DEPARTMENT OF MINERAL RESOURCES AND ENERGY

NO. 5572 **22 November 2024**

MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 OF 2002) ("THE ACT")

INVITATION FOR WRITTEN COMMENTS ON A PROPOSED INVESTIGATION IN TERMS OF SECTION 50 OF THE ACT

I, **SAMSON GWEDE MANTASHE,** Minister of Mineral Resources and Energy, hereby invite written comments on my intention to conduct an investigation to establish the subsurface geology and its structure as it relates to petroleum, on or under land depicted on the plan attached as **Annexure A**, and so, to establish the nature and extent of the subsurface geology and its structure, and assess any potential geological risks. All affected owners, occupiers or persons in control of such land are called upon to furnish their particulars. The investigation in question will be undertaken by;

(i) acquiring and processing new 2D land seismic data over the area or part thereof to obtain modern high-resolution seismic profiles to map and improve understanding of the regional geology of the south-central Karoo Basin; and

(ii) acquiring and processing new airborne magnetic and magneto-telluric over the area or part thereof to support seismic interpretation and to map and improve understanding of the regional geology and structure of the south-central Karoo Basin.

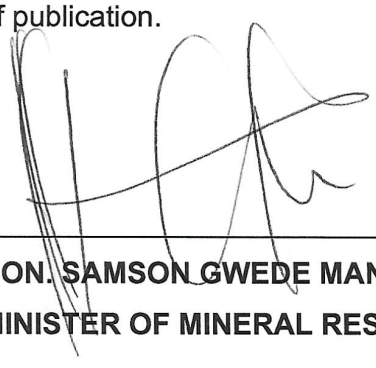
Written comments and particulars of owners, occupiers or persons in control of the land subject to this notice must be submitted to:

The Chief Executive Officer
Petroleum Agency SA
Heron Place
2nd Floor, Heron Close
CENTURY CITY
7441

