Appendix M2: Terrestrial Biodiversity, Flora & Fauna Assessments

Council for Geoscience

PROPOSED SEISMIC REFLECTION SURVEY AND WELL DRILLING, LEANDRA, MPUMALANGA

TERRESTRIAL BIODIVERSITY SPECIALIST REPORT

31 MARCH 2023

Submitted to : Nemai Consulting

NEMAI CONSULTING

Prepared by:

Helena Elizabeth Human (pr. Sci. Nat 147031)

Nitai Consulting (PTY) Ltd.

147 Bram Fischer Drive

Ferndale

2194

NITAI CONSULTING

SPECIALIST ENVIRONMENTAL CONSULTING

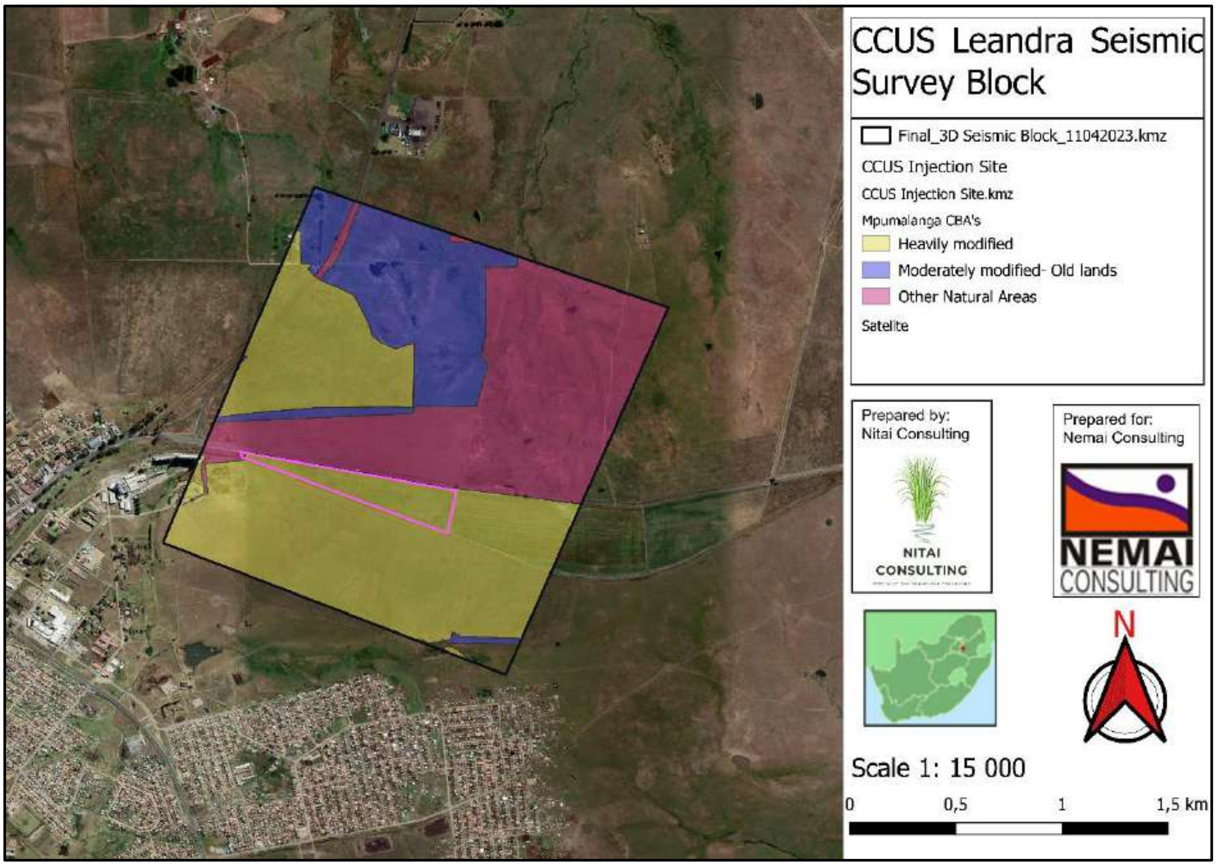
Executive Summary

Nitai Consulting (Pty) Ltd. was appointed by Nemai Consulting (Pty) Ltd. to undertake a terrestrial biodiversity assessment for the proposed 3d seismic survey and drilling project of the Councill for Geoscience, near Leandra in the Mpumalanga Province, South Africa.

According to the National Web Based Environmental Screening Tool (the "Screening Tool"), the terrestrial biodiversity sensitivity theme is very high as the project area falls within a Vulnerable Ecosystem.

Several biodiversity features were identified in terms of corridor linkages that could host various faunal and floral species.

The biodiversity importance for all the habitat units were identified and these are rated as medium to high sensitivity. The ecological impacts were calculated and with mitigation measures in place the impact of the project footprint ranges from moderate to low.



As a result of the very high sensitivity according to the DFFE Screening Tool, an assessment was conducted in order to mitigate possible loss of biodiversity and corridor linkages, ecological structure as well as erosion during the survey and drilling phases of the development. Possible impacts to the loss of biodiversity areas associated with the proposed project is destruction of floral communities and spread of alien invasive species. In addition, loss of wetland habitat could result due to seismic surveys and drilling activities while the possibility for erosion is increased if proper mitigation measures are not followed. The impact on the receiving environment is perceived to be moderate to low and can be further lowered if mitigation measures described in this report are followed.

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List of Abbreviations

CBA	Critical Biodiversity Area
CR	Critical
DFFE	Department of Forestry, Fisheries & the Environment
DWS	Department of Water and Sanitation
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GN	Government Notice
ha	Hectares
km	Kilometer (1 000m)
LC	Least Concern
MAP	Mean Annual Precipitation
m	Meters
NEMA	National Environmental Management Act (No. 107 of 1998)
NFEPA	National Freshwater Priority Areas
NWA	National Water Act
SANBI	South African National Biodiversity Institute
VU	Vulnerable

1 INTRODUCTION

1.1 Terms of Reference

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Biodiversity. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL BIODIVERSITY

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1. An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified on the screening tool as being of “very high sensitivity” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Specialist Assessment.

1.2. An applicant intending to undertake an activity identified in the scope of this protocol on a site identified by the screening tool as being “low sensitivity” for terrestrial biodiversity, must submit a Terrestrial Biodiversity Compliance Statement.

1.3. However, where the information gathered from the site sensitivity verification differs from the designation of “very high” terrestrial biodiversity sensitivity on the screening tool and it is found to be of a “low” sensitivity, then a Terrestrial Biodiversity Compliance Statement must be submitted.

1.4. Similarly, where the information gathered from the site sensitivity verification differs from that identified as having a “low” terrestrial biodiversity sensitivity on the screening tool, a Terrestrial Biodiversity Specialist Assessment must be conducted.

1.5. If any part of the proposed development footprint falls within an area of “very high” sensitivity, the assessment and reporting requirements prescribed for the “very high” sensitivity apply to the entire footprint, excluding linear activities for which impacts on terrestrial biodiversity are temporary and the land in the opinion of the terrestrial biodiversity specialist, based on the mitigation and remedial measures, can be returned to the current state within two years of the completion of the construction phase, in which case a compliance statement applies. Development footprint in the context of this protocol means the area on which the proposed development will take place and includes any area that will be disturbed.

Terrestrial Biodiversity Specialist Assessment

2.1. The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.

2.2. The assessment must be undertaken on the preferred site and within the proposed development footprint.

2.3. The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:

2.3.1. a description of the ecological drivers or processes of the system and how the proposed development will impact these;

2.3.2. ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the preferred site;

2.3.3. the ecological corridors that the proposed development would impede including migration and movement of flora and fauna;

2.3.4. the description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of strategic water source areas (SWSAs) or freshwater ecosystem priority area (FEPA) sub catchments;

2.3.5. a description of terrestrial biodiversity and ecosystems on the preferred site, including:

(a) main vegetation types;

(b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified;

(c) ecological connectivity, habitat fragmentation, ecological processes and fine- scale habitats; and

(d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement

patterns identified;

2.3.6. the assessment must identify any alternative development footprints within the preferred site which would be of a “low” sensitivity as identified by the screening tool and verified through the site sensitivity verification; and

2.3.7. the assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:

2.3.7.1. terrestrial critical biodiversity areas (CBAs), including:

(a) the reasons why an area has been identified as a CBA;

(b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;

(c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);

(d) the impact on ecosystem threat status;

(e) the impact on explicit subtypes in the vegetation;

(f) the impact on overall species and ecosystem diversity of the site; and

(g) the impact on any changes to threat status of populations of species of conservation concern in the CBA;

2.3.7.2. terrestrial ecological support areas (ESAs), including:

(a) the impact on the ecological processes that operate within or across the site;

(b) the extent the proposed development will impact on the functionality of the ESA; and

(c) loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;

2.3.7.3. protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including-

(a) an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;

2.3.7.4. priority areas for protected area expansion, including-

(a) the way in which the proposed development will compromise or contribute to the

expansion of the protected area network;

2.3.7.5. SWSAs including:

(a) the impact(s) on the terrestrial habitat of a SWSA; and

(b) the impacts of the proposed development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses);

2.3.7.6. FEPA sub catchments, including-

(a) the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;

2.3.7.7 indigenous forests, including:

(a) impact on the ecological integrity of the forest; and

(b) percentage of natural or near natural indigenous forest area lost and a statement on the

implications in relation to the remaining areas.

2.4. The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.

Terrestrial Biodiversity Specialist Assessment Report

3.1. The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:

3.1.1. contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;

3.1.2. a signed statement of independence by the specialist;

3.1.3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

3.1.4. a description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;

3.1.5. a description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;

3.1.6. a location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);

3.1.7. additional environmental impacts expected from the proposed development;

3.1.8. any direct, indirect and cumulative impacts of the proposed development;

3.1.9. the degree to which impacts and risks can be mitigated;

3.1.10. the degree to which the impacts and risks can be reversed;

3.1.11. the degree to which the impacts and risks can cause loss of irreplaceable resources;

3.1.12. proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);

3.1.13. a motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;

3.1.14. a substantiated statement, based on the findings of the specialist assessment, regarding the

acceptability, or not, of the proposed development, if it should receive approval or not; and

3.1.15. any conditions to which this statement is subjected.

3.2.The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.

3.3. A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report

2 LEGISLATION

Legislation relevant to this project is discussed below.

2.1 Convention on Biological diversity (CBD)

South Africa became a signatory to the United Nations Convention on Biological Diversity (CBD) in 1993, which was ratified in 1995. The CBD requires signatory states to implement objectives of the Convention, which are the conservation of biodiversity; the sustainable use of biological resources and the fair and equitable sharing of benefits arising from the use of genetic resources. According to Article 14 (a) of the CBD, each Contracting Party, as far as possible and as appropriate, must introduce appropriate procedures, such as environmental impact assessments of its proposed projects that are likely to have significant adverse effects on biological diversity, to avoid or minimize these effects and, where appropriate, to allow for public participation in such procedures.

2.2 National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA is the framework environmental management legislation, enacted as part of the government's mandate to ensure every person's constitutional right to an environment that is not harmful to his or her health or wellbeing. It is administered by the Department of Forestry, Fisheries and the Environment (DFFE) but several functions have been delegated to the provincial environment departments. One of the purposes of NEMA is to provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment. The Act further aims to provide for institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state and to provide for the administration and enforcement of other environmental management laws. NEMA requires, inter alia, that:

- "development must be socially, environmentally, and economically sustainable";
- "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied"; and
- "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions".

NEMA states that "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

2.3 National Environmental Management: Biodiversity Act, Act No. 10 of 2004 (NEM:BA)

As the principal national act regulating biodiversity protection, NEM:BA, is concerned with the management and conservation of biological diversity, as well as the use of indigenous biological resources in a sustainable manner. In terms of NEM:BA, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA Regulations).
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area is in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

Alien and Invasive Species

Chapter 5 of NEMBA relates to species and organisms posing a potential threat to biodiversity. The Act defines alien species and provides lists of invasive species. The Alien and Invasive Species (AIS) Regulations, in terms of Section 97(1) of NEMBA, was published in Government Notice R598 in Government Gazette 37885 in 2014 (NEMBA, 2014). The Alien and Invasive Species (AIS) lists were subsequently published in Government Notice R 864 of 29 July 2016 (NEMBA, 2016).

NEMBA regulates all invasive organisms in South Africa, including a wide range of fauna and flora. Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. The purpose of Chapter 5 is:

a) to prevent the unauthorized introduction and spread of alien species and invasive species to ecosystems and habitats where they do not naturally occur;
b) to manage and control alien species and invasive species to prevent or minimize harm to the environment and to biodiversity in particular;
c) to eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats;

According to Section 65 of the Act, "Restricted activities involving alien species":

1) A person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7. Restricted activities include the following:
   a) Importing into the Republic, including introducing from the sea, any specimen of a listed invasive species.
   b) Having in possession or exercising physical control over any specimen of a listed invasive species. c. Growing, breeding or in any other way propagating any specimen of a listed invasive species, or causing it to multiply.
   c) Conveying, moving or otherwise translocating any specimen of a listed invasive species.
   d) Selling or otherwise trading in, buying, receiving, giving, donating or accepting as a gift, or in any other way acquiring or disposing of any specimen of a listed invasive species.
   e) Spreading or allowing the spread of any specimen of a listed invasive species.
   f) Releasing any specimen of a listed invasive species. h. Additional activities that apply to aquatic species.
2) A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An **"alien species**" is defined in the Act as:

a. a species that is not an indigenous species; or
b. an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by means of migration or dispersal without human intervention.

According to Section 71 of the Act, "**Restricted activities involving listed invasive species**":

1. A person may not carry out a restricted activity involving a specimen of a listed invasive species without a permit issued in terms of Chapter 7.
2. A permit referred to in subsection (1) may be issued only after a prescribed assessment of risks and potential impacts on biodiversity is carried out.

An "**invasive species**" is defined in the Act as any species whose establishment and spread outside of its natural distribution range:

a. threaten ecosystems, habitats or other species or have demonstrable potential to threaten ecosystems, habitats or other species; and
b. may result in economic or environmental harm or harm to human health.

A **"listed invasive species**" is defined in the Act as any invasive species listed in terms of section 70(1). According to Section 73 of the Act, "Duty of care relating to listed invasive species":

2) A person who is the owner of land on which a listed invasive species occurs must:

a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and c) take all the required steps to prevent or minimize harm to biodiversity.

According to Section 75 of the Act, "Control and eradication of listed invasive species":

1. Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
2. Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
3. The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

<u>Government Notice No. 47526 of 2022: The revised National List of ecosystems that are threatened and in need of protection.</u>

This notice, published under Section 52(1)(a) of NEMBA, provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of NEMBA.

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List
Published under Section 56(1) of NEMBA.

Government Notice No. 40733 of 2017: Draft National Biodiversity Offset Policy

Published under NEMA. The aim of the Policy is to ensure that significant residual impacts of developments are remedied as required by NEMA, thereby ensuring sustainable development as required by section 24 of the Constitution of the Republic of South Africa, 1996. This policy should be taken into consideration with every development application that still has significant residual impact after the Mitigation Sequence has been followed. The mitigation sequence entails the consecutive application of avoiding or preventing loss, then at minimizing or mitigating what cannot be avoided, rehabilitating where possible and, as a last resort, offsetting the residual impact. The Policy specifies that one impact that has come across consistently as unmitigatable is the rapid and consistent transformation of certain ecosystems and vegetation types, leading to the loss of ecosystems and extinction of species. The Policy specifically targets ecosystems where the ability to reach protected area targets is lost or close to being lost. However, the Policy states that *“[w]here ecosystems remain* *largely untransformed, intact and functional, an offset would not be required for developments that lead to transformation, provided they have not been identified as a biodiversity priority"*. Biodiversity offsets should be considered to remedy residual negative impacts on biodiversity of 'medium' to 'high' significance. Residual impacts of 'very high' significance are a fatal flaw for development and residual biodiversity impacts of 'low' significance would usually not require offsets. The Policy indicates that impacts should preferably be 18 avoided in protected areas, Critical Biodiversity Areas (CBA), verified wetland and river features and areas earmarked for protected area expansion.

2.4 National Forests Act, Act no. 84 of 1998

Protected trees

According to this Act, the Minister may declare a tree, group of trees, woodland, or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. Forests Prohibits the destruction of indigenous trees in any natural forest without a licence.

2.5 National Water Act, Act 36 of 1998

Any areas that are defined in the National Water Act as a water resource that might be impacted on by certain activities that are contemplated require authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (Act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake, or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

2.6 Conservation of Agricultural Resources, Act No. 43 of 1983 as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands.

2.7 National Veld and Forest Fire Act, Act No. 101 of 1998

Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

2.8 Mpumalanga Nature Conservation Act, Act No. 10 of 1998

This Act provides for the sustainable utilisation of wild animals, aquatic biota, and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations in the Mpumalanga Nature Conservation Act, the following may apply to the current project:

- Various species are protected;
- The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species.

The Act provides lists of protected species for the province. According to the Mpumalanga Nature Conservation Act, a permit is required for the removal of any species on this list.

3 PROJECT DESCRIPTION

Carbon Capture Utilisation and Storage (CCUS) has been acknowledged by South Africa (RSA) as one of the technologies to mitigate the emission of CO_2 into the atmosphere and forms one of the Nationally Appropriate Mitigation Actions (NAMA) against climate change. It is also one of the national flagship projects. CCUS forms part of a just transition to a future low-carbon energy economy.

The Council for Geoscience (CGS) is undertaking a geoscientific research project for the piloting of CCUS in Leandra in Mpumalanga, where it is proposed to inject CO_2 into deep suitable geological formations, approximately 1km below the surface. The Government of SA has received funding from the World Bank's International Bank for Reconstruction and Development to finance the CCUS project and intends to apply part of the proceeds for conducting Geological Characterisation comprising, amongst others, of drilling exploration boreholes and undertaking high-resolution 3D seismic survey at the proposed site. This notice only focuses on the Geological Characterisation component of the overall CCUS.

3.1 Location

The proposed drilling site is located along the R29 from Leandra to Kinross and is bounded to the south by a railway line from Secunda to Springs. The area earmarked for the 3D seismic survey encompasses most of the town of Leandra, as well as rural areas to the east and north-east.

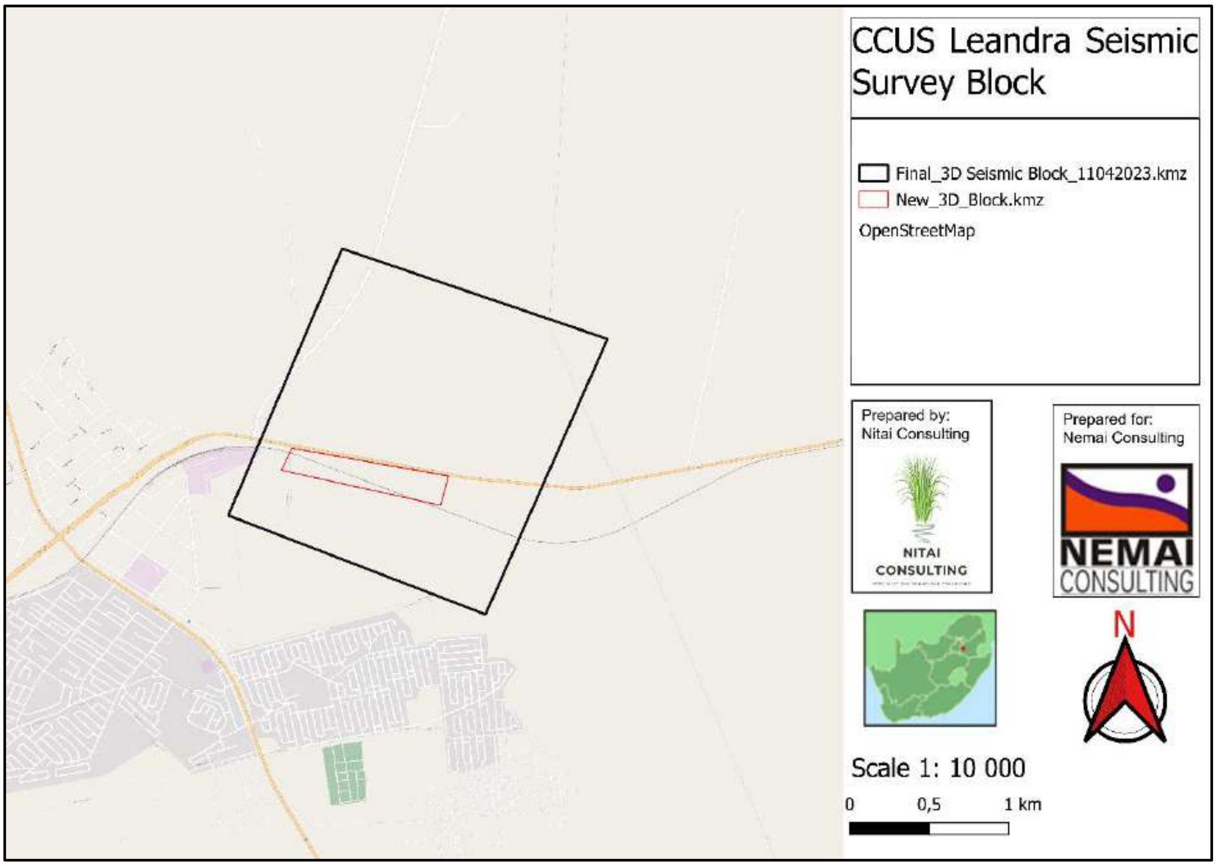

Figure 1: Project Locality

3.2 3D Seismic Survey

A seismic survey is a method of investigating subterranean structure. The technique is based on determining the time interval that elapses between the initiation of a seismic wave at a selected shot point (i.e., location where the seismic wave is generated) and the arrival of reflected or refracted impulses at one or more seismic detectors (Source: https://www.britannica.com/science/seismic-survey). The purpose of the high-resolution 3D survey for the CCUS Project is to map the structures, reservoir, and seal rocks in detail over the identified potential injection site. The 3D survey will also establish the baseline for future time-lapse CO_2 monitoring activities. 3D seismic surveys must be conducted over a large area in order to provide sufficient data for accurate interpretation of the subsurface geology. For the Project, the seismic waves will be induced by vibrating truck-mounted heavy plates on the ground. These specialised trucks are known as "Vibroseis". By analysing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped. 3D surveys are acquired by laying out energy source points (vibroseis) and receiver points (geophones) in a grid over the area to be surveyed. The 3D seismic data for the Project will be processed using pre-stack time/depth migration and post-stack time migration approaches for comparison purposes. The information from the existing legacy and borehole data will be utilised to provide constraints on the designs of the seismic surveys and processing of the seismic data. Methodology

3.3 Drilling

The boreholes will be cored from the top of the bedrock to total depth with a minimum hole diameter of c. 95 mm. At various intervals during the drilling, suites of geophysical instruments will be installed in the borehole to obtain geophysical information. In addition, tests to determine the presence and quantity of gasses, e.g., hydrocarbons/light gasses, and tests to determine hydrological information will be conducted at systematic horizons, e.g., where water strikes are intersected, in the borehole. Plant, equipment, and goods associated with the drilling shall include (amongst others):

- Drill rigs including masts or derricks;
- Drilling fluid mixing, pumping and recycling equipment;
- Grouting pumps, mixers and all other equipment necessary for grout casing of the borehole, when necessary;
- Lighting plants and other equipment necessary to allow safe and efficient 24-hour operation;
- Adequate power supply unit for the drilling operation and the staff camp;
- Water supply for drilling and potable water for workers;
- Site office accommodation, stores, workshops and kitchen facilities at the site;
- Office for CGS representatives;
- Adequate vehicles to allow completion of the work, including suitable transport to safely transport contractor personnel to and from the drill site;
- Adequate, approved temporary ablution and latrine facilities;
- A reliable communication system; and
- All spare parts and back-up plant and equipment to ensure safe and efficient completion of the work.

On completion, the borehole will be securely capped with a concrete sanitation block and a lockable metal cap with a clear sign to avoid potential hazards to people and animals. The drill site will also be suitably rehabilitated. New facilities will be created for the injection phase.

