associated piping and valves.
- Instrumentation and control systems.
- Electrical supply and safety devices.

The compression stage is required to optimize gas flow through the helium recovery and cryogenic separation systems.

5.3.5.1.3 HELIUM RECOVERY UNIT

The facility incorporates a **Helium Recovery Unit (HRU)**, which will recover helium from the natural gas stream through specialized separation technologies.

The unit is expected to:

- Concentrate helium from the feed gas.
- Remove impurities.
- Produce a helium-rich stream suitable for further purification and liquefaction.

Recovered helium will then be processed through cryogenic systems for final product preparation.

5.3.5.1.4 CRYOGENIC PROCESSING FACILITIES

As indicated on the layout below, the following will be present:



- Cryogenic equipment.
- Heat exchangers and cold boxes.
- Refrigeration systems.

These facilities will provide the low-temperature environment necessary for helium purification and separation. Key functions include:

- Removal of residual impurities.
- Helium concentration and purification.
- Cryogenic cooling and product conditioning.
- Recovery of valuable gas components.

Cryogenic systems will operate within insulated equipment designed to minimize heat gain and improve efficiency.

5.3.5.1.5 PRODUCT STORAGE AND LOADING FACILITIES

The development includes a **Loading Manifold System** with multiple truck loading bays.

The loading area will facilitate:

- Transfer of helium and hydrocarbon products into road tankers.
- Product dispatch to domestic and international markets.
- Metering and quality control.

The loading infrastructure will include:

- Loading arms and connections.
- Boil off gas recovery equipment.
- Vehicle circulation areas.
- Safety shutdown systems.

5.3.5.1.6 PRODUCED WATER MANAGEMENT

Produced water⁴ will be managed through:

- Two produced water tanks.
- An evaporation pond measuring approximately **25 m × 25 m, with 940 to 1,250 m³ storage capacity.**

Produced water generated during gas processing will be temporarily stored in the water tanks before transfer to the evaporation pond. The evaporation pond will:

- Receive process water and water condensate streams.
- Facilitate evaporation through natural climatic conditions.
- Provide interim management of non-hazardous saline wastewater, subject to water quality classification.

The pond will be constructed with an engineered liner system (high-density polyethylene Liner or similar) to prevent groundwater contamination.

⁴ Produced water is officially defined under the Minerals and Petroleum Resources Development Act (MPRDA) regulations as water that comes up from underground along with petroleum during exploration or production, which is then separated from the oil or gas with the plan to release it into the environment



5.3.5.1.7 FLARE SYSTEM

The facility includes a dedicated **flare stack** located within a large safety exclusion zone. The flare system will be used for:

- Emergency depressurization.
- Safe disposal of excess gas.
- Equipment maintenance activities.
- Process upset conditions.
- Disposal of inert gases.

The flare will have a small pilot light that will run continuously (subject to final design) but the flare will only be used intermittently and is designed to ensure safe combustion of hydrocarbons while maintaining compliance with applicable air quality requirements.

Utilities and Support Infrastructure

Supporting infrastructure includes:

- Control room.
- Internal access roads.
- Pipe racks.
- Electrical distribution systems.
- Instrument air systems.
- Fire protection systems.
- Security fencing.
- Site drainage infrastructure.

The control room will house operational personnel and process monitoring systems required for continuous plant supervision.

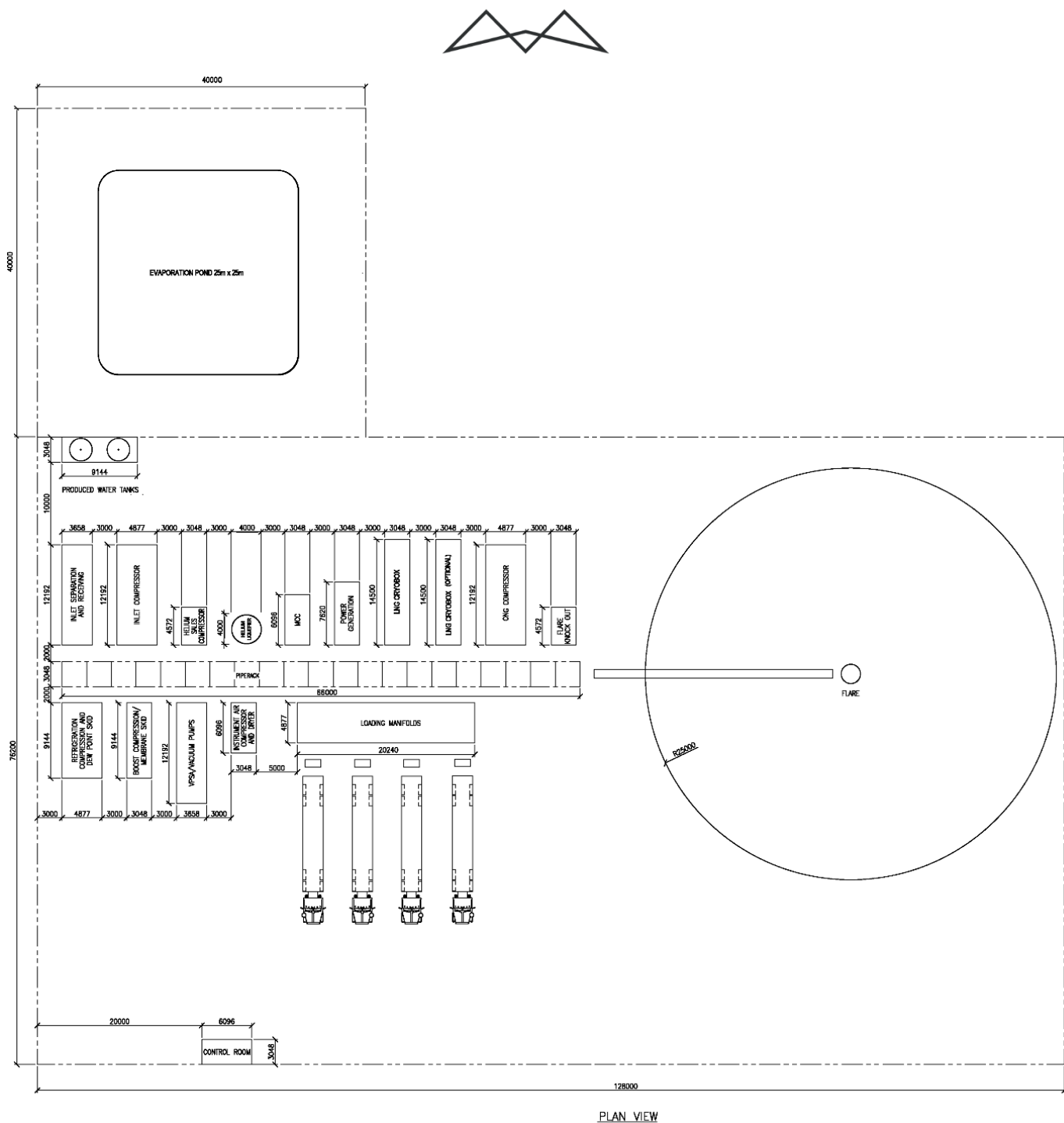


Figure 11: Helium Recovery and Gas Processing Plant layout.

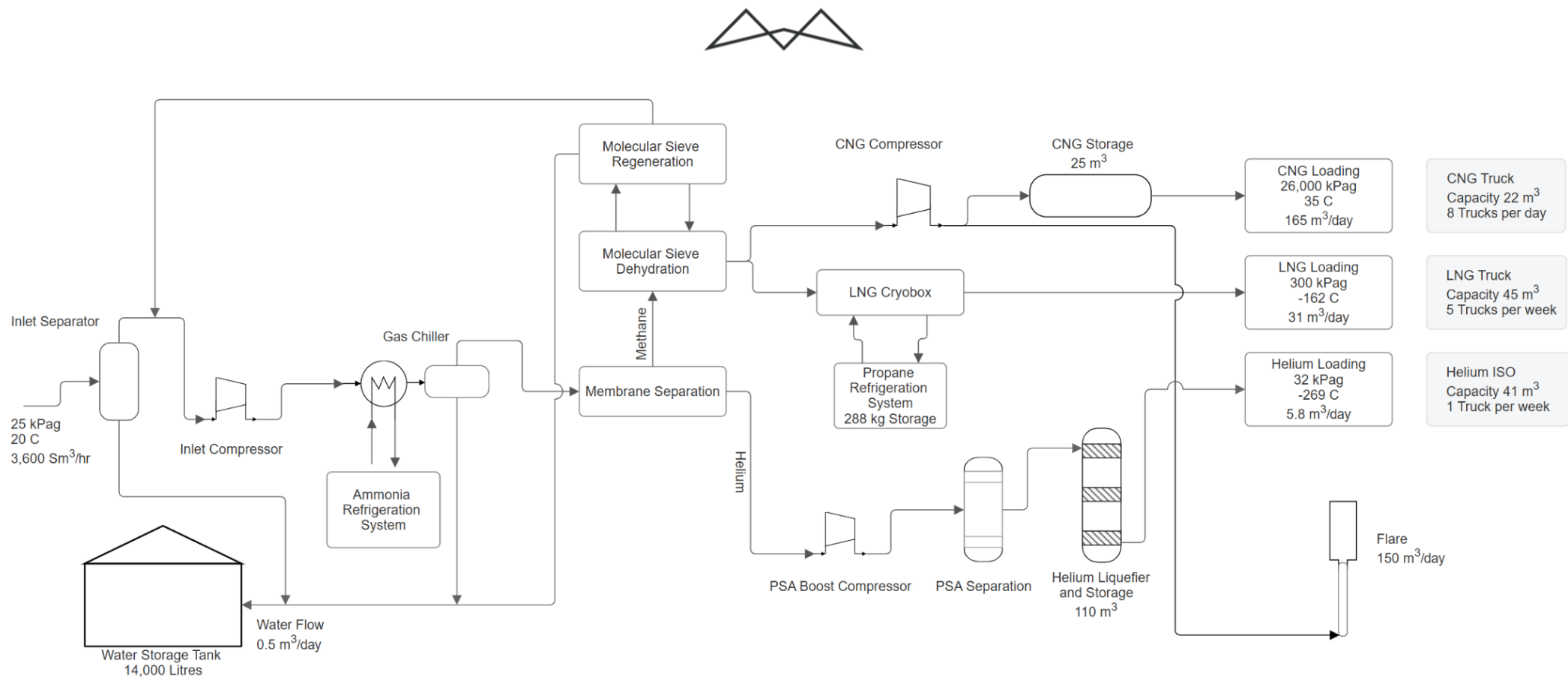


Figure 12: Helium Recovery and Gas Processing Plant Block Diagram.



5.3.5.2 HELIUM RECOVERY

The approximate 3.0 Million Standard Cubic Feet per Day (MMscfd) capacity helium recovery facility design features include a modular-based facility. The process modules include inlet compression, pretreatment, single stage membrane separation or cryogenic separation, Pressure Swing Adsorption (PSA) boost compression, vacuum PSA purification, helium sales compression and/or liquefaction. The process starts with the inlet reception equipment to manage the incoming process stream to the facility. After regulating the pressure and flow to approximately 25 kPag, the inlet gas is compressed to achieve the necessary pressure required to operate the membrane system.

The pretreatment module provides dew point control and removal of water that would otherwise condense in the membrane systems. The condensate water will go into an HDPE lined evaporation pond. The treated gas then flows to the inlet of the membrane separation system. The membrane separation system has been designed for single stage separation. The first stage separates the bulk contaminants from the crude helium permeate stream which flows to the PSA purification unit. The retentate stream (methane) is back-pressure controlled flowing to the package limits where it will flow into the inlet of the gas CNG or LNG facility.

The crude helium from the first stage permeate is compressed on route to the PSA purification package. Within the vacuum PSA module, the crude helium stream is purified to >98% within the PSA vessels before flowing to the helium sales compressor or liquefaction unit. For gaseous helium sales, the gas compressor is designed to deliver pressure up to 26,200 kPag to the 3-truck loading system. The manual loading system is located off the end of the helium sales gas compressor package.

If D3 Energy decides to liquify the helium gas on the project site, the helium liquefaction unit will receive purified helium from the PSA module and will deliver grade 5 helium to the liquid helium dewar at the outlet. From the liquid helium dewar, the liquid helium can be loaded into helium ISO containers for shipment.

5.3.5.3 METHANE GAS PROCESSING

The retentate stream (methane) from the helium recovery facility will flow into the inlet of either the CNG or LNG process modules. The CNG module will compress the gas from the inlet pressure of 2,500 kPag up to the 25,000 kPag required pressure for CNG tube trailers. As with the helium system, the compressed methane will flow from the module exit to the 3-truck loading system. The manual loading system is located off the end of the methane sales gas compressor package.

The LNG module, if installed, will take the feed gas and compress it up to the 5,000 kPag pressure required by the plant. Before liquefaction, impurities contained in the raw natural gas may need to be removed as they may freeze under the low temperature state used in the liquefaction process and block the equipment or reduce the performance of the heat exchanger. The liquefaction element adopts a propane precooling mixed refrigerant refrigeration process. The pre-coolant is propane, and the mixed refrigerant is nitrogen, methane, ethylene and propane components.

The purified, predominately methane gas, will be precooled to -20°C by a pre-coolant before entering the cold box. The gas entering the cold box uses the large amount of cold released by the mixed refrigerant in the cold box to liquefy the natural gas, and the liquefied LNG is sent to the manual loading system used to fill the LNG trucks.

5.3.6 ASSOCIATED ACTIVITIES AND INFRASTRUCTURE

The development of the area will require the construction of associated infrastructure. Although the proposed activity requires highly specialised equipment and professionals, local business / contractors and local communities will be instrumental in providing the workforce and equipment where appropriate and/or feasible.

5.3.6.1 OFFICE AND MAINTENANCE WORKSHOP

D3 Energy has a field office located in the nearby town of Virginia. D3 Energy plans to construct a maintenance workshop beside the helium and gas processing facilities. The multipurpose facility will be used as an office for field staff, company plant and equipment storage, maintenance activities, and storage warehouse. The office and workshop facility will have provision for storage of consumables and spares needed during the main



operating phase of the development. During the initial construction phase, there will be a need to store larger construction equipment, well casing/tubulars and HDPE pipes, these will be stored in the same workshop area.

5.3.6.2 ROADS AND SITE ACCESS

Wherever possible existing roads and tracks will be used for well and plant access. Where upgrades are required due to increased traffic or wet weather access there may be a requirement for utilizing road base materials or surfacing materials. Where access is not available, access tracks to accommodate a vehicle, approximately 3.5m wide will be created. These will be rehabilitated accordingly at the end of production in line with the post land use agreements where applicable. Below is a summary of anticipated number of vehicles and traffic trips during the construction and operational phases.

Table 6: Summary of anticipated number of vehicles/trips.

Phase	Vehicle Type	Number of Vehicles on site/day	Vehicle Trip Numbers
Construction	Light Vehicles	18	45
	Heavy Vehicles	14	30
Total		32	75
Operational	Light Vehicles	4	12
	Heavy Vehicles	1	2
Total		5	14
Gas and Helium Sales (Operational)	CNG Truck	8	8 per day
	LNG Trucks	2	5 per week
	Helium Truck	1	1 per week
Total		11	62 per week

5.3.6.3 ACCOMMODATION AND CONSTRUCTION RESOURCES

The greater majority of construction workers will be based in the local towns of Welkom, Virginia and surrounds. Prior to the commencement of the initial project construction period, D3 Energy will engage with accommodation providers to determine the anticipated availability of rooms throughout the period planned for the construction activities. It is paramount that the existing accommodation that is currently available for regular visitors remains available during the construction activities. Where demand is found to exceed supply, D3 Energy may consider alternative accommodation arrangements if local capacity is insufficient.

Many of the construction activities during the development of the area are very specialized and require specifically skilled contract workers to complete the construction activities. D3 Energy will strive to employ these contract skilled workers locally in the first instance and only when not available locally will specialized non-local contractors be engaged. Equipment for seismic surveys and drilling will be provided by specialist contractors. D3 Energy will concurrently utilize local contractors and workforce in the more non-specialized construction activities with a view to training these employees and contractors to the more skilled job tasks over time.



Electricity, if required during construction, will be provided by on-site generators which must be placed on impermeable surfaces. Water required for the operation of the drilling rig, as well as potable water will be obtained locally, by agreement with landowners or the local municipality, and in accordance with relevant legal requirements. **The water requirements for drilling operations will be a maximum of 70 000 litres per production well for a production well which has a maximum depth of ~650m.** Based on available data, the daily water demand during the operational phase-encompassing domestic use, sanitation, dust suppression, cooling, and miscellaneous requirements is projected to range from 10 500 to 32 000 litres, depending on the scale and intensity of the daily activities. The current plan is to obtain the water from the Local Municipality or authorised landowner boreholes, should the Applicant decide to rather consider abstracting the water from groundwater sources, the necessary assessments and applications will be obtained prior to abstraction.

Chemical toilets will be provided for the personnel. The toilets will be supplied and managed by a specialist contractor and the sewage disposed of at the nearest wastewater management facility, or as required by the local authority. All general and hazardous waste generated at the survey and/or drilling site will be separated and stored in containers, before being removed from site and disposed at an appropriate licensed waste disposal facility.

5.3.7 WASTE MANAGEMENT

The design philosophies for waste management are based on applicable legislation, in particular NEMWA, DWAF (DWS) best practice guidelines, and currently accepted good industry practice for waste management. Principles of waste minimisation at source, segregation for reuse, recycling and treatment or disposal will be applied to the handling of waste, wherever possible. The waste (general and hazardous) generated during construction and operations will be addressed as detailed below.

5.3.7.1 GENERAL WASTE

The following types of general waste (produced mainly during construction, with minimal amounts post construction/ operation) will be generated by the proposed production project:

- Domestic solid waste;
- Scrap metal; and
- Construction waste.

The project will temporarily store general waste on site in a designated area, and all waste will be collected by an approved, licensed waste contractor for removal and final disposal at a registered general waste disposal facility. No new landfills will be directly established by the project within the project boundaries.

5.3.7.2 HAZARDOUS WASTE

Hazardous waste, including but not limited to hydrocarbon containing waste (used oil and filters, diesel, lubricants, and grease) will be stored in clearly marked skip bins (solids) and containers (liquids). These skip bins/ containers will be placed in an isolated area on a hard, impervious surface. When full, the bins/ containers will be collected by a contractor for safe disposal or recycling companies which will be appointed to collect waste. A waste disposal certificate will be required from the contractor to ensure safe disposal.

Drilling waste will consist of wastewater and drilling mud which will not be stored more than 90 days on site. This waste will be stored in a lined pit adjacent to the drill rig and once drilling is completed, the waste will be removed from site and adequately disposed of at an appropriately licensed waste disposal facility.

During operation, several hazardous waste streams are expected to be generated from both the processing plant and the associated gas pipeline network. These waste streams require appropriate handling, storage, transportation, treatment, and disposal to prevent impacts on soil, groundwater, surface water, air quality, and human health.



Knockout Water⁵ and Condensate Water⁶ is expected to be generated from; inlet separation units, compressor suction scrubbers, compressor knockout drums, flare knockout drums, refrigeration systems, water catch tanks, and pipeline low-point drains. This water is typically separated from the raw gas stream. This wastewater is generally unsuitable for direct discharge to the environment. The following management principles will be undertaken to manage knockout water and condensate water:

- Collecting all knockout water in designated produced-water tanks.
- Preventing uncontrolled discharge to soil or drainage channels.
- Recycling water where technically feasible.
- Disposal of residual wastewater at licensed wastewater treatment facilities.
- Maintaining spill containment around all storage tanks.

Produced water is expected from; gas inlet separation systems, production gathering pipelines, wellhead facilities and water catch tanks. Produced water is normally the largest liquid waste stream associated with gas production. The following management principles will be undertaken to manage produced water:

- Temporary storage in produced-water tanks.
- Transfer to evaporation pond.
- Regular monitoring of pond integrity.
- Groundwater monitoring.
- Removal of accumulated sludge for disposal at licensed hazardous waste facilities.

Sewage and domestic wastewater from control room facilities, site offices, and ablution facilities will be managed as follows:

- Connecting the plant facilities to the municipal sewage infrastructure (if possible) or collecting sewage in bunded septic tank on site prior to disposal through licensed service providers at a registered facility.
- Preventing discharge to the environment.
- Routine inspections of collection systems for leaks.

All hazardous waste will be temporarily stored on sited, collected by an approved, licensed waste contractor for removal and final disposal at a registered hazardous waste disposal facility.

5.3.8 PROJECT TIMELINE

The major construction activities will occur during the initial 5 years of the development. The D3 Energy gas production project will comprise of three components namely the production well drilling, gas gathering network and the processing plant construction. The commencement of activities will be dependent on the issuance of relevant permits, authorisations and licences (including the EA). D3 Energy plans to initially conduct a multi-well drilling campaign of approximately 15 wells during 2027 and a further 15 wells during 2028. The CNG plant, and helium separation plant is planned to be ready to accept gas by mid-2028 based on the current indicative development schedule, and subject to obtaining all required regulatory approvals. The remainder of the wells are located on the Ventersburg fault and will be drilled as required to maintain the required sales production. The production right area has an expected life of at least 30 years which will then be followed by decommissioning, rehabilitation and closure.

⁵ knockout water (often originating from a Free Water Knockout (FWKO) or a gas-liquid separation system) refers to the water that is mechanically separated from a raw mineral or petroleum production stream.

⁶ "Condensate water" is not explicitly given a standalone, custom definition inside the text of either the NEMWA or the MPRDA. Instead, both laws view condensate water—which is liquid water formed when steam or vapor cools down during industrial processes—through its legal classification as either a waste product, a residue, or a potential pollutant.



5.3.9 ABNORMAL OR IRREGULAR EVENTS OR CONDITIONS

When undertaking an EIA, it is important to consider the potential abnormal operating conditions or unwanted events. These are especially significant in instances where these conditions or events may result in an unacceptable environmental impact. A predictive risk identification and assessment process should be followed by the proponent and updated on a regular basis. Many of these risks can be adequately mitigated through pre-emptive contingency planning and if necessary, embedded into relevant project design. **Table 7** provides a high-level identification and description of potential abnormal operating conditions and the embedded designs / controls that have been considered and incorporated for this project.

Table 7: Abnormal events and conceptual controls.