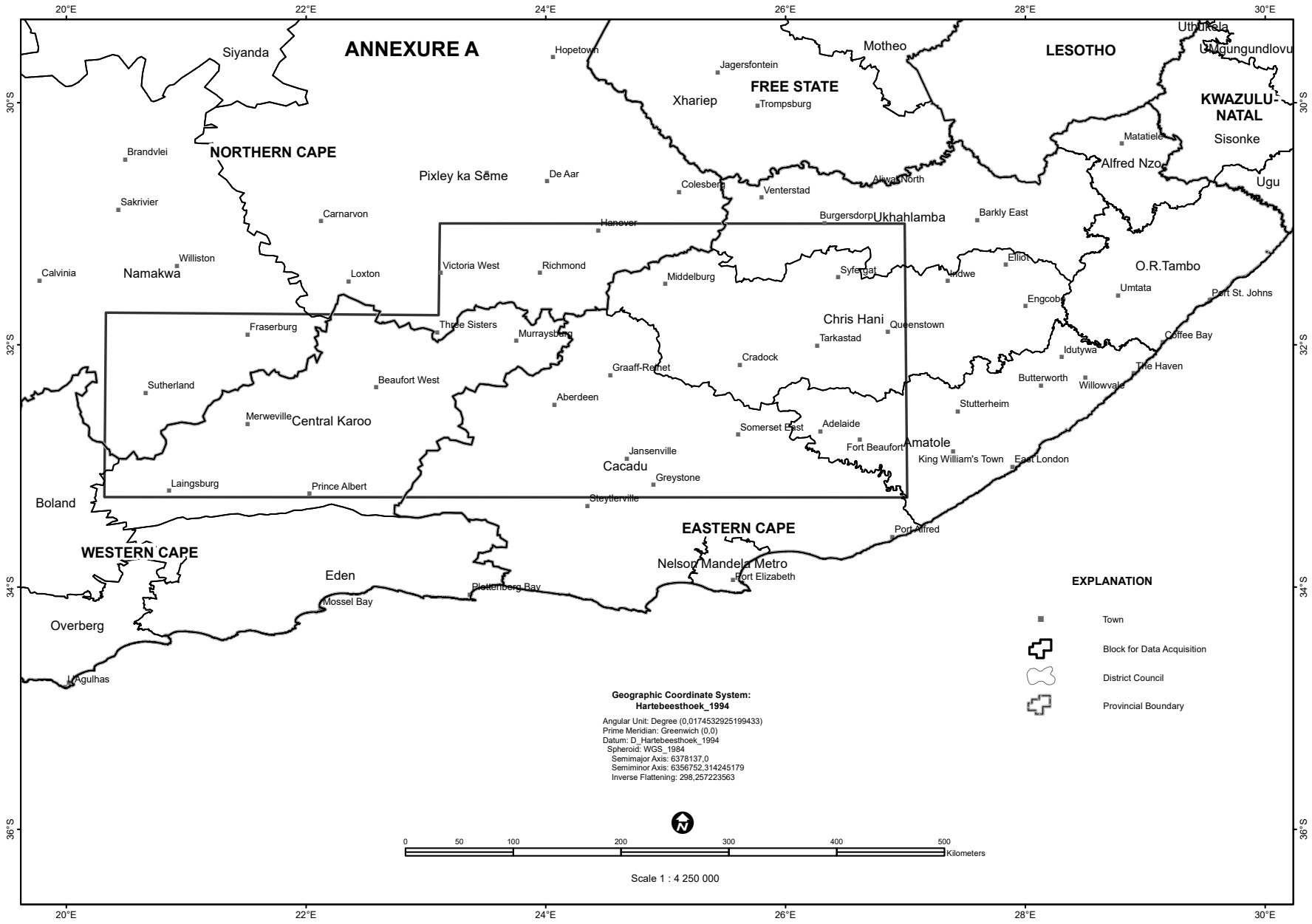
Fax: 021 938 3500

Email: section50@petroleumagencysa.com

Written comments must reach the Petroleum Agency SA by no later than 30 days from the date of publication.



HON. SAMSON GWEDE MANTASHE, (MP)
MINISTER OF MINERAL RESOURCES AND ENERGY



SUPPLEMENTARY INFORMATION

TO INVESTIGATE THE OCCURRENCE, NATURE AND EXTENT OF PETROLEUM RESOURCES IN TERMS OF SECTION 50 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 OF 2002)

1. AIM

To investigate the occurrence, nature and the extent of mineral resources in terms of section 50(1) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) ("the Act") in the southern part of the Karoo Basin depicted in the plan/map marked Annexure A (Government Notice).

2. INTRODUCTION

2.1 As required by the MPRDA, a Section 50 notice was approved by the Minister and subsequently published in the Government Gazette Vol. 710 No. 51138 on 30 August 2024, announcing the intention of the Minister to acquire new geophysical data in the Karoo.

2.2 The proposed investigation aims to acquire new geophysical data in the southern Karoo Basin to establish the subsurface geology and its structure as it relates to the occurrence of petroleum and assess any potential geological risks related to the exploration for and the production of petroleum.

2.3 Historically, reflection seismic data was acquired across the southern part of the Karoo by the former South African national oil company SOEKOR from 1966 to 1971. The data were acquired using the technology available at the time. However, the quality of the data is poor and therefore, detailed high-resolution interpretation of the data is not practical. It is therefore necessary to acquire new data using modern technology to generate improved and higher quality images of the subsurface for geological interpretation.

2.4 Airborne magnetic and radiometric data were collected over the area by various surveys flown for the South Africa Geological Survey and its successor, the Council for Geoscience, between the years 1958 and 1997. The area of interest was covered in two primary sections – the Karoo survey, done between 1976 and 1982 and covering almost half of the country;

and the rest, which was surveyed by various companies over a period of more than 30 years, starting in 1958 and ending in 1997.

2.5 Between 1965 and 2022 18 exploration boreholes were drilled in the area of interest in the southern Karoo Basin, several exceeding depths of 3000 m. All boreholes intersected the organic-rich shale (likely source rocks) of the Permian Ecca Group.

2.6 Production tests and water analyses from some of the exploration wells drilled in the Karoo indicated a presence of light hydrocarbons. In particular, methane gas was encountered in the well CR 1/68 drilled on the farm Cranemere near Pearston in 1968. Gas flowed from the Upper Ecca Group of rocks at rates of 1.83 million standard cubic feet of gas per day (MMscf/d) for a period of 24 hours. This discovery demonstrates the presence of gas accumulations in this region of the Karoo Basin.