3.4 Desktop Study

3.4.1 Leandra Footprint screening tool results

3.4.1.1 Relative terrestrial biodiversity theme sensitivity

The national web-based Environmental Screening Tool was queried in relation to the following infrastructure: Any activities within or close to a watercourse.

According to the National Web based Environmental Screening Tool ("Screening tool") the terrestrial biodiversity sensitivity theme is very high (Table 2) (Figure 2) due the fact it forms part of a Vulnerable ecosystem (discussed in section 3.4.3).

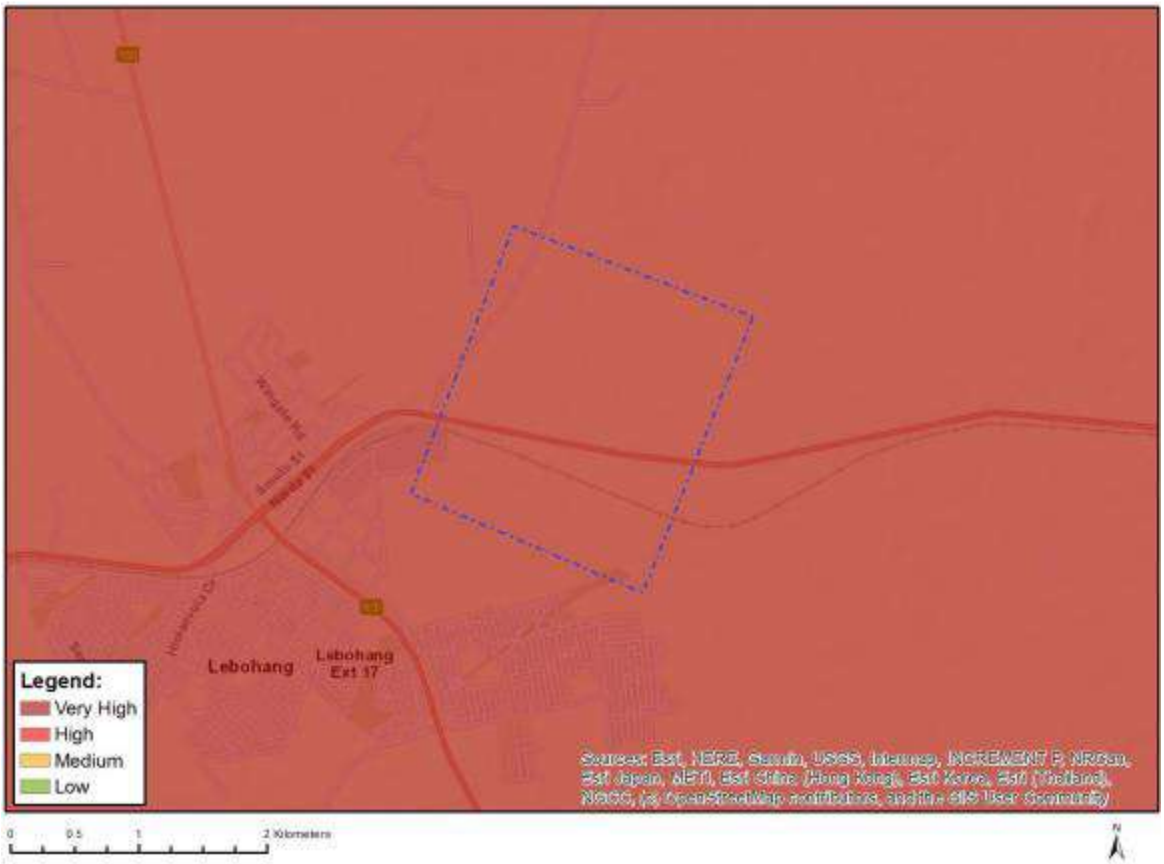

Figure 2: Terrestrial Biodiversity sensitivity

Table 1: Terrestrial Biodiversity sensitivity theme

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Very High	Vulnerable ecosystem

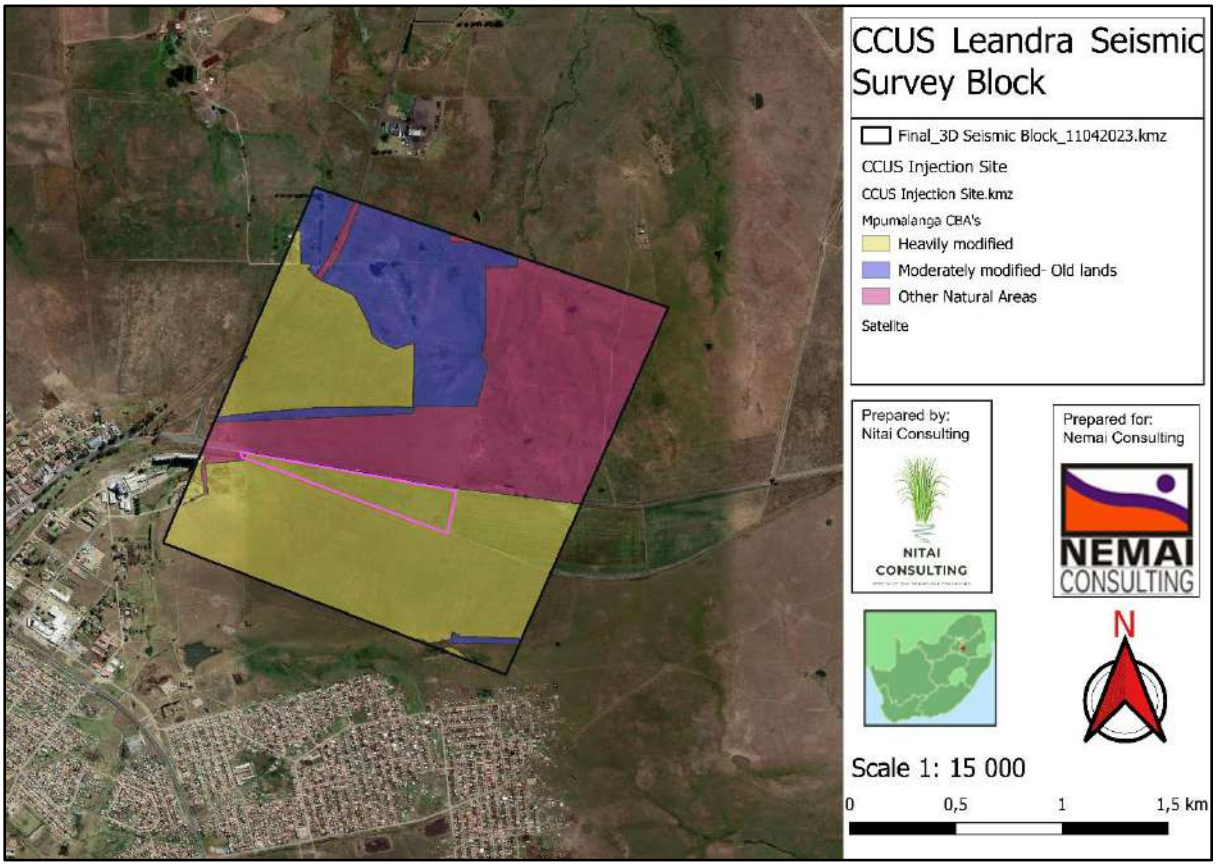

Figure 3: Terrestrial CBA's and modified areas of study site

Even though there is historical decline in habitat quality, the study site has been assessed in terms of endemism (Figure 4) and is considered a vulnerable ecosystem, (Figure 5) (SANBI & DFFE, 2021).

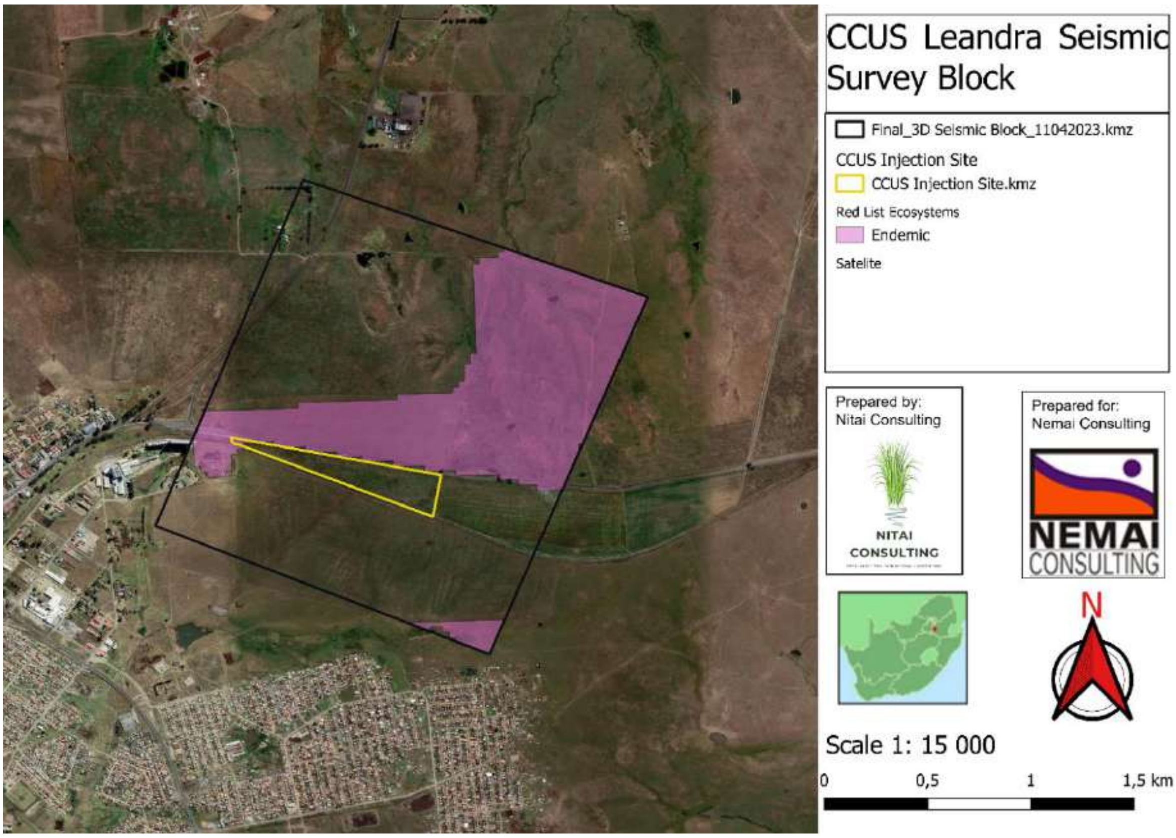

Figure 4: Study site with endemic classification

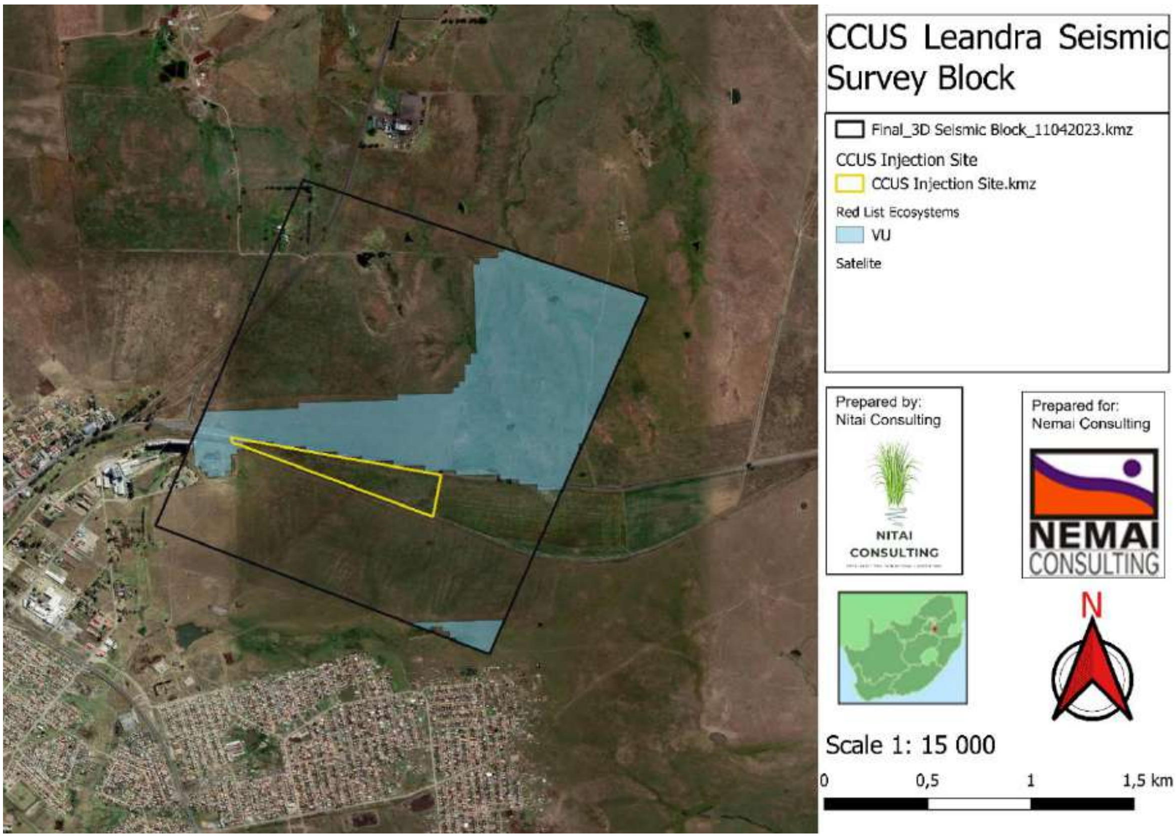

Figure 5: Study site within a vulnerable ecosystem

The DFFE online screening tool identifies Terrestrial Biodiversity as a theme of very high sensitivity. This is due to presence on site of a vulnerable ecosystem. The theme indicates almost the entire study area as being in the Very High sensitivity category, but there are significant areas that have been cultivated and impacted by heavy grazing that do not support this classification. This pattern of over-utilization affects all habitats on site, resulting in them being in moderate to poor condition. The remaining natural habitat on site, where it occurs in moderate to condition, therefore, has to be considered to have moderate biodiversity value.

3.4.2 Regional vegetation patterns

There is only one regional vegetation pattern encountered in the study site, which is the Soweto Highveld Grassland (Mucina & Rutherford, 2006; SANBI, 2012). It is probable that terrestrial vegetation patterns reflect the major vegetation type, Soweto Highveld grassland but since the study site is situated close to the border of the Eastern Highveld Grassland, the site may have characteristics of both bioregions since it is on the ecotone between the two areas. The vegetation types that occur in the study area and nearby areas are briefly described below.

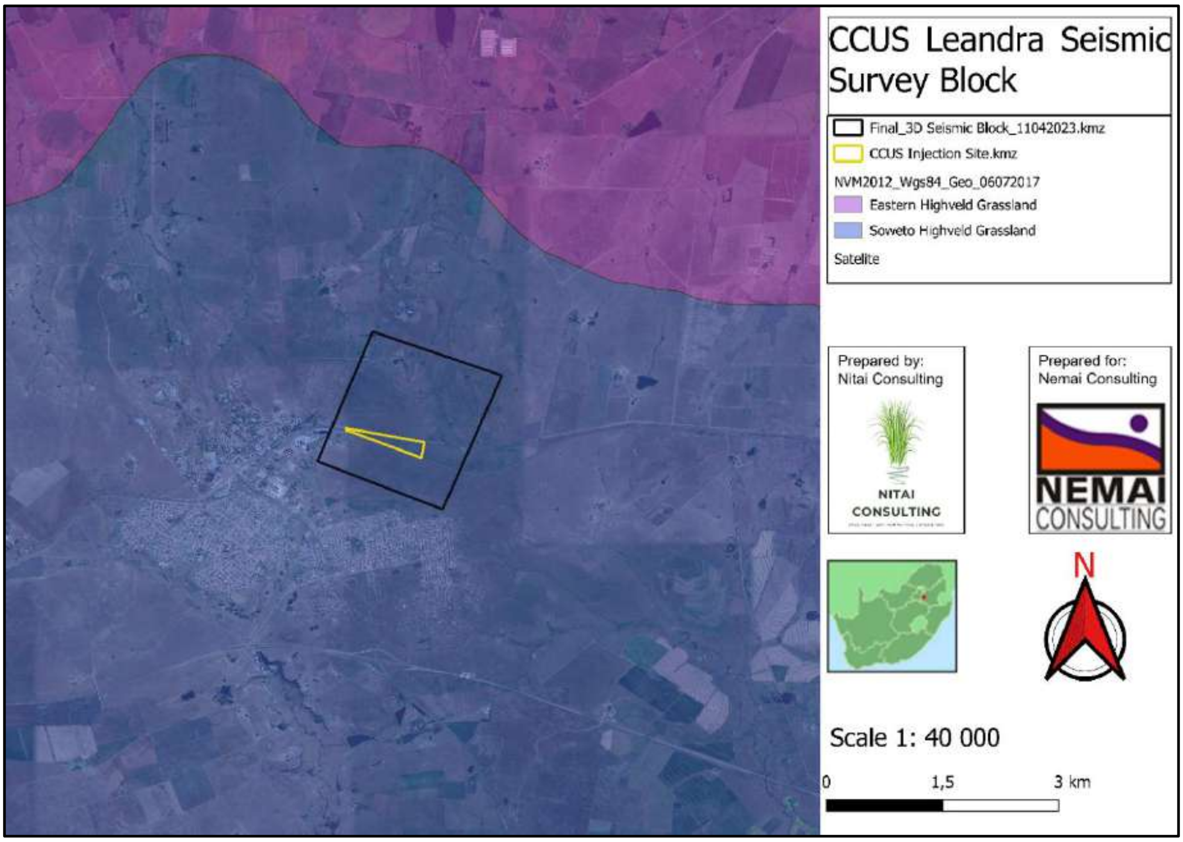

Figure 6: Regional vegetation types of the study area

3.4.2.1 Soweto Highveld Grassland

Vegetation & Landscape Features

Gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such as *Elionurus muticus*, *Eragrostis racemosa*, *Heteropogon contortus* and *Tristachya leucothrix*. In places not disturbed, only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover.

Geology and soils

Shale, sandstone, or mudstone of the Madzaringwe Formation (Karoo Supergroup) or the intrusive Karoo Suite dolerites which feature prominently in the area. In the south, the Volksrust Formation (Karoo Supergroup) is found and in the west, the rocks of the older Transvaal, Ventersdorp and Witwatersrand Supergroups are most significant. Soils are deep, reddish on flat plains and are typically Ea, Ba and Bb land types.

Climate

Summer-rainfall region (MAP 662 mm). Cool-temperate climate with thermic continentality (high extremes between maximum summer and minimum winter temperatures, frequent occurrence of frost, large thermic diurnal differences, especially in autumn and spring). See also climate diagram for Gm 8 Soweto Highveld Grassland (Figure 7).

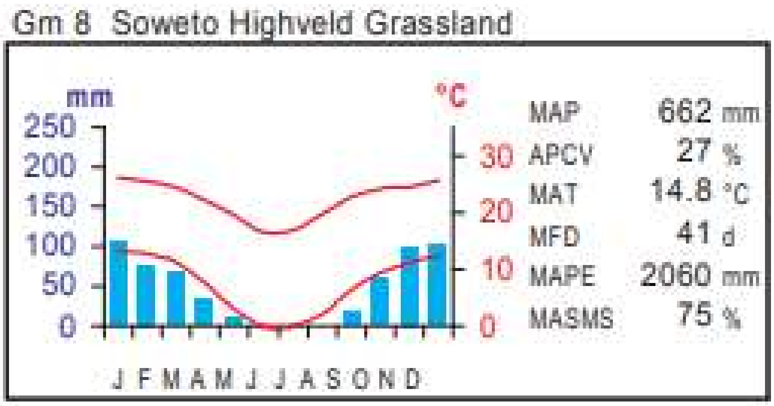

Figure 7: Climate diagram for Soweto Highveld Grassland (Mucina & Rutherford, 2006)

Important Taxa

Graminoids: *Andropogon appendiculatus (d), Brachiaria serrata (d), Cymbopogon pospischilii (d), Cynodon dactylon (d), Elionurus muticus (d), Eragrostis capensis (d), E. chloromelas (d), E. curvula (d), E. plana (d), E. planiculmis (d), E. racemosa (d), Heteropogon contortus (d), Hyparrhenia hirta (d), Setaria nigrirostris (d), S. sphacelata (d), Themeda triandra (d), Tristachya leucothrix (d), Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum.* **Herbs**: *Hermannia depressa (d), Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.* **Geophytic Herbs:** *Haemanthus humilis subsp. hirsutus, H. montanus.* **Herbaceous Climber:** *Rhynchosia totta*. **Low Shrubs:** *Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana.*

3.4.2.2 Eastern Highveld Grassland

Vegetation and Landscape Features

Slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra, Celtis africana, Diospyros lycioides subsp lycioides, Parinari capensis, Protea caffra, P. welwitschii* and *Rhus magalismontanum*).

Geology and Soils

Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types Bb (65%) and Ba (30%).

Climate

Strongly seasonal summer rainfall, with very dry winters. MAP 650–900 mm (overall average: 726 mm), MAP relatively uniform across most of this unit but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit but drops to 21% in the east and southeast. Incidence of frost from 13–42 days, but higher at higher elevations. See also climate diagram for Gm 12 Eastern Highveld Grassland (Figure 8).

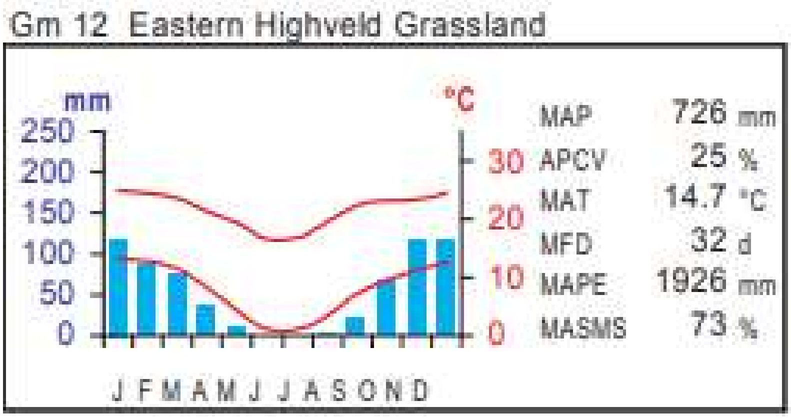

Figure 8: Climate Diagram for eastern Highveld Grassland (Mucina & Rutherford, 2006)

Important Taxa

Graminoids: *Aristida aequiglumis (d), A. congesta (d), A. junciformis subsp. galpinii (d), Brachiaria serrata (d), Cynodon dactylon (d), Digitaria monodactyla (d), D. tricholaenoides (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. curvula (d), E. plana (d), E. racemosa (d), E. sclerantha (d), Heteropogon contortus (d), Loudetia simplex (d), Microchloa caffra (d), Monocymbium ceresiiforme (d), Setaria sphacelata (d), Sporobolus africanus (d), S. pectinatus (d), Themeda triandra (d), Trachypogon spicatus (d), Tristachya leucothrix (d), T. rehmannii (d), Alloteropsis semialata subsp. eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Eragrostis capensis, E. gummiflua, E. patentissima, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides*. **Herbs:** *Berkheya setifera (d), Haplocarpha scaposa (d), Justicia anagalloides (d), Pelargonium luridum (d), Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.* **Geophytic Herbs:** *Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia.* **Succulent Herb:** *Aloe ecklonis.* **Low Shrubs:** *Anthospermum rigidum subsp. pumilum, Stoebe plumosa.*

3.4.3 Conservation Status of regional vegetation types

Based on a scientific approach used at national level by SANBI (Driver et al., 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (SANBI, 2012) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 3 below, as determined by best available scientific approaches (Driver et al., 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al., 2005).

Table 2: Determining ecosystem status (Driver et al., 2005).