Abnormal condition/ event	Description	Embedded design or preventative control
Downhole loss of fluids or cement.	Depending on the permeability of the geology through which the drill is moving there may be a potential to lose drilling fluids into the geological formation. Further there is a potential that the cement or grouting being used in the annulus may enter the surrounding geology or resource. This may compromise the functionality of the cementation job or even impact on the gas permeability of the geology (e.g. invasion of the cement into the natural fractures).	Readily available fluid loss control additive for the drilling process when drilling with fluid based mud systems. Drilling with air (underbalanced drilling) greatly reduces the risk of loss of drilling fluids and removes the need for fluid loss control additives. Cement design provides for lightweight slurry. This reduces the hydrostatic weight of the cement slurry. Readily available fluid loss additives would be available to add to the bentonite mix to seal off any voids encountered in susceptible formations. The annulus can be remediated by topping up with cement should losses occur.
Wellbore casing bursts due to excessive pressures	The wellbore may be exposed to additional pressures during the testing or cementing operations. This has the potential to damage or rupture the casing string and result in a loss of gas or fluids, as well as risk of pollution.	Ensure that the correct casing specification is selected and installed in accordance with the well engineer's design requirements and anticipated downhole conditions. The casing pressure rating must be suitable for the maximum pressures expected during drilling, well testing, cementing and production operations, while remaining within the safe operating limits of the drilling equipment and well design. Comprehensive casing and cement integrity verification will be undertaken following casing installation and cementing activities. This may include cement bond logging (CBL), casing pressure testing, and verification of cement compressive strength to confirm wellbore integrity and ensure the effective isolation of geological formations and groundwater resources.
Rupture of gas gathering network pipes.	The gas gathering system will include HDPE piping which could be damaged by unauthorised excavations, tree roots, etc. is susceptible to damage in	To facilitate the early detection of potential loss of containment events, the gas gathering system will incorporate continuous operational monitoring, including real-time



	abnormal instances. This could be due to excavations, burrowing animals, tree roots, etc.	pressure monitoring at strategic locations such as the wellheads and gas processing facility. Pressure monitoring data will be used to identify abnormal operating conditions, pressure drops, or other indications of a potential leak or pipeline failure, triggering investigation and corrective action where necessary. In addition to pressure monitoring, an Leak Detection and Repair (LDAR) programme will be implemented for above-ground equipment and components where fugitive emissions could occur, such as valves, flanges, connectors, and other fittings at well pads and processing facilities. The LDAR programme will comprise periodic inspection, leak identification, maintenance, and repair activities in accordance with the applicable operational procedures and industry good practice.
Excess water content in gas.	Excessive water content in the raw gas may result in damage to equipment and blockage for gathering lines.	Installation and operation of low point drains where required. Real time monitoring of pressures to detect pressure loss.
Medium to long term climate change vulnerability	The prevailing climatic conditions are predicted to change over time as per the climate change predictions (refer to Section 8.11 of the EIAr for a description of the likely changes predicted). Changes in temperature and rainfall may affect the optimal functioning of certain infrastructure and equipment.	Equipment design would provide for equipment to be operational under elevated temperatures and rainfall. Excess rainfall events would be catered for in the stormwater designs.
Uncontrolled releases of LNG or CNG from storage vessels.	Storage vessels may be damaged as a result of pressures exceeding design specifications, accidental physical impacts (e.g. vehicle collisions), equipment failure, or other abnormal operating conditions. Depending on the storage medium and the nature of the damage, such incidents could result in a gradual or sudden release of LNG or CNG.	Appropriate engineering controls will be implemented for both LNG and CNG storage systems. LNG will be stored in double-walled, insulated vessels with boil-off gas managed through the facility's gas handling system to prevent excessive pressure build-up. CNG will be stored in pressure-rated vessels fitted with pressure monitoring and relief systems to prevent over-pressurisation. For both storage types, physical barriers will be installed to protect against vehicle and equipment impacts, and routine inspection, maintenance, and integrity monitoring programmes will be undertaken to ensure the continued safe operation of storage infrastructure.



Sabotage, Community unrest, and terrorist attacks.	Production operations or equipment could be damaged as a result of sabotage, community unrest, unauthorised interference, or other deliberate acts, potentially resulting in a loss of containment and the uncontrolled release of gas	The gas gathering and processing system will incorporate continuous monitoring, leak detection, Emergency Shutdown (ESD) systems, and strategically located shut-off valves to enable the rapid detection and isolation of incidents, thereby minimising gas releases. Emergency response procedures and security measures will be implemented to support the safe shutdown of affected infrastructure and reduce the risk of unauthorised interference. Where required, gas will be managed through approved gas handling systems to minimise uncontrolled releases and avoid venting wherever reasonably practicable.
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This EIA process will identify and assess potential environmental impacts and make recommendations for relevant alternatives, management and mitigation measures.

5.3.10 OPERATIONAL ACTIVITIES

During operation, the facility will:

1. Receive raw gas.
2. Separate liquids and impurities.
3. Compress the gas stream.
4. Recover and purify helium.
5. Process gases through cryogenic equipment.
6. Store and manage produced water.
7. Export helium products via road tanker loading facilities.
8. Safely manage emergency gas releases using the flare system.

Operations are expected to be continuous, with routine maintenance undertaken periodically. **The production right area has an expected life of at least 30-years; thus, the activities are expected to be operational for at least 30-years before decommissioning and closure.** Is it important to note that the right may be renewed for further periods, each not exceeding 30 years, subject to compliance with the applicable legislative and licensing requirements.

5.3.11 DECOMMISSIONING AND CLOSURE

According to the NEMA and the associated Financial Provision Regulations (2015) (NEMA GNR 1147), every right holder must make financial provision for annual rehabilitation, final rehabilitation, decommissioning and closure activities at the end activities and remediation and management of latent or residual environmental impacts which may become known in the future. As such, D3 Energy is required to prepare and submit, as part of this EIA process, a final rehabilitation decommissioning and closure plan.

The EMPr outlines the closure objectives that are aimed at re-instating the landform, land use and vegetation units to the same state as before production operations take place, unless a specific, reasonable alternate land use is requested by the landowner. As such, the intended end use for the disturbed areas and the closure objectives will be defined in consultation with the relevant landowner. Proof of such consultation will be submitted together with the application for Closure Certificate. The overall aim of the rehabilitation plan is to



rehabilitate the environment to a condition as close as possible to that which existed prior to the gas production activities. This shall be achieved with a number of specific objectives.

- Ensuring rehabilitation allows for post-closure land-use activities such as agricultural activities, renewable energy developments or mining activities.
- Set the course for eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats.
- Prevent future environmental issues related to fluid or gas leakage or lateral movement through the well.
- Protection of water resources.
- Ensure that land is usable, in alignment with surrounding land uses.
- Making the area safe. i.e.: Decommission exploration and production activities so as to ensure that the environment is safe for people and animals. This entails refilling excavations, sealing and grouting wells where applicable, etc.
- Recreating a free draining landform. This entails earthworks infilling, reshaping, levelling, etc. to recreate as close as possible the original topography and to ensure a free draining landscape or to align this with the surrounding land and agreed post-closure land use.
- Re-vegetation. This involves either reseeding or allowing natural succession depending on the area, climate etc.
- Storm water management and erosion control. Management of storm water and prevention of erosion during rehabilitation. E.g. cut off drains, berms, etc. and erosion control where required.
- Verification of rehabilitation success through appropriate monitoring of rehabilitation.

Rehabilitation will be undertaken in accordance with the rehabilitation and closure plan as required by the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, GNR 1147, gazetted in November 2015. This includes the determination of the financial provisions attached as Appendix F5 of the EIAr. A closure certification application will be applied for in accordance with Section 43 of the Mineral and Petroleum Resources Development Act, 2002.



6 ENVIRONMENTAL MANAGEMENT APPROACH

6.1 GENERAL ENVIRONMENTAL MANAGEMENT APPROACH

The compilation of an EMPr for an activity which is likely to result in significant environmental impacts is typically compiled at the culmination of a thorough investigation into the receiving environment and the identification and assessment of likely environmental impacts (i.e. EIA). This EMPr forms part of a D3 Energy PR16 EA Application. This EMPr aims to comply with the requirement of Appendix 4 of the EIA Regulations (GNR 982). These requirements are systematically addressed in the subsequent sections of this report. The primary objectives of the EMPr are as follows:

- To promote sustainability and describe an action programme to mitigate negative impacts as far as possible;
- To be a practical document that sets out both the goals and actions required in mitigation. Though the term “mitigation” can be broad in definition, it means in this context to “allay, moderate, palliate, temper or intensify.” Mitigation of a negative impact means that its effect is reduced. Mitigation of a positive impact means that its effect is increased or optimised; and
- To indicate responsibilities for the implementation of these action items within the EMPr.

This EMPr shall be deemed to have contractual standing on the basis that its contents and specifically objectives are a detailed expansion of the environmental risks and consequent requirements of the EA (if, and when issued). Where relevant the Applicant is responsible for delegating responsibility for compliance to designated parties (internal or external). Such delegation must be legally binding to the extent relevant.

The objectives and targets in this EMPr are further guided by the NEMA, and specifically by GNR982. Thus, the underlying principles of sustainable development are the ultimate objectives and target of this report. The EMPr has included measures to ensure the development activity complies with the following principles, as instilled in the NEMA, amongst others:

- i. That the disturbance of ecosystems and loss of biological diversity are minimised and remedied;
- ii. That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- iii. That waste is avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner;
- iv. That a risk-averse and cautious approach is applied, which considers the limits of current knowledge about the consequences of decisions and actions; and
- v. That negative impacts on the environment and on people’s environmental rights be anticipated, prevented and remedied.

6.2 ENVIRONMENTAL MANAGEMENT APPROACH ASSOCIATED WITH PROPOSED ACTIVITIES

This section presents specific environmental management requirements for the proposed activities to be undertaken during the production activities. Impact and risk management actions that are considered as part of the management system, should be complementary to achieve the most cost-effective and environmentally sound approach, and should be based on the following principles:

- Integrate environmental issues and concerns into business decisions through formal management systems;
- Integrate health and safety of local communities and the environment into a single programme;
- Consider all environmental components and aspects (air, soil, water, ecology and biodiversity) in decision making;



- Prevent and reduce pollution at its source through implementation of pollution control measures;
- Aim at minimising resource inputs;
- Evaluate alternatives that included environmental values based on benefits/risks; and
- Strive for continual improvement of management system.

Based on guidelines by the Oil Industry International Exploration and Production Forum (EPI) (1994), the following components form a crucial part of a management systems:

- a. Leadership and commitment: Commitment and company culture is essential to the success of the system;
- b. Policy and strategic objectives: Principles of exploration actions and aspiration with respect to the health and safety of local communities and the receiving environment;
- c. Organization, resource planning and documentation: Organisation of human management structure, adequate resource planning and possession of all required documentation/authorisation;
- d. Evaluation and risk management: Identification and evaluation of financial, social, economic and environmental risks, and development of management measures to reduce/eliminate risks;
- e. Planning: Planning and conducting exploration/work activities, and prepare emergency responses;
- f. Implementation and monitoring: Performance and monitoring of activities, and implementation of corrective measures when necessary;
- g. Auditing and reviewing: Periodic assessments of system performance, suitability and effectiveness of management measures; and
- h. Review: review of audits by senior management.



7 ENVIRONMENTAL MANAGEMENT PRINCIPLES

NEMA establishes a general framework for environmental law, in part by prescribing national environmental management principles that must be applied when making decisions that may have a significant impact on the environment. These principles are briefly summarised below.

7.1 HOLISTIC PRINCIPLE

The Holistic principle, as defined by NEMA (Section 2(4) (b)) requires that environmental management must be integrated, acknowledging that all elements of the environment are linked and inter-related and it must take into account the effect of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option (defined below in **Section 7.2**). Holistic evaluation does not mean that a project must be looked at as a whole. It rather means that it must be accepted that there is a whole into which a project is introduced. If the indications are that the project could have major adverse effects, the project must be reconsidered and where appropriate re-planned or relocated to avoid an adverse impact or to ensure a beneficial impact.

7.2 BEST PRACTICABLE ENVIRONMENTAL OPTION

When it is necessary to undertake any action with environmental impacts, the different options that could be considered for the purpose must be identified and defined. The Best Practicable Environmental Option (BPEO) is defined in NEMA as “the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.” Other guidelines typically used for environmental management in terms of other legislation include BPM which is the Best Practicable Means and BAT which is the Best Available Technology.

7.3 SUSTAINABLE DEVELOPMENT

The concept of sustainable development was introduced in the 1980's with the aim to ensure that the use of natural resources is such that our present needs are provided without compromising the ability of future generations to meet their own needs. The constitution of South Africa is built around the fact that everyone has the right to have the environment protected through reasonable legislative and other measures that secure ecologically sustainable development. The National Environmental Principles included in the NEMA require development to be socially, environmentally and economically sustainable.

7.4 PREVENTATIVE PRINCIPLES

The preventative principle is fundamental to sustainable development and requires that the disturbance to ecosystems and the pollution, degradation of the environment and negative impacts on the environment be avoided, or, where they cannot be altogether avoided, are minimised and remedied.

7.5 THE PRECAUTIONARY PRINCIPLE

The precautionary principle requires that where there is uncertainty, based on available information, that an impact will be harmful to the environment, it is assumed, as a matter of precaution, that the said impact will be harmful to the environment until such time that it can be proven otherwise. The precautionary principle requires that decisions by the private sector, governments, institutions and individuals need to allow for and recognise conditions of uncertainty, particularly with respect to the possible environmental consequences of those decisions. In South Africa, the Department of Human Settlements, Water and Sanitation (then DWAF) adopted a BPEO guideline in 1991 for water quality management and in 1994 in the Minimum Requirements document for waste management.

In accordance with the precautionary approach embedded in South African environmental legislation, where there is uncertainty regarding the nature or significance of a potential environmental risk, a conservative assessment and management approach should be adopted to avoid or minimise potential adverse impacts until sufficient information is available to adequately characterise the risk.



In the context of the EIA process in South Africa, the precautionary principle also translates to a requirement to provide sound, scientifically based, information that is sufficient to provide the decision-making authority with reasonable grounds to understand the potential impacts on the environment, the extent thereof and how impacts could be mitigated. If such information is not adequate for this purpose, the relevant authority cannot be satisfied as is required and then the authority should require that further information be collected and provided.

7.6 DUTY OF CARE AND CRADLE TO THE GRAVE PRINCIPLE

In terms of the NEMA Section 28, “Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.”

By way of example, the principle of “duty of care” in terms of waste management emphasises the responsibility to make sure that waste is correctly stored and correctly transported, as it passes through the chain of custody to final point of disposal. This means that waste must always be stored safely and securely. The company removing and disposing of waste also holds the responsibility to hold the relevant licenses, and that waste is transported alongside the necessary paperwork.

The principle of “cradle to grave” waste management requires that waste be responsibly managed throughout its entire life cycle, from generation to final treatment or disposal. In accordance with the National Environmental Management: Waste Act, 2008, all parties involved in the generation, storage, transportation, treatment and disposal of waste must take reasonable measures to prevent pollution and environmental harm and ensure that waste is managed in compliance with applicable legal requirements. Such a person must retain documentation describing both the waste and any related transactions. In this way, he retains responsibility for the waste generated or handled.” This places responsibility for a waste on the Generator and is supported by the “Cradle to Grave” principle, according to which a “manifest” accompanies each load of Hazardous Waste until it is responsibly and legally disposed. This manifest is transferred from one transporter to the next along with the load, should more than one transporter be involved. Once the waste is properly disposed of at a suitable, permitted facility, a copy of the manifest must be returned to the point of origin.” Duty of Care offers one strategy to implement sustainable development.

7.7 POLLUTER MUST PAY PRINCIPLE

The “polluter pays principle” holds that the person or organisation causing pollution is liable for any costs involved in cleaning it up or rehabilitating its effects. It is noted that the polluter will not always necessarily be the generator, as it is possible for responsibility for the safe handling, treatment or disposal of waste to pass from one competent contracting party to another. The polluter may therefore not be the generator but could be a disposal site operator or a transporter. Through the ‘duty of care’ principle, however, the generator will always be one of the parties held accountable for the pollution caused by the waste. Accordingly, the generator must be able to prove that the transferral of management of the waste was a responsible action. The polluter pays principle acceding to NEMA dictates that “the cost of remedying pollution, environmental degradation and consequent adverse effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.”

7.8 DUTY OF CARE RESPONSIBILITIES

Section 28 of the NEMA makes provision for duty of care, and remediation of environmental damage. The binding principles are described below:

1. Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, as far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.



(1A) Subsection (1) also applies to a significant pollution or degradation that-

- a) occurred before the commencement of this Act;
 - b) arises or is likely to arise at a different time from the actual activity that caused the contamination; or
 - c) arises through an act or activity of a person that results in a change to pre-existing contamination.
2. Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-
- a) any activity or process is or was performed or undertaken; or
 - b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.
3. The measures required in terms of subsection (1) may include measures to-
- a) investigate, assess and evaluate the impact on the environment;
 - b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
 - c) cease, modify or control any act, activity or process causing the pollution or degradation;
 - d) contain or prevent the movement of pollutants or the cause of degradation;
 - e) eliminate any source of the pollution or degradation; or
 - f) remedy the effects of the pollution or degradation.

7.9 FAILURE TO COMPLY WITH ENVIRONMENTAL CONSIDERATIONS

Within the provisions of the relevant environmental legislation, there are a number of penalties for non-compliance or offences. Below a few extracts are presented for information purposes, however these must not be read in isolation and the reader is reminded that there are other Acts, or sections of Acts, that may be applicable to the relevant project:

- NEMA Section 49B(1): A person convicted of an offence in terms of section 49A(1)(a), (b), (bA), (c), (d), (e), (f), (g), (q) or (r) is liable to a fine not exceeding R10 million or imprisonment for a period not exceeding 10 years, or both such fine and imprisonment. This includes, amongst others, commencing with a listed activity without an environmental authorisation and non-compliance with environmental authorisation conditions or an approved EMP;.
- NEMA Section 49B(2): A person convicted of an offence in terms of section 49A(1)(i), (j) or (k) is liable to a fine not exceeding R5 million or imprisonment for a period not exceeding 5 years, and in the case of a second or subsequent conviction, to a fine not exceeding R10 million or imprisonment for a period not exceeding 10 years, or both;
- NEMA Section 49B(3): A person convicted of an offence in terms of section 49A(1)(h), (l), (m), (n), (o) or (p) is liable to a fine not exceeding R1 million or imprisonment for a period not exceeding one year, or both such fine and imprisonment;
- NWA Section 151 (1c): No person may fail to comply with any condition attached to a permitted water use under this Act;



- NWA Section 151 (2): Any person who contravenes any provision of subsection (1) is guilty of an offence and liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment;
- NEM:BA Section 102 (1): A person convicted of an offence in terms of section 101 is liable to a fine not exceeding R10 million, or an imprisonment for a period not exceeding ten years, or to both such a fine and such imprisonment;
- NEM:WA Section 68 (1): A person convicted of an offence referred to in section 67(1)(a), (g) or (h) is liable to a fine not exceeding R10 million or imprisonment for a period not exceeding 10 years, or both a fine and such imprisonment, in addition to any other penalty or award that may be imposed or made in terms of the National Environmental Management Act;
- NEM:WA Section 68 (2): A person convicted of an offence referred to in section 67(1)(b), (c), (d), (e), (f), (i), (j), (k) or (l), or section 67(2)(a), (b), (c), (d) or (e), is liable to a fine not exceeding R5 million or imprisonment for a period not exceeding 5 years, or both a fine and such imprisonment, in addition to any other penalty or award that may be imposed or made in terms of the National Environmental Management Act;
- NEM:WA Section 68 (3): Any person convicted of an offence referred to in section 67(1)(m) is liable to a fine or to imprisonment for a period not exceeding six months or to both a fine and such imprisonment;
- NEM:WA Section 68 (4): A person who is convicted of an offence in terms of this Act and who persists after conviction in the act or omission that constituted the offence commits a continuing offence and is liable on conviction to a fine not exceeding R1 000 or to imprisonment for a period not exceeding 20 days, or to both such fine and such imprisonment, in respect of each day that person persists with that act or omission.

It is recommended that a procedure for non-compliances (i.e. incentives or disincentives for conformance and non-conformance with the EMP requirements) must be employed to ensure that the EMP is adequately implemented. The system to be used must be determined before construction commences, included in the tender documents and contracts, and made clear to all project workers. The system shall be established prior to the commencement of construction, incorporated into the tender and contract documentation, and communicated to all contractors, subcontractors, and site personnel. The Environmental Control Officer (ECO) shall be responsible for identifying, documenting, and reporting instances of non-compliance, and may recommend appropriate corrective actions and contractual remedies where provided for in the contract. Such remedies may include the recovery of remediation costs, withholding of payments, issuing of non-conformance notices, or the application of contractual penalties by the Employer or authorised contract representative. These contractual remedies shall be separate from, and in addition to, any enforcement action or penalties that may be imposed by the relevant authorities in terms of applicable environmental legislation, authorisations, licences, or permit conditions.

8 POTENTIAL IMPACTS IN THEIR RESPECTIVE PHASES

The EMP includes preventative measures to firstly avoid potential risks and impacts. Where avoidance is not possible, the EMP provides mitigation measures to control, remedy or modify risks and impacts. Given that some of the proposed activities align with historical applications in the area such as the ER315 and ER386, it is essential to identify and adopt the successful mitigation measures implemented during previous projects. Therefore, the general interpretation of the activities and mitigation measures is indicated in **Table 8**. The updated potential risks and impacts identified for each phase, is summarised in **Table 9** below.

It must be noted that the gazetted Generic EMP for Gas Pipeline Development was reviewed during the compilation of the site-specific EMP. The requirements and mitigation measures contained therein were assessed for applicability to the proposed development. Where relevant and not already addressed through



project-specific management measures, the requirements of the Generic EMPr were incorporated into the site-specific EMPr. Where the site-specific EMPr prescribes equivalent or more stringent mitigation measures based on specialist findings and local environmental sensitivities, the project-specific measures take precedence.

Table 8: Interpretation of identified activities and mitigation measures.

Colour Text Reference	Colour Coding	Interpretation
xxxx	Black	Existing relevant management and mitigation measures tried and tested for the activities in the same region.
xxxx	Dark Blue	New relevant management and mitigation measures identified as part of the D3 Energy ER386 EMPr adopted for the proposed D3 Energy PR16 activities.
xxxx	Light Blue	New relevant management and mitigation measures identified as part of the D3 Energy PR16 EIA.