2.7 Historical data and information, internal archives, and public data confirm that the area has both oil and gas shows at the surface. Gas occurrences in association with dolerite sills have been observed in the Beaufort Group and in the Ecca Group of rocks, in water wells and deep exploration wells without the presence of dolerite sills.

2.8 Geochemical results obtained from recent soil gas baseline surveys undertaken in the Karoo Basin confirms the presence of methane gas in close proximity to some of the historical exploration wells and borehole locations. The microseepage of oil in the basin is a new finding.

3. BACKGROUND INFORMATION ABOUT GEOPHYSICAL SURVEYS

3.1 **What are geophysical surveys in general?**

Geophysical surveys are conducted to infer the structure and properties of the Earth’s interior. Typically, measurements are made of variations in the Earth’s gravitational and magnetic fields, natural radioactivity, the flow of electrical currents and the transmission and reflection of seismic waves. Geophysical surveys are routinely conducted to search for groundwater, minerals, petroleum and renewable energy sources. The surveys are also used for geotechnical and engineering applications, such as the assessment of the foundations of dams, the identification of pollution plumes, and the mitigation of geohazards. Geophysical surveys can be conducted on the Earth’s surfaces, in boreholes, in the air using aircraft, or at sea using ships.

3.2 **Ground vs airborne surveys**

Airborne surveys are generally quick and easier to conduct than ground surveys and are used for reconnaissance. However, some techniques (such as seismic, electrical resistivity and magnetotelluric) cannot be acquired in the air as the energy sources and detectors must be in direct contact with the ground or water. Ground surveys are usually conducted to focus on areas of interest selected from the study of airborne gravity, magnetic, radiometric and electromagnetic data. Ground surveys can be slow, costly and may demand extensive manpower during field work. However, they provide better quality data because the instruments are closer to the targeted geology. There are cases when ground surveys are deemed not to be feasible. For example, waterbodies or harsh topographical variations present as obstacles. Airborne surveys, on the other hand, are cost-effective if the areas covered are large enough so that the cost per data point is effectively reduced. Moreover, in many applications airborne data may lack spatial resolution and more detailed surveys will be required.

3.3 **Active vs passive geophysical methods**

Geophysical methods can either be active (i.e., use controlled man-made energy sources), or passive (i.e., use natural sources such as vibrations produced by ocean waves breaking against the shore, or uncontrolled man-made sources such as traffic noise). The man-made or natural source-generated signals (i.e., data acquisition) are measured in the field by the specialized sensitive detectors, processed in the field/office (i.e., to remove ‘unwanted information’ or ‘noise’). The output is displayed and interpreted geologically (i.e., determining the depth, size, and properties of the targets) using advanced computer techniques for further analysis and evaluation. Examples of passive methods are seismic ambient noise tomography, magnetotelluric, gravity, and magnetic methods, while examples of active methods include seismic reflection, EM, and electrical resistivity.

3.4 **General geophysical exploration workflow**

The typical geophysical exploration workflow starts with the site visit, physical property measurements, survey planning and design (often done in the office), site visits again for field trials, data acquisition (in the field), data processing (in the field and office), data interpretation and geological modelling (in the office).

4. PROPOSED GEOPHYSICAL SURVEYS IN THE KAROO BASIN

4.1. The work will utilize three geophysical surveys: **land reflection seismic method (active and passive)**, **magnetotelluric (MT)**, and **airborne magnetic and radiometric survey**. These techniques were chosen to meet the objectives of the survey, and also because they are cost-effective, novel and environmentally friendly.

(a) Land active and passive reflection seismic survey

The survey will use cost-effective, novel and environmentally friendly seismic instruments to investigate the subsurface geology of the Karoo Basin.

History of seismic surveys in South Africa

The main goal of seismic exploration is to collect information about the composition and structure of the subsurface. Reflection seismology was first used to explore for oil and gas in sedimentary rocks in the USA in the 1930s. In South Africa, it has been used since 1960s to search for oil and gas, mineral deposits, for deep mining planning and developments, and to investigate the deep crustal structure of the Earth for research and academic purposes. So, these will not be the first 2D seismic surveys in the Karoo or in South Africa. In fact, mining industry in South Africa uses the technique to mitigate mining related risks and improve ore resource evaluation.