Habitat remaining (%)	80 -100	Least Threatened	LT/ LC
	60 - 80	Vulnerable	VU
	Biodiversity target - 60	Endangered	EN
	0 – Biodiversity Target	Critically Endangered	CR

DFFE has published the revised national list of ecosystems that are threatened and in need of protection. The revised list has been published in Government Gazette 47526 (Notice No.689) on 18 November 2022 in terms of the National Environmental Management: Biodiversity Act (NEMBA). By listing the ecosystems that are threatened or in need of protection, anyone wanting to undertake any activity will require environmental authorisation to do so. The list of ecosystems is used to support decision-making and to inform bioregional planning. The revised national list of ecosystems that are threatened or in need of protection was developed between 2016 and 2020 and incorporates the best available information on terrestrial ecosystem extent and condition, pressures, and drivers of change (DFFE, 2022).

A total of 120 of the 456 terrestrial ecosystem types assessed are categorised as threatened. Together these threatened ecosystem types make up approximately 10% of the remaining natural habitat in the country. Of the 120 terrestrial ecosystems 55 are critically endangered, 51 endangered and 14 have been found to be vulnerable (DFFE, 2022).

Table 3: Conservation status of vegetation types in the study area (SANBI & DFFE, 2021)

Ecosystem Detail	Soweto Highveld Grassland
Reference number	Gm8

Threat status	Vulnerable
Listed under criterion	A & B (Criterion A and B)
Biome	Grassland
Original area	1457372 (ha)
Remaining area	39 %
Protected area	0,6 %
Description	In a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River (border with the Free State) in the south. It extends further westwards along the southern edge of the Johannesburg Dome (including part of Soweto) as far as the vicinity of Randfontein. In southern Gauteng it includes the surrounds of Vanderbijlpark and Vereeniging as well as Sasolburg in the northern Free State. Gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such *as Elionurus muticus, Eragrostis racemosa, Heteropogon contortus and Tristachya leucothrix.* In places not disturbed, only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover. Pressures & threats: This ecosystem has a broad range of pressures. Agriculture is a key pressure on this ecosystem type, with 5247.98 km2 of the ecosystem consisting of croplands and a further 1915.61 km2 of old fields. Urban and road development, as well as dam construction are also pressures, with of 1262.98 km2 the ecosystem consisting of built-up areas and 185.32 km^2 of artificial water bodies. Additionally, mining has impacted 131.3 km^2 of Soweto Highveld Grassland (Mucina & Rutherford, 2006)
Notes	Trigger Sub-Criteria: A3, B1(i) - National land cover data show that Soweto Highveld Grassland has experienced extensive spatial declines of approximately 61 % since 1750. Soweto Highveld Grassland is narrowly distributed with high rates of habitat loss in the past 28 years

	(1990-2018), placing the ecosystem type at risk of collapse. Scope: Global & national status (global extent assessed)

3.4.4 Biodiversity Conservation plans

The Mpumalanga Biodiversity Sector Plan (MBSP) (Mpumalanga Parks and Tourism Agency, 2014) classifies the natural vegetation of the province according to the following categories:

- Protected Areas (sub-divided into three categories).
    - Areas that are formally protected by law and recognised in terms of the Protected Areas Act, including contract protected areas declared through the biodiversity stewardship programme.
- Critical Biodiversity Areas (sub-divided into “Irreplaceable” and “Optimal”).
    - All areas required to meet biodiversity pattern and process targets; Critically Endangered ecosystems, critical linkages (corridor pinch-points) to maintain connectivity; CBAs are areas of high biodiversity value that must be maintained in a natural state.
- Other natural areas.
- Ecological Support Area (sub-divided into four categories); and
- Modified (sub-divided into Heavily or Moderately modified).
    - Areas in which significant or complete loss of natural habitat and ecological function has taken place due to activities such as ploughing, hardening of surfaces, open-cast mining, cultivation and so on.

Figure 3 shows the features within the study area within three of five classes, as follows:

Modified: Moderately and Heavily – The North-eastern and North-western corners, the southern part of the East-west boundary and the centre of the study site is either moderately or heavily modified.

The explanation for these designations is given below: (Mpumalanga Parks and Tourism Agency, 2014)

Moderately modified – Old lands: Old cultivated lands that have been allowed to recover (within the last 80 years) and support some natural vegetation. Although biodiversity pattern and ecological functioning may have been compromised, the areas may still play a role in supporting biodiversity and providing ecosystem services.

Heavily modified - All areas currently modified to such an extent that any valuable biodiversity and ecological functions have been lost.

3.5 Field data and ground truthing

3.5.1 Habitats on site

A map of the habitats within the study area is provided in Figure 9. The study area is found within typical mesic grassland with turf soil.

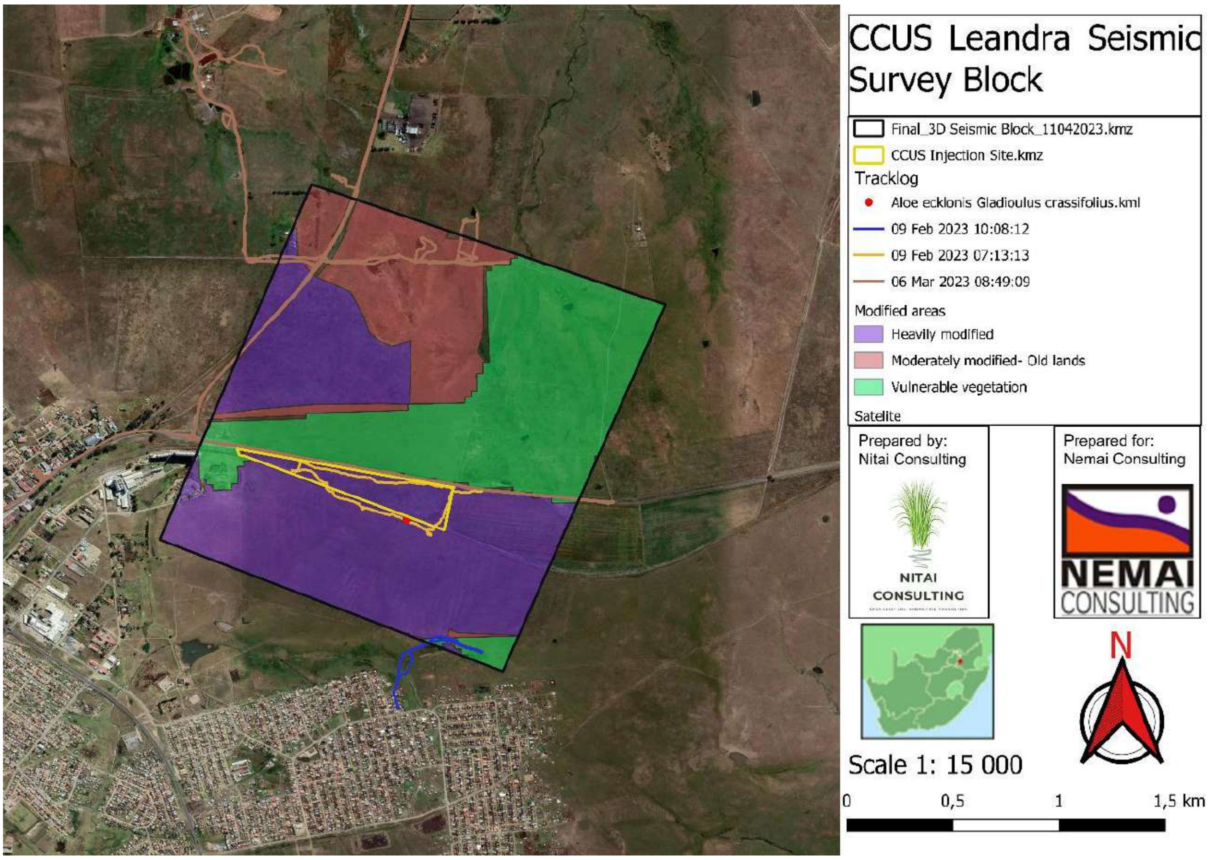

Figure 9: Habitat units identified in the study area

3.5.1.1 Vulnerable Habitat

This habitat type is characterised by natural vegetation with little disturbances. The vegetation structure ranges from short grassland vegetation on shallower soils to very tall grassland on deeper Arcadia soils (Figure 10).

Figure 10: General view of vegetation in vulnerable habitat.

The floristic composition of this habitat is dominated by true grassland species with virtually no trees or shrubs. The graminoid species found here include: *Digitaria eriantha, Hyparrhenia hirta, Cymbopogon caesius, Cynodon dactylon, Eragrostis trichophora, Setaria pumila, Aristida scabrivalvis, Themeda triandra, Urochloa mossambicensis, Sporobolus fimbriatus, Paspalum dilatatum, Setaria sphacelata var sphacelata, Brachiaria serrata, Elionurus muticus, Bulbostylis hispidula, Cyperus congestus, Juncus effusus.* The herbaceous layer comprise the following species: *Tagetes minuta, Arctotis arctotoides, Cotula anthemoides, Monsonia angustifolia, Taraxacum officinale, Kedrostis africana, Crabbea ovatifolia, Hermannia erodioides, Ocimum americanum, Euphorbia inaequilatera, Bidens bipinnata, Gomphocarpus fruticosa, Vernonia oligocephala, Berkheya zeyheri, Gladiolus crassifolius, Wahlenbergia caledonica, Crassula lanceolata, Scabiosa columbaria, Berkheya radula, Polygala hottentota, Rhynchosia minima, Lessertia stricta, Vernonia galpinii, Persicaria lapathifolia, Ipomoea crassipes, Gazania krebsiana, Aloe ecklonis, Ledebouria ovatifolia, Oxalis corniculata, Cirsium vulgare, Solanum elaeagnifolium, Hibiscus trionum, Galinsoga parviflora, Haplocarpa scaposa, Gerbera ambigua, Tragopogon dubius, Verbena bonariensis, Albuca tomentosa, Dianthus mooiensis, Euphorbia clavarioides, Habenaria falcicornis subsp. caffra, Asclepias eminens, Gomphrena celosioides, Felicia muricata, Trifolium africanum, Schkuhria pinnata, Bidens formosa.*

Three of the species found in this habitat are protected in terms of the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. These are *Gladiolus crassifolius, Habenaria falcicornis subsp. caffra,* and *Aloe ecklonis.*

There were quite a few exotic species found spread out all over the study area, these are: *Schkuhria pinnata, Solanum elaeagnifolium, Verbena bonariensis, Tagetes minuta, Bidens formosa, Taraxacum officinale* and *Bidens bipinnata.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis:	1b
Cirsium vulgare	1b

3.5.1.2 Aquatic habitats

The wetlands were mapped and delineated by and aquatic specialist using various databases and ground truthing. There is one main wetland within the study area. This wetland has various condition ratings. There are exotic species found within the areas: *Solanum elaeagnifolium and Verbena bonariensis plants*. This habitat forms part of the Aquatic specialist report and is mentioned here mainly because of the habitat discussion (Figure 11).

The following vegetation was found: *Persicaria lapathifolia, Paspalum distichum, Heteropogon contortus, Panicum coloratum, Themeda triandra, Cymbopogon caesius, Digitaria monodactyla, Verbena bonariensis, Solanum elaeagnifolium, Eragrostis curvula, Bulbostylis hispidula, Cyperus congestus, Bothriochloa insculpta, Sporobolus pyramidalis, Sporobolus africanus, Paspalum dilatatum, Paspalum urvillei, Fingerhuthia africana, Dactyloctenium aegyptium, Juncus effusus, Crinum bulbispermum, Gladiolus crassifolius, Aloe ecklonis* and *Diclis reptans.*

Figure 11: General view of Aquatic habitats.

Three species found in this habitat is protected in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. This is *Gladiolus crassifolius, Aloe ecklonis* and *Crinum bulbispermum.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis: 1b

3.5.1.3 Modified habitats (Moderate and Heavy)

These are areas that were previously ploughed for cultivation but have been left for an extended period without ploughing. Through natural succession processes, they generally develop a perennial cover of grasses (Figure 12), but these secondary grasslands are species poor and the original diversity of resprouting species is usually entirely absent. Non-grass species diversity usually consists of re-seeding and weedy species, and sometimes animal- and/or bird-dispersed woody species. On aerial photographs and satellite images with adequate resolution, these areas are often recognisable by the presence of residual plough lines and other structural features often present in cultivated fields.

Common graminoid found here are *Digitaria eriantha, Hyparrhenia hirta, Cymbopogon caesius, Cynodon dactylon, Eragrostis trichophora, Setaria pumila, Aristida junciformis, Themeda triandra, Urochloa mossambicensis, Bulbostylis hispidula, Sporobolus fimbriatus, Paspalum dilatatum, Setaria sphacelata var sphacelata.*

The herbaceous layer consist of a diverse species assemblage: *Tagetes minuta, Monsonia angustifolia, Conyza bonariensis, Verbena bonariensis, Bidens formosa, Kedrostis africana, Crabbea ovatifolia, Hermania erodioides, Chamaecrista mimosoides, Ocimum americanum, Euphorbia inaequilatera, Bidens pinnata, Gomphocarpus fruticosa, vernonia oligocephala, Berkheya zeyheri, Gladiolus crassifolius, Wahlenbergia caledonica, Tragopogon dubius, Crassula lanceolata, Scabiosa columbaria, Berkheya radula, Polygala hottentota, Tephrosia crassipes, Vernonia galpinii, Helichrysum nudifolium, Ipomoea crassipes, Gazania krebsiana, Aloe ecklonis, Oxalis corniculata, Cuscuta campestris, Cirsium vulgare, Hibiscus trionum, Galinsoga parviflora, Haplocarpa scaposa.*

In a general sense this area has a medium species richness and is dominated by medium to short graminoid species with herbaceous vegetation in between. The area has a high cover of plant species. There are clear indicators that this system is undergoing old land succession and has several pioneer plant species although the perennial species are well established and seems to propagate well.

Figure 12: General view of old land habitats.

Two species found in this habitat is protected in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. This is *Gladiolus crassifolius* and *Aloe ecklonis.*

There were quite a few exotic species found spread out all over the study area, these are: *Schkuhria pinnata, Tagetes minuta, Verbena bonariensis, Bidens formosa, Ocimum americanum, Bidens pinnata, Tragopogon dubius, Cuscuta campestris.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis: 1b

The following species is listed as invader weeds and plants in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 13 to which section 80 (1) (a) applies. This is: *Cuscuta campestris*.

3.5.2 Habitat sensitivity

To determine ecological sensitivity in the study area, site-specific, local, and regional factors were considered. There is one habitat type (Vulnerable) in the study area that have been described as sensitive. A detailed assessment and delineation of the aquatic habitats was undertaken by an Aquatic Ecologist, and they are only considered here in terms of being important habitat for flora and fauna.

A summary of sensitivities that occur on site and that may be vulnerable to damage from the proposed project are as follows:

Natural Grassland – Vulnerable habitat units: In general, this study area has natural vegetation intact with a few protected species and has been classified as vulnerable and endemic by SANBI in 2022. **This must be kept in a natural state, with no further loss of habitat.** (Mpumalanga Parks and Tourism Agency, 2014)

Plant species of concern: There are four species of conservation concern listed for the site. Please note that the Screening Tool report includes lists of bird, mammal, reptile, amphibian, butterfly and plant species of conservation concern known or expected to occur on the proposed development footprint. Some of these SCC are sensitive to illegal harvesting. Such species have had their names obscured and are listed as sensitive plant unique number / sensitive animal unique number.

Sensitive Species 1252 **(Vulnerable A2cd)**

This species is extremely rare in the wild and is known to be exploited, utilised or traded. The localities of remaining populations need to be protected to avoid any further exploitation, which is likely to drive it to extinction. This species dos does not occur on the study site.

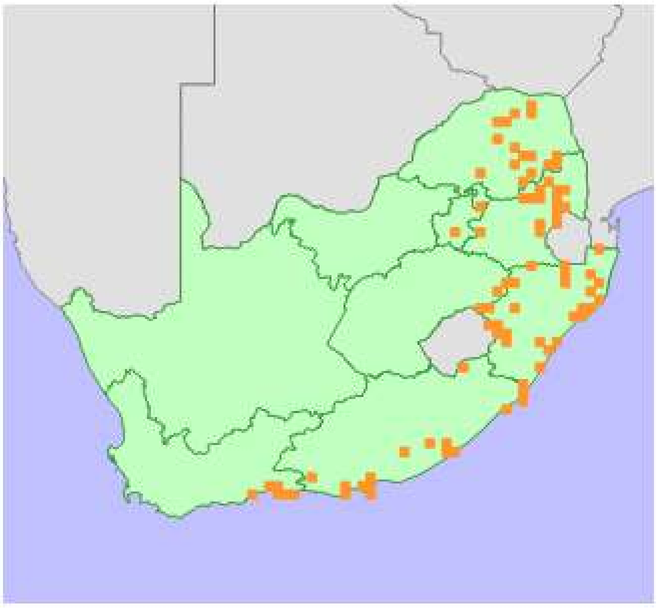

Figure 13: Distribution of Sensitive Species 1252.

Sensitive Species 691 **(Vulnerable B1ab(ii,iii,v)**

According to the SANBI Red List Assessment, this species is Vulnerable as it is known from less than 10 locations that are threatened by habitat loss and degradation (Raimondo, 2013). Few known locations of occurrence with existing threats causing population decline, makes this species vulnerable to further population decline. This species does not occur on the study site.

Figure 14: Distribution of Sensitive species 691.

Pachycarpus suaveolens

Threatened by agriculture, mining and aliens. Seventy-five percent of the known localities occur in heavily transformed areas, with about 45% of the habitat within its known range already transformed. Urban expansion may have led to the local extinction of this species in Gauteng. This species does not occur on site.

Figure 15: Distribution of Pachycarpus suaveolens.

Even though none of the listed species occur on site, two protected species was found in various localities over the site.

3.5.3 Impact analysis

Impact analysis, describing how impact significance was calculated and information/receptors informing the execution and timing of the fieldwork.

Site Ecological importance (SEI) is a function of the biodiversity importance (BI) of the receptor (e.g., species of conservation concern, the vegetation/fauna community or habitat type present on the site) and its resilience to impacts (receptor resilience [RR]) as follows:

SEI = BI + RR

BI in turn is a function of conservation importance (CI) and the functional integrity (FI) of the receptor as follows:

BI = CI + FI

Conservation importance (CI) is evaluated in accordance with recognised established internationally acceptable principles and criteria for the determination of biodiversity-related value, including the IUCN Red List of Species, Red List of Ecosystems and Key Biodiversity Areas (KBA; IUCN, 2016; Table 2).

Table 4:Conservation importance (CI) criteria

Conservation importance	Fulfilling criteria
Very high	Confirmed or highly likely occurrence of CR, EN, VU or Extremely Rare[23] or Critically Rare[24] species that have a global EOO of < 10 km^2.
	Any area of natural habitat[25] of a CR ecosystem type or large area (> 0.1% of the total ecosystem type extent[26]) of natural habitat of EN ecosystem type.
	Globally significant populations of congregatory species (> 10% of global population).
High	Confirmed or highly likely occurrence of CR, EN, VU species that have a global EOO of > 10 km^2. IUCN threatened species (CR, EN, VU) must be listed under any criterion other than A. If listed as threatened only under Criterion A, include if there are less than 10 locations or < 10 000 mature individuals remaining.
	Small area (> 0.01% but < 0.1% of the total ecosystem type extent) of natural habitat of EN ecosystem type or large area (> 0.1%) of natural habitat of VU ecosystem type.
	Presence of Rare species.
	Globally significant populations of congregatory species (> 1% but < 10% of global population).
Medium	Confirmed or highly likely occurrence of populations of NT species, threatened species (CR, EN, VU) listed under Criterion A only and which have more than 10 locations or more than 10 000 mature individuals.
	Any area of natural habitat of threatened ecosystem type with status of VU.
	Presence of range-restricted species.
	> 50% of receptor contains natural habitat with potential to support SCC.
Low	No confirmed or highly likely populations of SCC.
	No confirmed or highly likely populations of range-restricted species.
	< 50% of receptor contains natural habitat with limited potential to support SCC.
Very low	No confirmed and highly unlikely populations of SCC.
	No confirmed and highly unlikely populations of range-restricted species.
	No natural habitat remaining.

[23] For butterflies, as per Armstrong *et al*. (2013).
[24] For plants, as per Raimondo *et al*. (2009).
[25] This excludes areas of transformed habitat within a defined ecosystem even if these are partially restored, e.g. Highveld grasslands that have been converted to maize fields and then abandoned so that some form of functional grassland is restored; this is not natural habitat as it does not and will not in the future have species composition representative of the original natural habitat.
[26] This can be calculated from the threatened ecosystem of South Africa shapefile available from the SANBI (current available version 2011: http://bgis.sanbi.org/Projects/Detail/49).
[27] Persistent ecological disruptors must not include components that landowners are legally obliged to address or that should be addressed as norm for best practice. Wilful neglect of these legal obligations or the presence of invasive alien species that can practically be controlled through management actions should not negatively influence the FI score to a major extent.

Functional integrity (FI) of the receptor (e.g. the vegetation/fauna community or habitat type) is defined here as the receptors' current ability to maintain the structure and functions that define it, compared to its known or predicted state under ideal conditions (Table 3).

Table 5:Functional integrity (FI) criteria.

Functional integrity	Fulfilling criteria
Very high	Very large (> 100 ha) intact area for any conservation status of ecosystem type or > 5 ha for CR ecosystem types.
	High habitat connectivity serving as functional ecological corridors, limited road network between intact habitat patches.
	No or minimal current negative ecological impacts with no signs of major past disturbance (e.g. ploughing).
High	Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type or > 10 ha for EN ecosystem types.
	Good habitat connectivity with potentially functional ecological corridors and a regularly used road network between intact habitat patches.
	Only minor current negative ecological impacts (e.g. few livestock utilising area) with no signs of major past disturbance (e.g. ploughing) and good rehabilitation potential.
Medium	Medium (> 5 ha but < 20 ha) semi-intact area for any conservation status of ecosystem type or > 20 ha for VU ecosystem types.
	Only narrow corridors of good habitat connectivity or larger areas of poor habitat connectivity and a busy used road network between intact habitat patches.
	Mostly minor current negative ecological impacts with some major impacts (e.g. established population of alien and invasive flora) and a few signs of minor past disturbance. Moderate rehabilitation potential.
Low	Small (> 1 ha but < 5 ha) area.
	Almost no habitat connectivity but migrations still possible across some modified or degraded natural habitat and a very busy used road network surrounds the area. Low rehabilitation potential.
	Several minor and major current negative ecological impacts.
Very low	Very small (< 1 ha) area.
	No habitat connectivity except for flying species or flora with wind-dispersed seeds.
	Several major current negative ecological impacts.

Recalling that biodiversity importance (BI) is a function of conservation importance (CI) and the functional integrity (FI) of a receptor, BI can be derived from a simple matrix of CI and FI as follows:

Table 6:Determining the BI

Biodiversity importance		Conservation importance				
		Very high	High	Medium	Low	Very low
Functional integrity	Very high	Very high	Very high	High	Medium	Low
	High	Very high	High	Medium	Medium	Low
	Medium	High	Medium	Medium	Low	Very low
	Low	Medium	Medium	Low	Low	Very low
	Very low	Medium	Low	Very low	Very low	Very low

Receptor resilience (RR) is defined here as: 'The intrinsic capacity of the receptor to resist major damage from disturbance and/or to recover to its original state with limited or no human intervention.' See Table 4.

Table 7: Resilience criteria

Resilience	Fulfilling criteria
Very high	Habitat that can recover rapidly (~ less than 5 years) to restore > 75%[28] of the original species composition and functionality of the receptor functionality, or species that have a very high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a very high likelihood of returning to a site once the disturbance or impact has been removed.
High	Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a high likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a high likelihood of returning to a site once the disturbance or impact has been removed.
Medium	Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality of the receptor functionality, or species that have a moderate likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a moderate likelihood of returning to a site once the disturbance or impact has been removed.
Low	Habitat that is unlikely to be able to recover fully after a relatively long period: > 15 years required to restore ~ less than 50% of the original species composition and functionality of the receptor functionality, or species that have a low likelihood of remaining at a site even when a disturbance or impact is occurring, or species that have a low likelihood of returning to a site once the disturbance or impact has been removed.
Very low	Habitat that is unable to recover from major impacts, or species that are unlikely to remain at a site even when a disturbance or impact is occurring, or species that are unlikely to return to a site once the disturbance or impact has been removed.