Table 9: Potential impacts and risks in their respective phases

Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
9.1. General	Project Life Cycle	Exploration & production. Short to long term, localized	• Demarcation of sensitive areas in consultation with relevant specialists and ECO. • Minimise removal of vegetation as far as possible. • Obtain necessary specialist input and undertake relocation of protected species where necessary. • Implement dust suppression measures in all areas that will be affected by construction activities and where dust will be generated. Dust suppression must also be undertaken during windy and dry weather conditions. • Limit vehicle access. • Compile and Implement alien vegetation management plan due to Category 1b Alien Species on site. • Ongoing identification of risks and impacts. and • Monitoring and review. • The working hours stipulated in the Construction permit, where applicable, must be adhered to. Where this is not applicable, the following working hours must be adhered to: Monday to Friday from sunrise to sunset and where applicable on a Saturday or Sunday which must be agreed upon between the affected parties and the Contractor. • The contractor must attempt to restrict noisy activities as far as is possible to times and locations whereby the potential for noise nuisance is reduced. Noise producing activities must be limited to daytime after 07h00 and 17h00 on weekdays. A minimum of a 48-hour notice period is required to the landowner and directly adjacent landowners prior the activities. • A suitable qualified Environmental Officer (EO) or Environmental Compliance Officer (ECO) must be appointed prior to the establishment phase. • The duration of the activities must be minimized to as short term as possible, to reduce the period of disturbance on the area. • Areas outside the direct project footprint, must under no circumstances be disturbed. • Speed restriction of no more than 40km/h must be implemented for all construction vehicles within the construction site.	NEMA MPRDA NEMBA NEMAQA Dust Regulations NWA DWAF Best Practice Guidelines	Throughout project life cycle



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Soils and agricultural fields outside the direct project footprint, must under no circumstances be disturbed. • Landowner engagement must be undertaken during the project phases to investigate possible scenarios for appropriate compensation of landowners for loss / disturbance of high land capability and/or grazing areas where necessary. • No activities are to be permitted within on wetlands or watercourses (32 m pre-mitigation and a 15 m post-mitigation buffer) without the necessary Water Use Authorisation. • Areas rated as High sensitivity outside of the direct construction / activity areas must be declared as 'no-go' areas during the life of the project, and all efforts must be made to prevent impacts and access to these areas from construction workers and machinery. • All laydown, chemical toilets etc. must be restricted to low / medium sensitivity areas. Any materials may not be stored for extended periods of time and must be removed from the project area once the construction / activities have been concluded. • All contractors and employees must have appropriate site identification. • Vehicles must have appropriate vehicle/site access identification. • There must be access control to the entry / exit points of the sites. • The financial provision must be updated based on the final design prior commencement of activities. • A noise complaints register must be kept. If complaints are received, noise sampling should be undertaken at the NSRs, the source of noise must be investigated. Channels for logging of complaints must be communicated to all residents within 2 km of the drilling site and 1km of the seismic transects. • Should noise become a nuisance (complaints), adequate / viable noise suppression measures must be implemented. • All equipment must be kept in line with manufacturers specifications. This should particularly include the regular inspection and, if necessary, replacement of rotary equipment. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance. • Use physical structures such as retaining walls or silt fences on steep or unstable slopes to prevent soil erosion.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• The Holder should work with the existing and preferred farmers' security group and implement the AgriSA farm access protocol (or equivalent protocol) for everybody that need to access the properties. • Maintain regular and proactive communication with landowners to inform them of activities, schedules, and any changes to personnel or site access. • Adopt a formal recruitment policy that ensures equal access to employment and training opportunities for women and other marginalised groups. • If the drill pads and/or site camps are fenced, the fences must be checked for snares on a daily basis for the duration of the activities. All incidences must be recorded, and the ECO must be informed to advise on additional mitigation measures. Anti-poaching toolbox talks must form part of the induction process of all the fencing teams. Any contractor or employee caught poaching must be removed from site. • Applicant must appoint and maintain a dedicated Public/Landowner Liaison Officer throughout the life of the project. • Reinstate drainage systems, irrigation channels and farm roads as soon as reasonably practicable following disturbance. • Where topsoil stripping is required, ensure topsoil is stripped, stored separately and reinstated to maintain agricultural capability. • Post-rehabilitation monitoring must continue until agricultural productivity and grazing suitability are restored to baseline conditions or as agreed with the affected landowner. • Applicant must coordinate with affected mining right holders and prevent and/or manage any potential impacts on mining activities. • Verify the location of active and historical mine workings through consultation with mining companies and available records. • Any service interruption must be reported immediately to the affected party and repaired within agreed response times. • Maintain emergency contact details for all service providers and affected landowners. • Regularly maintain project access roads to minimise dust and road deterioration. • Maintain an accessible grievance mechanism throughout all project phases. • Restrict flaring to commissioning, maintenance and emergency situations.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Conduct periodic noise monitoring during drilling near occupied residences. • Prior to commencing work each day, at least one individual must traverse the working area in order to scare away any fauna within the seismic or drilling area, promoting temporary fauna migration from direct line of impact. • Any holes/deep excavations must be done in a progressive manner on a need only basis. Minimal holes/excavations may be left open overnight. In the event holes/excavations are required to remain open overnight, these areas must be subsequently inspected prior to backfilling. • Implement Local Economic Development (LED) projects identified through the approved Social and Labour Plan (SLP) and ensure that such projects are aligned with the relevant municipal Integrated Development Plans (IDPs) and community development needs. • Implement the approved SLP Human Resource Development and Local Economic Development commitments and engage with the relevant municipalities and stakeholders during their planning and implementation. • Disclose water-use requirements to affected landowners and agree abstraction arrangements to avoid placing additional pressure on local resources. • Site wells and pipelines away from residences where feasible and implement and communicate emergency-response and safety procedures. • Where reasonably practicable, promote participation by women-, youth-, and locally owned enterprises in skills development and Local Economic Development initiatives implemented through the approved SLP, in consultation with relevant stakeholders and municipalities. • Provide a full project information and engagement where reasonable to key community structures (e.g. MEJCON-SA, forums) on request. • Conduct water-quality assessments of all identified nearby boreholes and surface-water sources in line with the water monitoring plan prior to commencement and share results with landowners.		
9.2. Site Planning and Preparations	Planning	Exploration & production. Short term and localized	• Prior to accessing any portion of land, the Applicant must enter into formal written agreements with the affected landowner. This formal agreement should additionally stipulate landowners' special conditions which would form a legally binding agreement. • Where there are any other pre-existing rights / agreements (predating either the agreement between the landowner and the Applicant or the Approval of the	NEMA NEMBA CARA NEMAQA	Throughout Planning Phase



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			of the existing Exploration Right), the Applicant must seek and obtain co-existence agreements with the relevant party i.e., establish coexistence agreements where activities overlap with approved renewable-energy developments or mining rights. - Local residents (landowners and directly adjacent landowners) must be notified of any potential significant noisy activities or work, and these activities must be undertaken at reasonable times of the day; - Landowners must be notified beforehand of the activities to be undertaken in their properties and requested to indicate the type and location of services within their properties; - There must be a formal procedure in place on how to report incidents to ensure records of all grievances are kept, and responses are given within a certain time; - Utilize local labour as far as possible; - Have an adequate emergency preparedness plan. The Plan must include: ➤ A fire prevention and response plan; ➤ A Spill Prevention and Response Plan specifically addressing gas, fuel and chemical releases from transport and loading/unloading operations - If any damage occurs to services / infrastructure caused by the project, the applicant will be liable to fix it to its original state; - Before the project commences, an asset and services baseline of services that may be affected within 50m of the area must be compiled. A copy of the baseline records should be given to each landowner/ service provider, and a master document must be kept by the applicant; - Underground mining companies (if any) within the identified drilling locations must be engaged during the planning phase to ensure the drilling activities do not interfere with underground mining activities. - The Developer shall inform all landowners of the commencement of construction activities at least 30 days before commencement. Landowners must be requested to indicate the type and location of services within their properties; - Before the project commences, an asset and services baseline of services that may be affected within 10m of the centreline of the seismic transect and 10m from the edge of drilling point must be compiled. A copy of the baseline records	Dust Regulations Road Traffic Act	



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			should be given to each landowner/ service provider, and a master document must be kept by the applicant; • A services impact and interruption plan must be developed for sites which intersect existing services in order to minimize and manage potential interruptions should they occur due to an incident. Notice of planned any service interruptions (if any) must be given at least 2 days before the interruption takes place and must be as short as reasonably possible – an SMS or e-mail system can be used for this purpose; and • All residents within 2 km of drilling activities and 1 km of seismic surveys must be informed regarding the activities. Scheduling of activities should be communicated and coordinated with adjacent residents (where applicable). • Signage indicating the channels for logging grievances must be posted at the closest public road boundary and/or at the central site entrance. • The Emergency Response Plan must be updated to contain measures to prevent and react to abnormal events including but not limited to: ➤ Blowout Preventers / Diverters ➤ Shut-In Procedures to trigger the Blowout Preventers / Diverters system to physically seal the well and stop the flow of fluids ➤ Emergency Shutdown Systems (ESD) to isolate valves and shuts rig power to prevent escalation into a major incident ➤ Use of feasible and available high-efficiency flare systems (achieving a 98% or higher destruction efficiency) for flaring of excess gas during drilling activities ➤ Specific, site-tailored intervention strategies to be deployed to circulate out reservoir influxes and re-establish reservoir equilibrium pressure ➤ A 100-meter danger zone is immediately enforced around the wellhead ➤ Active Spill Prevention, Control, and Countermeasure ➤ Adequate emergency response team with sufficient containment materials and berms to be used to prevent leaked fluids from entering local waterways or soil • A walkdown by a qualified independent ECO must be undertaken at final drilling sites, along final seismic transects, gas plant location sites and along final gas gathering pipeline routes as part of the preconstruction survey. The ECO must advise on additional mitigation measures where applicable.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• A walkdown by a suitable specialist (ecologist) must be undertaken along final drilling sites, seismic transects, gas plant location sites and along final gas gathering pipeline routes as part of the preconstruction survey. The specialist must investigate and/or confirm presence of SCCs. Should any SCCs be identified, the specialist must provide additional mitigation measures to avoid impacts on the identified SCCs. Permits / Licenses must be obtained prior any disturbance and/or relocation of SCCs. The Ecologist must identify all wetlands within 500m of the activities and depending on the outcome of the NWA Risk Assessment, the Applicant must obtain the relevant water use authorizations. • A walkdown by a qualified archaeologist must be undertaken at final drilling site, along final seismic transects as well as final gas plant location sites and along final gas gathering pipeline routes as part of the preconstruction survey. The archaeologist must advise on additional mitigation measures should any heritage features be identified along the seismic transects and/or drilling site. • A well design must be developed by a suitably qualified professional (such as a well/ reservoir engineer). The design shall comply with recognised petroleum industry standards and any requirements of PASA, the approved work programme, exploration or production right, and applicable legislation. Relevant well planning and drilling information shall be submitted to PASA in accordance with regulatory and reporting requirements prior to commencement of drilling. • The well design shall comply with Good International Industry Practice (GIIP) and must ensure that all installed casing strings and associated cementing are engineered to withstand anticipated worst-case formation pressures and the pressures associated with contingency well control (kill) operations. • Adequate contingency provisions shall be maintained on site or within close proximity, including the availability of base fluids and additives (if required based on expected reservoir pressures) and/or pre-mixed drilling fluids, to enable the rapid preparation and deployment of kill fluid where required. • Co-develop Access and Rehabilitation Agreements outlining duration, extent of disturbance, rehabilitation obligations, biosecurity protocols, and opt-out clauses for landowners.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Prior to commencement on a property, conduct appropriate meetings with affected landowners to explain the exact scope and timing of activities on the specific property. • Compliance with all statutory requirements relating to the design, manufacture, installation, operation, inspection, testing, certification and maintenance of pressure vessels and pressure equipment. This includes compliance with the Occupational Health and Safety Act, 1993 (Act 85 of 1993), specifically the Pressure Equipment Regulations, 2009 (as amended), and all incorporated standards, including SANS 347 (Categorisation and Conformity Assessment Criteria for Pressure Equipment), applicable ASME Codes, and other prescribed SANS standards relevant to gas processing, storage, transportation and pressure systems. • All pressure vessels must be designed, verified, tested, certified, marked, registered where required, and inspected by suitably qualified persons and approved inspection authorities prior to commissioning and throughout the operational life of the facility. • Compliance with applicable SANS codes, i.e., SANS 10087, SANS 10089, SANS 10108, SANS 10142. • Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into the designs. • Completion of a recognised process hazard analysis (such as a HAZOP study, FMEA, etc.) on the proposed facility prior to construction to ensure that design and operational hazards have been identified and that adequate mitigation is put in place. • Application of IEC 61508 and IEC 61511 for safety instrumented systems, or equivalent recognised standards, where the process hazard analysis identifies instrumented protection, as necessary. The required safety functions, integrity targets, independence, reliability, testing, maintenance and management arrangements must be defined and maintained throughout the facility life cycle: ➤ The designer must provide documented verification that the protective instrumentation is sufficient, suitably independent and reliable for the identified hazards and is correctly specified, installed, commissioned, proof-tested and maintained		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• During detailed design, a Safety Basis Document (or equivalent process safety document) should be prepared and maintained. The document shall describe the principal design features, assumptions, engineered safeguards, safety instrumented systems, and management measures adopted to prevent and mitigate the consequences of fires, explosions, loss of containment events, flammable or toxic releases, and oxygen-deficient atmospheres. The document should be informed by the project's process hazard analyses, risk assessments, and applicable requirements of the OHS Act, relevant regulations, and recognised industry standards. ➢ Demonstration of compliance with applicable legislation, codes and standards and recognised good engineering practice; ➢ Including the listing of statutory and non-statutory inspections, giving frequency of inspections; and, ➢ Prior to commissioning, an independent verification or commissioning readiness review should be undertaken to confirm that the as-built facility conforms to the approved design basis, safety philosophy, and critical safety requirements. Any deviations shall be identified, documented, appropriately risk assessed, and either rectified or formally accepted through the project management of change process before start-up • Noting that codes, such as IEC 61511 can be used to achieve these requirements. • Verification during detailed design, using complete engineering information and final maximum hazardous-material inventories, that the aggregation value remains below the lower-tier threshold and that the gas gathering pipelines do not meet the Chapter 3 criteria. The assessment and supporting calculations must be documented and reviewed by a competent process-safety practitioner. If the final design, inventories, containment arrangements or operating conditions cause any applicable threshold or Chapter 3 criterion to be met or exceeded, the MHI Regulations (2022) must be applied and an MHI risk assessment must be undertaken by an Approved Inspection Authority before construction or operation, as applicable; • Signature of all designs by a professional engineer registered in South Africa in accordance with the Professional Engineers Act, who takes responsibility for suitable designs.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Submission of the final design safety basis and documented tier-reassessment outcome to the relevant local government authority as part of the applicable approval process (where applicable). Based on the current design information, the facility falls below the lower-tier threshold and is not classified as a Major Hazard Establishment. An MHI risk assessment and registration will therefore only be required if the final design, maximum hazardous-material inventories, containment arrangements, operating conditions or pipeline design trigger an applicable threshold or Chapter 3 criterion: ➤ The final verification must be based on the completed design and maximum credible inventories and must account for all engineering safeguards and mitigations. • Prior to construction and commissioning, obtain and retain documented confirmation from a suitably qualified and registered design engineer that the facility design incorporates sufficient, appropriate, and reliable instrumentation for the safe monitoring, control, and protection of all production processes and pressure systems. Evidence shall include approved instrumentation and control drawings, instrument specifications, alarm and shutdown philosophies, and commissioning records demonstrating that all specified instrumentation has been installed, tested, calibrated, and is fully operational. • Completion of an emergency preparedness and response document for on-site and off-site scenarios prior to construction. • Prior to construction, the holder shall obtain all permits, approvals, authorisations and consents required by applicable legislation and the relevant authorities having jurisdiction, including, where applicable, land-use planning, building control, emergency services, water use, environmental and petroleum regulatory approvals. Where facility risk assessments or emergency response plans are required by legislation or permit conditions to be submitted to a competent authority, evidence of such submission, review or approval shall be retained and made available for audit purposes. Construction may only commence once all legally required approvals and authorisations have been obtained. Construction may only commence once all required approvals, permits, and authorisations have been issued and are available for audit purposes.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Where possible, work must be restricted to one area at a time and be systematic. This is to reduce the number and extent of on-site activities, allowing fauna to move off as the Project progresses. This will give the smaller birds, mammals and reptiles a chance to weather the disturbance in an undisturbed zone close to their natural territories. • Schedule seismic surveys and drilling activities outside critical planting and harvesting seasons where reasonably practicable. • Avoid locating drilling pads within high-value cultivated areas unless no reasonable alternative exists. • Prioritise degraded land, existing servitudes, fence lines and previously disturbed areas for infrastructure placement, where reasonably practicable. • Maintain access for agricultural machinery and farming operations at all times unless otherwise agreed with the landowner. Temporary access restrictions may only be allowed if agreed upon with the landowner. • Implement farm-specific biosecurity measures to prevent the spread of weeds, pests and livestock diseases. • Establish formal engagement procedures with renewable energy developers where activities occur within 200m of approved renewable energy projects. • Where activities overlap with renewable energy developments, obtain confirmation of planned infrastructure from renewable energy developers prior to finalising drilling locations. • Confirm the location of existing and approved renewable energy infrastructure prior to final route selection. • Prepare a conflict avoidance protocol where future gas, mining and renewable energy developments may overlap. This can be addressed through the co-existence arrangements. • Engage existing mining right holders to request and if possible, obtain confirmation of planned infrastructure from mining companies prior to finalising drilling and pipeline routes. • Communicate execution plans, drilling locations, methods and depth with affected mining right holders. Take necessary measures to avoid impacting any mining activities. • Clearly demarcate all identified services and infrastructure which may potentially be affected prior to activities.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Maintain minimum separation distances from existing utility infrastructure in accordance with applicable standards. • Maintain a minimum of 50m setbacks from known gas wells, monitoring boreholes and related infrastructure. • Avoid planned electrical collector routes, substations and solar infrastructure wherever feasible. • Schedule seismic surveys and drilling outside planting and harvesting seasons where practicable. • Schedule drilling, seismic and gathering pipelines ahead of renewable-energy construction where possible. • Temporary livestock relocation (where applicable) must be planned in consultation with affected landowners before activities commence. • Any temporary livestock relocation costs incurred due to project activities must be compensated by the Holder where applicable. • Livestock exclusion zones must be minimised to the smallest practical area and duration. • Safe livestock crossings must be maintained during pipeline construction and trenching activities. • Open trenches must either be backfilled daily, fenced or fitted with escape ramps to prevent livestock entrapment. • All temporary fencing must be installed in consultation with the affected landowner. • Water points, supplementary feeding areas and handling facilities must remain accessible wherever possible. • Production well locations must be positioned adjacent to existing fence lines, farm roads and disturbed areas wherever practical to minimise fragmentation of grazing land. • A fire action plan needs to be complied and implemented to restrict the impact unplanned fires might have on the surrounding areas. This should be part of the emergency response plan. • Install temporary acoustic screens around drilling equipment within 1 km of occupied residences. • Exploration and drilling should be planned for dry weather conditions to minimise damage to road infrastructure.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			Existing accommodation facilities should be utilised wherever feasible to reduce social, visual and disturbance impacts associated with temporary construction camps.		
9.3. Establishment of site infrastructure	Construction / Exploration / Production	Exploration & production. Short term and localized	- Minimise physical footprint of construction. Construction / activity impacts associated with the proposed project must be contained within the footprint of the assessed areas; - Ensure construction is consistent with occupational health and safety requirements; - Minimize vegetation clearance. Existing gravel roads must be used as far as possible. Clearance of vegetation must be kept to the required footprint (i.e. 50 x 50 m drill pad). Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, must under no circumstances be fragmented or disturbed; - Ensure proper and adequate drainage; - Minimise waste and control waste disposal; - Fencing of all drill sites with security / access control and warning signs; - Establish waste storage areas for recycling; - Ensure adequate containment of waste to prevent pollution; - Minimise dust generation; - Limit vehicle access to approved access roads; - All construction plant and other equipment must be in a good working order to reduce possible noise pollution. - Minimise the height and visual prominence of aboveground infrastructure where technically and operationally feasible. - Avoid unnecessary night-time illumination outside operational and safety requirements.	NEMA MPRDA NEMBA NEMAQA Dust Regulations NWA DWAF Best Practice Guidelines	Throughout construction phase
9.4. Storage of construction vehicles	Construction and Operation	Short term and localized	- Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. Drip trays and/or adequate containment must be of a size that the equipment can be placed inside it; - Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility; and	NWA DWAF BPG	Throughout construction and operation



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed activities to reduce the compaction of soils.		
9.5. Transportation/ access to and from activities	Construction and Operation	Short term and localized	• Where possible, drill sites must be located along existing access roads to reduce the requirement for additional access roads; • Any new temporary access routes must result in minimal disturbance to existing vegetation as far as possible; • All farm gates must be closed immediately upon entry/exit; • Reasonable measures to prevent damage of farm gates, fences, etc. must be implemented. Any damage caused by the activities must be repaired or replaced as soon as practically possible; • On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic (where relevant); • All construction and vehicles using public roads must be in a roadworthy condition and their loads secured. They must adhere to the speed limits and all local, provincial and national regulations with regards to road safety and transport; • Damage caused to public roads as a result of the construction activities must be repaired in consultation with the relevant municipal authorities; and • Appropriate measures must be implemented to minimize the potential of dust generation.	NEMA NEMBA CARA NEMAQA Dust Regulations Road Traffic Act	Throughout Construction and Operation
9.6. Storage of hazardous substances	Construction and Operation	Exploration & production. Short to long term, localized.	• All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill; and • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall.	NWA NEMWA DWAF BPG	Throughout Construction and Operation
9.7. Waste Management	Construction and Operation	Exploration & production. Short to long term, localized.	• Waste generated on site must be recycled as far as possible. Recyclable waste must not be stored on site for excessive periods to reduce risk of environmental contamination;	DWAF requirements for waste disposal	Throughout Construction and Operation