- **How does the reflection seismic method work?** A survey involves the recording of the vibrations and waves in the Earth's crust. Seismic surveys can be either active or passive. For example, in an active seismic survey, man-made controlled sources include dynamite or mechanical vibrators, while a passive seismic survey utilizes the energy coming from natural sources such as earthquakes, road traffic noise, industry and human activity, wind and ocean waves. The generated waves travel through the Earth and are refracted and reflected at boundaries between rocks that have different physical properties. As these waves return to the surface, the ground motion is recorded by specialized sensors (known as geophones). The information is analyzed (processed) and the output is interpreted to allow us to create a detailed picture of the structure and composition of the subsurface.

- **Where would the data be acquired?** The data will be acquired along the public roads.

- **What method will be utilized?** The method will utilize both passive and active seismic methods.

- **What instrument will be used as an active energy source?** A vibroseis truck will be used to generate energy at 20 m interval offroad along roadside. The vibroseis truck was chosen because it provides better depth of penetration and quality data, but also has lower environmental impact compared to impulsive sources (drop hammer, accelerated weight drop) and explosives (shots).

- **What is a Vibroseis truck?** It is a vehicle that is used to generate seismic signals. In contrast to older technologies that used explosives (shots), the vibroseis vehicle generates artificial seismic waves through mechanical vibration. The vehicle is equipped with a vibrator (vibroseis source) that is in contact with the ground surface. The vibrator generates controlled vibrations with different frequencies and amplitudes. These vibrations propagate underground as seismic waves and reflect to the surface where the energy intensity of the reflected waves is recorded on surface geophones (sensors). With the vibroseis truck, the operator has control over the seismic energy and frequencies being emitted into the ground.

- **What are the technical parameters of the vibroseis truck proposed for Karoo:** P-wave vibrator, frequency range: 10-150 Hz, Peak Force: 278 kN / 62,400 lbf, hold down weight: 28,294 kg / 63,610 lb, length: 10.64 m, width: 3.42 m; height: 3.22 m.

- **What are the impacts and risks associated with the seismic survey?** The surveys have been designed along the public roads to reduce the environmental footprints from the vibrating seismic truck. Prior to seismic surveys, site visits will be conducted as part of the environmental impact assessment and stakeholder engagement processes to identify any potential risk to infrastructure and the environment that may be caused by the vibrating truck. If a potential risk is identified, the vibration point (VP) will be moved to a more suitable position, or only passive seismic data will be collected in those areas, which doesn't require the use of the vibroseis truck.

- **What recording system will be used?** The survey will utilize the latest wireless (cable-free) nodal technology. This technology was chosen to reduce and risk and minimize any environmental impact that could result from deploying cables across the roads and carrying/transporting a large volume of cables in difficult ground terrain. The survey will also utilize the seismic land streamer. The land streamer is an array of geophones attached on the

belt that can be towed in behind the vibrating truck without the need to install geophones on the ground, therefore reducing any envisaged environmental footprint.

- **How is the seismic survey designed:** Sensors (10 Hz geophones) will be placed at 20 m intervals offroad and the truck will generate energy offroad along roadsides to avoid blocking the road. The landstreamer will be pulled behind the truck.

(b) Airborne magnetic and radiometric surveys

- **How does an airborne magnetic/radiometric survey work?** An aeromagnetic/radiometric survey is conducted using an aircraft with an attached magnetometer and installed spectrometer. As the aircraft flies, the magnetometer measures and records the total intensity of the magnetic field at the sensor. This measurement includes the desired magnetic field generated in the Earth as well as tiny variations due to the constantly varying solar wind and the magnetic field of the survey aircraft. Different rock types and soils have varying content of magnetic and radioactive minerals, so the data allow visualization of the geological structure of the upper crust, especially where bedrock is obscured by surface sediments, soil, or water.

- **How will the survey be conducted in the Karoo?** Aeromagnetic/radiometric surveys will be flown on a grid basis along survey lines with further perpendicular (tie) lines. Data will be acquired at 1 km line spacing, and the flight height will be 50 m Mean Terrain Clearance above ground level. Data will be collected with the aircraft in the field, processed (removing unwanted information) and interpreted in the office using advanced computer systems.