Finally, after the successful evaluation of both BI and RR as described above, it is possible to evaluate SEI from the final matrix as follows (Table 6) and interpreted accordingly (Table 7).:

Table 8: Determining the SEI.

Site ecological importance		Biodiversity importance				
		Very high	High	Medium	Low	Very low
Receptor resilience	Very low	Very high	Very high	High	Medium	Low
	Low	Very high	Very high	High	Medium	Very low
	Medium	Very high	High	Medium	Low	Very low
	High	High	Medium	Low	Very low	Very low
	Very high	Medium	Low	Very low	Very low	Very low

Table 9: Guidelines for interpreting SEI in the context of the proposed development activities.

Site ecological importance	Interpretation in relation to proposed development activities
Very high	Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/not possible (i.e. last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
High	Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted; limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
Medium	Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
Low	Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.
Very low	Minimisation mitigation – development activities of medium to high impact acceptable and restoration activities may not be required.

4 RESULTS

4.1 Sampling limitations

Sampling was conducted during summer, seeing as this is the best season to survey for vegetation and animals as plants are actively growing and animals are actively moving about during this season.

4.2 Regional context

At a regional level, the Critical Biodiversity Area (CBA) map for Mpumalanga indicates some other natural areas on the site and is considered a vulnerable ecosystem. Large parts of the study area are considered moderately to heavily modified, mainly by agricultural practices. The CBA map therefore does correspond well in terms of functioning of available natural habitat on site. Natural habitats include areas in different condition classes, including those that are frequently grazed by cattle.

4.3 Local context and fieldwork results

There are sensitive habitat units since parts of the study area is considered vulnerable endemic ecosystems. There were sensitive/ protected species found on site, these are: *Gladiolus crassiflora,* and *Aloe ecklonis*. There is a medium probability of a sensitive species occurring on site, but this was not found during the field work.

4.4 General sampling conditions

The prevailing weather conditions were either sunny and hot or overcast and cloudy. This is typical of summer weather in Highveld Grassland ecosystems. Site visits took place on the 9 February, 6 March and 27 March 2023.

4.5 Description of sampling effort

The sampling technique that is recommended by SANBI is the timed random meander where the scientist meanders over the study area recording all the species found in the area. Once the search effort exceeds the effort required to find new species, the scientist moves on to a new area.

See Figure 9: Habitat units identified in the study area for evidence of area sampled.

4.6 Current Impacts

The current impacts on the study site are urban settlements and associated infrastructure, agricultural livestock farming, subsistence cattle and goat farming, old agricultural lands, railroad tracks and pollution.

4.7 Site Ecological Importance

4.7.1 Biodiversity Importance

Habitat type	Conservation Importance	Functional Integrity	Biodiversity Importance
Vulnerable Habitat	High	High	High
Aquatic Habitats	High	High	High
Modified Habitats	Medium	Medium	Medium

4.7.2 Site ecological Importance

	Receptor resilience	Biodiversity Importance	Site Ecological Importance
Vulnerable Habitat	High	High	Medium
Aquatic Habitats	Medium	High	High
Modified Habitats	Medium	Medium	Medium

4.7.3 Guidelines for interpreting SEI in the context of the proposed development activities

The calculation of Site Ecological Importance matches the sensitivity classification given in the previous section of this report but includes an explicit recognition of the ability of each ecosystem to tolerate and recover from disturbance. Guidelines for development activities within different importance levels are given in the below:

- Very High – Avoidance mitigation – no destructive development activities should be considered. Offset mitigation not acceptable/ not possible (i.e., last remaining populations of species, last remaining good condition patches of ecosystems/ unique species assemblages). Destructive impacts for species/ecosystems where persistence target remains.
- High – Avoidance mitigation wherever possible. Minimisation mitigation – changes to project infrastructure design to limit the amount of habitat impacted, limited development activities of low impact acceptable. Offset mitigation may be required for high impact activities.
- Medium – Minimisation and restoration mitigation – development activities of medium impact acceptable followed by appropriate restoration activities.
- Low - Minimisation and restoration mitigation – development activities of medium to high impact acceptable followed by appropriate restoration activities.

5 IMPACT ANALYSIS, INCLUDING MITIGATION MEASURES AND MANAGEMENT RECOMMENDATIONS.

5.1 Current Impacts on Biodiversity

Considering the anthropogenic activities and influences within the landscape, several negative impacts to biodiversity were observed within the project area. These include:

- Agricultural practises.
- Farm roads and main roads (and associated traffic and wildlife road mortalities);
- Grazing and trampling of natural vegetation by livestock.
- Invasive species; and
- Fences and associated maintenance.

Anthropogenic activities drive habitat destruction causing displacement of fauna and flora and possibly direct mortality. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting/burrowing sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features. The removal of natural vegetation may reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

5.2 Anticipated Impacts

Table 10: Anticipated impacts for the proposed activities on terrestrial biodiversity

Main Impact	Project activities that can cause loss/impacts to habitat (especially regarding the proposed infrastructure areas):	Secondary impacts anticipated
	Physical removal of vegetation, including protected species.	Displacement/loss of flora & fauna

1. Destruction, fragmentation and degradation of habitats and ecosystems	Access roads	Increased potential for soil erosion
	Soil dust precipitation	Habitat fragmentation
	Dumping of waste products	Increased potential for establishment of alien & invasive vegetation
	Random events such as fire (cooking fires or cigarettes)	Erosion
2. Spread and/or establishment of alien and/or invasive species	Vegetation removal	Habitat loss for native flora & fauna
	Vehicles potentially spreading seed	Spreading of potentially dangerous diseases due to invasive and pest species
	Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents	Alteration of fauna assemblages due to habitat modification
	Creation of infrastructure suitable for breeding activities of alien and/or invasive birds	
3. Direct mortality of fauna	Clearing of vegetation	Loss of habitat
	Roadkill due to vehicle collision	Loss of ecosystem services
	Pollution of water resources due to dust effects, chemical spills, etc.	Increase in rodent populations and associated disease risk
	Mortality of ground living mammals (moles, gerbils, rats, mice, mongooses) due to vibrations from seismic survey vehicles.	Loss of faunal species

	Intentional killing of fauna for food (hunting)	Reduced dispersal/migration of fauna
4. Reduced dispersal/migration of fauna	Loss of landscape used as corridor	Loss of ecosystem services
	Compacted roads	Reduced plant seed dispersal
	Removal of vegetation	
5. Environmental pollution due to water runoff, spills from vehicles and erosion	Erosion	Faunal mortality (direct and indirectly)
		Groundwater pollution
		Loss of ecosystem services
6.Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust, and light pollution.	Operation of machinery (Large earth moving machinery, vehicles)	Disruption/alteration of ecological life cycles due to noise
		Loss of ecosystem services
	Project activities that can cause disruption/alteration of ecological life cycles due to dust	Secondary impacts associated with disruption/alteration of ecological life cycles due to dust
	Vehicles	Loss of ecosystem services
7. Staff and others interacting directly with fauna (potentially dangerous) or poaching of animals	All unregulated/supervised activities outdoors	Loss of SCCs

The planned activities will have anticipated impacts as discussed; however, unplanned events may occur on any project and may have potential impacts which will need management. Table 11 is a summary of the findings of an unplanned event assessment from a terrestrial biodiversity perspective. Note, not all potential unplanned events may be captured herein, and this must therefore be managed throughout all phases according to recorded events.

Table 11:Summary of unplanned events for terrestrial biodiversity

Unplanned Event	Potential Impact	Mitigation
Spills into the surrounding environment	Contamination of habitat as well as water resources associated with a spillage.	A spill response kit must be always available. The incident must be reported on and if necessary, a biodiversity specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Fire	Uncontrolled/unmanaged fire that spreads to the surrounding natural areas.	Appropriate/Adequate fire management plan need to be implemented.
Erosion caused by water runoff from the surface	Erosion on the side of the road	Storm water management plan must be compiled and implemented.

5.3 Significance of Impacts

Impact 1	Destruction, fragmentation and degradation of habitats and ecosystems
Problem	Construction activities will require clearing of natural habitat, to be replaced by the infrastructure. This will result in permanent local loss of habitat. Daily operational activities will permanently damage habitat and fragment it further.
Type	Direct
Nature	Negative
Phases	Drilling and seismic surveys

	Drill site		**Seismic Survey site**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	3	2	3	2
Duration	3	2	2	2
Reversibility	3	2	2	1
Severity	3	2	3	1
Probability	5	4	5	3
Significance	60 (Moderate)	32 (Low)	50 (Moderate)	18 (Very Low)
Mitigation actions				
Recommendations	1. Restrict impact to development footprint only and limit disturbance in surrounding areas. 2. Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval. 3. Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.			
Monitoring				
Recommendations	As per management plans			
Impact 2	Spread and/or establishment of alien and/or invasive species			
Problem	Establishment and continued spread of alien invasive plants due to the clearing and disturbance of indigenous vegetation			
Type	Indirect			

Nature	Negative			
Phases	Drilling and seismic surveys			
	Drill site		**Seismic Survey site**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	4	2	2	1
Duration	5	5	3	1
Reversibility	4	2	3	2
Severity	4	2	3	2
Probability	5	3	3	3
Significance	85 Very High	33 Low	33 Low	24 Low
Mitigation actions				
Recommendations	1. Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications. 2. Undertake regular monitoring to detect alien invasions early so that they can be controlled. 3. Implement control measures.			
Monitoring				
Recommendations	As per management plans			
Impact 3	Direct mortality of fauna			
Problem	Mortality of fauna due to higher traffic (Vehicles and staff) on site			

Type	Direct			
Nature	Negative			
Phases	Drilling and seismic surveys			
	Drill site		**Seismic Survey site**	
Criteria	Without mitigation	With Mitigation	Without mitigation	With Mitigation
Extent	2	1	2	1
Duration	3	2	3	2
Reversibility	3	2	3	2
Severity	3	2	3	2
Probability	3	2	3	2
Significance	33 Low	14 Low	33 Low	14 Low
Mitigation actions				
Recommendations	Education and awareness of staff and construction personal regarding importance of faunal populations and ecosystem functioning			
Monitoring				
Recommendations	Continued monitoring of faunal populations and awareness programs as per management plan			
Impact 4	Reduced dispersal/migration of fauna			
Problem	Internal roads, fencing and infrastructure will cut off migratory routes of faunal populations			
Type	Direct			

Nature	Negative			
Phases	Drilling and seismic surveys			
	Drill site		**Seismic Survey site**	
Criteria	Without mitigation	With Mitigation	Without mitigation	With Mitigation
Extent	3	2	2	1
Duration	3	2	2	2
Reversibility	3	2	2	1
Severity	2	2	1	1
Probability	2	2	2	2
Significance	22 Low	16 Low	14 Low	10 Low
Mitigation actions				
Recommendations	Create corridors during construction phase for faunal species to move through artificial barriers			
Monitoring				
Recommendations	Continuously monitor faunal populations as per management plans			
Impact 5	Environmental pollution due to water runoff, spills from vehicles and erosion			
Problem				
Type	Direct and Indirect			
Nature	Negative			
Phases	Drilling and seismic surveys			

	Drill site		Seismic Survey site	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	3	2	3	2
Duration	5	5	3	2
Reversibility	3	2	3	1
Severity	4	3	3	1
Probability	3	2	3	2
Significance	45 Moderate	24 Low	36 Low	12 Low
Mitigation actions				
Recommendations	Proper storage of harmful fluids or powders			
Monitoring				
Recommendations	Diligence checks as per storage SOP according to management plans			
Impact 6	Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise, dust, and light pollution.			
Problem	Construction and maintenance vehicles moving around on site			
Type	Direct and Indirect			
Nature	Negative			
Phases	Drilling and seismic surveys			
	Drill site		**Seismic Survey site**	
Criteria	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation

Extent	3	2	2	2
Duration	3	2	2	2
Reversibility	3	2	2	1
Severity	3	2	2	1
Probability	5	3	3	2
Significance	60 Moderate	24 Low	24 Low	12 Low
Mitigation actions				
Recommendations	Keep within footprint, drive within speed limits, do not idle vehicle for unnecessary periods			
Monitoring				
Recommendations	Follow SOP's as set out in Management plan, monitor faunal populations			
Impact 7	Staff and others interacting directly with fauna (potentially dangerous) and flora or poaching of animals and plants			
Problem	Staff interacting/ killing/ poaching fauna or flora species			
Type	Direct			
Nature	Negative			
Phases	Drilling and seismic surveys			
	Drill site		**Seismic Survey site**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	3	2	3	1
Duration	5	5	2	2

Reversibility	4	2	3	1
Severity	4	2	3	1
Probability	4	3	3	2
Significance	64 Moderate	33 Low	33 Low	10 Low
Mitigation actions				
Recommendations	Awareness training for staff on site regarding sensitive fauna and flora species, including relevant laws for protection of species			
Monitoring				
Recommendations	Monitoring of area for snares and disturbed soil (plant poaching), monitoring of personal effects of staff			

5.4 Summary of Mitigation Measures

The following mitigation measures are recommended to address known potential impacts:

- Restrict impact to development footprint only and limit disturbance in surrounding areas.
- Prior to commencement of construction, compile a Rehabilitation Plan including monitoring specifications, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile an Alien Plant Management Plan, to be included into the EMPr during final approval.
- Prior to commencement of construction, compile and implement an alien management plan, which highlights control priorities and areas and provides a programme for long-term control, including monitoring specifications.
- Undertake regular monitoring to detect alien invasions early so that they can be controlled.
- Prior to commencement of construction, compile and implement a stormwater management plan including monitoring specifications.
- Monitor surfaces for erosion, repair and/or upgrade, where necessary.
- Prior to decommissioning commencing, compile a Rehabilitation Plan in compliance with the regulatory requirements at the time of decommissioning.

5.5 Summary of Monitoring recommendations

Specific monitoring recommendations should be provided in the Alien Invasive Management Plan, and the Rehabilitation Plan. The following are broad recommendations:

Alien Invasive Species:

- Monitor for early detection, to find species when they first appear on site. This should be as per the frequency specified in the management plan and should be conducted by an experienced botanist. Early detection should provide a list of species and locations where they have been detected. Summer (vegetation maximum growth period) is usually the most appropriate time, but monitoring can be adaptable, depending on local conditions – this must be specified in the management plan.
- Monitor for the effect of management actions on target species, which provides information on the effectiveness of management actions. Such monitoring depends on the management actions taking place. It should take place after each management action.
- Monitor for the effect of management actions on non-target species and habitats.

Rehabilitated areas:

- Rehabilitation Plan must be compiled by an approved ecologist prior to achieving COD and prior to the start of decommissioning.
- All management actions associated with rehabilitation must be recorded after each management action has taken place.
- All rehabilitated areas should be monitored to assess vegetation recovery. This should be for a minimum of three years after post-construction rehabilitation but depends on the assessed trajectory of rehabilitation (whether it is following a favourable progression of vegetation establishment or not – this depends on the total vegetation cover present, and the proportion that consists of perennial growth of desired species). For each monitoring site, an equivalent comparative site in adjacent undisturbed vegetation should be similarly monitored. Monitoring data collection should include the following:
    - total vegetation cover and height, as well as for each major growth form;
    - species composition, including relative dominance;
    - soil stability and/or development of erosion features;
    - representative photographs should be taken at each monitoring period.
- Monitoring of rehabilitated areas should take place at the frequency and for the duration determined in the rehabilitation plan, or until vegetation stability has been achieved.

6 Discussion and Conclusion

The study area for the proposed projects consists of a combination of natural vegetation and cultivated areas. The grassland area that contributes to the study area is in various stages and grades of utilisation. The remaining natural habitat on site, where it occurs in moderate to condition, therefore, has to be considered to have moderate biodiversity value.

The DFFE online screening tool identifies Terrestrial Biodiversity as a theme of very high sensitivity. This is due to presence on site of a vulnerable ecosystem. The theme indicates almost the entire study area as being in the Very High sensitivity category, but there are significant areas that have been cultivated and impacted by heavy grazing that do not support this classification. This pattern of over-utilization affects all habitats on site, resulting in them being in moderate to poor condition.

The proposed seismic surveys and test drilling will be extremely short-term activities, with no long-term or cumulative effects anticipated. The nature of the proposed seismic survey, along a grid of existing main and district roads and established plantation roads and tracks, will limit the extent of potential environmental damage.

6.1 Conclusions

The vegetation type that occurs on site is Soweto Highveld grassland and is listed as Vulnerable and endemic, but in the greater study area this is only a small portion within the proposed footprint.

The natural vegetation on site is currently in moderate to poor condition due to previous overuse. The protected plants in the high sensitivity zones should be avoided or where possible rescued and relocated (Wetlands, Drainage, Riparian areas, and Vulnerable habitats) and impact mitigation strategies should be employed on all project areas.

On this basis, the project is therefore deemed acceptable from a terrestrial biodiversity perspective. The author is of the opinion that the impacts associated with the project can be mitigated to acceptable levels provided the recommended mitigation measures identified are implemented.

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APPENDIX 1: SPECIALIST CV

Personal Particulars

Profession:	Biodiversity Specialist
Date of Birth:	13 March 1987
Name of Firm:	Nitai Consulting
Name of Staff:	Elzet Human
Nationality:	RSA
Membership of Professional Societies	SACNASP (Pr. Sci. Nat. 147031)

Education:

M-Tech Nature Conservation, (Plant DNA Barcoding and phylogenetics), TUT, South Africa, 2021

B-Tech Nature Conservation, (Resource Management, Vegetation ecology and rehabilitation) TUT, South Africa, 2011

N. Dip Nature Conservation, TUT, South Africa, 2008

Employment Record:

2022 – Present Biodiversity Specialist, Nitai Consulting

Conduct Biodiversity Impact Assessments.

Conduct Plant Ecological Assessments.

Conduct Animal Ecological Assessments

Biodiversity monitoring programs; and,

GIS Mapping

2013 – 2022 Lecturer: Nature Management, Centurion academy

Lectured various subjects for undergraduate students in Nature Management:

Botany and Vegetation Ecology, Zoology, Animal Health, Conservation Development, Ecology, Game Ranch Management, Biostatistics, Research Methodology, Genetics, Soil Science

2009 – 2013 HOD Rangers Department, Zebula Gold Estate and Spa

Ecological Monitoring, Reserve Maintenance, Animal Husbandry, Neonatal care of Endangered carnivore species, Zoological display, and permit compliance

2008 – Conservation Student, Ann van Dyk Cheetah Research Centre

Neonatal Care of Carnivore species,

Veterinary assistance work – vaccine, diets, Endo scoping, pregnancy tests, health monitoring, quarantine care of species, emergency c-sections, bleeding procedures on vultures

Enclosure Maintenance

Tracking wild cheetahs

Rewilding cheetahs

Anatolian Shepard project assistance

Selected Consultancies

Ecological assessment for Victorius Game farm, Visgat, Ellisras, Limpopo

2018, Ecologist, Ecological condition assessment and game carrying capacity for game farm. Habitat evaluation and rehibition program for problem areas

Elephant impact study on Mabula Game Reserve, Bela-Bela, Limpopo,

2019, Ecologist, Ecological impact study on Private Nature reserve to see extent of elephant utilisation and impact. Woody species analysis – structure classification and net primary production. Elephant movement patterns and carrying capacity. Identification of vulnerable habitats and management program.

Faan Meintjies Municipal Nature Reserve, Matlosana, North West

2018-2022, Ecologist, Habitat assessments, game carrying capacities, ecological condition assessments, game counts and game recommendations, ecological rehabilitation programs, white rhino monitoring, anti-poaching programs, Environmental Education programs.

Kroonstad Solar PV Facilities

2022, Biodiversity Specialist. Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Vals River.

Kroonstad South Solar PV Facilities

2022, Biodiversity Specialist. Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the five solar PV facilities as well as perform aquatic biomonitoring of the Blomspruit.

Proposed Nketoana Regional Bulk Water Scheme Project

2023, Biodiversity Specialist. Nketoana Local Municipality is experiencing severe water shortages in its towns Reitz/Petsana/ Petrus Steyn/ Mamafubedu/ Arlington/ Leratswana and Lindley. Solutions to the water shortages are the proposed Nketoana Regional Bulk Water Scheme Pipeline, South Africa, Assess and map all biodiversity, plant and animal features associated within the footprint of the bulk water scheme project.

Rustenburg Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Rustenburg, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the three solar PV facilities.

Grootvlei Solar PV Facility

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the one solar PV facility.

Paulputs 400 kV Strengthening (Transmission Line Loop in Loop Out) Project

2023, Biodiversity Specialist. Proposed Paulputs 400kv Strengthening Project (Transmission Line Loop In Loop Out From Aries – Kokerboom Transmission Line), South Africa, Assess and map all biodiversity, plant and animal features within the power line footprint as well as perform biodiversity monitoring.

400kV Transmission and 132kV distribution power lines for the Apollo-Lepini-Mesong Project

2023, Biodiversity Specialist. Proposed development of a 400kV transmission and 132kV power lines for the Apollo-Lepini-Mesong Project, Gauteng Province, South Africa, undertake assessments and map all biodiversity, plant, and animal features along the proposed routes for the 400kV and 132kV power lines.

Languages:

English - excellent speaking, reading, and writing

Afrikaans – excellent speaking, reading and writing

APPENDIX 2: DECLARATION OF INDEPENDENCE

I, **Helena Elizabeth Human**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

___________________________________ **19/03/2023**

Helena Elizabeth Human (Pr. Sci. Nat. 147031) **Date**

Terrestrial Biodiversity Specialist

APPENDIX 3: PLANT SPECIES LIST

Albuca tomentosa

Aloe ecklonis

Asclepias eminens

Berkheya radula

Berkheya zeyheri

Bidens bipinnata

Bidens formosa

Bulbostylis hispidula

Chamaecrista mimosoides

Cirsium vulgare

Conyza podocephala

Crabbea ovatifolia

Crassula lanceolata

Cuscuta sp.

Cyperus congestus

Dianthus mooiensis

Euphorbia clavarioides

Euphorbia inaequilatera

Felicia muricata

Galinsoga parviflora

Gazania krebsiana

Gladiolus crassifolius

Gomphocarpus fruticosa

Gomphrena celosioides

Habenaria falcicornis

Haplocarpa scaposa

Helichrysum caespititium

Helichrysum nudifolium

Hermani erodioides

Hibiscus trionum

Indigofera melanadenia

Ipomoea crassipes

Juncus dregeanus

Kedrostis africana

Ledebouria ovatifolia

Monsonia angustifolia

Nerine krigei

Ocimum americanum

Oxalis corniculata

Paspalum dilatatum

Persicaria lapathifolia

Polygala hottentota

Rhynchosia totta

Scabiosa columbaria

Schkuhria pinnata

Solanum elaeagnifolium

Sporobolus fimbriatus

Tagetes minuta

Taraxacum officinale

Tephrosia capensis

Tephrosia lupinifolia

Tragopogon dubius

Trifolium africanum

Verbena bonariensis

Vernonia galpinii

Vernonia oligocephala

Wahlenbergia caledonica

Aristida scabrivalvis

Brachiaria serrata

Cymbopogon caesius

Cynodon dactylon

Digitaria eriantha

Elionurus muticus

Eragrostis trichophora

Hyparrhenia hirta

Setaria Sphacelata var sericea

Setaria sphacelata var torta

Setaria sphacelata var. sphacelata

Themeda triandra

Urochloa mosambicensis

Council for Geoscience

PROPOSED SEISMIC REFLECTION SURVEY AND WELL DRILLING, Leandra, MPUMALANGA

TERRESTRIAL PLANT SPECIES SPECIALIST REPORT

31 MARCH 2023

Submitted to : Nemai Consulting

NEMAI CONSULTING

Prepared by:

Helena Elizabeth Human (pr. Sci. Nat 147031)

Nitai Consulting (PTY) Ltd.