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Drill muds, formation water (if encountered), etc. would constitute waste and must be classified and ranked in terms of relevant legislation for correct disposal; and • A Waste Management System must be implemented, and provide for adequate waste storage (in the form of containers, skips, etc.) waste separation for recycling, and frequent removal of non-recyclable waste for permanent disposal at an appropriately licensed waste disposal facility. No waste material is to be disposed of on site.		
9.8. Aerial Surveys	Operation	Localized and Short Term	• Aerial flying for gravity/magnetic data must be undertaken in accordance with the CAA regulations as well as any reasonable specific requirements of the affected landowners; • Minimum flight height restrictions include 2500ft above nature reserves and 500ft in open areas unless otherwise agreed to with the CAA and the affected landowners; • A risk assessment associated with the aerial surveys must be prepared by the appointed aerial survey contractor and/or aircraft operator prior to conducting this activity and must include a flight plan with due cognisance of the noise receptors and risks along the flight paths.	CAA Regulations	Throughout operation
9.9. Gas plant, well drilling and seismic Surveys – hydrology and hydrogeology	Operation	Localized and Short term	• The activities assessed as part of the EIA may only be undertaken within the assessed buffers / corridors. • Construction / drilling must preferably not be conducted during rainy days. If drilling is to be undertaken during rainy days, additional precautionary measures in consultation with the ECO must be implemented to prevent contamination on surface water; • Undertake pre- and post-drilling water quality monitoring in accordance with the approved monitoring programme or specialist recommendations. Monitoring results shall be recorded, assessed against baseline conditions, retained for auditing purposes, and submitted to the relevant competent authority where required by an Environmental Authorisation, Water Use Licence, other regulatory approval, or upon request by the authority; • Dust suppression methods must be applied when necessary to restrict the visual impact of dust emissions; • Any spills of hydrocarbons or fluids used during operation, must be cleaned up immediately;	MPRDA Regulations GN R527 SANS 10103 ECA Noise Regulations NEMAQA Dust Regulations NWA DWAF BPG NHRA	Throughout operation



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Excavations must be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated. Above ground steel or plastic sumps at the riparian areas must be used which must include a secondary containment barrier to eliminate possible soil and shallow aquifer contamination; • Construction vehicles and machines must be maintained properly to ensure that oil spillages are kept at a minimum; • Spill trays must be provided if refuelling of drilling rig and vehicles are done on site; • A Groundwater Monitoring Program must be implemented in nearby private boreholes to establish impacts of groundwater extraction. Monitoring results should be reviewed bi-annually by a registered hydrogeologist and submitted to DWS upon request. Baseline data must be obtained on groundwater and surface water quality prior to any drilling commencing; • No boreholes may be drilled in the immediate vicinity (<50m) of existing private boreholes unless adequate engineering measures such as well design and construction controls are in place to avoid affecting the integrity of the private borehole as well as approval from the private owner is obtained prior; • Where topsoil stripping is required, soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils; • Appropriate stormwater, erosion and contamination containment measures shall be implemented at drill pads based on site-specific drainage, topographical and environmental conditions. Measures may include berms, diversion drains, cut-off drains, containment trenches, sediment controls, or other suitable infrastructure where required to prevent erosion, contaminated runoff, and off-site migration of pollutants. The final design shall be informed by detailed engineering design and site-specific risk assessments; • A liner must be placed at the drill pad where there is potential for spills / contamination and drip trays must be used in all areas where hydrocarbons are handled;		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			- On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic; - Workforce should be kept within defined boundaries and to agreed access routes. - Regular monitoring of fugitive emissions must be undertaken throughout the drilling activity up to the decommissioning of the wells. - The holder must comply with the approved PASA Basis of Design Report specifies the engineering design principles and methodology which are applicable to this project. - Seismic surveys, drilling sites, gas plants and gathering pipelines should be located within the EIA-assessed corridors. Should additional exploration and/or production activities fall outside of the EA assessed footprint areas, but within PR16, then depending on the final location of the seismic survey, drill site, gas plant or gas gathering pipeline with respect to the locations sensitivity as defined by the sensitivity maps, and in consultation with the ECO and relevant specialists, the following must be undertaken prior to surveying / drilling: - In low sensitive areas, an ECO walkdown (at minimum) must be undertaken by an independent ECO to assess potential impacts and/or provide site-specific mitigation measures as well as identify any additional specialist input requirements prior the commencement of activities. The conditions of the EMPr (as a minimum) must be complied with; - In medium sensitive areas, the respective specialists must be brought to site to assess the final seismic transect and drill site and surroundings (100m corridor for seismic transect, 100m corridor for gathering pipelines, 1km radius for drill site and 1km radius for gas plant) and develop site-specific mitigation measures. Furthermore, the conditions of the EMPr must be complied with; and - In high-sensitive areas, the respective specialists must be brought to site to assess the seismic transect and final drill sites and surroundings (100m corridor for seismic transect, 100m corridor for gathering pipelines, 1km radius for drill site and 1km radius for gas plant) and develop site specific mitigation measures. These measures (site specific EMPr conditions) must be submitted to the PASA for approval prior to commencement with the activities.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Due to the sensitivity of the riparian zone, any development and/or drilling which takes place within the primary porosity aquifer associated with alluvium material deposited in flood plains must be restricted if it cannot be avoided. Pitless drilling must be implemented for drilling within the riparian zone to further reduce the risk of contamination from the drill sump. • Drilling localities should ideally be determined in consultation with a suitably qualified hydrogeologist and sited means of a geophysical survey to target lineaments and weathered zones acting as preferred groundwater flow pathways and contaminant transport mechanisms. • An adequate representative of newly established monitoring boreholes must be subjected to aquifer hydraulic parameters testing to supplement and verify existing hydraulic parameters interpreted as part of the first phase drilling and testing run. • Due to limited aquifer characterisation data pertaining to the deep hydrostratigraphical unit, it is recommended that potential water strikes encountered during proposed exploration drilling be recorded along with associated water levels in order to get a better understanding of the deeper aquifer piezometric head and expected behaviour. • Geological exploration logs and data recording must include major water strikes and depths, water loss or water make volumes and depths as well as blow yields if applicable. Should water from the deeper, fractured aquifer be encountered, a sample should be collected where possible to be subjected for inorganic testing as well as isotopes ($\delta^{18}\text{O}$, $\delta^2\text{H}$) and radionuclide analysis in order to determine potential risks as well as validate surface water and groundwater interactions • The calibrated groundwater flow model must be reviewed periodically by a suitably qualified hydrogeologist and updated where monitoring results, additional site-characterisation data, drilling information, significant deviations from predicted groundwater behaviour, or material changes to the development indicate that refinement or recalibration of the model is required. The model shall remain an active groundwater management tool throughout the life of the project. • The monitoring program and network in Section 13.3.3 must be implemented and adhered to. It is imperative that monitoring be conducted to serve as an		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			early warning and detection system. Monitoring results must be evaluated on a bi-annual basis by a suitably qualified person for interpretation and trend analysis and submitted to the Regional Head: Department of Water and Sanitation upon request. • The Applicant must establish a weather station at a suitable place in order to keep record of all climatic events including rainfall, temperature and wind to assess potential climatic changes in the region. The latter should be incorporated into the climate change and numerical groundwater flow models as and when necessary. • Due to the sensitivity of the riparian areas, seismic activities must be as minimal as far as possible within the riparian areas. • Prior to drilling of the proposed production borehole targets, an updated hydrocensus user survey must be conducted within a 500.0m buffer zone at target areas where limited boreholes were surveyed to identify any potential groundwater receptors or privately owned boreholes being utilised. It should be noted that a hydrocensus surveys was conducted as part of this investigation to cover the majority of buffer zone areas, however an updated survey is recommended in order to verify any newly established borehole positions and will be used to substitute the existing database. • Any development and/or drilling which takes place within the primary porosity aquifer associated with alluvium material deposited in flood plains must be avoided where possible and restricted if it cannot be avoided. If there are no other alternatives available and drilling within the riparian zone aquifer is necessary, mitigation and management measures should be strictly adhered to. • Additional monitoring boreholes must be established within the proposed target areas buffer zone as identified in Section 13.3.3, to evaluate the mass load contribution to sensitive environmental and groundwater receptors. • Develop and implement a stormwater management plan in accordance with GN704 to separate dirty/contact water from clean water circuits. • If significant gas is encountered during drilling, respective boreholes must be sealed-off with a combination of casing and grouting to ensure isolation of the gas from the host-aquifer(s). Well design must be undertaken according to designs developed by a qualified well engineer.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• A surface casing vent flow test must be conducted to determine whether gas or liquid or a combination thereof is escaping from the casing. If gas is detected during this test, remedial work should be designed and implemented. • The Gas Plant footprint must be positioned outside wetlands and, where possible, outside recommended wetland buffers. • Wetlands downstream of the facility must be inspected after major incidents or storm events. • Surface runoff from operational areas must be managed to prevent discharge into wetlands. • Stormwater infrastructure must be designed for extreme rainfall and upset conditions. • Clean and dirty water systems must be separated and maintained. • Stabilise exposed soils and stockpiles using mulch, brush packing, sheeting, or similar temporary measures where heavy rainfall risk exists. • Install temporary sediment barriers downslope of exposed trenching areas and stockpiles where required based on erosion/runoff risk. • Fire detection, suppression and emergency shutdown systems must be installed and maintained. • Alien invasive plant monitoring and control must be implemented within and around the gas plant footprint. • Inspect pipeline infrastructure and maintenance equipment regularly for signs of leaks or failure. • Place topsoil, spoil, and construction material stockpiles outside wetlands, drainage lines, and natural flow paths. • Keep stockpiles to the minimum required size and duration and stabilise them where erosion risk is evident. • Do not place excavated material on the downslope side of wetlands or drainage features where it may obstruct or redirect flow. • Inspect stockpile and trench areas regularly, especially after rainfall, and correct any flow diversion or erosion immediately. • Prevent trench water from discharging directly into wetlands, drainage lines, or other watercourses. • Pump or decant trench water to stable, vegetated upland areas only where sediment can settle and no runoff to wetlands will occur.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			Designate refuelling and maintenance areas at least 50 m from any wetland or watercourse.		
9.10. Heritage and Palaeontology	life cycle of the project	Long term Regional	- Due to the possible occurrence of sacred sites in the area, a public participation process must be implemented during which the Interested & Affected Parties are invited to come forward and state whether they are aware of any sacred water sites (secret or not) located within a 200m radius area from each proposed exploration / production positions. It is important to note that at this stage the Interested & Affected Parties will not be requested to provide information on the exact location of such sacred sites, only whether such sites are located within a 500 m radius area from the proposed drilling position(s) or not. Care must be taken during the public participation to ensure that the cartographic and location information presented to the Interested & Affected Parties contain clear enough information for them to confidently recognize the positions of such proposed drilling site(s) should these be located anywhere in proximity to the properties and landscapes they have knowledge of. The presentation of such cartographic information in English, Afrikaans and Sesotho would be paramount: ➤ Should an Interested & Affected Party state that such a sacred site is indeed located within 200 m of a proposed drilling position, a heritage specialist and Geohydrologist (if the sacred site is associated with a spring, wetland, seep, stream, borehole, or other groundwater-dependent feature) must accompany the Interested & Affected Party to the sacred site for confirmation purposes; ➤ The heritage specialist and Geohydrologist must compile a letter to indicate the findings of their fieldwork i.e. whether such a sacred site was indeed identified within 200 m from the proposed drilling position; ➤ All aspects relating to the location of the sacred site must be kept strictly confidential. At no stage will any information regarding the position of the sacred site (GPS coordinates, property description etc.) be contained in the letter, or in any other report, document or verbal communication; ➤ The confidential manner in which this mitigation will be approached and undertaken with regards to the locations of Sacred Natural Sites, must be clearly communicated to the Interested & Affected Parties from the outset; - No drilling may be allowed within 100 m of a confirmed Sacred Natural Site;	NEMA NHRA	Throughout the life cycle of the project



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• The planning of all additional footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional footprints of the activities; • A qualified and independent heritage specialist must undertake heritage walkthroughs of the additional footprint areas to identify any heritage sites and/or provide additional mitigation measures. ➤ The appointed heritage specialist must compile a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed activity(ies) on the identified heritage sites and outlining mitigation measures which may be required. ➤ The report aimed specifically at the additional activity footprints, and must be submitted to SAHRA as well; • The Archaeologist must apply for a valid permit from SAHRA for the collection / removal of fossils if any fossils are identified; • An independent and suitably qualified ECO must be appointed and must train the Contractor to recognise potential heritage and / palaeontological features; • A 30m buffer around all identified heritage structures (particularly MPR018) and the LSA site (MPR019) must be implemented, within which no proposed activities are to take place. • A 50m buffer around all identified graves (particularly MPR021) must be implemented within which no proposed activities are to take place. If this is not possible, the graves could be relocated after completion of a detailed grave relocation process, that includes a thorough stakeholder engagement component, adhering to the requirements of s36 of the NHRA and its regulations as well as the National Health Act and its regulations; and • Should any heritage / palaeontological features be exposed during excavation, work on the area where the artefacts were discovered, shall cease immediately and the ECO shall be notified within 24hours, and a Chance Find Protocol must be implemented. The responsible heritage resources authority (FSPHRA), as well as the South African Police Service (SAPS) must be notified within 72hours.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
9.11. Refuelling	Construction and Operation	Short term and localized	• Refuelling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil; • Drip trays must be utilized in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly.	NWA DWAf BPG	Throughout construction and operation
9.12. Maintenance and Repair	Construction and Operation	Short term and Localized	• Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilized; • Excessive accidental hydrocarbon spillages (>200 litres) must be reported immediately to the ECO and DWS if spillage entered a watercourse, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility.		Throughout Construction and Operation
9.13. Air Quality & Climate Change	Construction and Operation	Medium term and Localized	• Reducing methane releases during well testing. Methane emissions must be monitored during well testing to assist with the greenhouse gas quantification. • 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. Also, maintenance and repair of diesel engines should be carried out as prescribed by manufacturer in order to maximise combustion and reduce gaseous emissions. • The Grievance Mechanism must be established and maintained throughout the project activities to indicate air quality complaints and responses. Channels for logging of complaints should be communicated to all residents within 600 m of the target areas and 300 m of the seismic transects. If complaints are received, they must be promptly investigated, recorded and addressed. • Robust Leak Detection and Repair (LDAR) Programs: ➤ Advanced LDAR programs can include visual checks and adequate and feasible methods which can include utilising calibrated rotameter combined with Tedlar bags with field-based or laboratory analysis for methane, infrared cameras (optical gas imaging), drones, satellites, or sensors, etc. to detect, locate, and quantify methane leaks from wells.	NEMAQA	Throughout Construction and Operation



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			➤ Leading practices recommend frequent (quarterly or even continuous) inspections. ➤ Upon detection, leaks must be repaired promptly to minimise fugitive emissions • Ensure all onsite employees receive extreme heat (hot-weather) training, maintain updated risk assessments, and monitor heat-related incidents. • Restrict flaring to commissioning, maintenance and emergency situations other than the pilot flare required for operational and safety reasons. • The selection of appropriate valves, flanges, fittings, seals, and packings should consider safety and suitability requirements as well as their capacity to reduce gas leaks and fugitive emissions. • During well testing, flaring of produced hydrocarbons must be avoided wherever practical and possible, and especially near local communities or in environmentally sensitive areas • Implementing a health and safety plan for work practices to manage heat stress and temperature extremes for workers. This could consider the following measures: ➤ Rotation of staff on hot days, ➤ Wearing of protective safety or reflective clothing when exposed to the sun or being outdoors to reflect radiant heat from the ground or infrastructure, ➤ Heat-related incidences should also be reported as part of the facilities health and safety reporting, to have such records for future heat related stress, ➤ Provision of work-rest procedure – frequent breaks and short work periods. • Measures consistent with the Global Gas Flaring and Venting Reduction Voluntary Standard (part of the World Bank Group's Global Gas Flaring Reduction Public-Private Partnership (GGFR program) should be adopted when considering flaring and venting options for onshore activities. • Before flaring is adopted, feasible alternatives for the use of the gas should be evaluated to the maximum extent possible and integrated into production design. If alternatives to flaring are not feasible, measures should be implemented to minimise flare volumes and continuous production flaring should be eliminated as a long-term objective.		



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			Implement an Air Quality Monitoring Programme including dustfall, VOC and NO₂ monitoring as specified in Table 16.		
9.14. Well Plugging	Decommissioning	Short term and localized	- All inactive drilling sites must be properly sealed to trap gases from escaping. Wells should be plugged to prevent crossflow of gas into aquifers and isolate all potential hydrocarbon / water bearing formations by utilizing placed cement plugs extending at least 30m above and below the reservoir; - Any mixing must be completed on a temporary impermeable layer or in a container; - All pouring of cement or grouting must be completed over a temporary impermeable layer to avoid spillage; - Prior to well suspension and decommissioning, the required approvals from PASA / DMPR must be obtained; - A decommissioning plan must be prepared and approved by the designated agency; - Cement and liquid concrete are hazardous to the natural environment on account of the very high pH of the material, and the chemicals contained therein. As a result, the contractor shall ensure that: - Concrete shall not be mixed directly on the ground; - The visible remains of concrete, either solid, or from washings, shall be physically removed immediately and disposed of as waste, (Washing of visible signs into the ground is not acceptable); and - All excess aggregate shall also be removed. - Proper plugging and abandonment - To prevent leaks from abandoned or inactive wells, wells must be plugged in accordance with international best practice and aligned with the approved FRDCP. - Regular monitoring of plugged wells is necessary to identify and remediate leakage from degraded cement or casing, which is a major source of methane seepage	NWA DWAF BPG	Throughout Decommissioning
9.15. Removal of surface infrastructure	Decommissioning	Small scale and localized	All infrastructure, equipment, and other items used during the activities must be removed from the site in line with the preferred closure option and post-closure land-use.	MPRDA In accordance with Rehabilitation Plan	Decommissioning



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			• Compaction of soil must be avoided as far as possible. The use of heavy machinery must be restricted in areas outside of the proposed sites to reduce the compaction of soils		
9.16. Removal of waste	Construction, Operation and Decommissioning	Small scale and localized	• Any general waste, excess or waste material or chemicals, including drilling muds etc. must be removed from the site and must preferably be recycled (e.g. oil and other hydrocarbon waste products). Any waste materials or chemicals that cannot be recycled must be disposed of at a suitably licensed waste facility. A signed copy of service agreement must be provided to Authorities when requested to demonstrate that indeed provision will be made to render such services; • No empty containers, drums, liner, concrete, foreign sand and stone, scrap materials or any such will remain on site; and • No foreign matter such as rubble or waste material shall be introduced into the well.	NWA DWAF BPG	Decommissioning
9.17. Rehabilitation	Rehabilitation	All disturbed areas	• Rehabilitation of the disturbed areas must be made a priority. Any disturbed area must be re-habilitated to either its pre-disturbed state as defined in the pre-drill survey or to support its post-closure land-use. This must be undertaken within six (6) months post drilling activities on areas which do not form part of the ongoing operations; • All debris and contaminated soils must be removed and suitably disposed of; • Natural drainage patterns must be restored; • The stockpiled topsoil will be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank; • During and after rehabilitation ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment; • Temporary access routes/roads no longer required or forming part of post-closure land-use must be suitably rehabilitated; and • Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved. • Apply mulch, geotextiles, or cover crops to protect bare soil while vegetation establishes.	MPRDA In accordance with the Rehabilitation Plan	Rehabilitation



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			- Engage ECO to review rehabilitation success and recommend improvements. Where rehabilitation affects watercourses, obtain input from wetland specialist on rehabilitation success and recommend improvements. - Rehabilitation monitoring must include assessment of post-construction grazing suitability where grazing forms part of the agreed post-closure land use.		
9.18. Monitoring	Post-operational	All rehabilitated areas	Following decommissioning and closure, post-closure monitoring, management and maintenance shall be implemented by suitably qualified independent specialists for periods appropriate to the identified environmental risks and the approved Final Rehabilitation, Decommissioning and Closure Plan (FRDCP). Monitoring and management shall continue until the relevant closure objectives, performance targets and relinquishment criteria have been achieved, or as otherwise required by the competent authority. The post-closure monitoring programme shall include, as applicable: - Biodiversity and rehabilitation monitoring, including revegetation success, erosion control and alien invasive species management; - Groundwater and surface water monitoring, including water level measurements and water quality analyses; - Monitoring of rehabilitated and disturbed areas and implementation of supplementary rehabilitation measures where required; - Monitoring of wetlands, drainage features and associated aquatic habitats where relevant; - Monitoring of fugitive gas emissions from abandoned well sites and associated infrastructure; - Monitoring and management of any latent or residual environmental impacts, risks or contamination identified during closure planning, decommissioning, rehabilitation or post-closure monitoring; and - Monitoring of any unforeseen impacts identified during the post-closure period, with the monitoring programme and management measures being adaptively updated to address such impacts where necessary.	MPRDA Regulations In accordance with Rehabilitation plan	Post-operation



Activities	Phase	Size and Scale of Disturbance	Mitigation Measures	Compliance with Standards	Time Period for Implementation
			Monitoring frequencies and durations shall be aligned with the approved FRDCP, specialist recommendations and regulatory requirements, and may be amended based on monitoring results, trend analyses and approval by the competent authority.		



9 PRE-COMMENCEMENT VERIFICATION AND APPROVAL SCHEDULE

The final positions and alignments of the production wells, exploration wells, seismic survey lines, gathering pipelines, access routes, processing facility and associated infrastructure shall be subject to pre-commencement verification. The purpose of this verification is to confirm that the final activity footprint remains within the authorised and assessed development envelope, avoids designated no-go areas and sensitive environmental or social features as far as reasonably practicable, and incorporates all applicable specialist mitigation, permitting and stakeholder requirements.

No site establishment, vegetation clearance, earthworks, drilling, trenching, survey activity or construction may commence at a specific site within the medium-high or high sensitivity until the applicable requirements in the schedule below (**Table 10**) have been completed and the site has been released in writing by the Environmental Control Officer or other designated responsible person .

Completion of the verification schedule shall not, by itself, authorise activities outside the footprint or development envelope authorised in the EA. Where the final layout differs materially from the assessed layout, falls outside an assessed corridor, affects a designated no-go area, or triggers an additional permit, licence or authorisation, the EAP shall determine the appropriate regulatory process in consultation with the relevant authority before the affected activity commences. All verification records, specialist findings, approvals and site-release certificates shall be retained by the Holder and made available for compliance monitoring and auditing.