- **Any risks and environmental impact associated with this survey?** The survey will be performed by a highly experienced contractor. The key risks associated with the survey include radar contact loss with the aircraft, collision with topography or infrastructure, and sudden changing weather conditions. A full project risk assessment for the survey block to be flown will be provided, this will be updated after a reconnaissance flight of the survey area in order to identify additional/unidentified risks or issues such as rural development, terrain, power lines and communication antennae. Due consideration will be given to dangerous obstacles such as power lines, communication antennae, trees, mine headgear, buildings etc. Safety systems (including radar/laser antennae, loading pre-existing infrastructure, etc) are in place that ensures that the contract specified minimum terrain clearance is not breached during the survey. The aircraft is equipped with advanced weather warning systems, 24/7 live tracking via radar and communication radios not only with the air-traffic control but with operational centres on the ground.

(c) Magnetotelluric (MT) surveys

- **About the method:** MT is a passive geophysical method that uses natural electromagnetic fields to investigate the electrical conductivity structure of the earth from 100's of metres to 100's of km depth below ground surface. The non-destructive nature of the MT, in addition to good resolution it provides, was the main reason behind its choice for the Karoo survey.

- **What type of data will be recorded?** Audio Magnetotelluric (AMT) and Broadband Magnetotelluric (BBMT). The difference between the two recording is the type of magnetometer used and the amount of recording time.

- **Where will the data be collected?** The data will be collected along the seismic profiles (on the verge adjacent to the road) for several days using specialised MT instruments (e.g., electrodes and magnetic sensors that will be installed/buried for continuous data recording of the data). The instruments will be installed (buried 30 cm deep) at 1-2 km away from each other along the seismic profiles. The data will be processed (removing noise) and interpreted (inversion) using software packages to produce final 3D Earth's subsurface models.

- **Any environmental impact associated with MT survey?** No environmental impact or infrastructure damage is expected.

4.2. During the seismic survey, vibrator trucks will be used as an energy source Wireless receivers will be installed at the ground surface, offroad along roadsides, for receiving and recording the data. No disturbances to land and infrastructure are expected and any impact on people during operations is expected to be minimal to nil. An environmental impact assessment for the areas of survey operation will be conducted as part of the project.

4.3. The expected value to be derived from the survey investigation includes:

- Delivery of a new suite of high-resolution reflection seismic data and imagery of the subsurface for the purposes of geological interpretation.

- Delivery of a new suite of high-resolution airborne magnetic, radiometric and ground magnetotelluric data over the area of investigation to support the seismic interpretation.

Magnetic data will image magnetite-bearing sills and dykes; magnetotelluric data will image electrically conductive geological formations, faults and dykes.

4.4. The data and information delivered will be integrated to provide a detailed interpretation of subsurface structure, thickness and intrusion density, not possible with existing legacy onshore seismic data.

4.5. This will allow for a reduction in uncertainty of the geological risk parameters, regional target identification and hydrocarbon preservation from igneous intrusions. It is therefore envisaged that the new data contribute to incentivising new petroleum exploration activity and accelerates the development of South Africa's onshore petroleum resources.

4.6. Survey results will also inform the geo-environmental baseline research initiatives underway, such as implementation of a groundwater monitoring network, well risk integrity assessments and seismicity monitoring network.

4.7. The study will assist with the identification and delineation of areas that may be too risky from an environmental point of view and therefore should be excluded from shale gas development.

4.8. In terms of infrastructure, the proposed survey area is serviced by a road network consisting of both highways and main roads that are owned and maintained by the South African National Roads Agency. Furthermore, the area is within 100-400 km of air and seaports of Cape Town, George (airport), Mossel Bay (seaport), East London (air and seaports), Ngqura (seaport), Port Elizabeth (air and seaports) and Durban (air and seaports). The Ngqura (Coega) Industrial Development Zone (IDZ) is one of the selected sites for the development of a 1000MW Gas to Power Station. The land within the defined area consists of State-owned land, privately owned farmlands, commonage land, and communal land managed by tribal authorities. The identified sensitive areas such as National and Provincial parks, and wetlands are excluded in the investigation.

4.9. The total amount of data acquisition, processing, and interpretation is of approximately 2 246-line km of 2D reflection seismic surveys, 21 253-line km of airborne magnetic and radiometric surveys, and approximately 2 318 magnetotelluric stations will be deployed along the seismic profiles. The data obtained by this investigation will enable the Department to make informed decisions regarding the issuing of exploration rights in the area. Of importance, an

environmental impact assessment and public consultation will be undertaken prior to data acquisition operations.