147 Bram Fischer Drive

Ferndale

2194

NITAI CONSULTING

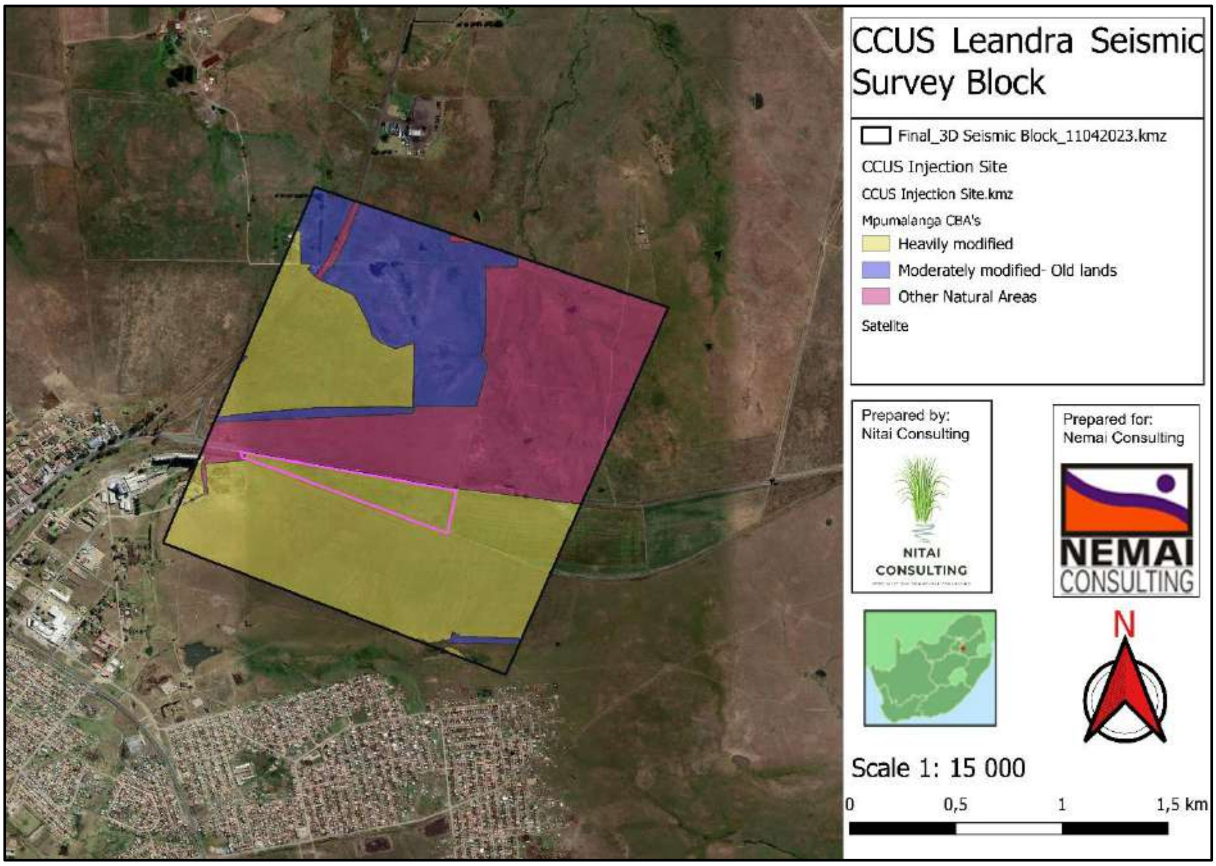
SPECIALIST ENVIRONMENTAL CONSULTING

Executive Summary

Nitai Consulting (Pty) Ltd. was appointed by Nemai Consulting (Pty) Ltd. to undertake a terrestrial plant assessment for the Councill for Geoscience for a Proposed Seismic Reflection Survey and Well Drilling, Leandra, Mpumalanga.

According to the The National Web based Environmental Screening Tool the Plant species theme is medium due to potential presence of various species of Conservation Concern, three in total. Two provincially protected plant species was found on site.

The sensitivity of the habitat units was identified, and these are rated as high to medium sensitivity. The project impacts were calculated and with mitigation measures in place the impact of the project footprint is low.



As a result of the medium sensitivity according to the DFFE Screening Tool, an assessment was conducted to mitigate possible loss of plant species of conservation concern. Possible impacts to the loss of biodiversity areas associated with the proposed development is clearing of natural vegetation and disturbance of protected plant species. In addition, loss of wetland habitat could result due to construction activities while the possibility for erosion is increased if proper mitigation measures are not followed. The impact on the receiving environment is perceived to be low and can be further lowered if mitigation measures described in this report are followed.

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List of Abbreviations

CBA	Critical Biodiversity Area
CR	Critical
DFFE	Department of Forestry, Fisheries & the Environment
DWS	Department of Water and Sanitation
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GN	Government Notice
ha	Hectares
km	Kilometer (1 000m)
LC	Least Concern
MAP	Mean Annual Precipitation
m	Meters
NEMA	National Environmental Management Act (No. 107 of 1998)
NFEPA	National Freshwater Priority Areas
NWA	National Water Act
SANBI	South African National Biodiversity Institute
VU	Vulnerable

1 INTRODUCTION

1.1 Terms of Reference

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Plant Species. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL PLANT SPECIES

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “very high” or “high” sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Specialist Assessment Report.

1.2 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “medium sensitivity” for terrestrial plant species, must submit either a Terrestrial Plant Species Specialist Assessment Report or a Terrestrial Plant Species Compliance Statement, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.

1.3 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “low” sensitivity for terrestrial plant species, must submit a Terrestrial Plant Species Compliance Statement.

1.4 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “very high” or “high” for terrestrial plant species sensitivity on the screening tool, and it is found to be of a “low” sensitivity, then a Terrestrial Plant Species Compliance Statement must be submitted.

1.5 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “low” terrestrial plant species sensitivity and it is found to be of a “very high” or “high” terrestrial plant species sensitivity, a Terrestrial Plant Species Specialist Assessment must be conducted.

1.6 If any part of the development falls within an area of confirmed “very high” or “high” sensitivity, the assessment and reporting requirements prescribed for the “very high” or “high” sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol, means the area on which the proposed development will take place and includes the area that will be disturbed or impacted.

1.7 The Terrestrial Plant Species Specialist Assessment and the Terrestrial Plant Species Compliance Statement must be undertaken within the study area.

1.8 Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site.

1.9 Where the nature of the activity is expected to have an impact on SCC beyond boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.

Terrestrial Plant Species Specialist Assessment

2.1 The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups ("taxa") for which the assessment is being undertaken.

2.2 The assessment must be undertaken within the study area.

2.3 The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:

2.3.1 Identify the SCC which were found, observed or are likely to occur within the study area;

2.3.2 provide evidence (photographs) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);

2.3.3 identify the distribution, location, viability and detailed description of population size of the SCC identified within the study area;

2.3.4 identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;

2.3.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, Red List of South African Plants, and/or other relevant databases;

2.3.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area;

2.3.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;

2.3.8 identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fire-prone systems;

2.3.9 identify any potential impact on ecological connectivity within the broader landscape, and resulting impacts on the identified SCC and its long term viability;

2.3.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC; and

2.3.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species; and

2.3.12 identify any alternative development footprints within the preferred development site which would be of "low" sensitivity" or "medium" sensitivity as identified by the screening tool and verified through the site sensitivity verification.

2.4 The findings of the assessment must be written up in a Terrestrial Plant Species Specialist Assessment Report.

Terrestrial Plant Species Specialist Assessment Report

3.1 This report must include as a minimum the following information:

3.1.1 contact details and relevant experience as well as the SACNASP registration number

of the specialist preparing the assessment including a curriculum vitae;

3.1.2 a signed statement of independence by the specialist;

3.1.3 a statement on the duration, date and season of the site inspection and the relevance

of the season to the outcome of the assessment;

3.1.4 a description of the methodology used to undertake the site sensitivity verification and impact assessment and site inspection, including equipment and modelling used where relevant;

3.1.5 a description of the assumptions made and any uncertainties or gaps in knowledge or data;

3.1.6 a description of the mean density of observations/number of samples sites per unit area of site inspection observations;

3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;

3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;

3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant;

3.1.10 a discussion on the cumulative impacts;

3.1.11 impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);

3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the specific theme considered, and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and

3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph 2.3.12 above that were identified as having “low” or “medium” terrestrial plant species sensitivity and were not considered appropriate.

3.2 A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

Terrestrial plant species compliance statement

Where the sensitivity in the Screening Report from the web-based Online Screening Tool has been confirmed to be LOW, a Plant Species Compliance Statement is required, either (1) for areas where no natural habitat remains, or (2) in natural areas where there is no suspected occurrence of SCC.

The compliance statement must be prepared by a SACNASP registered specialist under one of the two fields of practice (Botanical Science or Ecological Science).

The compliance statement must:

1. be applicable within the study area

2. confirm that the study area is of “low” sensitivity for terrestrial plant species; and

3. indicate whether or not the proposed development will have any impact on SCC.

The compliance statement must contain, as a minimum, the following information:

1. contact details of the specialist, their SACNASP registration number, their field of

expertise and a curriculum vitae;

2. a signed statement of independence by the specialist;

3. a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

4. a baseline profile description of biodiversity and ecosystems of the site;

5. the methodology used to verify the sensitivities of the terrestrial biodiversity and plant species features on the site including the equipment and modelling used where relevant;

6. in the case of a linear activity, confirmation from the terrestrial biodiversity specialist that, in their opinion, based on the mitigation and remedial measures proposed, the land can be returned to the current state within two years of completion of the construction phase;

7. where required, proposed impact management outcomes or any monitoring requirements for inclusion in the EMPr;

8. a description of the assumptions made as well as any uncertainties or gaps in knowledge or data; and

9. any conditions to which this statement is subjected.

A signed copy of the compliance statement must be appended to the Basic Assessment

Report or Environmental Impact Assessment Report

2 STUDY SITE

Carbon Capture Utilisation and Storage (CCUS) has been acknowledged by South Africa (RSA) as one of the technologies to mitigate the emission of CO_2 into the atmosphere and forms one of the Nationally Appropriate Mitigation Actions (NAMA) against climate change. It is also one of the national flagship projects. CCUS forms part of a just transition to a future low-carbon energy economy.

The Council for Geoscience (CGS) is undertaking a geoscientific research project for the piloting of CCUS in Leandra in Mpumalanga, where it is proposed to inject CO_2 into deep suitable geological formations, approximately 1km below the surface. The Government of SA has received funding from the World Bank's International Bank for Reconstruction and Development to finance the CCUS project and intends to apply part of the proceeds for conducting Geological Characterisation comprising, amongst others, of drilling exploration boreholes and undertaking high-resolution 3D seismic survey at the proposed site. This notice only focuses on the Geological Characterisation component of the overall CCUS.

2.1 Location

The proposed drilling site is located along the R29 from Leandra to Kinross and is bounded to the south by a railway line from Secunda to Springs. The area earmarked for the 3D seismic survey encompasses most of the town of Leandra, as well as rural areas to the east and north-east.

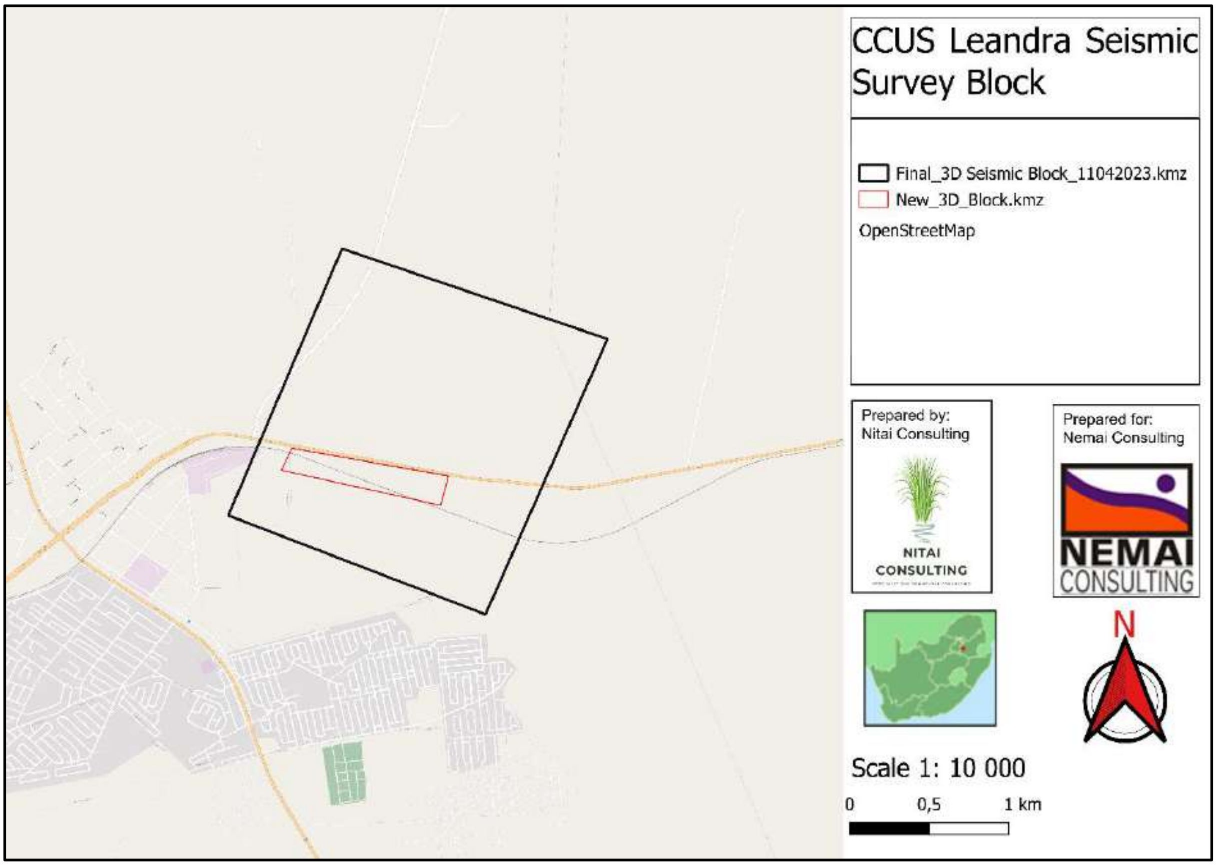

Figure 1: Project Locality

2.2 3D Seismic Survey

A seismic survey is a method of investigating subterranean structure. The technique is based on determining the time interval that elapses between the initiation of a seismic wave at a selected shot point (i.e., location where the seismic wave is generated) and the arrival of reflected or refracted impulses at one or more seismic detectors (Source: https://www.britannica.com/science/seismic-survey). The purpose of the high-resolution 3D survey for the CCUS Project is to map the structures, reservoir, and seal rocks in detail over the identified potential injection site. The 3D survey will also establish the baseline for future time-lapse CO_2 monitoring activities. 3D seismic surveys must be conducted over a large area in order to provide sufficient data for accurate interpretation of the subsurface geology. For the Project, the seismic waves will be induced by vibrating truck-mounted heavy plates on the ground. These specialised trucks are known as "Vibroseis". By analysing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped. 3D surveys are acquired by laying out energy source points (vibroseis) and receiver points (geophones) in a grid over the area to be surveyed. The 3D seismic data for the Project will be processed using pre-stack time/depth migration and post-stack time migration approaches for comparison purposes. The information from the existing legacy and borehole data will be utilised to provide constraints on the designs of the seismic surveys and processing of the seismic data. Methodology

2.3 Drilling

The boreholes will be cored from the top of the bedrock to total depth with a minimum hole diameter of c. 95 mm. At various intervals during the drilling, suites of geophysical instruments will be installed in the borehole to obtain geophysical information. In addition, tests to determine the presence and quantity of gasses, e.g., hydrocarbons/light gasses, and tests to determine hydrological information will be conducted at systematic horizons, e.g., where water strikes are intersected, in the borehole. Plant, equipment, and goods associated with the drilling shall include (amongst others):

- Drill rigs including masts or derricks;
- Drilling fluid mixing, pumping and recycling equipment;
- Grouting pumps, mixers and all other equipment necessary for grout casing of the borehole, when necessary;
- Lighting plants and other equipment necessary to allow safe and efficient 24-hour operation;
- Adequate power supply unit for the drilling operation and the staff camp;
- Water supply for drilling and potable water for workers;
- Site office accommodation, stores, workshops and kitchen facilities at the site;
- Office for CGS representatives;
- Adequate vehicles to allow completion of the work, including suitable transport to safely transport contractor personnel to and from the drill site;
- Adequate, approved temporary ablution and latrine facilities;
- A reliable communication system; and
- All spare parts and back-up plant and equipment to ensure safe and efficient completion of the work.

On completion, the borehole will be securely capped with a concrete sanitation block and a lockable metal cap with a clear sign to avoid potential hazards to people and animals. The drill site will also be suitably rehabilitated. New facilities will be created for the injection phase.

3 IDENTIFIED THEME SENSITIVITIES

The national web-based Environmental Screening Tool was queried in relation to the following infrastructure: Any activities within or close to a watercourse. According to the The National Web based Environmental Screening Tool the terrestrial plant species sensitivity theme is medium (Table 1) (Figure 2) due the fact that four sensitive species could occur on site. These are Sensitive species 691 and 1252 as well as *Pachycarpus suaveolens* and *Brachycorythis conica* subsp. *transvaalensis.*

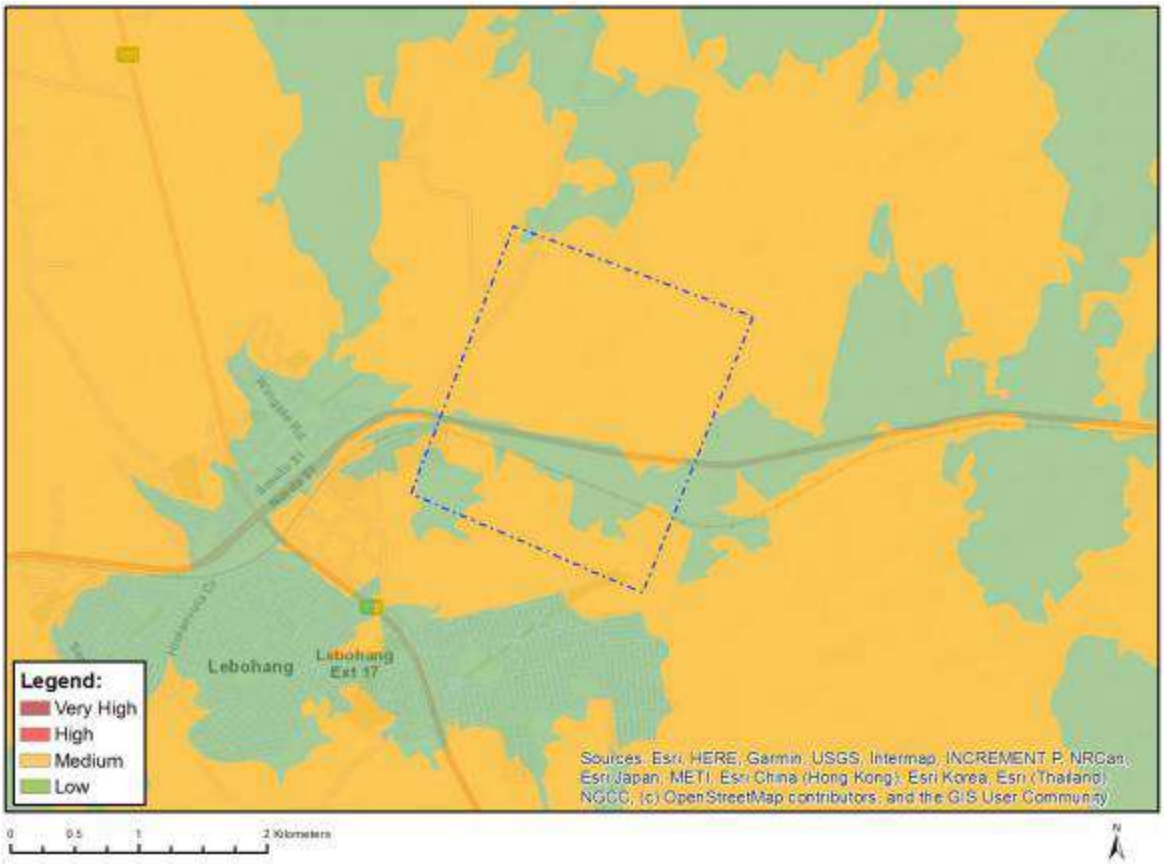

Figure 2: Plant species theme sensitivity

Table 1: Plant Species theme Sensitivity

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity
Medium	Sensitive species 1252
Medium	Sensitive species 691
Medium	Pachycarpus suaveolens

4 METHODOLOGY

The study commenced as a desktop-study followed by a site-specific field study on 9th February, 6 march and 27 March 2023. The site is within the grassland biome with a peak rainfall season in summer, which occurs from October to March (Figure 3, Figure 4). There is, however, a delay between rainfall and vegetation growth, which means the peak growing season is from November to April, with most perennial species characteristic of the vegetation being easily identifiable from January to

March. The timing of the field survey was therefore ideal in terms of assessing the vegetation condition and flora composition of the site.

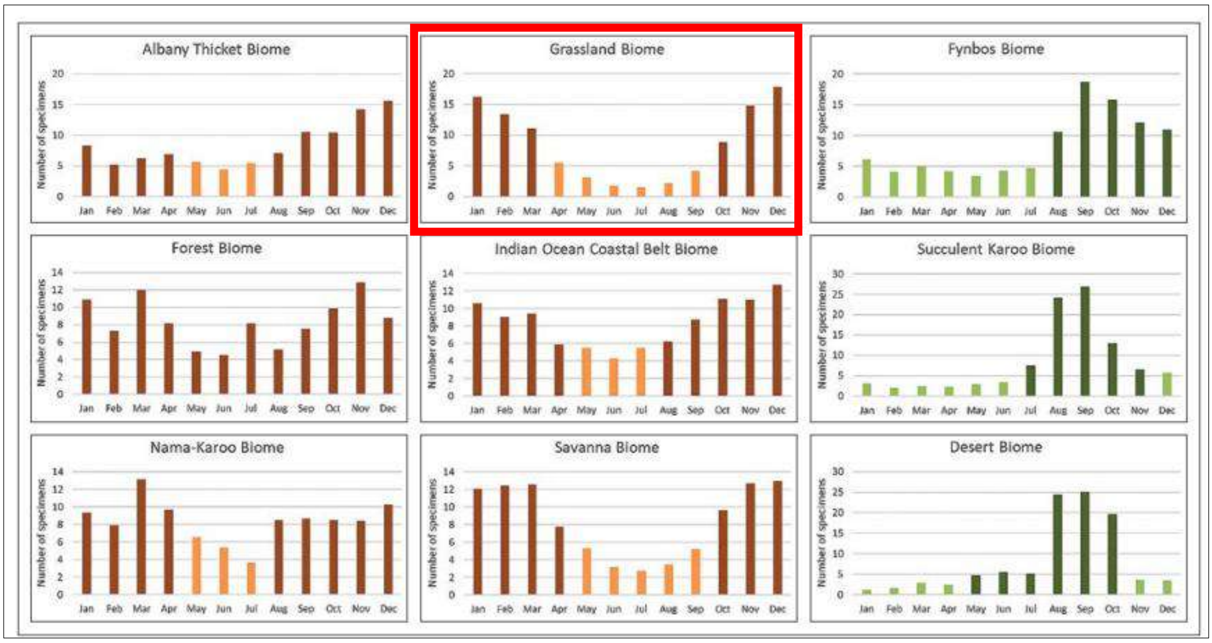

Figure 3: Recommended survey season for plant species assessment

4.1 Field Survey Approach

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A Geo tracking cell phone application was used to record a track within which observations were made. Aerial imagery from Google Earth was used to identify and assess habitats on site.

Patterns identified from satellite imagery were verified on the ground. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground during the search for plant species. From this ground survey, as well as ad hoc observations on site, a checklist of plant species occurring on site was compiled.