Table 10: Pre-commencement Verification and Approval Schedule

No.	Verification or deliverable	Applicability and minimum requirements	Responsible party	Evidence or close-out record	Hold point
1	Confirmation of authorised footprint	Confirm that the final site, route or activity is located within the authorised Production Right area and the footprint or corridor assessed in the EIAR. Record the coordinates and overlay the final footprint against the approved layout and sensitivity mapping.	Applicant's project manager and GIS specialist, verified by ECO	Signed layout-verification form, coordinates and GIS map of site/s.	Final layout may not be released for construction until verified
2	Sensitivity-screening classification	Classify the final activity footprint as low, medium, high or no-go sensitivity using the consolidated sensitivity maps and relevant specialist spatial data. No-go areas must be excluded.	ECO with EAP and relevant specialists, where required	Site sensitivity screening form and annotated map	Determines the level of specialist verification required
3	ECO appointment and initial walkdown	Appoint a suitably qualified independent ECO before construction. The ECO must undertake a walkdown of all final sites and routes and identify additional management, specialist or permitting requirements.	Applicant	ECO appointment letter and signed walkdown report	Mandatory before physical disturbance
4	Specialist verification based on sensitivity	For low-sensitivity areas, an ECO walkdown must be completed as a minimum. For medium- and high-sensitivity areas, the relevant specialists (determined by the applicable theme) must inspect the final footprint and prescribe any additional site-specific mitigation. Where required by the authorisation, site-specific measures for high-sensitivity areas must be submitted to PASA for approval before commencement. The report currently identifies assessment areas of 100 m around seismic and pipeline corridors and 1 km around drill sites and the gas plant.	ECO, EAP and applicable specialist	Specialist walkdown report, site-specific mitigation schedule and proof of submission or approval where applicable	No commencement until required specialist sign-off and approval are obtained
5	Terrestrial biodiversity walkdown	Confirm the presence or absence of protected plants, floral and faunal species of conservation concern, sensitive habitats and ecological corridors. Micro-site infrastructure to avoid identified features. Obtain applicable permits before disturbance or relocation of protected species.	Qualified SACNASP Registered ecologist	Ecological walkdown report, marked-up layout, permit record and relocation plan where applicable	Vegetation clearance prohibited until close-out
6	Aquatic and wetland verification	Confirm delineated wetlands, watercourses, riparian areas, applicable buffers and hydrological connectivity against the final footprint. Avoid wetlands, watercourses and buffers as far as reasonably practicable. Identify and approve the design of unavoidable crossings and confirm applicable water-use authorisation requirements.	Freshwater specialist, or ECO	Aquatic verification memorandum, crossing schedule, final design drawings and authorisation record	No work in or adjacent to a water resource until the applicable authorisation and controls are in place



No.	Verification or deliverable	Applicability and minimum requirements	Responsible party	Evidence or close-out record	Hold point
7	Floodline and stormwater verification	Confirm that permanent infrastructure, wells and the processing facility avoid the 1:100-year floodline wherever feasible. Verify crossing designs, clean and dirty water separation, erosion protection and stormwater-control measures against the final layout.	ECO	Floodline overlay, stormwater plan and engineering sign-off	Earthworks may not commence until design controls are accepted
8	Heritage walkdown and buffer demarcation	A qualified archaeologist must inspect final project sites and routes where required. Identified archaeological or historical structures must be retained and protected by the prescribed 30 m buffer, and graves by the prescribed 50 m buffer. The Chance Find Procedure must be incorporated into the site documentation and induction.	Qualified archaeologist and ECO	Heritage walkdown report, buffer-demarcation plan, photographic record and Chance Find Procedure	No disturbance until heritage clearance is issued
9	Palaeontological readiness	Confirm that the Chance Find Protocol is included in the method statements and that site supervisors and relevant personnel have received training on fossil recognition, work stoppage and reporting requirements.	ECO and appropriately qualified palaeontologist, where required	Approved protocol, attendance register and training material	No excavation, trenching or drilling until induction is complete
10	Groundwater and water-user baseline	Conduct baseline water-quality assessment of identified boreholes and surface-water sources near the relevant activity before fieldwork begins. Record borehole use and condition and provide the relevant results to affected landowners.	Hydrogeologist or suitably qualified water specialist	Baseline monitoring report, laboratory certificates, photographic record and proof of communication	Drilling or site establishment may not commence until baseline data are recorded
11	Well design and integrity controls	A site-specific well design must be prepared by a suitably qualified professional and submitted to PASA for approval before commencement of the relevant drill site. Confirm casing, cementing, aquifer-isolation, pressure-control and contingency requirements.	Well or reservoir engineer and Applicant	Approved well design, professional sign-off and PASA submission or approval record	Drill-site hold point
12	Drilling-fluid, sump and containment verification	Confirm that the selected drilling-fluid system, lined sump or aboveground containment arrangement is appropriate to the site sensitivity. Pitless drilling or aboveground containment must be used within riparian zones. Verify liner specification, capacity, secondary containment and spill equipment.	Drilling manager and ECO	Method statement, inspection checklist and photographic record	Drilling may not commence until containment is accepted
13	Landowner access and land-use agreement	Complete written access, rehabilitation and, where applicable, compensation or servitude agreements with each affected landowner. Confirm the work area, access route, programme,	Applicant and landowner liaison officer	Signed agreement and property-specific conditions register	No access to the property before agreement or written authorisation while agreement is being finalised



No.	Verification or deliverable	Applicability and minimum requirements	Responsible party	Evidence or close-out record	Hold point
		biosecurity controls, rehabilitation obligations and landowner-specific conditions.			
14	Renewable-energy and other rights-holder coordination	Where the final layout interacts with an authorised or proposed renewable-energy footprint, mining activity, servitude or other infrastructure, conclude the necessary coexistence or coordination arrangements before on-site activity.	Applicant and affected rights holder	Signed coexistence agreement, interface plan or meeting record	No work within an overlapping area before issue / conflict is resolved
15	Asset and services baseline	Record the condition and location of roads, fences, gates, drains, irrigation infrastructure, pipelines, cables and other services that may be affected within 50 m of the work area. Provide the property-specific baseline to the landowner or service provider and retain a master copy.	Applicant, contractor and landowner liaison officer	Dated photographic condition survey and signed baseline record	Site establishment prohibited until completed
16	Noise and receptor notification	Identify nearby noise-sensitive receptors and confirm applicable operating restrictions. Notify residents within the distances prescribed in the specialist recommendations before drilling or seismic activities commence and communicate complaint channels.	Applicant, ECO and landowner or community liaison officer	Receptor map, notification register and copies of notices	Activity may not commence until notification is completed
17	Traffic, access and road-protection planning	Confirm approved access routes, traffic controls, road-condition baseline, maintenance responsibilities, gate protocols and scheduling relative to farming activities. Avoid critical planting and harvesting periods where reasonably practicable and agreed with landowners.	Contractor, Applicant and liaison officer	Traffic management, route map and landowner consultation record	Mobilisation hold point
18	Emergency preparedness and public safety	Finalise applicable emergency-response, fire-management, spill-response and security arrangements. Confirm emergency contacts, equipment, trained personnel, evacuation arrangements and coordination with neighbouring landowners or emergency services where relevant.	Applicant's health and safety manager and ECO	Approved plans, drill or training records and equipment inspection	Site establishment may not commence until readiness is verified
19	Permits, licences and approvals register	Confirm that all activity-specific permits, licences and approvals required for the final location and method have been obtained, including any water-use, biodiversity, heritage or other approvals.	Applicant and EAP	Updated legal register and copies of approvals	Hold point before commencement of the activity to which the relevant permit, licence or approval applies



No.	Verification or deliverable	Applicability and minimum requirements	Responsible party	Evidence or close-out record	Hold point
20	Construction environmental documentation	Approve the site-specific method statements, environmental induction material, vegetation-clearance plan, waste controls, erosion and stormwater controls, Chance Find procedures, grievance mechanism and incident-reporting arrangements.	ECO and Applicant	Approved method-statement register and induction records	Contractor may not mobilise until documents are accepted
21	Final pre-commencement inspection and release	Conduct a joint inspection to confirm that sensitive areas and buffers are demarcated, access is controlled, required controls are installed and all preceding actions are closed. Any outstanding item must be recorded and closed before release.	ECO, Applicant, contractor and relevant specialist where required	Signed pre-commencement release certificate or report with associated photographic record	Written release required before commencement



10 IMPACT MANAGEMENT ACTIONS AND OUTCOMES

The potential risks and impacts identified for each phase, are provided in **Table 9**, whereas the impact management actions and outcomes (**Table 11**) identifies the key environmental and social impacts associated with each project activity, the management actions required to avoid, minimise, rehabilitate or compensate for such impacts, and the desired environmental outcomes to be achieved through implementation of the EMPr. The table further provides measurable performance indicators against which the effectiveness of mitigation and overall environmental performance can be monitored throughout the project lifecycle.

Table 11: Summary of the Impact management outcomes

Activity	Potential Impact	Management Actions	Desired Outcome (Impact Management Outcome)	Performance Indicator / Target
Site Clearance	Loss of natural habitat, vegetation removal, soil disturbance, erosion and pollution.	• Delineate no-go areas; • Restrict clearing to approved footprint; • Undertake search and rescue for SCC where required; • Stockpile topsoil separately; implement erosion controls.	Minimise loss of natural habitat and maintain ecosystem functioning outside the approved development footprint.	• No unauthorized clearing outside demarcated areas; • Topsoil conserved; • No significant erosion observed.
Establishment of Base Camps and Access Roads	Habitat loss, surface runoff, dust generation, increased disturbance.	• Locate camps in transformed areas where reasonably practicable; • Limit footprint; • Install stormwater controls; • Implement dust suppression; • Rehabilitate temporary areas after use.	Disturbance footprint restricted to authorised areas and surrounding habitats protected from degradation.	• No unnecessary expansion of camp areas; • Dust complaints minimized; • Runoff managed without erosion.
Storage of Construction Vehicles	Hydrocarbon spills and soil compaction.	• Designated parking areas; • Drip trays; • Spill kits available; • Routine inspections; Immediate spill response.	Prevention of contamination of soil, surface water and groundwater resources.	• No hydrocarbon contamination incidents; • Spills cleaned immediately.



Activity	Potential Impact	Management Actions	Desired Outcome (Impact Management Outcome)	Performance Indicator / Target
Transportation to and from Sites	Dust, road degradation, disturbance to fauna and communities.	• Use designated routes; • Speed restrictions; • Dust suppression where required; • Transport scheduling.	Reduced nuisance impacts and protection of surrounding receptors.	• Compliance with speed limits; • No significant dust nuisance or road safety incidents.
Storage of Hazardous Substances	Soil and water contamination.	• Store chemicals in bunded areas; • Secondary containment; • Inspection and maintenance of storage areas; • Spill response procedures.	Hazardous substances are contained and prevented from entering the receiving environment.	• No contaminated runoff; • No uncontrolled releases.
Waste Management	Pollution of land and water resources.	• Waste segregation; • Licensed waste disposal; • Covered waste receptacles; • Prohibit illegal dumping.	Waste generated is managed according to legal requirements and does not pollute the environment.	• No illegal dumping; • Waste disposal records maintained.
Well Drilling and Associated Infrastructure	Habitat loss, groundwater contamination, dust, noise, heritage impacts, wastewater generation and social disturbance.	• Implement approved EMPr; • Maintain well integrity through casing and cementing; • Control wastewater; • Avoid sensitive areas; • Implement biodiversity, heritage and social mitigation measures.	Production infrastructure constructed and operated without unacceptable impacts on biodiversity, water resources, heritage resources or neighbouring communities.	• Compliance with well integrity specifications; • No groundwater contamination; • No significant residual impacts to sensitive receptors.
Refuelling	Hydrocarbon spills.	• Refuel only in designated areas or using appropriate containment and spill-control measures; • Use drip trays;	Prevention of fuel contamination of soil and water resources.	• Zero significant fuel spill incidents.



Activity	Potential Impact	Management Actions	Desired Outcome (Impact Management Outcome)	Performance Indicator / Target
		• Maintain spill kits; • Train personnel.		
Maintenance and Repair	Hydrocarbon leaks and contamination.	• Routine inspection and maintenance of equipment; • Immediate repair of leaks; • Proper storage of maintenance materials.	Infrastructure remains operational without causing environmental contamination.	• No persistent leaks; equipment maintained according to schedule.
Well Plugging and Abandonment	Groundwater contamination and residual environmental liabilities.	• Wells plugged according to internationally accepted industry best practices; • Cement plugs verified; • Decommissioning inspections undertaken.	Long-term isolation of gas-bearing formations and protection of aquifers.	• Wells certified as properly abandoned; • No post-closure leakage detected.
Removal of Surface Infrastructure	Soil disturbance and habitat degradation.	• Remove redundant infrastructure; • Salvage recyclable materials; • Limit disturbance footprint; • Rehabilitate disturbed areas.	Site prepared for rehabilitation with minimal residual environmental impact.	• Infrastructure removed and waste disposed at authorised facilities.
Rehabilitation	Loss of habitat, erosion, drainage alteration and visual impacts.	• Replace topsoil; • Re-establish natural drainage; • Reseed disturbed areas where required and appropriate to the approved post-closure land use and rehabilitation objectives; • Implement erosion control measures.	Disturbed areas returned to a stable land capability and ecological condition consistent with surrounding land uses.	• Vegetation cover re-established; • Erosion controlled; • Land capability restored.



Activity	Potential Impact	Management Actions	Desired Outcome (Impact Management Outcome)	Performance Indicator / Target
Monitoring of Rehabilitated Areas	Failure of rehabilitation objectives.	• Conduct post-closure monitoring; • Implement corrective actions where required; • Monitor vegetation establishment and erosion.	Sustainable long-term rehabilitation success and environmental stability achieved.	• Rehabilitation targets met and maintained over the monitoring period.



11 CLOSURE AND REHABILITATION

Section 24 P of the NEMA requires that an applicant for an environmental authorisation relating to prospecting, 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. Therefore, the potential environmental liabilities associated with the proposed activity must be quantified and indicate the method of financial provision in line with the National Environmental Management Act (1998): Regulations pertaining to the financial provision for prospecting exploration, mining and production, (2015).

11.1 CLOSURE GOALS AND OBJECTIVES

The closure goals and objectives for the proposed D3 Energy Project are the following:

- **Ensure the site is safe and stable for future land users and the environment.**
 - Decommission all production wells, exploration wells, gas gathering pipelines, gas processing facilities, flare systems, produced water management facilities, roads and associated infrastructure in accordance with applicable legal requirements and industry standards.
 - Minimize physical, chemical and safety hazards to people, livestock, wildlife and property.
- **Prevent future gas migration, leakage and groundwater contamination.**
 - Permanently plug, seal and abandon all exploration and production wells using approved cementing and casing removal techniques.
 - Verify well integrity and ensure there is no migration of methane, helium, saline water or other fluids between geological formations or to the surface.
- **Remove infrastructure and restore land capability.**
 - Remove all above-ground infrastructure unless otherwise agreed with the landowner.
 - This includes processing plant equipment, compressors, tanks, flare systems, workshops, foundations, pipelines above ground, fencing, utilities and redundant access infrastructure.
 - Restore disturbed areas to a land capability and land use agreed with the landowner and consistent with the surrounding agricultural landscape.
- **Decommission and rehabilitate underground pipeline infrastructure.**
 - Remove or safely decommission underground gas gathering pipelines in accordance with regulatory requirements and closure risk assessments.
 - Ensure that any retained buried infrastructure does not pose a future safety, environmental or land-use constraint.
- **Restore natural drainage patterns and landforms.**
 - Backfill excavations, trenches, pits, foundations, evaporation ponds and disturbed areas.
 - Re-establish stable topography and natural drainage patterns to prevent ponding, erosion or sedimentation.
 - Ensure a free-draining and stable post-closure landscape.
- **Protect surface water and groundwater resources.**
 - Remove all potentially contaminated materials.
 - Decommission produced water storage tanks and evaporation ponds.
 - Remediate any contaminated soil or groundwater identified during closure.



- Demonstrate, through monitoring and specialist assessment, that groundwater and surface water resources meet the applicable closure and relinquishment criteria, and implement remedial or adaptive management measures where monitoring identifies project-related impacts or unacceptable trends.
- **Rehabilitate soils and agricultural productivity.**
 - Replace stockpiled topsoil where required.
 - Alleviate soil compaction and restore soil functionality.
 - Reinstatement agricultural land to a condition suitable for grazing, cultivation or other agreed land uses.
- **Re-establish vegetation and ecological function.**
 - Rehabilitate disturbed areas through reseedling, revegetation and/or natural regeneration as appropriate.
 - Promote the establishment and maintenance of locally occurring indigenous plant species and ecological processes that are compatible with the agreed post-closure land use and rehabilitation objectives, with the aim of achieving vegetation cover, species composition, ecosystem functionality and land capability comparable to surrounding reference areas and sufficient to support the intended post-closure land use.
 - Take appropriate measures to prevent and control the establishment and spread of invasive alien plant species.
- **Manage stormwater and erosion risks.**
 - Implement erosion control measures where necessary.
 - Maintain stormwater controls during rehabilitation until disturbed areas are stabilised.
 - Minimize sediment transport and loss of topsoil from rehabilitated areas.
- **Manage closure-related waste and contamination.**
 - Remove all general and hazardous waste from the site for recycling, treatment or disposal at appropriately licensed facilities.
 - Ensure that waste, contaminated material and pollution sources are appropriately removed, treated or managed as part of closure.
- **Demonstrate successful rehabilitation and closure.**
 - Monitor vegetation establishment, erosion, land stability, well integrity and water quality for a period agreed with the regulator and landowner.
 - Demonstrate achievement of closure objectives and agreed post-closure land-use outcomes before applying for a Closure Certificate in terms of the MPRDA.
- **Facilitate sustainable post-closure land use.**
 - Ensure that rehabilitated land can support the agreed post-closure land use, including agricultural activities where applicable.
 - Minimise long-term management requirements and residual environmental liabilities

11.2 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 address the 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 activities and over which the Holder has responsibility. Closure and rehabilitation measures include:

- Plugging and sealing wells.
- Preventing future fluid or gas leakage.
- Protection of water resources.
- Refilling excavations.
- Reshaping and recontouring disturbed areas.
- Re-establishing free-draining landforms.
- Re-vegetation through reseeding or natural succession.
- Stormwater management and erosion control.
- Restoration of ecosystem function, habitats and hydrology.
- Returning land to pre-existing or agreed land use.
- Rehabilitation monitoring and verification of success.
- Closure certificate application in terms of the MPRDA.

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

11.3 REHABILITATION PLAN

11.3.1 INTEGRATED REHABILITATION AND CLOSURE PLAN

The main aim in developing this rehabilitation plan is to mitigate the impacts caused by the exploration and production activities and to restore land back to a satisfactory standard. It is best practice to develop the rehabilitation plan as early as possible so as to ensure the optimal management of rehabilitation issues that may arise. It is important that the project's closure plan is defined and understood from before starting the process and is complementary to the rehabilitation goals. Rehabilitation and closure objectives need to be tailored to the project at hand and be aligned with the EMPr. The overall rehabilitation objectives for this project are as follows:

- Maintain and minimise impacts to the ecosystem within the study area;
- Re-establishment of the pre-developed land capability to allow for a suitable post activities land use;
- Mitigate soil, surface water and groundwater contamination;
- Comply with the relevant local and national regulatory requirements; and
- Maintain and monitor the rehabilitated areas.

Successful rehabilitation must be sustainable, and requires an understanding of the basic baseline environment, as well as project management to ensure that the rehabilitation program is a success. This will be undertaken in accordance with the rehabilitation and closure plan as required by the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, GNR 1147, gazetted in November 2015. This includes the determination of the financial provision as well. A closure certification application will be applied for in accordance with section 43 of the Mineral and Petroleum Resources Development Act, 2002.



11.3.2 WELL CLOSURE PROCESS

According to Chapter 10 of GN. 446 of 2015 under the MPRDA (2002) a holder may only suspend an exploration and/or production well on obtaining the approval of the designated agency. The holder must submit a decommissioning plan, as per the requirements of Section 132 of GN. 446 of 2015 under MPRDA (2002) to the designated agency for approval.

11.3.2.1 PHASE 1: WELL SAFETY

Abandon wells in a safe and stable condition. The method of plugging and abandonment of each well shall be determined using an internationally recognised guideline such as the British Oil and Gas OP071 “Guidelines for Suspension and Abandonment of Wells, Issue 4, July 2012”, as updated, as well as the requirements of Section 132 (2) of GN.446 (2015).

The method shall be designed to ensure that aquifers are isolated and the long-term risk of aquifer or surface pollution is minimised. Table 12 provides an indication of typical procedures that would be followed in abandoning a well.

Table 12: Summary of the typical international requirements for well abandonment.

Isolate all potential hydrocarbon / water bearing formations by utilizing placed cement plugs extending at least 30m above and below the reservoir.
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.
All plugs are tagged with the drill string to ensure successful placement.
Integrity of the plugs is confirmed by setting weight down on the upper most plug (using the drill string) as well as a differential pressure test of at least 500 PSI or more.
A surface / shallow cement plug (+/-50m below ground Level) is set, and the well is cut and capped +/-1m below ground level to remove the wellhead and all casing above this point.
The cellar is then collapsed and the surface reinstated and the site rehabilitated.
For Perforated Intervals:
Should the well tests indicate that a production well is not successful, the perforated zone is squeezed off with cement by setting a mechanical plug (cement retainer) just above the zone, stabbing into the retainer and pumping cement into the formation under pressure.
The cement squeeze is then followed by another series of stacked cement plugs above the retainer at pre-determined intervals all the way to surface.
Integrity of the plugs is confirmed by setting weight down on the upper most plug (utilizing the drill string) as well as a differential pressure test of at least 500 PSI or more.



All plugs are tagged with the drill string to ensure successful placement. A surface / shallow cement plug (+/- 50m below ground Level) is set, and the well is cut and capped +/-1m below ground level to remove the wellhead and all casing above this point.

The cellar is then collapsed and the surface reinstated and the site rehabilitated.

11.3.2.2 PHASE 2: LANDFORM DESIGN, EROSION CONTROL AND RE-VEGETATION

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.

This requires the following:

- Shape, level and de-compact the final landscape after removing all of the project infrastructure, dress with topsoil and, where necessary, vegetate with indigenous species. Commission specialists to assist in planning re-vegetation and the management of environmental impact, as required.
- Remove access roads with no beneficial re-use potential by deep ripping, shaping and levelling after the removal and disposal of any culverts, drains, ditches and/or other infrastructure. Natural drainage patterns are to be reinstated as closely as possible.
- Shape all channels and drains 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.
- Promote re-vegetation through the encouragement of the natural process of secondary succession.
- Natural re-vegetation is dependent on de-compaction of subsoils and adequate replacement of the accumulated reserves of topsoil (for example, over the well sites), so as to encourage the establishment of pioneer vegetation.
- Remove alien and/or exotic vegetation.
- Undertake a seeding programme only where necessary, and as agreed with the re-vegetation specialist.