4.2 Information sources

Plant species

1. Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (http://bgis.sanbi.org). The description of each vegetation type includes a list of plant species that may be expected to occur within the vegetation type.

2. Plant species that could potentially occur on in the general area was extracted from the NewPosa database of the South African National Biodiversity Institute (SANBI) for the quarter degree grids in which the site is located. There was no data found to display using the map tools to demarcate the study area.

3. The IUCN Red List status for plant species, as well as supplementary information on habitats and distribution, was obtained from the SANBI Threatened Species Programme (Red List of South African Plants, http://redlist.sanbi.org).

4. Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (Index - BRAHMS Online (sanbi.org)) for the quarter degree grids within which the study area is situated. There was no data found to display using the map tools to demarcate the study area.

5. Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI database (www.newposa.sanbi.org) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 50 km), or where it is considered possible that they could occur there, were listed, and were considered as being at risk of occurring there.

5 Results

5.1.1 Regional vegetation patterns

There is only one regional vegetation pattern occurring on the study site, this is the Soweto Highveld grassland (Mucina & Rutherford, 2006; SANBI, 2012). It is probable that terrestrial vegetation patterns reflect the major vegetation type, Soweto Highveld grassland but since the study site is situated close to the border of the Eastern Highveld grassland, the site may have characteristics of both bioregions since it is on the ecotone between the two areas. The vegetation types that occur in the study area and nearby areas are briefly described below.

5.1.1.1 Soweto Highveld Grassland

Vegetation & Landscape Features

Gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by Themeda triandra and accompanied by a variety of other grasses such as Elionurus muticus, Eragrostis racemosa, Heteropogon contortus and Tristachya leucothrix. In places not disturbed, only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover.

Geology and soils

Shale, sandstone or mudstone of the Madzaringwe Formation (Karoo Supergroup) or the intrusive Karoo Suite dolerites which feature prominently in the area. In the south, the Volksrust Formation (Karoo Supergroup) is found and in the west, the rocks of the older Transvaal, Ventersdorp and Witwatersrand Supergroups are most significant. Soils are deep, reddish on flat plains and are typically Ea, Ba and Bb land types.

Climate

Summer-rainfall region (MAP 662 mm). Cool-temperate climate with thermic continentality (high extremes between maximum summer and minimum winter temperatures, frequent occurrence of frost, large thermic diurnal differences, especially in autumn and spring). See also climate diagram for Gm 8 Soweto Highveld Grassland (**Error! Reference source not found.**).

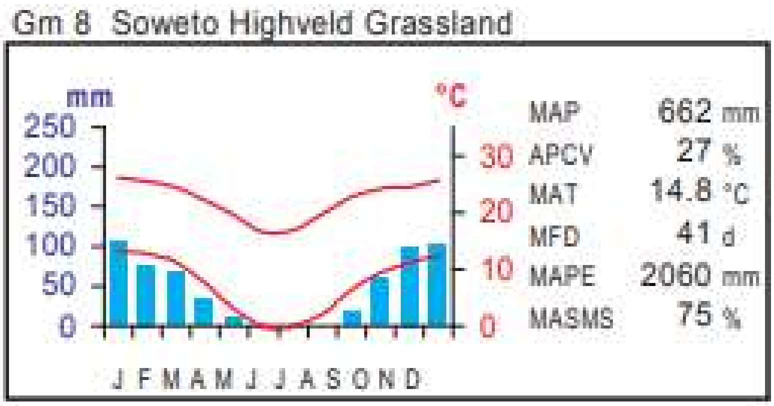

Figure 4: Climate diagram for Soweto Highveld Grassland (Mucina & Rutherford, 2006)

Important Taxa

Graminoids: Andropogon appendiculatus (d), Brachiaria serrata (d), Cymbopogon pospischilii (d), Cynodon dactylon (d), Elionurus muticus (d), Eragrostis capensis (d), E. chloromelas (d), E. curvula (d), E. plana (d), E. planiculmis (d), E. racemosa (d), Heteropogon contortus (d), Hyparrhenia hirta (d), Setaria nigrirostris (d), S. sphacelata (d), Themeda triandra (d), Tristachya leucothrix (d), Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum. **Herbs**: Hermannia depressa (d), Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata. **Geophytic Herbs:** Haemanthus humilis subsp. hirsutus, H. montanus. **Herbaceous Climber:** Rhynchosia totta. Low Shrubs: Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana.

5.1.1.2 Eastern Highveld Grassland

Vegetation and Landscape Features

Slightly to moderately undulating plains, including some low hills and pan depressions. The vegetation is short dense grassland dominated by the usual highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra, Celtis africana, Diospyros lycioides subsp lycioides, Parinari capensis, Protea caffra, P. welwitschii* and *Rhus magalismontanum*).

Geology and Soils

Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types Bb (65%) and Ba (30%).

Climate

Strongly seasonal summer rainfall, with very dry winters. MAP 650–900 mm (overall average: 726 mm), MAP relatively uniform across most of this unit but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit but drops to 21% in the east and southeast. Incidence of frost from 13–42 days, but higher at higher elevations. See also climate diagram for Gm 12 Eastern Highveld Grassland (**Error! Reference source not found.**).

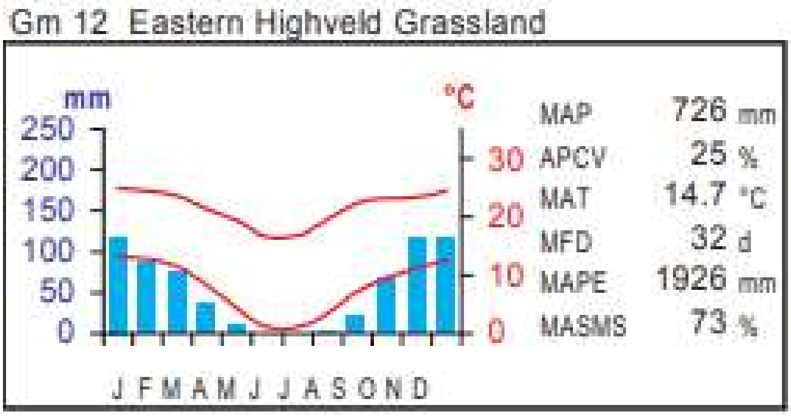

Figure 5: Climate Diagram for eastern Highveld Grassland (Mucina & Rutherford, 2006)

Important Taxa

Graminoids: *Aristida aequiglumis (d), A. congesta (d), A. junciformis subsp. galpinii (d), Brachiaria serrata (d), Cynodon dactylon (d), Digitaria monodactyla (d), D. tricholaenoides (d), Elionurus muticus (d), Eragrostis chloromelas (d), E. curvula (d), E. plana (d), E. racemosa (d), E. sclerantha (d), Heteropogon contortus (d), Loudetia simplex (d), Microchloa caffra (d), Monocymbium ceresiiforme (d), Setaria sphacelata (d), Sporobolus africanus (d), S. pectinatus (d), Themeda triandra (d), Trachypogon spicatus (d), Tristachya leucothrix (d), T. rehmannii (d), Alloteropsis semialata subsp. eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Eragrostis capensis, E. gummiflua, E. patentissima, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides*. **Herbs:** *Berkheya setifera (d), Haplocarpha scaposa (d), Justicia anagalloides (d), Pelargonium luridum (d), Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides subsp. latifolia, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata.* **Geophytic Herbs:** *Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia.* **Succulent Herb:** *Aloe ecklonis.* **Low Shrubs:** *Anthospermum rigidum subsp. pumilum, Stoebe plumosa.*

5.1.2 Conservation Status of regional vegetation types

Based on a scientific approach used at national level by SANBI (Driver et al., 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (SANBI, 2012) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 3 below, as determined by best available scientific approaches (Driver et al., 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al., 2005).

Table 2: Determining ecosystem status (Driver et al., 2005).

Habitat remaining (%)	80 -100	Least Threatened	LT/ LC
	60 - 80	Vulnerable	VU
	Biodiversity target - 60	Endangered	EN
	0 – Biodiversity Target	Critically Endangered	CR

DFFE has published the revised national list of ecosystems that are threatened and in need of protection. The revised list has been published in Government Gazette 47526 (Notice No.689) on 18 November 2022 in terms of the National Environmental Management: Biodiversity Act (NEMBA). By listing the ecosystems that are threatened or in need of protection, anyone wanting to undertake any activity will require environmental authorisation to do so. The list of ecosystems is used to support decision-making and to inform bioregional planning. The revised national list of ecosystems that are threatened or in need of protection was developed between 2016 and 2020 and incorporates the best available information on terrestrial ecosystem extent and condition, pressures, and drivers of change (DFFE, 2022).

A total of 120 of the 456 terrestrial ecosystem types assessed are categorised as threatened. Together these threatened ecosystem types make up approximately 10% of the remaining natural habitat in the country. Of the 120 terrestrial ecosystems 55 are critically endangered, 51 endangered and 14 have been found to be vulnerable (DFFE, 2022).

Table 3: Conservation status of vegetation types in the study area (SANBI & DFFE, 2021)

Ecosystem Detail	Soweto Highveld Grassland
Reference number	Gm8
Threat status	Vulnerable
Listed under criterion	A & B (Criterion A and B)

Biome	Grassland
Original area	1457372 (ha)
Remaining area	39 %
Protected area	0,6 %
Description	In a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River (border with the Free State) in the south. It extends further westwards along the southern edge of the Johannesburg Dome (including part of Soweto) as far as the vicinity of Randfontein. In southern Gauteng it includes the surrounds of Vanderbijlpark and Vereeniging as well as Sasolburg in the northern Free State. Gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such *as Elionurus muticus, Eragrostis racemosa, Heteropogon contortus and Tristachya leucothrix.* In places not disturbed, only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover. Pressures & threats: This ecosystem has a broad range of pressures. Agriculture is a key pressure on this ecosystem type, with 5247.98 km2 of the ecosystem consisting of croplands and a further 1915.61 km2 of old fields. Urban and road development, as well as dam construction are also pressures, with of 1262.98 km2 the ecosystem consisting of built-up areas and 185.32 km^2 of artificial water bodies. Additionally, mining has impacted 131.3 km^2 of Soweto Highveld Grassland (Mucina & Rutherford, 2006)
Notes	Trigger Sub-Criteria: A3, B1(i) - National land cover data show that Soweto Highveld Grassland has experienced extensive spatial declines of approximately 61 % since 1750. Soweto Highveld Grassland is narrowly distributed with high rates of habitat loss in the past 28 years (1990-2018), placing the ecosystem type at risk of collapse. Scope: Global & national status (global extent assessed)

5.2 Habitats on site

A map of the habitats within the study area is provided in Figure 6 The study area is found within typical mesic grassland with turf soil.

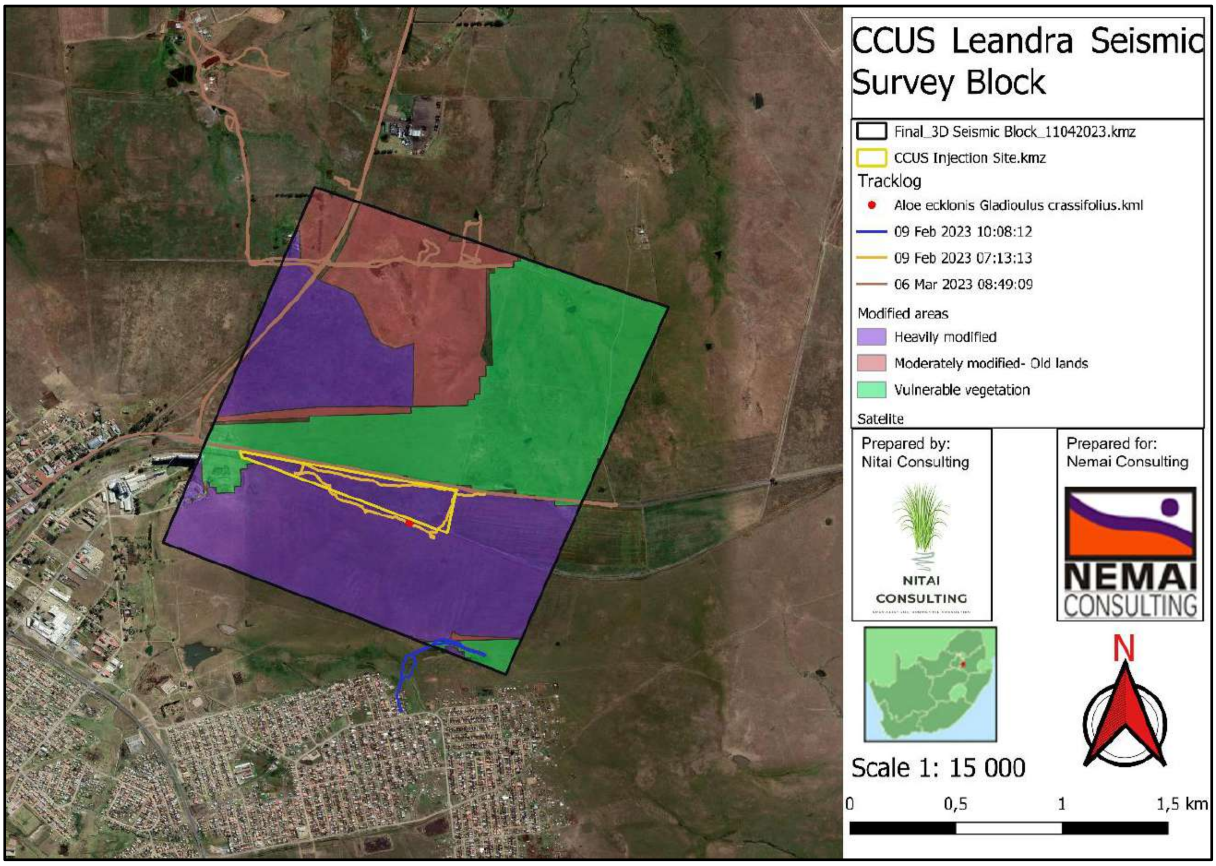

Figure 6: Habitat units found on the study site.

5.2.1.1 Vulnerable Habitat

This habitat type is characterised by natural vegetation with little disturbances. The vegetation structure ranges from short grassland vegetation on shallower soils to very tall grassland on deeper Arcadia soils (Figure 7).

Figure 7: General view of vegetation in vulnerable habitat.

The floristic composition of this habitat is dominated by true grassland species with virtually no trees or shrubs. The graminoid species found here include: *Digitaria eriantha, Hyparrhenia hirta, Cymbopogon caesius, Cynodon dactylon, Eragrostis trichophora, Setaria pumila, Aristida scabrivalvis, Themeda triandra, Urochloa mossambicensis, Sporobolus fimbriatus, Paspalum dilatatum, Setaria sphacelata var sphacelata, Brachiaria serrata, Elionurus muticus, Bulbostylis hispidula, Cyperus congestus, Juncus effusus.* The herbaceous layer comprise the following species: *Tagetes minuta, Arctotis arctotoides, Cotula anthemoides, Monsonia angustifolia, Taraxacum officinale, Kedrostis africana, Crabbea ovatifolia, Hermannia erodioides, Ocimum americanum, Euphorbia inaequilatera, Bidens bipinnata, Gomphocarpus fruticosa, Vernonia oligocephala, Berkheya zeyheri, Gladiolus crassifolius, Wahlenbergia caledonica, Crassula lanceolata, Scabiosa columbaria, Berkheya radula, Polygala hottentota, Rhynchosia minima, Lessertia stricta, Vernonia galpinii, Persicaria lapathifolia, Ipomoea crassipes, Gazania krebsiana, Aloe ecklonis, Ledebouria ovatifolia, Oxalis corniculata, Cirsium vulgare, Solanum elaeagnifolium, Hibiscus trionum, Galinsoga parviflora, Haplocarpa scaposa, Gerbera ambigua, Tragopogon dubius, Verbena bonariensis, Albuca tomentosa, Dianthus mooiensis,* *Euphorbia clavarioides, Habenaria falcicornis subsp. caffra, Asclepias eminens, Gomphrena celosioides, Felicia muricata, Trifolium africanum, Schkuhria pinnata, Bidens formosa.*

Three of the species found in this habitat are protected in terms of the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. These are *Gladiolus crassifolius* and *Aloe ecklonis.*

There were quite a few exotic species found spread out all over the study area, these are: *Schkuhria pinnata, Solanum elaeagnifolium, Verbena bonariensis, Tagetes minuta, Bidens formosa, Taraxacum officinale* and *Bidens bipinnata.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis:	1b
Cirsium vulgare	1b

5.2.1.2 Aquatic habitats

The wetlands were mapped and delineated by and aquatic specialist using various databases and ground truthing. There is one main wetland within the study area. This wetland has various condition ratings. There are exotic species found within the areas: *Solanum elaeagnifolium and Verbena bonariensis plants*. This habitat forms part of the Aquatic specialist report and is mentioned here mainly because of the habitat discussion (Figure 8).

The following vegetation was found: *Persicaria lapathifolia, Paspalum distichum, Heteropogon contortus, Panicum coloratum, Themeda triandra, Cymbopogon caesius, Digitaria monodactyla, Verbena bonariensis, Solanum elaeagnifolium, Eragrostis curvula, Bulbostylis hispidula, Cyperus congestus, Bothriochloa insculpta, Sporobolus pyramidalis, Sporobolus africanus, Paspalum dilatatum, Paspalum urvillei, Fingerhuthia africana, Dactyloctenium aegyptium, Juncus effusus, Crinum bulbispermum, Gladiolus crassifolius, Aloe ecklonis* and *Diclis reptans.*

Figure 8: General view of Aquatic habitats.

Three species found in this habitat is protected in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. This is *Gladiolus crassifolius, Aloe ecklonis.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis: 1b

5.2.1.3 Modified habitats (Moderate and Heavy)

These are areas that were previously ploughed for cultivation but have been left for an extended period without ploughing. Through natural succession processes, they generally develop a perennial cover of grasses (Figure 9), but these secondary grasslands are species poor and the original diversity of resprouting species is usually entirely absent. Non-grass species diversity usually consists of re-seeding and weedy species, and sometimes animal- and/or bird-dispersed woody species. On aerial photographs and satellite images with adequate resolution, these areas are often recognisable by the presence of residual plough lines and other structural features often present in cultivated fields. Common graminoid found here are *Digitaria eriantha, Hyparrhenia hirta, Cymbopogon caesius,* *Cynodon dactylon, Eragrostis trichophora, Setaria pumila, Aristida junciformis, Themeda triandra, Urochloa mossambicensis, Bulbostylis hispidula, Sporobolus fimbriatus, Paspalum dilatatum, Setaria sphacelata var sphacelata.*

The herbaceous layer consist of a diverse species assemblage: *Tagetes minuta, Monsonia angustifolia, Conyza bonariensis, Verbena bonariensis, Bidens formosa, Kedrostis africana, Crabbea ovatifolia, Hermania erodioides, Chamaecrista mimosoides, Ocimum americanum, Euphorbia inaequilatera, Bidens pinnata, Gomphocarpus fruticosa, vernonia oligocephala, Berkheya zeyheri, Gladiolus crassifolius, Wahlenbergia caledonica, Tragopogon dubius, Crassula lanceolata, Scabiosa columbaria, Berkheya radula, Polygala hottentota, Tephrosia crassipes, Vernonia galpinii, Helichrysum nudifolium, Ipomoea crassipes, Gazania krebsiana, Aloe ecklonis, Oxalis corniculata, Cuscuta campestris, Cirsium vulgare, Hibiscus trionum, Galinsoga parviflora, Haplocarpa scaposa.*

In a general sense this area has a medium species richness and is dominated by medium to short graminoid species with herbaceous vegetation in between. The area has a high cover of plant species. There are clear indicators that this system is undergoing old land succession and has several pioneer plant species although the perennial species are well established and seems to propagate well.

Figure 9: General view of old land habitats.

Two species found in this habitat is protected in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. This is *Gladiolus crassifolius* and *Aloe ecklonis.*

There were quite a few exotic species found spread out all over the study area, these are: *Schkuhria pinnata, Tagetes minuta, Verbena bonariensis, Bidens formosa, Ocimum americanum, Bidens pinnata, Tragopogon dubius, Cuscuta campestris.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis: 1b

The following species is listed as invader weeds and plants in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 13 to which section 80 (1) (a) applies. This is: *Cuscuta campestris*.

5.3 Plant species flagged for the study area

Plant species of concern: There are four species of conservation concern listed for the site. Please note that the Screening Tool report includes lists of bird, mammal, reptile, amphibian, butterfly and plant species of conservation concern known or expected to occur on the proposed development footprint. Some of these SCC are sensitive to illegal harvesting. Such species have had their names obscured and are listed as sensitive plant unique number / sensitive animal unique number

Sensitive Species 1252 **(Vulnerable A2cd)**

This species is extremely rare in the wild and is known to be exploited, utilised, or traded. The localities of remaining populations (Figure 10) need to be protected to avoid any further exploitation, which is likely to drive it to extinction. This species does not occur on the study site.

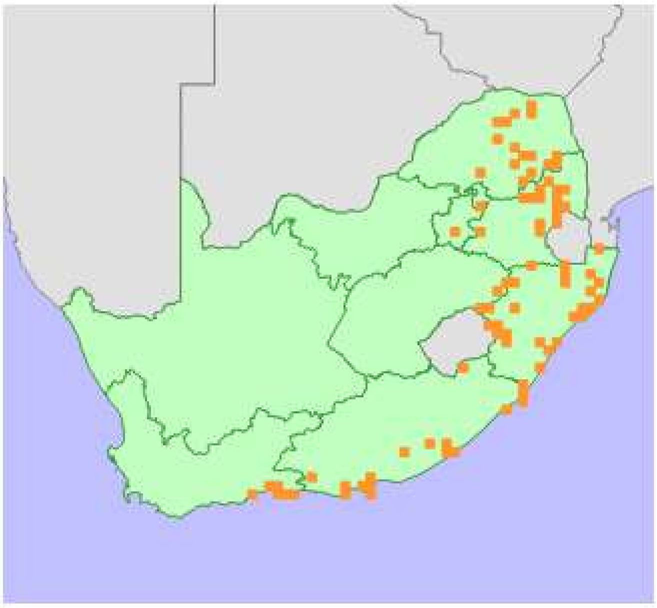

Figure 10: Distribution of Sensitive Species 1252.

Sensitive Species 691 **(Vulnerable B1ab(ii,iii,v)**

According to the SANBI Red List Assessment, this species is Vulnerable as it is known from less than 10 locations that are threatened by habitat loss and degradation (Raimondo, 2013). Few known locations of occurrence (Figure 11) with existing threats causing population decline, makes this species vulnerable to further population decline. This species does not occur on the study site.

Figure 11: Distribution of Sensitive species 691.

Pachycarpus suaveolens

Threatened by agriculture, mining and aliens. Seventy-five percent of the known localities (Figure 12) occur in heavily transformed areas, with about 45% of the habitat within its known range already transformed. Urban expansion may have led to the local extinction of this species in Gauteng. This species does not occur on site.

Figure 12: Distribution of Pachycarpus suaveolens.

Even though none of the listed species occur on site, two protected species was found in various localities over the site.

5.4 Protected species found on site

Gladiolus crassifolius

This taxon was not selected in any one of four screening processes for highlighting potential taxa of conservation concern for detailed assessment and was hence given an automated status of Least Concern. The Threatened Species Programme is currently systematically completing full assessments for all taxa with an automated status.

Gladiolus crassifolius (Figure 13) is a widespread species of eastern southern Africa, common in the Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, North West and Mpumalanga Provinces of South Africa, and in Swaziland and Lesotho. It is one of the few southern African species shared with tropical Africa and its distribution extends through southern and eastern Zimbabwe and central Mozambique, northwards to Malawi and southwestern Tanzania. It is not endemic to South Africa since it grows in other African countries as well. It grows scattered on grassy plains and slopes, from warm, low-lying areas near sea level, to the high mountain slopes of the Drakensberg, to about 2 500 m altitude.

Figure 13: Gladiolus crassifolius found in various locations throughout the site.