11.3.2.3 PHASE 3: MONITORING, MAINTENANCE AND RELINQUISHMENTS

The purpose of monitoring is to ensure that the objectives of the rehabilitation programme are met, and that the rehabilitation process is followed.

- Groundwater and Surface Water
 - The post-closure monitoring should take place for five years or until a long-term acceptable trend can be determined.
- Flora
 - The following recommendations have been suggested for post rehabilitation and monitoring of the proposed development area. Biodiversity assessments mid wet season should be undertaken by a qualified ecologist / botanist to monitor the rehabilitation progress with regards to flora.



11.4 POST-CLOSURE MONITORING AND MAINTENANCE

Prior to decommissioning and rehabilitation activities, a monitoring programme shall be developed and submitted to the relevant Ministry for approval, as a part of the Final Rehabilitation Plan. The programme is to include proposed monitoring during and after the closure of the wells and related activities.

It is recommended that the post-closure monitoring include the following:

- Confirmation that any waste, wastewater or other pollutants that are generated as a result of decommissioning will be managed appropriately, as per the detailed requirements set out in the Final Rehabilitation Plan;
- Confirmation that all de-contaminated sites are free of residual pollution after decommissioning
- 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 undisturbed areas, non-eroding and free of invasive alien plants; and
- Confirmation that abandoned wells are safe and are not resulting in a pollution hazard.

Post-closure monitoring of abandoned well sites shall include continued inspection and testing of water quality from the boreholes situated adjacent to the wells at intervals to be determined in the monitoring programme and agreed with the Designated Authority.

Annual environmental reports will be submitted to the Designated Authority and other relevant Departments for at least three years post-decommissioning. In the case of well sites, the frequency of this reporting period may be extended to include longer term water quality monitoring, at intervals to be agreed with the Designated Authority.

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.



12 COMPLIANCE MONITORING

12.1 MECHANISMS FOR MONITORING COMPLIANCE

The implementation of proper monitoring programmes shall allow early detection of possible impacts of the project on the environment and enable the implementation of management measure to management the risk outcomes. The monitoring requirements necessary during the project is defined in the **Table 13** below.

Table 13: Monitoring requirements during the proposed project.

Source Activity	Impacts Requiring Monitoring Programme	Functional Requirements for Monitoring	Roles and Responsibilities	Monitoring and Reporting Frequency and Time Periods for Implementation
Site preparation	Possession of permits for protected species	Document control	Environmental Site Officer (same as ECO) Environmental Specialist	Once-off control of documents, site visit and reporting
	Relocation of protected species Alien vegetation management ECO Walkdown Ecologist Walkdown Archaeological Walkdown	Site inspections and Reports	Environmental Site Officer Environmental Specialist Independent Environmental Auditor	Monthly Site Visits and Reports during construction and quarterly during operations
		Report review and development of actions plans	Senior Environmental Management	Monthly Reports Annual Performance Assessment
Exploration & Production Activities	Groundwater Surface water Alien vegetation management Noise (if any complaints are registered by residents) Air quality (if complaints are registered)	Site inspections, checklists and reporting	Environmental Site Officer Environmental Specialist Independent Environmental Auditor	Monthly Site Visits and Reports during construction and quarterly during operations
		Report review and development of corrective action plans	Environmental representatives Surface water specialist	Monthly Site Visits and Reports during construction and quarterly during operations



Source Activity	Impacts Requiring Monitoring	Functional Requirements for Monitoring	Roles and Responsibilities	Monitoring and Reporting Frequency and Time Periods for Implementation
		Site inspections and audits	Environmental Site Officer Environmental Specialist Independent Environmental Auditor	Monthly Reports Annual Performance Assessment
Decommission and Rehabilitation	Groundwater Surface water Alien vegetation management Noise (if any complaints are registered by residents) Air quality (if complaints are registered)	Site inspections, checklists and reporting	Environmental Site Officer Environmental Specialist Independent Environmental Auditor	Monthly Site Visits and Reports
		Report review and development of corrective action plans	Environmental representatives Surface water specialist	Monthly Site Visits and Reports
		Site inspections and audits	Environmental Site Officer Environmental Specialist Independent Environmental Auditor	Monthly Reports Annual Performance Assessment



12.2 ENVIRONMENTAL ASPECTS THAT REQUIRE MONITORING

A monitoring strategy must be defined to ensure that the effectiveness of mitigation measures can be tracked, and corrective actions identified if necessary. Monitoring is intended to evaluate the effectiveness of environmental management actions as specified in the EMP. Proper monitoring shall ensure early detection of any impacts of the proposed project on the environment and allow for corrective measures to be implemented in order to reduce risk outcomes.

The monitoring of various environmental aspects and the impact on them because of the proposed project shall take place by means of both quantitative and qualitative techniques in order to determine whether or not the requirements of the Environmental Management Programme are being complied with. The importance and value of detailed environmental monitoring networks cannot be overstated.

Environmental monitoring serves as a tool to track compliance, assist with potential liability identification, and mitigation throughout the construction and all phases of the proposed project. Where monitoring is specified as a requirement as per **Table 13** the responsible party shall develop a monitoring measurement and reporting procedure that shall outline the following Monitoring objectives:

A detailed description of monitoring measures including:

- Responsibilities;
- Parameters to be measured;
- Monitoring methods to be used;
- Sampling locations;
- Frequency of measurements;
- Detection limits and thresholds;
- Thresholds that need corrective actions; and
- Reporting requirements with defined responsibility in order to ensure early detection of conditions that require corrective actions.

Environmental Aspects to be monitored include:

- Air quality;
- Surface water;
- Groundwater;
- Noise;
- Ecology;
- Wetlands and Aquatic Ecology;
- Waste Management.

Refer to **Section 13.3** for the Monitoring Programmes of respective environmental aspects.

12.3 REHABILITATION MONITORING

The purpose of a Rehabilitation Monitoring Program is to ensure that the management measures, rehabilitation and decommissioning objectives for the management of various environmental aspects, are met and that the rehabilitation process is followed. The frequency of monitoring must be adequate to identify potential gaps in the effectiveness of the management plans. A rehabilitation programme must be implemented during the exploration, production and decommissioning phases of the activities. The following identified aspects require monitoring during the phases:



- Erosion and sedimentation status of disturbed areas;
- Surface drainage and surface water quality;
- Groundwater quality;
- Successful re-vegetation and basal cover proportions;
- Rehabilitation effectiveness;
- Fauna and flora re-colonization; and
- Control of invasive vegetation species.

To achieve the primary objective, management infrastructure must be designed and operated with the following objectives in mind (DWAF, 2008):

- Visual impacts of disturbed areas should be minimized by restoring the landform to a condition suited to the surrounding landscape;
- Management of invasive/alien vegetation;
- Restoration of native vegetation covers and ecology;
- Minimize the area of vegetation clearing for activities;
- Ensure that water management measures take into account and fit into the broader regional water management context;
- Ensure that water of different quality (clean and dirty water) is kept separate and managed separately if possible. This implies minimizing the contact between water of different qualities to minimize potential deterioration of water quality;
- Address water pollution issued at sources; and
- The need for long-term monitoring must be reduced.

12.4 ROLES AND RESPONSIBILITIES

This section provides an overall organisational structure for the EMP on the project and defines the responsibilities and authority of the various organisations and individuals involved in the project. The project structure and associated personnel shall be sufficient to ensure that the required standards of environmental performance are met. The roles and responsibilities of various organisations and individuals are summarized in **Table 14** below:



Table 14: Summary of the Roles and Responsibilities.

Role	Responsibility	Report to
Independent Environmental Control Officer (ECO) (same as Environmental Site Officer)	• Liaise with the Environmental Coordinator on specialist environmental issues and non-compliances; • Liaise with specialist consultants when necessary; • Liaise with Landowners when necessary; • Liaise with Community/Tribal Authorities regarding environmental issues that could potentially affect the surrounding communities; • Be thoroughly familiar with existing information on the immediate environment and sensitivities as described in the Scoping and EIA Reports; • Be thoroughly familiar with the specifications and conditions set out in the EMP with which sub-contractors are obliged to comply to; • Perform management actions required to monitor performance of sub-contractors according to specifications in the EMP; • Report non-compliances by contractors to the Applicant Representative in order to instruct necessary actions required to ensure that contractors rectify non-compliances as rapidly and effectively as possible;	• Applicant or Authority Representative • Field Superintendent.



Role	Responsibility	Report to
	- Record keeping of monitoring for the purpose of audits; - Assist Environmental Coordinator in preparation of monthly reports that shall be presented at monthly meetings and distributed to the following individuals: - Sub-contractors; - Applicant Representative; - Environmental Coordinator; and - Drilling Manager. - Prepare monthly compliance reports containing a brief description of non-compliances with EMP specifications, responsible party, result/consequence and corrective actions taken; - Prepare the Rehabilitation Plan in conjunction with the Environmental Coordinator and specialist Consultants and ensure that the Rehabilitation Plan is implemented.	
Environmental Coordinator (EC)	Provide support to the ECO by means of regular site visits (preferably on a monthly basis) during the duration of the project, and assist with the compilation of the most effective and structured monitoring reporting strategy according to the EMP conditions;	Applicant Representative



Role	Responsibility	Report to
	• Prepare monthly monitoring reports in conjunction with the ECO; • Report and discuss non-compliances with the Applicant Representative and steps to be taken to rectify non-compliance issues; • Prepare the Rehabilitation Plan in conjunction with the ECO; • Participate in monthly site visits; • Assist with internal and external audit reports; • Prepare the project close-out report.	
Specialist Consultants	• Provide specialist input and advise with regard to impact management; • Prepare integrated reports on environmental aspects of the project; • Monitor the impacts of the proposed activities on the environment with particular emphasis on areas of environmental sensitivity; • Audit compliance by contractors with the environmental standards as and when necessary, and prepare ad-hoc audit reports documenting the effectiveness of environmental management actions;	• ECO • Environmental Coordinator



Role	Responsibility	Report to
Community Liaison Officer (CLO)	• Act as guides and advisors to Contractors in respect of the EMP on communication and local community issues during the project duration; • Support communication requirements of the EMP; • Assist in consultation with village leaders for recruitment of temporary workers from the affected villages; • Maintain open communication channels with affected landowners; • Support the development of a transparent communication structures with communities; • Inform communities about upcoming activities and progress on project; • Arrange occasional site visits for District Government community leaders and senior community leaders when necessary.	• Contractor • ECO • Environmental Coordinator • Applicant
Applicant Representative/ Field Superintendent	• Instruct rectifications on non-compliances reported by the ECO and EC.	• Single communication channel for the ECO and EC.



12.5 TIME PERIOD FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS

The time periods for implementation of the impact management actions are provided in **Table 13** above.

12.6 THE EMPR PERFORMANCE ASSESSMENT

According to Regulation 55 of the MPRDA regulations compliance with the EMPr must be monitored on a continuous basis. This requirement shall be accomplished through the continuous monitoring of compliance undertaken by the EO and ECO. The performance assessment will focus on the following Key Aspects:

- Compliance with the Approved EMPr; and
- Appropriateness and validity (technical content) of the EMPr.

An EMPr performance assessment report shall be submitted to the Petroleum Agency of South Africa (PASA) on an annual basis (each year of activities and before applying for closure). The holder of the production right may appoint an independent qualified person for the monitoring and to compile a report, but the responsibilities remain the holder's. The performance assessment will include:

- The period when the performance assessment was conducted;
- The scope of the assessment;
- The procedures used for conducting the assessment;
- Interpreted information gained from monitoring the EMPr (e.g. ECO reports);
- Evaluation criteria used during the assessment; and
- Results of the assessment are to be discussed and mention must be made of any gaps in the EMPr and how it can be rectified.

12.7 REVIEW AND REVISION OF THE EMPR

It is important to note that this EMPr is made legally binding on the applicant at such time as the EA is granted and the EMPr is approved by the decision-making authority. Since this is a production project, the overarching legislation is the MPRDA, and it is important to note that in accordance with Section 102 of the MPRDA, no EMPr may be amended or varied without the written consent of the minister. It is however also important to consider that the EMPr is a dynamic document which may require such alteration and /or amendment as the project evolves.

The Applicant in consultation with the ECO should be responsible for ensuring that the registration and updating of all relevant EMPr documentation is carried out. It shall be the responsibility of the Applicant / Contractor to ensure that all personnel are performing according to the requirements of this procedure and to initiate the revision of controlled documents, when required by changes in process or operations and shall notify the ECO of such changes.

It is recommended that a risk assessment protocol must be developed and implemented by the ECO which shall be utilised to evaluate the environmental risk associated with the potential proposed alterations and/or amendments. The results of the risk assessment must then be included in the submission to the competent authority for the amendment process. It is important to note that if alterations and/or amendments are required, these may only be affected with written approval from the competent authority and in accordance with the then-in-effect relevant legal processes. Subsequently, as part of the EIA, a risk assessment has been compiled as part of Appendix G of the EIA Report.

12.8 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

Management of operational risk is a key consideration for production projects operating within the social and economic context of South Africa. Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. Operational risks and impacts are usually



managed through the implementation of the Environmental and Social Management System (ESMS) and Safety, Health and Environmental (SHE) system. A formal, effective ESMS is an important requirement for establishing and maintaining effective environmental management and should be undertaken during the planning phase of the Project. As such the Applicant shall be required to develop the ESMS to be implemented on the well sites and within the production area in general. Adequate resources (people, financial and technical) need to be made available to ensure effective establishment, implementation, maintenance and continual improvements of the ESMS. The roles and responsibilities for these key environmental personnel should be clearly defined and communicated throughout the organisation. The ESMS should include the requirement to constantly monitor environmental performance and assess the adequacy of environmental resources provided for the project. If required, D3 Energy would need to procure further environmental resources to ensure the successful implementation of the ESMS and EMP. The development and implementation of an ESMS is a requirement in terms of compliance with international standards of best practise such as the IFC Performance Standards and Equator principles.

The D3 Energy PR16 ESMS will be based on:

- D3 Energy's corporate vision;
- South African legal requirements; and
- Mining / production best practice.

The ESMS to be developed for the D3 Energy PR16 Project should incorporate and provide for:

- A project specific Environmental Policy;
- Organisational capacity and competency;
- The ESMS shall identify roles and responsibilities of key role players;
- The ESMS shall incorporate a mechanism for ongoing identification of risks and impacts;
- Integration of the ESMS with the SHE management system may be undertaken to form a holistic SHE risk management system;
- The ESMS shall comprise appropriate management plans and procedures to ensure effective operational control;
- The ESMS shall provide for emergency response and also make provision for emergency protocols;
- Effective communication (both internal and external) is a key requirement for successful implementation of the ESMS and an appropriate communication procedure to this effect shall be developed;
- The ESMS shall involve engagement between the client, its workers, landowners and local communities directly affected by the project (the affected communities) and where appropriate, other stakeholders. It is therefore imperative that there is integration between Stakeholder Engagement procedures and the ESMS;
- The ESMS shall make provision for ongoing compliance monitoring, performance assessment and external audits; and
- The ESMS shall make provision for internal auditing and continual improvement which should be incorporated into internal management review processes. The ESMS should provide for setting and reviewing objectives and targets to demonstrate continual SHE improvements associated with the project.

Ultimately an effective ESMS should provide for effective management of social and environmental risks and impacts whilst maintaining legal compliance and meeting international standards of best practise where these are feasible and appropriate.



12.9 DOCUMENT CONTROL

A formal document control system should be established during the development of the ESMS. The document control system must provide for the following requirements:

- Documents are approved for adequacy prior to use;
- Review and update documents as necessary and re-approve documents;
- Ensure that changes and the current version status of documents are identified;
- Ensure that relevant versions of applicable documents are available at points of use;
- Ensure that documents remain legible and readily identifiable;
- Ensure that documents of external origin necessary for the ESMS are identified and their distribution controlled; and
- Prevent unintended use of obsolete documents and apply suitable identification to them if they are retained for any purpose.

12.10 RECORD KEEPING

It is essential that an official procedure for control of records be developed to ensure records required to demonstrate conformity to environmental and social standards are maintained. D3 Energy is, therefore, required to develop and maintain a procedure for the identification, storage, protection, retrieval, retention and disposal of records as part of the ESMS. Records must be legible, identifiable and traceable.

12.11 AUDITING AND REPORTING PROCEDURES

D3 Energy shall develop an auditing and reporting procedure, for conveying information from the compliance monitoring activities and to ensure that management is able to take rapid corrective action should certain thresholds be exceeded. The sections below present a framework for the development of the necessary procedures. Different reporting mechanisms may include:

- Inspections;
- Accidents and emergencies;
- Measuring performance indicators and interpreting and acting on the indicators;
- Records of monitoring activities to test the effectiveness of mitigation measures and impact controls, as well as for compliance auditing purposes; and
- Training programmes and evidence of appropriate levels/amount of skills/capacities created.

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 Applicant and /or the Relevant Competent Authorities. All reports shall be signed by the relevant parties to ensure accountability. 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 EMP should be viewed as a dynamic document aimed at continual environmental performance improvement.

The following auditing and reporting shall be required throughout the construction phase:

- Bi-weekly / Monthly Compliance Reports: These reports must be prepared by the supervisor or similar and must aim to monitor and report on-site environmental performance;
- Monthly Compliance Audits: These audits must be undertaken by the ECO and must aim to monitor and report on compliance with the requirements of the relevant authorisations, licences and permits, the approved EMP; and



- **Annual Audit Reports:** The ECO must compile annual compliance reports (audits) which are to be submitted to the applicant for his review and correction of non-compliance issues. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified.

12.12 RESPONDING TO NON-COMPLIANCES

Non-compliance will be identified and managed through the following four key activities including;

- **Inspections** of the site and activities across the site;
- **Monitoring** of selected environmental quality variables;
- **Audits** of the site and relevant documentation as well as specific activities; and
- **Reporting** on a regular basis.

An environmental non-conformance and incident register must be prepared and maintained by the ECO throughout the lifespan of the activities in order to monitor environmental concerns, incidents, and non-conformances. The register must include details of date, location, description of the non-compliance or Incident, applicable environmental commitment/standard, corrective action taken, adequacy of corrective action, date rectified, etc.

Non-compliance with the EMPr or any other environmental legislation, specifications or standards shall be recorded by the ECO in the non-conformance register. This register shall be maintained by the ECO and will be sent to the Applicant and Contractor on a regular basis (at least monthly), and the Applicant shall ensure that the responsible party takes the necessary corrective actions. Non-conformances may only be closed out in the register by the ECO upon confirmation that adequate corrective action has been taken. The register should be utilised to measure overall environmental performance.

12.13 ENVIRONMENTAL INCIDENTS

For the purposes of this project, an environmental incident can be divided into three levels, i.e. major, medium and minor. All major and medium environmental incidents shall be recorded in the incident register. Minor incidents do not need to be reported but require immediate rectification on site. Definitions and examples of environmental incidents are provided in **Table 15** below.

Table 15: Description of incidents and non-conformances for the purpose of the project

Non-Conformance	Any deviation from work standards, practices, procedures, regulations, management system performance etc. that could either directly or indirectly lead to injury or illness, property damage, damage to the workplace environment, or a combination of these.
Major Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread, long-term, irreversible significant negative impact on the environment and/or has a high risk of legal liability. A major environmental incident usually results in a significant pollution and may entail risk of public danger. Major environmental incidents must be reported to the authorities. The ECO shall make the final decision as to whether a particular incident should be classified as a Major incident. An example of a Major environmental incident would be a significant spillage (e.g. 500 litres) of fuel into a watercourse.
Medium Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread or localised, short term, reversible significant negative impact on the environment and/or has a risk of legal liability. A medium environmental incident may be reported to the authorities, can result in significant pollution or may entail risk of public danger. The impact of medium environmental incidents should be reversible within a short to medium term with or



	without intervention. The ECO shall make the final decision as to whether a particular incident should be classified as a Medium incident. An example of a Medium environmental incident would be a large spill of fuel (e.g. ~ 50 litres) onto land.
Minor Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, where the environmental impact is negligible immediately after occurrence and/or once-off intervention on the day of occurrence. An incident where there is unnecessary wastage of a natural resource is also classified as a minor environmental incident. An example would be leaking water pipes that result in the wastage of water. A minor environmental incident is not reportable to authorities. An example of a minor incident is day to day spills of fuel or oil onto the ground.

The following incident reporting procedures shall apply to this project:

- All environmental incidents shall be reported to drilling contractor who shall ensure that the appropriate rectification is undertaken;
- The ECO shall record all medium and major incidents in the incident register and advise on the appropriate measures and timeframes for corrective action;
- An incident report shall be completed by party responsible for the incident for all medium and major incidents and the report shall be submitted to the drill site manager and ECO within 5 calendar days of the incident; and
- The ECO shall investigate all medium and minor incidents and identify any required actions to prevent a recurrence of such incidents.

In the event of an emergency incident (unexpected sudden occurrence), including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the Applicant shall notify the relevant authorities in accordance with legal requirements (e.g. Section 30 of NEMA and Section 20 of the NWA). In the event of a dispute in terms of the classification of a such an incident, the Applicant shall engage the ECO to advise on the potential reporting requirements in terms of the above.

12.14 ENVIRONMENTAL AWARENESS PLAN AND TRAINING

Training and environmental awareness is an integral part of a complete EMPr. The overall aim of the training will be to ensure that all site staff are informed of their relevant requirements and obligations pertaining to the relevant authorisations, licences, permits and the approved EMPr and protection of the environment.

The applicant and contractor must ensure that all relevant employees are trained and capable of carrying out their duties in an environmentally responsible and compliant manner, and are capable of complying with the relevant environmental requirements. To obtain buy-in from staff, individual employees need to be involved in:

- Identifying the relevant risks;
- Understanding the nature of risks;
- Devising risk controls; and
- Given incentive to implement the controls in terms of legal obligations.

The applicant shall ensure that adequate environmental training takes place. All employees shall have been given an induction presentation on environmental awareness. Where possible, the presentation needs to be conducted in the language of the employees. All training must be formally recorded and attendance registers retained. The environmental training should, as a minimum, include the following:



- General background and definition to the environment;
- The importance of compliance with all environmental policies;
- The environmental impacts, actual or potential, of their work activities;
- Compliance with mitigation measures proposed for sensitive areas;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving compliance with the environmental policy and procedures and with the requirement of the applicant's environmental management systems, including emergency preparedness and response requirements;
- The potential consequences (legal and/or other) of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying out their work activities; and
- All operational risks must be identified and processes established to mitigate such risk, proactively. Thus, the applicant needs to inform the employees of any environmental risks that may result from their work, and how these risks must be dealt with in order to avoid pollution and/or degradation of the environment.

In the case of new staff (including contract labour) the contractor / applicant shall keep a record of adequate environmental induction training.

12.15 MANNER IN WHICH EMPLOYEES WILL BE INFORMED OF ENVIRONMENTAL RISKS

The specific requirements for environmental training include:

- Site Environmental Induction Training: All site staff and employees will receive induction training. The induction training must include an environmental management component which will be prepared by the ECO and presented where possible by the ECO. The training material must include general environmental awareness and an overview of the EMPr and EA requirements. The Induction Training Material must be reviewed and approved by the ECO; and
- Informal training of all staff on site is also required on an on-going basis through informal discussions, on-site supervision and through facilitation of day to day activities. Such training must be given or otherwise facilitated by the ECO.

12.16 MANNER IN WHICH RISKS WILL BE DEALT WITH TO AVOID POLLUTION OR DEGRADATION

D3 Energy will be required to develop an ESMS which provides a mechanism for ongoing assessment of operational risks and impacts associated with their activities and any new activities that may arise. The impacts and risks identified will be managed through the framework of internal procedures which specify the mechanisms and actions required to effectively manage the risks and impacts on the ground. Where any unexpected events occur that have the potential to result in environmental damage, these shall be managed through the emergency response procedure. The framework for the emergency response procedure is provided **Section 14**.



13 ENVIRONMENTAL MONITORING PLANS

13.1 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES

The purpose of monitoring is not merely to collect data, but to provide information necessary to make informed decisions on managing and mitigating potential impacts. Monitoring therefore serves the following functions:

- Serve as early warning system to detect any potential negative impacts;
- To provide information to feedback into management controls to avoid, prevent or minimise potential negative impacts;
- Provide quantitative data that can serve as evidence for the presence of negative impacts or the lack thereof;
- Allows for trending, modelling and prediction of future conditions or potential impacts;
- Based on the above, the Applicant must ensure that monitoring programmes comprise of the following (at a minimum) in order to obtain valuable environmental data;
- All equipment used in monitoring must be correctly calibrated and serviced regularly;
- Samples required for analysis will be sent to an independent and accredited laboratory;
- Monitoring data must be stored;
- Data must be checked and interpreted and trend analysis undertaken on a quarterly basis;
- Both the data and reports on environmental monitoring must be kept on record and where relevant provided to I&APs; and
- The general and site-specific parameters to be monitored must be identified by an independent specialist, the authorities and where relevant I&APs.

13.2 LIST OF ASPECTS THAT REQUIRE MONITORING PLANS

The list of aspects that require on-going environmental monitoring includes the following:

- Air quality;
- Surface water (quality/ quantity);
- Groundwater (quality/ quantity);
- Waste Management; and
- Rehabilitation.

This list provided is by no means conclusive and must instead be used as a guideline for the impacts that require monitoring.

13.3 MONITORING PLANS FOR ENVIRONMENTAL ASPECTS

The monitoring of various environmental aspects and the impact on them as a result of the proposed project shall take place by means of both quantitative and qualitative techniques in order to determine whether or not the requirements of the EMPr are being complied with. The importance and value of detailed environmental monitoring networks cannot be overstated.

Environmental monitoring serves as a tool to track compliance, assist with potential liability identification, and mitigation throughout the life of the proposed project. This is achieved through the provision of actual evidence-based monitoring and reporting thereof. In essence, monitoring is a continuous data-gathering, data interpreting, and control procedure that ranges from visual inspection to in-depth investigative monitoring and reporting. These monitoring plans need to be drawn into standalone plans that can be updated and amended



as per authority requirements and additional data requirements identified during the activities. These plans need to include the site-specific roles and responsibilities for actions.

Where monitoring is specified as a requirement as per Table 13, the responsible party shall develop a monitoring measurement and reporting procedure that shall outline the following:

Monitoring objectives;

A detailed description of monitoring measures including:

- Responsibilities;
- Parameters to be measured;
- Monitoring methods to be used;
- Sampling locations;
- Frequency of measurements;
- Detection limits and thresholds;
- Thresholds that need corrective actions; and
- Reporting requirements with defined responsibility in order to ensure early detection of conditions that require corrective actions.

13.3.1 AIR QUALITY

Due to the nature of the activity, air quality impacts are expected to be low, localised and short-term.

In terms of air quality, the main pollutant of concern during the drilling phase is particulates (dust) and methane releases. As such, the design and implementation of the air quality monitoring program must incorporate the following considerations:

- Monitoring of dust fallout;
- Monitoring of methane during drilling operations; and
- Review and amendment of the monitoring program as required.

Implementing Air Quality Monitoring as shown in **Table 16**. Methane emissions (for climate change) can be monitored during the exploration and production activities to assist with the greenhouse gas quantification.

Table 16: Recommended air quality monitoring (Airshed Planning Professionals, 2026).

Project phase	Activity	Pollutant	Performance indicator	Frequency
Recommended air quality monitoring for the plant				
Construction	Construction of access roads and the plant	Dustfall	< 1200 mg/m ² /day	Monthly dust fallout
Operation	Combustion and process emissions at the plant	VOCs NO ₂	Benzene – 5 µg/m ³ NO ₂ – 40 µg/m ³ VOC – 200 µg/m ³	Quarterly or biannual passive sampling campaign for two weeks (VOC and NO ₂) Stationary sensors which can be supplemented with periodic mobile gas imaging to spot fugitive emission hot-spots (LDAR for VOCs) can be considered as part the final design



Project phase	Activity	Pollutant	Performance indicator	Frequency
				and risk assessment process supplemented
Recommended air quality monitoring for the well sites				
Exploration	Well drilling and testing	VOCs	Benzene – 5 µg/m ³ VOC – 200 µg/m ³	Stationary sensors can be supplemented with periodic mobile gas imaging to spot fugitive emission hot spots (LDAR)
Operation	Fuel combustion emissions of drill rigs at the wells Fugitive emissions at the wells	VOCs NO ₂	Benzene – 5 µg/m ³ NO ₂ – 40 µg/m ³ VOC – 200 µg/m ³	Quarterly or biannual passive sampling campaign for two weeks (at the relevant active wells) Stationary sensors can be supplemented with periodic mobile gas imaging to spot fugitive emission hot-spots (LDAR for VOCs)

13.3.2 SURFACE WATER MONITORING

D3 Energy is required to develop a surface water monitoring program based on the Best Practice Guidelines G3: Water Monitoring Systems (DWAF, 2006). It is recommended that all water containment facilities on site be monitored for water quality and quantity on a monthly basis. The water quality results should meet applicable standards or ensure that water released and associated risks are well understood. Streams or natural drainage lines with flowing water within the catchment of the site (zone of impact) should be monitored on a monthly basis.

A biomonitoring programme is recommended for perennial streams. The programme should be on a bi-annual basis upstream and downstream of the site and include at least macro-invertebrate and habitat integrity assessments, but further assessments may be required, depending on the stream conditions. The main objective of the monitoring program is to effectively monitor the surface water quality in the vicinity of the activities to ensure the protection of surrounding water users. This translated into the following composite objectives:

- To determine the current water quality in the vicinity of the drilling operations and if water quality changes over time. Baseline sampling will be important prior to commencing with the activities;
- Monitor pollution status and assess the impacts, which could possibly lead to pollution prevention; and
- Assess the performance of pollution prevention measures in order to determine if activities comply to license conditions.
- Ensure compliance with the requirements of the relevant legislation;
- Ensure the identification of suitable water quality parameters.

The Surface Water Quality Monitoring Program entails the following:

- Monthly water quality and quantity monitoring of water containment facilities on site, and quality and quantity monitoring of boreholes, streams and natural drainage lines with flowing water within the catchment of the site; and
- Bi-annual monitoring of perennial streams near to the drill-sites.

Details of the proposed monitoring programme are presented in the **Table 17** below. The monitoring programme should be amended according to on-site operations and future permit requirements.



Table 17: Proposed monitoring programme.

Water Type	Details	Monitoring Frequency
Surface Water	Sample point in the wetland area upstream and downstream of the drilling areas; Clean water discharge points (if any);	10 monitoring events over a 5-year post-closure period (i.e. twice per year).
Drinking Water (pipelines, boreholes)	Any supplied water used for domestic purposes should be monitored for parameters such as total faecal coliform;	Bi-annually

The following table presents the applicable parameters that should be monitored on a Monthly basis in the Surface Water Quality Monitoring Program:

Table 18: Applicable parameters to be monitored on a monthly basis.

Monthly analysis	
pH at 22°	Chloride (Cl)
Conductivity (mS/m)	Sulphate (SO ₄)
Total Dissolved Solids	Nitrate (NO ₃)
Calcium (Ca)	Fluoride (F)
Magnesium (Mg) (mg/l)	Aluminium (Al)
Sodium (Na)	Manganese (Mn)
Potassium (K)	Iron (Fe)
Total Alkalinity as CaCO₃	Zinc (Zn)
Bicarbonate (HCO₃)	Total Petroleum Hydrocarbons (TPH)
Diesel Range Organics (DRO)	

The following table presents the applicable parameters that should be monitored on a bi-annual basis in the Surface Water Quality Monitoring Program.

Table 19: Applicable parameters to be assessed on a bi-annual basis

Bi-annual analysis	
Antimony (Sb)	Nickel (Ni)
Arsenic (As)	Selenium (Se)
Barium (Ba)	Silicon (Si)
Beryllium (Be)	Silver (Ag)
Bismuth (Bi)	Strontium (Sr)
Cadmium (Cd)	Tin (Sn)



Cobalt (Co)	Titanium (Ti)
Lithium (Li)	Vanadium (V)
Mercury (Hg)	Zirconium (Zr)
Molybdenum (Mo)	

13.3.2.1 SURFACE WATER MONITORING LOCATIONS

Prior to exploration / production and once the target areas for drilling have been determined, a qualified hydrologist must assist in determining suitable surface water monitoring locations near to the activities.

13.3.2.2 SAMPLING PROCEDURE AND METHODOLOGY

The sampling procedure should be in accordance with the following publications:

- SANS ISO 5667 – 1:2008 Guidance on the design of sampling programmes
- SANS ISO 5667 – 2:1991 Guidance on sampling techniques
- SANS ISO 5667 – 3:2006 Guidance on the preservation and handling of samples
- SANS ISO 5667 - 6:2006 Water quality - Sampling Part 6: Guidance on sampling of rivers and streams
- SANS ISO 5667 – 11:2015 Guidance on sampling of groundwater

Samples must be submitted to a SANAS-accredited Laboratory Service. Field observations such as the following must be recorded on field data sheets:

- Coordinates of each surface water sampling point;
- In-situ Electrical Conductivity (EC), pH, Temperature and redox potential (Eh) are measured and recorded for each sampling point; and
- Documenting general characteristics of the water samples such as colour, turbidity and smell.
- Any potential sources of contamination at the sampling points;
- Regular photographs of each sampling point;
- A chain of custody should be filled in at the time of sampling recording the following information:
 - Date and time of sampling;
 - Coordinates of each sample point (at first sampling event only);
 - In-situ measurements for each sampling point, namely pH, electrical conductivity, total dissolved solids and temperature;
 - General characteristics of the water samples such as colour, turbidity (murky/clear) and smell, as well as visual observations of the sample site; and
 - The chain of custody form shall be completed when the samples are transported and transferred to the laboratory for analysis.

Care should be taken to ensure that the samples taken are sufficiently large enough (1ℓ) to allow the laboratory to run duplicate analysis if required. Samples should be kept cool when stored and transported. Samples for metal analysis should be filtered through a 0.45 µm pore size membrane in the field and preserved with nitric acid.

13.3.3 GROUNDWATER MONITORING

The monitoring objectives are to detect and manage the possible impacts of the proposed petroleum activities on the hydrological environment. The impacts are influenced by the management of the activities, the physical



and chemical composition of the possible contamination source, and the vulnerability of the receiving environment.

The main objective of the monitoring is to:

1. Obtain accurate information of the chemical, micro biological and physical characteristics of the receiving environment before any activity commences.
2. The timely detection of any changes in the chemical, micro biological and physical characteristics of the receiving environment.
3. The timely detection of any changes in the chemical, micro biological and physical characteristics of the receiving environment due to pollutants released into the environment.
4. To detect any spills at or leakages.
5. To obtain information that can be used to update the environmental management plan.
6. To determine if applicable environmental laws and standards is adhered to.

This will ensure that any possible impacts on the receiving environment are detected and rectified in time. Once the drilling sites have been finalized, the monitoring programme should be finalised for each site and a hydro-census within a 3km radius of each borehole should be performed to identify existing boreholes that can be used for monitoring of each borehole.

13.3.3.1 MONITORING NETWORK

Table 20 summarises the proposed monitoring network with relevant information while **Figure 13** indicates a spatial distribution map of the monitoring localities in relation associated activities. It is recommended that additional monitoring boreholes be strategically placed in close proximity to proposed production zones in order to create a groundwater baseline and formulate local background conditions prior to drilling of relevant gas production boreholes in order to serve as early warning system for potential water level and water quality impacts which may arise. The monitoring network includes privately owned boreholes situated in close proximity to proposed production borehole drilling targets, newly drilled site characterisation boreholes as well as newly proposed monitoring localities to be incorporated into the monitoring network. It should be noted that newly proposed monitoring borehole positions proposed are conceptual only should be refined in consultation with a suitably qualified hydrogeologist by means of a geophysical survey in order to target lineaments and weathered zones acting as preferred groundwater flow pathways and contaminant transport mechanisms. Depending on the outcome of the geophysical survey, proposed boreholes can be established as a pair in order to target the shallow, intergranular or primary porosity as well as fractured aquifer units should it be applicable

13.3.3.2 SAMPLING PARAMETERS

Baseline and background water quality results should be evaluated to set a site-specific limit per parameter and applied as benchmark for monitoring purposes. Supplementary guidelines i.e., Water Use Licence (WUL) conditions as well as WMA Resource Quality Objectives (RQO) should also be considered as part of the monitoring protocol. All monitoring localities should be subjected to an initial comprehensive water quality analysis to evaluate hydrochemical composition and identify potentially elevated parameters going forward⁷. Chemical variables to form part of the sampling run are listed below. Groundwater monitoring boreholes should be analysed for the following chemical constituents:

- i. **Physical and aesthetic determinants:** pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS) and Total Hardness.
- ii. **Macro determinants:** Total Alkalinity (Malk + PAlk), Sulphate (SO₄), Nitrate (NO₃), Chloride (Cl), Fluoride (F), Calcium (Ca), Magnesium (Mg), Potassium (K) and Sodium (Na).

⁷ It is recommended that a comprehensive water quality analysis be repeated annually. Also note that should additional parameters be requested in existing permits/licence conditions, these should be adhered to.



- iii. **Micro determinants:** Aluminium (Al), Iron (Fe), Manganese (Mn), Cadmium (Cd), Total Chromium (Cr), Chromium (6⁺), Cyanide (CN), Arsenic (As), Copper (Cu), Uranium (U), Radon, Nickel (Ni), Lead (Pb), Cobalt (Co) and Zinc (Zn), dissolved Methane (CH₄), dissolved Ethane (C₂H₆).
- iv. **Organic determinants:** Total Oil and Grease, Dissolved Organic Carbon (DOC), Total Organic Carbon (TOC), Total Petroleum Hydrocarbons (TPH), GRO C6-C10, TPH C28-C40.

The following monitoring is recommended:

13.3.3.3 GROUNDWATER LEVEL MONITORING

1. Pre-development (pre-drilling) hydraulic heads: Groundwater levels should be measured less than 1 month before the borehole starts drilling, in at least 2 existing boreholes within a 3km radius around the proposed borehole. If active DWS groundwater monitoring boreholes are available within the 3km radius of the borehole, then hydraulic head data from these boreholes can be used as pre-development measurements.
2. During drilling groundwater levels: Groundwater levels should be measured in the close existing boreholes when drilling starts. The groundwater levels should also be measured immediately after drilling is completed (as soon as practically possible), in 2 nearby existing boreholes (if available) and in the borehole itself.
3. Post-drilling and grouting (cementing) groundwater levels: Groundwater levels should be measured in selected existing monitoring boreholes, 1 month after drilling has completed. A final groundwater level measurement run can be synchronised with the water quality sampling run, 6 months after drilling has completed.

13.3.3.4 GROUNDWATER AND SURFACE WATER-QUALITY MONITORING

1. Pre-development groundwater qualities: Once the borehole locations are known, groundwater quality should be sampled at the nearest existing borehole or spring, less than 1 month before drilling starts. This can be synchronised with the groundwater level measurement run. If more than one borehole is within a 1 km radius of the planned borehole, then two boreholes should be sampled and water qualities analysed.
2. Pre-development surface water qualities: If nearby (< 1 km) flowing surface water drainages or springs exist, then the drainage should be sampled downstream of the drilling site, within 1 km distance from proposed drilling pad. Similarly, nearby downstream spring should be sampled. This sampling can be synchronised with the less than 1 month before drilling groundwater sampling run.
3. During drilling groundwater quality: Directly after cleaning and purging of the borehole drilling fluid (if fluid was utilised), the borehole groundwater quality should be sampled and its water quality analysed. This is a very important water quality analysis.
4. Post-drilling surface water quality: If nearby (< 1 km) flowing surface water drainages or springs exist, then the drainage should be sampled downstream of the drilling site, within 1 km distance of proposed drilling pad. Similarly nearby downstream spring should be sampled. This sampling run should be conducted directly after drilling and sealing of the borehole has been completed. Furthermore, if springs and nearby (< 1 km) mountain pools in the borehole location exist, these should be sampled 1 month after the drilling and sealing activities were completed, should that be completed in the wet season. This surface water sampling (if applicable) can be synchronised with the groundwater sampling.
5. Post drilling groundwater quality: Selected nearby existing boreholes or springs should be sampled 1 month after drilling has completed. A final groundwater quality sampling run can be conducted at nearby (< 1 km) existing boreholes 6 months after drilling has completed.
6. Groundwater quality deterioration complaints in nearby (< 1 km) existing water supply boreholes, after borehole drilling, should be investigated by confirmative sampling and analysis.



7. Full spectrum initial groundwater constituents should be analysed in the initial sampling run and in the final sampling run. These constituents are listed in **Table 20**.
8. Surface water qualities should be analysed for the surface water quality constituents as described in **Section 13.3.2**.
9. Groundwater quality samples other than initial and final water quality sampling runs, should be analysed for the constituents as shown in **Table 20**.



Table 20: Integrated monitoring network and programme (Gradient Groundwater Consulting, 2026).

Monitoring locality	Latitude	Longitude	Locality description	Monitoring frequency		Parameters
				Water quality	Water level	
Newly drilled monitoring boreholes (Note, monthly is recommended during the active development and early operational phases (1-2 years))						
MTBH03	-28.241076	26.973778	Newly established monitoring borehole targeting the fractured aquifer.	Quarterly	Monthly	As in Section 13.3.3.2
MTBH04	-28.211000	26.957670	Newly established monitoring borehole targeting the fractured aquifer.	Quarterly	Monthly	
MTBH05	-28.286273	26.970084	Newly established monitoring borehole targeting the fractured aquifer.	Quarterly	Monthly	
MTBH06	-28.224400	26.938920	Newly established monitoring borehole targeting the fractured aquifer.	Quarterly	Monthly	
Privately owned monitoring boreholes						
BH7	-28.191800	26.946020	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	As in Section 13.3.3.2
BH16	-28.191540	27.008550	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH18	-28.192410	27.007000	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH30	-28.278690	26.974910	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH31	-28.281070	26.976780	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH33	-28.274890	26.980150	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH39	-28.275510	26.988510	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH43	-28.211350	26.945930	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH44	-28.217110	26.940480	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH45	-28.248140	26.949610	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH50	-28.252940	26.964460	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	



Monitoring locality	Latitude	Longitude	Locality description	Monitoring frequency		Parameters
				Water quality	Water level	
BH51	-28.269690	26.978120	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH52	-28.266910	26.978100	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH53	-28.265830	26.988440	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH54	-28.253070	26.990840	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
BH55	-28.252290	26.991230	Privately owned borehole situated in close proximity to proposed gas production borehole.	Bi-annual	Bi-annual	
Newly proposed monitoring boreholes** (Note, monthly is recommended during the active development and early operational phases (1-2 years))						
MTBH07	-28.207664	26.943958	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	As in Section 13.3.3.2
MTBH08	-28.227951	26.934893	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH09	-28.275280	26.938445	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH10	-28.263949	26.942999	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH11	-28.251696	26.949592	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH12	-28.278265	26.961347	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH13	-28.265875	26.966074	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH14	-28.253549	26.971019	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH15	-28.276652	26.980435	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH16	-28.268338	26.981381	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH17	-28.263796	26.982178	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH18	-28.243371	26.991904	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	



Monitoring locality	Latitude	Longitude	Locality description	Monitoring frequency		Parameters
				Water quality	Water level	
MTBH19	-28.230849	26.997846	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH20	-28.226360	27.000569	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH21	-28.209985	27.008820	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH22	-28.194086	27.016713	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH23	-28.190759	27.019429	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH24	-28.182748	27.023170	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH25	-28.174130	27.026810	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH26	-28.272824	26.980524	Down-gradient conceptual borehole situated within the production zone buffer area.	Quarterly	Monthly	
MTBH27	-28.218615	26.939636	Down-gradient conceptual borehole situated in close proximity to the processing plant.	Quarterly	Monthly	
Notes: **Monitoring to commence in conjunction with gas production borehole drilling schedule						

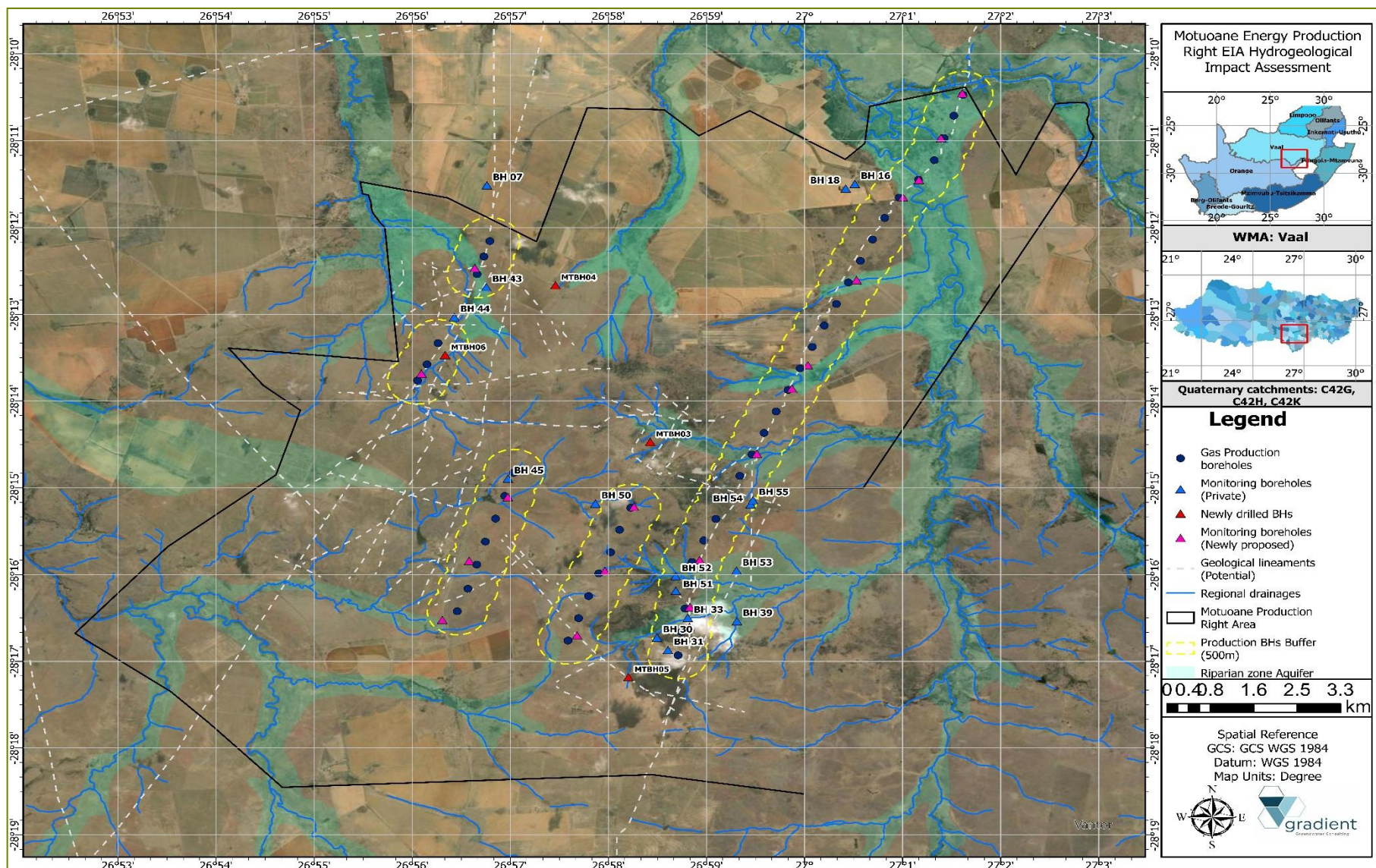


Figure 13: Integrated groundwater monitoring network (Gradient Groundwater Consulting, 2026).