Aloe ecklonis

This species occurs from the Eastern Cape northwards through the KwaZulu-Natal interior and eastern Free State to the Mpumalanga Highveld in South Africa. It also occurs in Swaziland and Lesotho. It occurs in highly variable habitats, but generally prefers heavy clay soils in grassland. It occurs in moist as well as well-drained sites, and from near sea level to very high altitudes in the Drakensberg. It is often found in severely degraded and disturbed species-poor grasslands as well as in areas under heavy alien infestation.

A. ecklonis (Figure 14) is the most common and widespread species of grass aloe in South Africa. It is one of the few species of grass aloe able to survive in habitats that have been severely degraded or otherwise altered by the impacts of dense human populations and alien invasive encroachment. It is one species that is likely to remain a part of the grassland flora long after many species have declined to extinction (Craib, 2005).

Figure 14: Aloe ecklonis found throughout various locations on site.

6 IMPACTS

6.1 Anticipated Impacts

For all infrastructure components there is the possibility that individuals or populations of plant species of conservation concern may be lost due to construction impacts. Based on known information, and data collected on site, the probability of encountering species of conservation concern at any particular location is considered to be low. Due to the high degree of transformation on site, there is limited amount of habitat in which rare species are likely to be found.

The best mitigation to address uncertainty issues related to SCC is to do a walk-through survey of all final infrastructure positions to check for SCC, and to collect the necessary data for any flora permits that may be required.

Impact 1	Loss of individuals of Species of Conservation Concern due to clearing for construction, losing corridors of vegetation for faunal populations			
Problem	Clearing of natural habitat for construction and permanent disturbance of habitat during drilling and survey phase.			
Type	Direct			
Nature	Negative			
Phases	Drilling and Seismic Surveying			
	Drill site		**Seismic survey site**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	3	2	3	2
Duration	3	5	2	2
Reversibility	3	5	3	3
Severity	2	2	2	3
Probability	3	1	3	2
Significance	33 Low	14 Low	30 Low	20 Low
Mitigation actions				
Recommendations	1. Prior to construction commencing, undertake a detailed walk-through survey of footprint areas that are within habitats where SCC are likely to occur. 2. Where significant populations of SCC are found, collect the data for any flora permits or micro-siting of infrastructure that may be required.			

	3. Prior to construction commencing, compile a Plant Rescue Plan, including monitoring specifications (timeframe, frequency etc). 4. Undertake monitoring (as per the Plant Rescue Plan specifications) to evaluate whether further measures would be required to manage impacts
Monitoring	As per management plans
Recommendations	As per management plans

6.2 Summary of mitigation measures

1. It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project.
2. A detailed pre-construction walk-through survey will be required during a favourable season where possible, to locate any individuals of protected plants, as well as for any populations of threatened plant species. This survey must cover the footprint of all approved infrastructure, including internal service roads and footprints of structures (final infrastructure layout). The best season is early to late Summer if possible, taking administrative processes into account, but will be influenced by recent rainfall and vegetation growth.
3. It is possible that some plants lost to the development can be rescued and planted in appropriate places in rehabilitation areas, but the description and appropriateness of such measures must be included in a Plant Rescue Plan. Any such measures will reduce the irreplaceable loss of resources as well as the cumulative effect. Note that Search and Rescue is only appropriate for some species and that a high mortality rate can be expected from individuals of species that are not appropriate to transplant.
4. Prior to construction commencing, a Plant Rescue Plan must be compiled to be approved by the appropriate authorities as part of the EMPr approval.
5. For any plants that are transplanted, annual monitoring should take place to assess survival. This should be undertaken as per the frequency specified in the management plan and be undertaken by a qualified botanist. The monitoring programme must be designed prior to translocation of plants and should include control sites (areas not disturbed by the project) to evaluate mortality relative to wild populations.
6. No collecting or poaching of any plant species.

6.3 Summary of monitoring recommendations

Specific monitoring recommendations should be provided in the Plant Rescue Plan, the Alien Invasive Management Plan, and the Rehabilitation Plan. The following are broad recommendations:

6.3.1 Rescued plants

1. The location of all transplanted/rescued plants must be recorded, along with the identity of the plant.
2. The health / vigour of each transplanted individual should be monitored as per the frequency and duration specified in the management plan.
3. As a scientific control, an equal number of non-transplanted individuals of the same species, within similar habitats, should be monitored in the same way as the transplanted specimens. This will provide comparative data on the survival of wild populations relative to transplanted plants.

6.3.2 Threatened species.

1. If populations of threatened plant species are found to occur on site, annual monitoring of population health should take place. This should be appropriate to the species concerned.

7 CONCLUSIONS

There are three plant species of conservation concern flagged by the screening tool that could possibly occur on site. These did not occur during field surveys, but two other protected plant species was found. Those species can be transplanted or rescued. The required walk-through surveys for permitting purposes are required prior to the commencement of the project. It is recommended that this is undertaken in optimum growing season where possible.

8 REFERENCES

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APPENDIX 1: SPECIALIST CV

Personal Particulars

Profession:	Biodiversity Specialist
Date of Birth:	13 March 1987
Name of Firm:	Nitai Consulting
Name of Staff:	Elzet Human
Nationality:	RSA
Membership of Professional Societies	SACNASP (Pr. Sci. Nat. 147031)

Education:

M-Tech Nature Conservation, (Plant DNA Barcoding and phylogenetics), TUT, South Africa, 2021

B-Tech Nature Conservation, (Resource Management, Vegetation ecology and rehabilitation) TUT, South Africa, 2011

N. Dip Nature Conservation, TUT, South Africa, 2008

Employment Record:

2022 – Present Biodiversity Specialist, Nitai Consulting

Conduct Biodiversity Impact Assessments.

Conduct Plant Ecological Assessments.

Conduct Animal Ecological Assessments

Biodiversity monitoring programs; and,

GIS Mapping

2013 – 2022 Lecturer: Nature Management, Centurion academy

Lectured various subjects for undergraduate students in Nature Management:

Botany and Vegetation Ecology, Zoology, Animal Health, Conservation Development, Ecology, Game Ranch Management, Biostatistics, Research Methodology, Genetics, Soil Science

2009 – 2013 HOD Rangers Department, Zebula Gold Estate and Spa

Ecological Monitoring, Reserve Maintenance, Animal Husbandry, Neonatal care of Endangered carnivore species, Zoological display, and permit compliance

2008 – Conservation Student, Ann van Dyk Cheetah Research Centre

Neonatal Care of Carnivore species,

Veterinary assistance work – vaccine, diets, Endo scoping, pregnancy tests, health monitoring, quarantine care of species, emergency c-sections, bleeding procedures on vultures

Enclosure Maintenance

Tracking wild cheetahs

Rewilding cheetahs

Anatolian Shepard project assistance

Selected Consultancies

Ecological assessment for Victorius Game farm, Visgat, Ellisras, Limpopo

2018, Ecologist, Ecological condition assessment and game carrying capacity for game farm. Habitat evaluation and rehibition program for problem areas

Elephant impact study on Mabula Game Reserve, Bela-Bela, Limpopo,

2019, Ecologist, Ecological impact study on Private Nature reserve to see extent of elephant utilisation and impact. Woody species analysis – structure classification and net primary production. Elephant movement patterns and carrying capacity. Identification of vulnerable habitats and management program.

Faan Meintjies Municipal Nature Reserve, Matlosana, North West

2018-2022, Ecologist, Habitat assessments, game carrying capacities, ecological condition assessments, game counts and game recommendations, ecological rehabilitation programs, white rhino monitoring, anti-poaching programs, Environmental Education programs.

Kroonstad Solar PV Facilities

2022, Biodiversity Specialist. Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Vals River.

Kroonstad South Solar PV Facilities

2022, Biodiversity Specialist. Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the five solar PV facilities as well as perform aquatic biomonitoring of the Blomspruit.

Proposed Nketoana Regional Bulk Water Scheme Project

2023, Biodiversity Specialist. Nketoana Local Municipality is experiencing severe water shortages in its towns Reitz/Petsana/ Petrus Steyn/ Mamafubedu/ Arlington/ Leratswana and Lindley. Solutions to the water shortages are the proposed Nketoana Regional Bulk Water Scheme Pipeline, South Africa, Assess and map all biodiversity, plant and animal features associated within the footprint of the bulk water scheme project.

Rustenburg Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Rustenburg, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the three solar PV facilities.

Grootvlei Solar PV Facility

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the one solar PV facility.

Paulputs 400 kV Strengthening (Transmission Line Loop in Loop Out) Project

2023, Biodiversity Specialist. Proposed Paulputs 400kv Strengthening Project (Transmission Line Loop In Loop Out From Aries – Kokerboom Transmission Line), South Africa, Assess and map all biodiversity, plant and animal features within the power line footprint as well as perform biodiversity monitoring.

Seelo Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant, and animal features within the three solar PV facilities as well as perform biodiversity monitoring.

400kV Transmission and 132kV distribution power lines for the Apollo-Lepini-Mesong Project

2023, Biodiversity Specialist. Proposed development of a 400kV transmission and 132kV power lines for the Apollo-Lepini-Mesong Project, Gauteng Province, South Africa, undertake assessments and map all biodiversity, plant, and animal features along the proposed routes for the 400kV and 132kV power lines.

Languages:

English - excellent speaking, reading, and writing

Afrikaans – excellent speaking, reading and writing

APPENDIX 2: DECLARATION OF INDEPENDENCE

I, **Helena Elizabeth Human**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

_________________________________ **19/03/2023**

Helena Elizabeth Human (Pr. Sci. Nat. 147031) **Date**

Terrestrial Biodiversity Specialist

Appendix 3: Plant species list

Albuca tomentosa

Aloe ecklonis

Asclepias eminens

Berkheya radula

Berkheya zeyheri

Bidens bipinnata

Bidens formosa

Bulbostylis hispidula

Chamaecrista mimosoides

Cirsium vulgare

Conyza podocephala

Crabbea ovatifolia

Crassula lanceolata

Cuscuta sp.

Cyperus congestus

Diathus mooiensis

Euphorbia clavarioides

Euphorbia inaequilatera

Felicia muricata

Galinsoga parviflora

Gazania krebsiana

Gladiolus crassifolius

Gomphocarpus fruticosa

Gomphrena celosioides

Habenaria falcicornis

Haplocarpa scaposa

Helichrysum caespititium

Helichrysum nudifolium

Hermani erodioides

Hibiscus trionum

Indigofera melanadenia

Ipomoea crassipes

Juncus dregeanus

Kedrostis africana

Ledebouria ovatifolia

Monsonia angustifolia

Nerine krigei

Ocimum americanum

Oxalis corniculata

Paspalum dilatatum

Persicaria lapathifolia

Polygala hottentota

Rhynchosia totta

Scabiosa columbaria

Schkuhria pinnata

Solanum elaeagnifolium

Sporobolus fimbriatus

Tagetes minuta

Taraxacum officinale

Tephrosia capensis

Tephrosia lupinifolia

Tragopogon dubius

Trifolium africanum

Verbena bonariensis

Vernonia galpinii

Vernonia oligocephala

Wahlenbergia caledonica

Aristida scabrivalvis

Brachiaria serrata

Cymbopogon caesius

Cynodon dactylon

Digitaria eriantha

Elionurus muticus

Eragrostis trichophora

Hyparrhenia hirta

Setaria Sphacelata var sericea

Setaria sphacelata var torta

Setaria sphacelata var. sphacelata

Themeda triandra

Urochloa mosambicensis

Council for Geoscience

PROPOSED SEISMIC REFLECTION SURVEY AND WELL DRILLING, LEANDRA, MPUMALANGA

TERRESTRIAL ANIMAL SPECIES SPECIALIST REPORT

31 MARCH 2023

Submitted to : Nemai Consulting

Prepared by:

Helena Elizabeth Human (pr. Sci. Nat 147031)

Nitai Consulting (PTY) Ltd.

147 Bram Fischer Drive

Ferndale

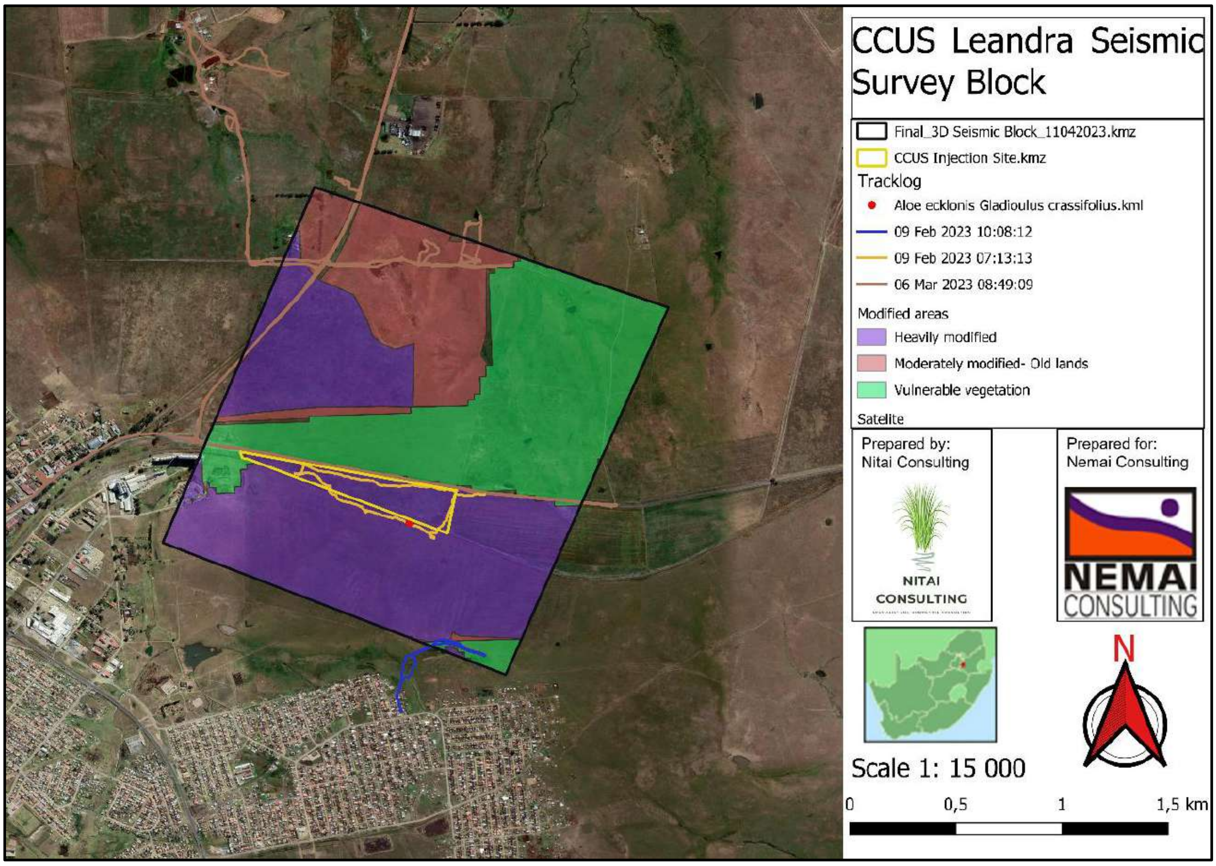
2194

Executive Summary

Nitai Consulting (Pty) Ltd. was appointed by Nemai Consulting (Pty) Ltd. to undertake a biodiversity risk assessment for the Proposed Seismic Reflection Survey and Well Drilling, Leandra, Mpumalanga.

According to the The National Web based Environmental Screening Tool the Animal species theme is high due to potential presence of a variety of species of Conservation Concern.

The sensitivity of the habitat units was identified and these are rated as low sensitivity. The construction impacts were calculated and with mitigation measures in place the impact of the project footprint is low.



As a result of the medium sensitivity according to the DFFE Screening Tool, an assessment was conducted in order to mitigate possible loss of animal species of conservation concern. Possible impacts to the loss of biodiversity areas associated with the proposed development is the loss of faunal habitat due to clearing of vegetation. In addition, loss of wetland habitat could result due to construction activities while the possibility for erosion is increased if proper mitigation measures are not followed. The impact on the receiving environment is perceived to be low and can be further lowered if mitigation measures described in this report are followed.

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List of Abbreviations

CBA	Critical Biodiversity Area
CR	Critical
DFFE	Department of Forestry, Fisheries & the Environment
DWS	Department of Water and Sanitation
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GN	Government Notice
ha	Hectares
km	Kilometer (1 000m)
LC	Least Concern
MAP	Mean Annual Precipitation
m	Meters
NEMA	National Environmental Management Act (No. 107 of 1998)
NFEPA	National Freshwater Priority Areas
NWA	National Water Act
SABAP 2	South African Bird Atlas project 2
SANBI	South African National Biodiversity Institute
VU	Vulnerable

1 Introduction

1.1 Terms of Reference

The specialist study is required to follow the published Protocols, provided in full below for the assessment of impacts on Terrestrial Animal Species. Note that the Protocols require determination of the level of sensitivity, which then determines the level of assessment required, either a full assessment, or a Compliance Statement.

PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON TERRESTRIAL ANIMAL SPECIES

This site sensitivity assessment follows the requirements of The Environmental Impact Assessment Regulations, as promulgated in terms of Section 24 (5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998), published in GN. No. 320 dated 20 March 2020.

General information

1.1 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “very high” or “high” sensitivity for terrestrial animal species, must submit a Terrestrial Animal Species Specialist Assessment Report.

1.2 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “medium sensitivity” for terrestrial animal species, must submit either a Terrestrial Animal Species Specialist Assessment Report or a Terrestrial Animal Species Compliance Statement, depending on the outcome of a site inspection undertaken in accordance with paragraph 4.

1.3 An applicant intending to undertake an activity identified in the scope of this protocol, on a site identified by the screening tool as being of “low” sensitivity for terrestrial animal species, must submit a Terrestrial Animal Species Compliance Statement.

1.4 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “very high” or “high” for terrestrial animal species sensitivity on the screening tool, and it is found to be of a “low” sensitivity, then a Terrestrial Animal Species Compliance Statement must be submitted.

1.5 Where the information gathered from the site sensitivity verification differs from the screening tool designation of “low” terrestrial animal species sensitivity and it is found to be of a “very high” or “high” terrestrial animal species sensitivity, a Terrestrial Animal Species Specialist Assessment must be conducted.

1.6 If any part of the development falls within an area of confirmed "very high" or "high" sensitivity, the assessment and reporting requirements prescribed for the "very high" or "high" sensitivity, apply to the entire development footprint. Development footprint in the context of this protocol, means the area on which the proposed development will take place and includes the area that will be disturbed or impacted.

1.7 The Terrestrial Animal Species Specialist Assessment and the Terrestrial Animal Species Compliance Statement must be undertaken within the study area.

1.8 Where the nature of the activity is not expected to have an impact on species of conservation concern (SCC) beyond the boundary of the preferred site, the study area means the proposed development footprint within the preferred site.

1.9 Where the nature of the activity is expected to have an impact on SCC beyond boundary of the preferred site, the project areas of influence (PAOI) must be determined by the specialist in accordance with Species Environmental Assessment Guideline, and the study area must include the PAOI, as determined.

Terrestrial Animal Species Specialist Assessment

2.1 The assessment must be undertaken by a specialist registered with the South African Council for Natural Scientific Professions (SACNASP), within a field of practice relevant to the taxonomic groups ("taxa") for which the assessment is being undertaken.

2.2 The assessment must be undertaken in accordance with the Species Environmental Assessment Guideline and must:

2.2.1 Identify the SCC which were found, observed or are likely to occur within the study area;

2.2.2 provide evidence (photographs) of each SCC found or observed within the study area, which must be disseminated by the specialist to a recognized online database facility immediately after the site inspection has been performed (prior to preparing the report contemplated in paragraph 3);

2.2.3 identify the distribution, location, viability and detailed description of population size of the SCC

identified within the study area;

2.2.4 identify the nature and the extent of the potential impact of the proposed development to the population of the SCC located within the study area;

2.2.5 determine the importance of the conservation of the population of the SCC identified within the study area, based on information available in national and international databases including the IUCN Red List of Threatened Species, South African Red List of Species, and/or other relevant databases;

2.2.6 determine the potential impact of the proposed development on the habitat of the SCC located within the study area;

2.2.7 include a review of relevant literature on the population size of the SCC, the conservation interventions as well as any national or provincial species management plans for the SCC. This review must provide information on the need to conserve the SCC and indicate whether the development is compliant with the applicable species management plans and if not, a motivation for the deviation;

2.2.8 identify any dynamic ecological processes occurring within the broader landscape, that might be disrupted by the development and result in negative impact on the identified SCC, for example, fires in fireprone systems;

2.2.9 identify any potential impact on ecological connectivity in relation to the broader landscape, resulting in impacts on the identified SCC and its long term viability;

2.2.10 determine buffer distances as per the Species Environmental Assessment Guidelines used for the population of each SCC;

2.2.11 discuss the presence or likelihood of additional SCC including threatened species not identified by the screening tool, Data Deficient or Near Threatened Species, as well as any undescribed species, or roosting and breeding or foraging areas used by migratory species where these species show significant congregations, occurring in the vicinity; and

2.2.12 identify any alternative development footprints within the preferred development site which would be of “low” or “medium” sensitivity as identified by the screening tool and verified through the site sensitivity verification.

2.3 The findings of the assessment must be written up in a Terrestrial Animal Species Specialist Assessment Report.

Terrestrial Animal Species Specialist Assessment Report

3.1 This report must include as a minimum the following information:

3.1.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the assessment including a curriculum vitae;

3.1.2 a signed statement of independence by the specialist;

3.1.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

3.1.4 a description of the methodology used to undertake the site sensitivity verification and impact assessment and site inspection, including equipment and modelling used where relevant;

3.1.5 a description of the mean density of observations/number of samples sites per unit area of site inspection observations;

3.1.6 a description of the assumptions made and any uncertainties or gaps in knowledge or data;

3.1.7 details of all SCC found or suspected to occur on site, ensuring sensitive species are appropriately reported;

3.1.8 the online database name, hyperlink and record accession numbers for disseminated evidence of SCC found within the study area;

3.1.9 the location of areas not suitable for development and to be avoided during construction where relevant;

3.1.10 a discussion on the cumulative impacts;

3.1.11 impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);

3.1.12 a reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not, of the development related to the specific theme considered, and if the development should receive approval or not, related to the specific theme being considered, and any conditions to which the opinion is subjected if relevant; and

3.1.13 a motivation must be provided if there were any development footprints identified as per paragraph

2.2.12 above that were identified as having “low” or “medium” terrestrial animal species sensitivity and were not considered appropriate.

3.2 A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.

Terrestrial Animal Species Compliance Statement

5.1 The compliance statement must be prepared by a SACNASP registered specialist under one of the two fields of practice (Zoological Science or Ecological Science).

5.2 The compliance statement must:

5.2.1 be applicable within the study area;

5.2.2 confirm that the study area is of “low” sensitivity for terrestrial animal species; and

5.2.3 indicate whether or not the proposed development will have any impact on SCC.

5.3 The compliance statement must contain, as a minimum, the following information:

5.3.1 contact details and relevant experience as well as the SACNASP registration number of the specialist preparing the compliance statement including a curriculum vitae;

5.3.2 a signed statement of independence by the specialist;

5.3.3 a statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;

5.3.4 a description of the methodology used to undertake the site survey and prepare the compliance statement, including equipment and modelling used where relevant;

5.3.5 the mean density of observations/ number of samples sites per unit area;

5.3.6 where required, proposed impact management actions and outcomes or any monitoring requirements for inclusion in the EMPr;

5.3.7 a description of the assumptions made and any uncertainties or gaps in knowledge or data;

5.3.8 any conditions to which the compliance statement is subjected.

A signed copy of the Terrestrial Animal Species Compliance Statement must be appended to the Basic Assessment Report or the Environmental Impact Assessment Report.

2 STUDY SITE

Carbon Capture Utilisation and Storage (CCUS) has been acknowledged by South Africa (SA) as one of the technologies to mitigate the emission of CO_2 into the atmosphere and forms one of the Nationally Appropriate Mitigation Actions (NAMA) against climate change. It is also one of the national flagship projects. CCUS forms part of a just transition to a future low-carbon energy economy.