13.3.4 ERADICATION AND MONITORING PROGRAMME

The Biodiversity Company conducted an ecological assessment of the application area, in order to identify potential impacts and recommend management and mitigation measures. Various mitigation measures were recommended to alleviate and/or reduce the potential ecological impacts. Based on findings and recommendations from ecology specialist, D3 Energy is required to implement an Eradication and Monitoring Programme to evaluate the success of mitigation measures for the identified Category 1b Alien Invasive Species and sensitive floral species. The implementation of the Eradication and Monitoring Programme is based on the following objectives:

- Ensure that all required permits, according to National and Provincial legislation, for the removal and relocation of protected species are obtained (if and where necessary);
- To monitor the relocation of protected species in order to establish if the intervention was successful or not;
- To monitor the impacts of activities on sensitive habitats;
- To enforce continual eradication of alien and invasive species; and
- To ensure successful conservation of habitats and species.

13.3.5 WASTE MANAGEMENT PROGRAMME

If the elimination of waste is not achieved through pollution prevention measures, waste management must be accomplished through a waste management plan.

An area specific waste management programme relates directly to the type of waste handling and disposal options to the ecological sensitivities, regulatory requirements and availability of facilities within the area. The implementation of an area specific waste management programme provides assurance in terms of protection of the environment and ongoing compliance with regulatory requirements, and minimisation of the volume and toxicity of waste. A waste management programme should be a living document which requires periodic review and revision in order to allow for changes and identification of new impacts during the course of the project duration.

The following steps form the structure of an area specific Waste Management Programme:

1. Management approval

Management approval and support for the Waste Management Programme should be obtained. Management should be aware of the timing and scope of the plan, and the goals of the management plan should be established with measurable objectives for each goal.

2. Area definition

The management plan should be site-or area specific and should include a description of the geographical area and operational activities addressed.

3. Waste identification

Operations personnel should identify all waste generated within the area defined for each activity. A brief description of each waste type will assist in further management steps.

4. Regulatory analysis

Review national laws and regulations to determine the types of waste for which management practices should be highlighted. Waste types for which the regulations do not adequately define, management requirements should also be addressed.

5. Waste categorisation

The physical, chemical and toxicological properties of each waste type should be identified, and waste should be grouped according to their health and environmental hazards.



6. Evaluation of waste management and disposal options

Waste management options for each waste type should be identified and compiled. Each option should be reviewed by appropriate operations personnel and management. Evaluation should include the following:

- Environmental considerations;
- Locations;
- Limitations;
- Regulatory restrictions;
- Operating feasibility;
- Potential long-term liability; and
- Waste minimisation.

Waste, volume and toxicity reduction, recycling and reclaiming or treatment should be evaluated. Revision of the waste management programme should be made to reflect any minimisation practices implemented.

7. Selection of preferred waste management practices

Select the best practice for the specific operation and location. Life-cycle analysis including use, storage, treatment, transport and disposal should be considered.

8. Implementation of area specific waste management programme

Waste management and disposal options for each waste type should be compiled into one comprehensive waste management plan. Waste management practices should be summarised, including waste description, indicating the chosen waste management and disposal practice.

9. Management plan review and update

Effective waste management is an on-going process. The waste management programme should be reviewed by senior management whenever new management practices and options are identified. A procedure to review and update the waste management programme should be established, and practices modified to reflect changing technologies, needs and regulations.

13.3.6 REHABILITATION MONITORING

The purpose of a Rehabilitation Monitoring Program is to ensure that the management measures, rehabilitation and decommissioning objectives for the management of various environmental aspects, are met and that the rehabilitation process is followed. The frequency of monitoring must be adequate to identify potential gaps in the effectiveness of the management plans. A rehabilitation programme must be implemented during the exploration, production and decommissioning phases of the activities. The following identified aspects require monitoring during the phases:

- Erosion and sedimentation status of disturbed areas;
- Surface drainage and surface water quality;
- Groundwater quality;
- Successful re-vegetation and basal cover proportions;
- Rehabilitation effectiveness;
- Fauna and flora re-colonization; and
- Control of invasive vegetation species.

To achieve the primary objective, management infrastructure must be designed and operated with the following objectives in mind (DWAF, 2008):



Visual impacts of disturbed areas should be minimized by restoring the landform to a condition suited to the surrounding landscape;

- Management of invasive/alien vegetation;
- Restoration of native vegetation covers and ecology;
- Minimize the area of vegetation clearing for activities;
- Ensure that water management measures take into account and fit into the broader regional water management context;
- Ensure that water of different quality (clean and dirty water) is kept separate and managed separately if possible. This implies minimizing the contact between water of different qualities to minimize potential deterioration of water quality;
- Address water pollution issued at sources; and
- The need for long-term monitoring may be reduced when monitoring results indicate no adverse impacts.



14 EMERGENCY RESPONSE PLAN

D3 Energy must identify potential emergencies and develop procedures for preventing and responding to them. There are several options for dealing with high priority impacts and risks, as the paradigm has two components, probability and consequence. The design of control measures rest on the understanding the cause and effect. Best practise is to intervene with the ultimate factors where feasible, rather than treat the outcomes. Emergency response therefore has the option of reducing probability, or reducing the consequence, reducing the probability is the preferred option. Below are some common emergency preparedness approaches:

- Threat consequence if and when the risk eventuates, when the risk becomes an issue;
- Combine reducing the probability and treating the consequence;
- Offset environmental losses by investing in other assets;
- Not manage some of the risks because there are too many; and
- Make provision to manage residual impacts or issues that arise because of shortcomings in risk identification and rating, avoidance and mitigation or because a rare event has occurred.

Residual impacts are those impacts that despite reducing the probability and consequence might still occur. In these cases, parties will have to be compensated, pollution cleaned up and damage to the environment remediated.

The Applicant shall be required to develop and implement an Emergency Preparedness and Response Plan prior to commencing work. The Emergency Preparedness and Response Plan should be based on a baseline Hazard and Risk Assessment and should provide for the following as a minimum:

- Risk assessment (identification of areas where accidents and emergency situations may occur, communities and individuals that may be impacted);
- Response procedures;
- Provision of equipment and resources;
- Designation of responsibilities;
- Communication and reporting (including that with potentially Affected Communities);
- Periodic training to ensure effective response; and
- Periodic review and revision, as necessary, to reflect changing conditions.

The Applicant must ensure that the Emergency Preparedness and Response Plan makes provision for environmental emergencies, including, but not limited to;

- Fire Prevention;
- Fire Emergency Response;
- Spill prevention;
- Spill Response;
- Contamination of a water resource;
- Accidents to employees; and
- Use of hazardous substances and materials, etc.

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.



The Emergency Response Plan must be updated to contain measures to prevent and react to abnormal events, including but not limited to:

- Blowout Preventers / Diverters
- Shut-In Procedures to trigger the Blowout Preventers / Diverters system to physically seal the well and stop the flow of fluids
- Emergency Shutdown Systems (ESD) to isolate valves and shuts rig power to prevent escalation into a major incident
- Use of feasible and available High-Efficiency Flare Systems for flaring of excess gas to destroy toxic Volatile Organic Compounds (VOCs) and prevent dangerous emissions
- Specific, site-tailored intervention strategies to be deployed to circulate out reservoir influxes and re-establish reservoir equilibrium pressure
- A 100-meter danger zone is immediately enforced around the wellhead
- Active Spill Prevention, Control, and Countermeasure
- Emergency contact numbers of nearby response team with sufficient containment materials and berms to be used to prevent leaked fluids from entering local waterways or soil

14.1.1 FIRE PREVENTION AND CONTROL

Fires represent a significant risk to the activities and require special attention in the Emergency Response Plan. The contractor/Applicant must take all reasonable measures to ensure that fires are not started as a result of activities on site. No smoking is allowed near containers with flammable contents or at areas that are highly flammable (directly near the drill rig in case of methane release). Smoking is only permitted at areas designated for smoking. No open fires are permitted on site and no burning of waste is to be allowed on site. The contractor/Applicant shall ensure that there is sufficient firefighting equipment available on site at all times. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities. The contractor/Applicant is to ensure that he/she has the contact details of the nearest fire station in case of an emergency. Appropriate and correctly serviced equipment must be available for all activities that are likely to generate fire.

It is further anticipated that firebreaks may be required around the perimeter of the activities. It is recommended that such fire prevention measures are implemented in consultation with landowners and where necessary that the Applicant coordinate fire prevention efforts with local Fire Protection Agency (FPA).

14.1.2 HEALTH AND SAFETY

The Applicant and Contractor shall make allowance for the supply, erection, maintenance and removal of the information boards. Information boards shall also provide the name of the drill site managers, relevant contact person and contact number. This will ensure that the public access to request information and/or to lodge any complaints. The boards will essentially be to advise the communities of the activities to be undertaken, or being undertaken and to advise of the prohibition of entering demarcated “no-go” areas.

The Applicant and Contractor must ensure that compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) is strictly adhered to. All reasonable measures must be taken to ensure the safety of all site staff and the surrounding community is not compromised. No weapons may be brought onto the property by any person. Where fencing is temporarily affected, temporary security must be provided at all times until the fence is reinstated.

The Applicant and Contractor must ensure that all vehicles using public roads are in a roadworthy condition, that drivers adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to.

The Applicant and Contractor must ensure that all accidents and incidents are recorded and reported to the ECO. The Applicant/ contractor must have easy access to all relevant emergency numbers for example, spill



response teams, fire authorities, fire protection associations, medical emergency, nearest emergency rooms (hospitals) to the site, of both private and public hospitals. The Applicant and Contractor must take all reasonable measures to ensure the health and safety of all employees, visitors and the public.

14.1.3 SPILL RESPONSE PROCEDURE

All employees, staff and labourers must be instructed regarding implementation of spill prevention measures and spill response procedures. In the event of a spill, the following general requirements shall apply and the detailed spill procedure to be developed prior to commencement must cater for these requirements;

- Immediately reporting of spills by all employees and/or visitors to the relevant site supervisor and ECO (this requirement must be including in induction training);
- Take immediate action to contain or stop the spill where it is safe to do so;
- Contain the spill and prevent its further spread (e.g. earth berm or oil absorbent materials for spill to land or by deploying booms and/or absorbent material for a spill to water);
- Dispose of any contaminated soil or materials according to appropriate waste disposal procedure (waste from spills of hazardous materials shall be disposed of as hazardous waste at a suitably licensed waste disposal facility);
- The ECO shall record details of the spill in the incident register; and
- Photographic evidence shall be obtained of the spill clean-up.

In the case of large spills, the services of a specialist spill response agency shall be required, who shall advise on appropriate clean-up procedures and follow-up monitoring (if required).

In the event of any spills which are classified as medium or major incidents. The ECO shall record the incident non-conformance and incident register and advice on the appropriate measures and timeframes for corrective action. Environmental incident reports shall be completed and submitted to the drill site manager and Applicant within 5 working days for all medium and major incidents. If there is a requirement to report the incident to the authorities, this shall be done by the Applicant in consultation with the ECO.

The Applicant must also, (as per Section 30 of the NEMA) notify the Director-General (PASA, DWS, DFFE and DMRE), South African Police Services and Local Municipality and any persons whose health may be affected of the nature of an incident including:

- Any risks posed to public health, safety and property;
- Toxicity of the substance or by-products released by the incident; and
- Any step taken to avoid or minimise the effects of the incident on public health and the environment.

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

14.1.4 MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION

The broad measures to control or remedy any causes of pollution or environmental degradation as a result of the proposed activities taking place are provided below:

- Limit the size of the area to be disturbed as far as is practically possible;
- Contain potential pollutants and contaminants (where possible) at source;
- Handling of potential pollutants and contaminants (where possible) must be conducted in bunded areas and on impermeable substrates;
- Ensure the timeous clean-up of any spills;
- Implement a waste management system for all waste stream present on site;



- Investigate any I&AP claims of pollution or contamination as a result of the activities;
- Rehabilitate the sites in line with the requirements of the detailed rehabilitation and closure plan; and
- Implement the impact management objectives, outcomes, and actions, as described in **Section 10** above.

It is of critical importance that the broad measures to control or remedy any causes of pollution or environmental degradation are applied during all phases of the proposed activities. This is essential and allows for the activities to be conducted in a manner that will allow for the decommissioning and rehabilitation goals and objectives to be met.



15 GROUNDWATER MANAGEMENT PLAN

The purpose of the groundwater management plan is to provide a guideline and framework for the applicant to identify, mitigate and minimise potential impacts of the proposed operations on sensitive environmental and groundwater receptors. This management plan is applicable to the construction, operational and decommissioning/ post-closure phases of the project.

15.1 POTENTIAL IMPACTS AND ASSOCIATED RISKS

The following main impacts and associated risks have been identified as part of the groundwater impact assessment:

- i. Inadequate casing or cementing can create a vertical flow pathway between different aquifers/ hydrostratigraphical units or between the production zone and potable aquifer.
- ii. Gas production can alter pressure differences and alter hydraulic gradients between different hydrostratigraphical units resulting in modification of local groundwater flow pathways.
- iii. Upward migration of saline groundwater or groundwater with a different chemical composition originating from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas production phase can cause mixing between aquifers.
- iv. Upward migration of stray formation gas from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas production phase can cause mixing between aquifers.
- v. Multiple gas wells can collectively affect groundwater levels, quality and hydraulic connectivity over a larger area.
- vi. Hydrocarbon contamination of groundwater resources caused by heavy vehicles, drilling rigs as well as associated machinery on-site may cause hydrocarbon contamination or other petroleum products of groundwater resources.
- vii. Groundwater pollution as a result of contact with drilling fluids, additives and lubricants used in the drilling mud sump(s) to the intergranular, potable aquifer(s) during the construction as well as operational phases.

15.2 KEY RESPONSIBILITIES

The following management and mitigation measures should be implemented as part of the integrated groundwater management plan. The applicant will be responsible for compliance with the proposed groundwater management plan. Operational staff shall implement the following measures:

- i. The Licensee shall appoint a suitably qualified and responsible person to give effect to all recommendations as stipulated in specialist reports to ensure compliance to licence conditions pertaining to activities to ensure that potential impact(s) are minimised, and mitigation measures proposed are functioning effectively.
- ii. An ECO must be appointed to oversee the rehabilitation phase and ensure least possible harm to biodiversity and ensure compliance to the rehabilitation plan.
- iii. Compile annual reports that will be submitted to the applicable regulatory authorities.
- iv. Listed environmental activities should be authorised in terms of the National Environmental Management Act (Act 107 of 1998) while any water use activity exercised in terms of Section 21 of the National Water Act (Act 36 of 1998) should be authorised.

15.3 MITIGATION AND MANAGEMENT

The description of mitigation and management measures to be implemented per phase are indicated in **Table 9**.



16 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

In the scoping phase, PASA requested the following information to be addressed in the EIA and / EMPr:

Table 21: Information required by the Competent Authority.

PASA Comment / Concern	Response Provided to PASA	Where Addressed in EIAr
1. Clarify WUL and AEL requirements and applicability. PASA indicated that the Scoping Report should already determine whether NWA and NEMAQA authorisations are required.	EIMS confirmed that an AEL is not triggered and that a WUL/General Authorisation process under the NWA will be undertaken for applicable Section 21 water uses.	Section 4 (Legislative Framework) discusses NWA requirements, Section 21(c), (i) and potential Section 21(g) triggers, General Authorisation/WUL requirements, watercourse crossings and DWS consultation. The EIAr also states that the relevant WUL/GA process will be undertaken in parallel with the EA process.
2. Number of exploration wells and survey extent not specified. PASA requested the total number of wells and survey distances.	EIMS clarified that up to 48 exploration wells are proposed and that 8 seismic transects with a length of approximately 66.74 km are proposed.	Section 3 Project Description quantify the development as up to 48 production wells, and seismic transects (~120.00 km).
3. Premature statement that below-ground wellsite facilities will reduce impacts. PASA requested proper assessment before drawing conclusions.	EIMS advised that the below-ground well-site option would remain an alternative and would be assessed during EIA.	Section 6 (Alternatives Assessment) evaluates wellhead placement alternatives and discusses the advantages and disadvantages of below-ground versus above-ground wellheads. The project description also notes that below-ground chambers are only being considered and not assumed to be preferable without assessment.
4. Helium Recovery Facility and Gas Processing Plant insufficiently described. PASA requested clearer facility descriptions.	EIMS committed to including a block diagram and refined process flow description.	Section 3.1.5 Helium Recovery Facility and Gas Processing Plant now contains detailed descriptions of components and processes, including inlet separation, compression systems, helium recovery unit, cryogenic processing, loading facilities, flare system, produced-water management, a block diagram, and a detailed process description.
5. Management of dissolved and suspended substances in condensate water not explained.	EIMS explained that condensate water will be directed to an HDPE-lined evaporation pond, with solids removed and disposed of at licensed facilities. No discharge to the environment is proposed.	The EIAr provides substantial additional detail on produced water and condensate management, including produced-water tanks, a 25m x 25m lined evaporation pond, oil-water separation systems, wastewater controls, monitoring requirements, sludge disposal, and produced-water management infrastructure. The process flow description also states that condensate water from pretreatment will be routed to the HDPE-lined evaporation pond.
6. Exclusion of IsiXhosa from public participation materials. PASA requested justification for using English, Afrikaans and Sesotho only.	EIMS stated that the study area falls within wards where Sesotho is the predominant language, although	Section 7 (Public Participation Process) records that notification letters, advertisements, gazette notices, site notices and posters were distributed in English, Afrikaans and Sesotho. The EIAr also records



PASA Comment / Concern	Response Provided to PASA	Where Addressed in EIAr
	IsiXhosa is widely spoken in the district.	PASA's comment and EIMS's rationale in the comments-and-responses section.



17 UNDERTAKING

The EAP herewith confirms:

- a) The correctness of the information provided in the reports;
- b) The inclusion of comments and inputs from stakeholders and I&APs;
- c) The inclusion of inputs and recommendations from the specialist reports where relevant; and
- d) That the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein.

I **Vukosi Mabunda**, a Registered EAP (EAPASA Registration Number: 2019/867) employed by **Environmental Impact Management Services (Pty) Ltd** declare that the information provided in this report is correct and relevant to the activity / project, that comments from interested and affected parties have been incorporated into this report that the information was made available to interested and affected parties for their comments.



SIGNATURE OF EAP

29/09/2026
.....
DATE



18 TECHNICAL SUPPORTING INFORMATION

The following specialist reports have been incorporated in this EMPr and provided in full in the EIA Report as:

- Appendix F1: Air Quality Impact Assessment
- Appendix F2: Archaeological and Cultural Heritage Impact Assessment
- Appendix F3: Aquatics and Wetland Impact Assessment
- Appendix F4: Climate Change Impact Assessment
- Appendix F5: Financial Provisions for Closure & Rehabilitation
- Appendix F6: Hydrological / Floodline Assessment
- Appendix F7: Geohydrological Impact Assessment
- Appendix F8: Noise Impact Assessment
- Appendix F9: Palaeontological Impact Assessment
- Appendix F10: Quantitative Risk Assessment
- Appendix F11: Social Impact Assessment
- Appendix F12: Soils & Agricultural Impact Assessment
- Appendix F13: Terrestrial Biodiversity Impact Assessment.



19 REFERENCES

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