The Council for Geoscience (CGS) is undertaking a geoscientific research project for the piloting of CCUS in Leandra in Mpumalanga, where it is proposed to inject CO_2 into deep suitable geological formations, approximately 1km below the surface. The Government of SA has received funding from the World Bank's International Bank for Reconstruction and Development to finance the CCUS project and intends to apply part of the proceeds for conducting Geological Characterisation comprising, amongst others, of drilling exploration boreholes and undertaking high-resolution 3D seismic survey at the proposed site. This notice only focuses on the Geological Characterisation component of the overall CCUS.

2.1 Location

The proposed drilling site is located along the R29 from Leandra to Kinross and is bounded to the south by a railway line from Secunda to Springs. The area earmarked for the 3D seismic survey encompasses most of the town of Leandra, as well as rural areas to the east and north-east.

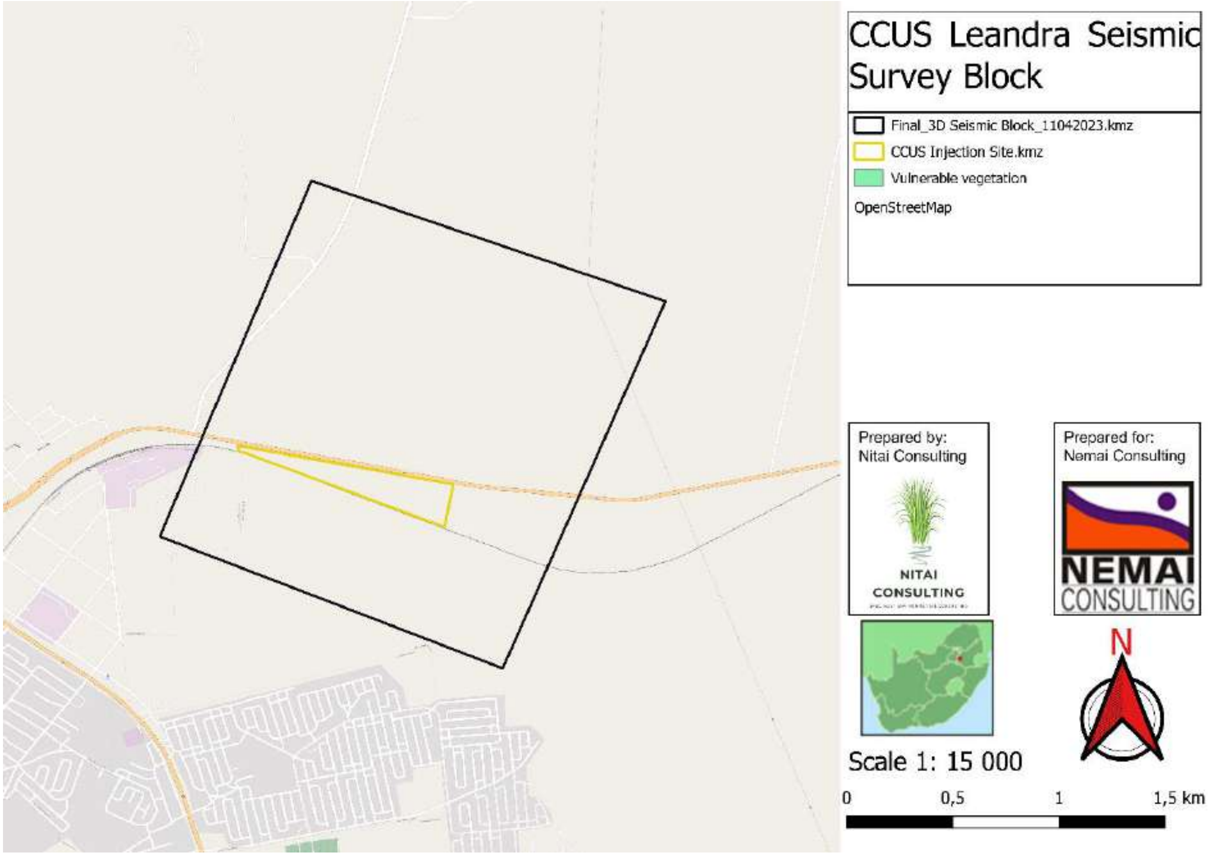

Figure 1: Project Locality

2.2 3D Seismic Survey

A seismic survey is a method of investigating subterranean structure. The technique is based on determining the time interval that elapses between the initiation of a seismic wave at a selected shot point (i.e., location where the seismic wave is generated) and the arrival of reflected or refracted impulses at one or more seismic detectors (Source: https://www.britannica.com/science/seismic-survey). The purpose of the high-resolution 3D survey for the CCUS Project is to map the structures, reservoir, and seal rocks in detail over the identified potential injection site. The 3D survey will also establish the baseline for future time-lapse CO_2 monitoring activities. 3D seismic surveys must be conducted over a large area in order to provide sufficient data for accurate interpretation of the subsurface geology. For the Project, the seismic waves will be induced by vibrating truck-mounted heavy plates on the ground. These specialised trucks are known as “Vibroseis”. By analysing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped. 3D surveys are acquired by laying out energy source points (vibroseis) and receiver points (geophones) in a grid over the area to be surveyed. The 3D seismic data for the Project will be processed using pre-stack time/depth migration and post-stack time migration approaches for comparison purposes. The information from the existing legacy and borehole data will be utilised to provide constraints on the designs of the seismic surveys and processing of the seismic data. Methodology

2.3 Drilling

The boreholes will be cored from the top of the bedrock to total depth with a minimum hole diameter of c. 95 mm. At various intervals during the drilling, suites of geophysical instruments will be installed in the borehole to obtain geophysical information. In addition, tests to determine the presence and quantity of gasses, e.g., hydrocarbons/light gasses, and tests to determine hydrological information will be conducted at systematic horizons, e.g., where water strikes are intersected, in the borehole. Plant, equipment, and goods associated with the drilling shall include (amongst others):

- Drill rigs including masts or derricks;
- Drilling fluid mixing, pumping and recycling equipment;
- Grouting pumps, mixers and all other equipment necessary for grout casing of the borehole, when necessary;
- Lighting plants and other equipment necessary to allow safe and efficient 24-hour operation;
- Adequate power supply unit for the drilling operation and the staff camp;
- Water supply for drilling and potable water for workers;
- Site office accommodation, stores, workshops and kitchen facilities at the site;
- Office for CGS representatives;
- Adequate vehicles to allow completion of the work, including suitable transport to safely transport contractor personnel to and from the drill site;
- Adequate, approved temporary ablution and latrine facilities;
- A reliable communication system; and
- All spare parts and back-up plant and equipment to ensure safe and efficient completion of the work.

On completion, the borehole will be securely capped with a concrete sanitation block and a lockable metal cap with a clear sign to avoid potential hazards to people and animals. The drill site will also be suitably rehabilitated. New facilities will be created for the injection phase.

3 IDENTIFIED THEME SENSITIVITIES

3.1 Screening tool

The national web-based Environmental Screening Tool was queried in relation to the following infrastructure: Any activities within or close to a watercourse.

According to the The National Web based Environmental Screening Tool the terrestrial animal sensitivity theme is medium (Table 1, Figure 2) due the fact seven species having a medium probability of occurrence on site.

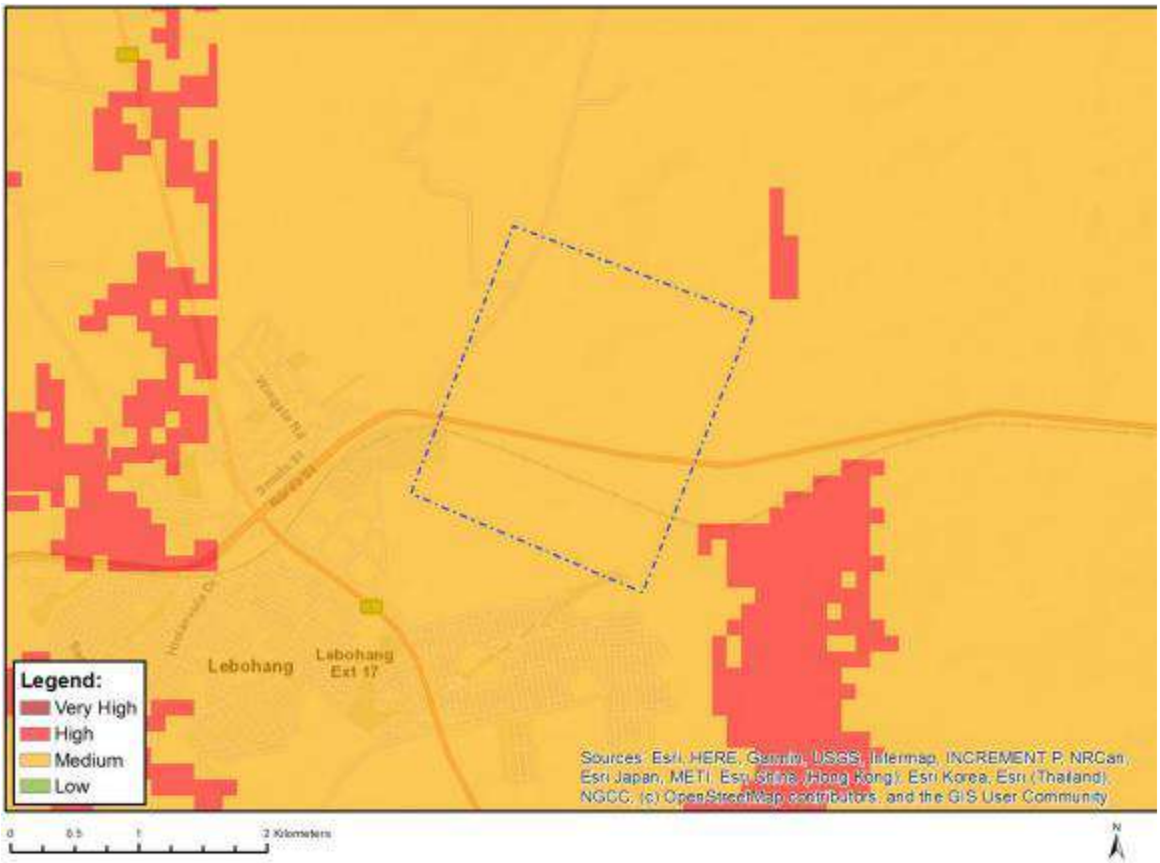

Figure 2: Animal Species theme sensitivity

Table 1: Sensitive species identified for Animal Species theme

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
		X	

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Aves-Tyto capensis
Medium	Aves-Eupodotis senegalensis
Medium	Aves-Grus carunculata
Medium	Insecta-Lepidochrysops procera
Medium	Mammalia-Chrysospalax villosus
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Hydrictis maculicollis

Sensitive burrowing animals are discussed in 3.2.5

3.2 Animal species flagged for the study area.

3.2.1 Grus carunculate (Critically Endangered, C1+2a(ii))

South Africa's population of Wattled Cranes was historically widespread and found in all four of the former provinces. However, the species' range has reduced significantly, resulting in it being confined to the eastern grasslands of South Africa (Figure 3), with the core of the population located in the KwaZulu-Natal Midlands. In South Africa, breeding pairs are largely sedentary, while non-breeding birds or 'floaters' tend to move up to 130 km away from the breeding sites. There is no evidence of movement in and out of the region (McCann 2001) and the regional population is therefore considered a single sub-population of the African population.

The primary threat and main cause of decline over the past three decades has been the loss and degradation of permanent, palustrine wetlands through intensified agriculture, afforestation, dam construction, alien plant infestation and draining of wetlands (McCann, 2001). Grassland areas surrounding breeding sites are vital for foraging and cover for chicks.

According to the latest data from SABAP 2, this species does occur on site.

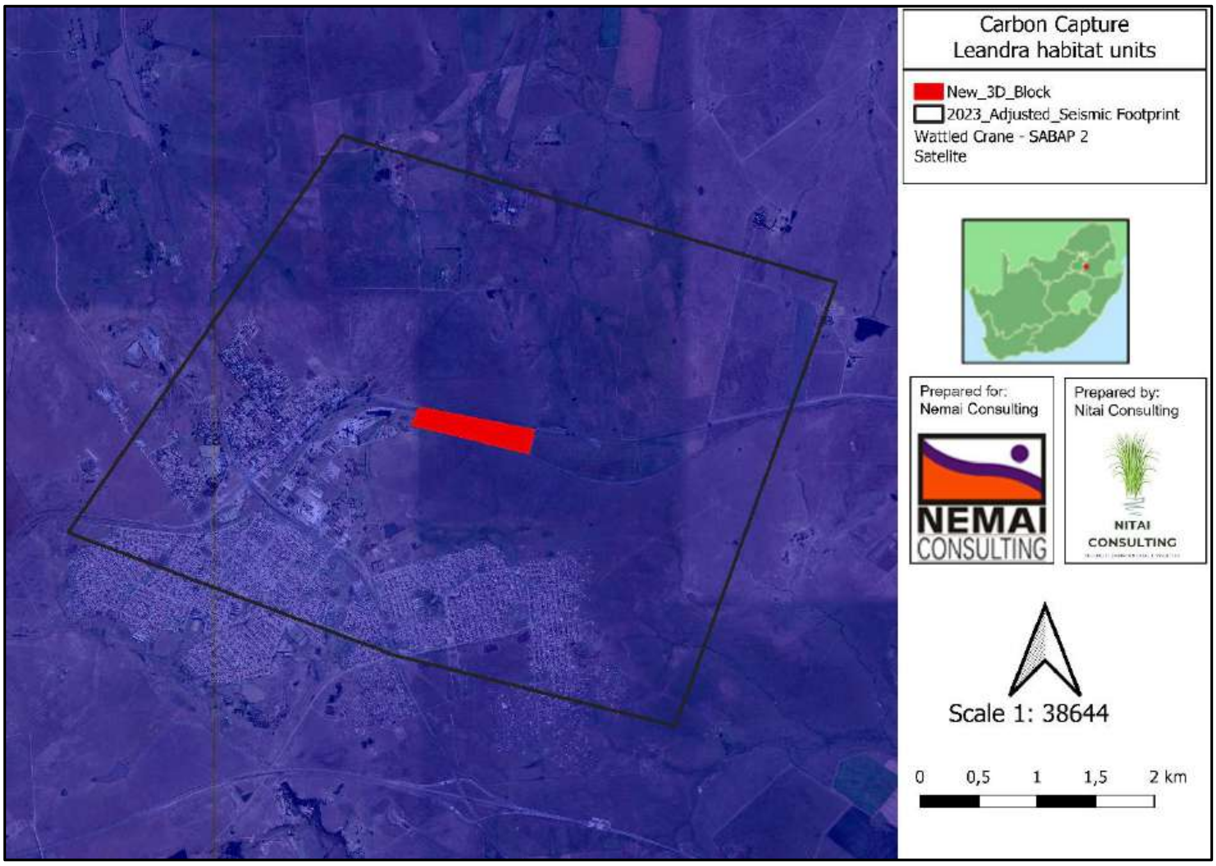

Figure 3: Wattled Crane distribution in study site.

3.2.2 Tyto capensis

The African Grass Owl is listed as Vulnerable. It is confined to the higher rainfall areas in the eastern half of South Africa (Figure 4), where it typically roosts and breeds in tall, rank grass or sedges associated with damp substrates, such as permanent and non-perennial wetlands and streams. The Olifants River is an important corridor for the species. A detailed avifaunal assessment has been undertaken for this project where additional information can be obtained regarding this species.

According to the latest data from SABAP 2, this species does occur on site.

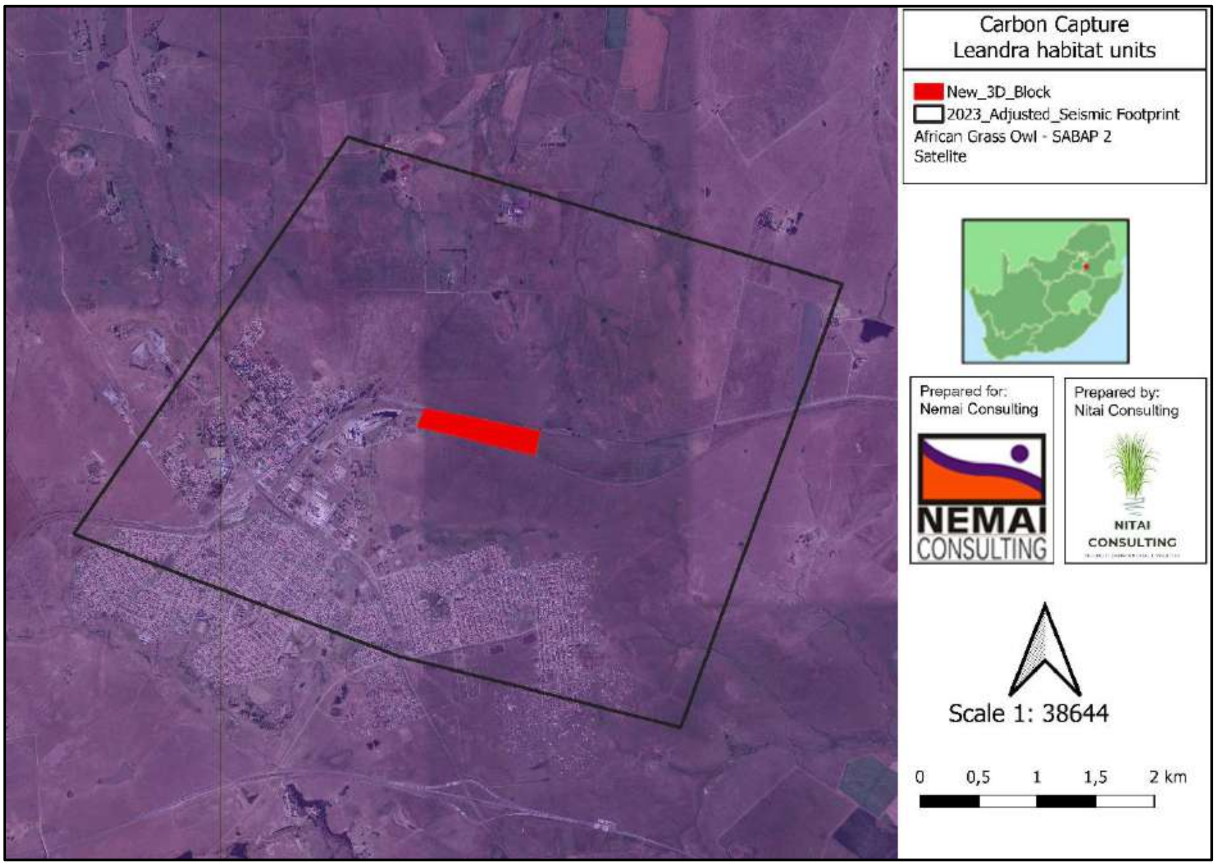

Figure 4: African Grass Owl distribution in study site.

3.2.3 Eupodotis senegalensis (Vulnerable, A2c+3c+4c, C1)

The White-bellied Korhaan is patchily distributed in the Afrotropics from West Africa to South Africa (Allan 2005). Densities vary greatly in different parts of the range, but overall, it is most common in the Highveld regions east of Potchefstroom (Maclean and Robert 1985) to southern Mpumalanga (Figure 5)(where it occurs mainly in the Wakkerstroom district; Moreira 2004), as well as in north-eastern Free State and the upper districts and midlands of KwaZulu-Natal.

The main threats of particular concern are habitat loss and degradation due to agriculture, afforestation (invasive alien vegetation and timber plantations), overgrazing, urban development, unsuitable burning practices, and other habitat modifications because of growing human populations (Moreira 2004, Allan 2005).

According to the latest data from SABAP 2, this species does occur on site.

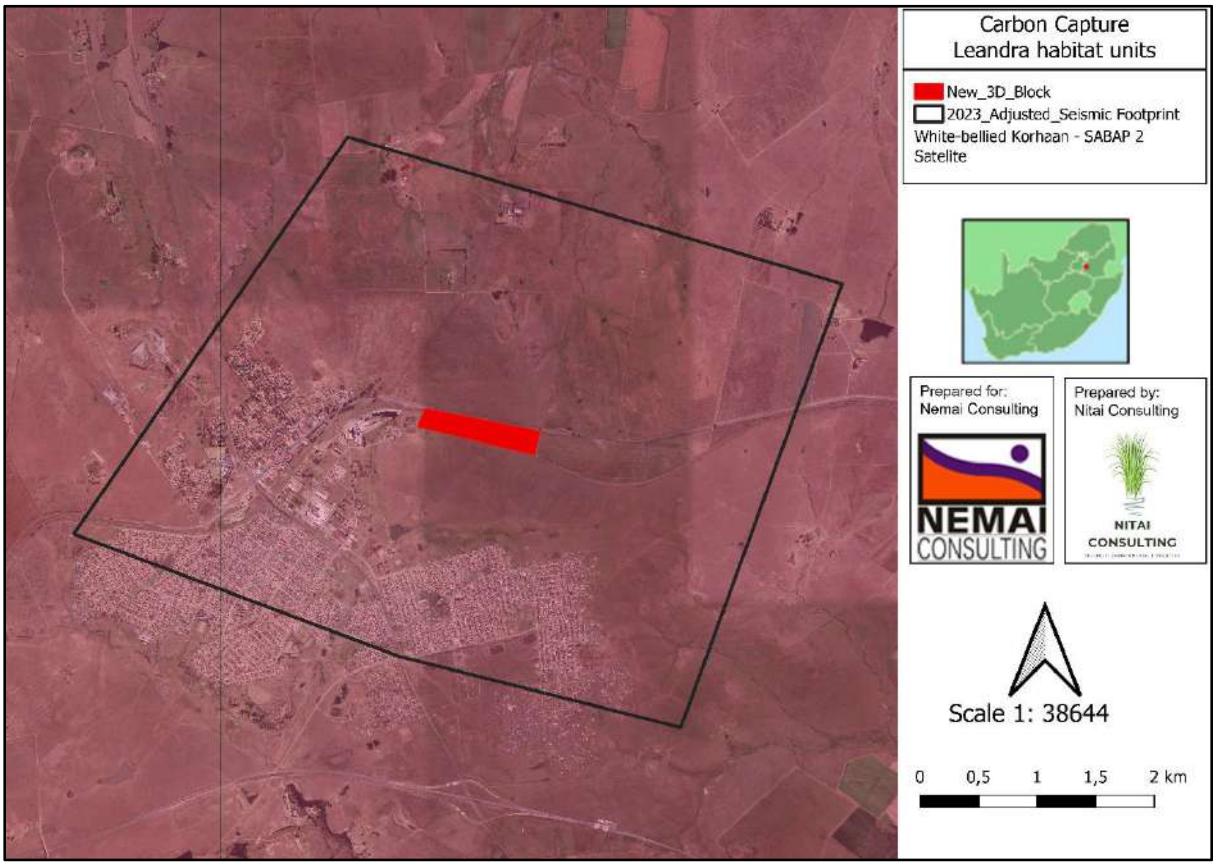

Figure 5: White-bellied Korhaan distribution in study site.

3.2.4 *Lepidochrysops procera* (Rare)

Endemic to the Gauteng, KwaZulu-Natal, Mpumalanga, North West, and Eastern Cape provinces in South Africa, from Kokstad in the south to Komatipoort in the north-east and Potchefstroom in the west.

Much of the habitat containing the Highveld populations of *Lepidochrysops procera* is under pressure from residential development and overgrazing by cattle. Elsewhere the taxon appears to thrive in grassland subjected to annual winter fires. Fire suppression, or fires during the butterfly's flight period of late September/October may be significant threats.

3.2.5 *Chrysospalax villosus* (Vulnerable)

While the extent of occurrence of this species appears large (> 20,000 km2), it has very specific habitat requirements and has been recorded from only 11 locations (Figure 6). Known locations are scattered far apart suggesting possible fragmentation into numerous subpopulations with little gene flow. Even at sites where this species occurs it is uncommon, suggesting that population densities are low.

Found on sandy soils in grasslands, meadows and along edges of marshes in Savanna and Grassland biomes of South Africa. Recorded from gardens and parklands, also found in dense stands of kikuyu grass (*Pennisetum clandestinum*) and marginally on golf courses adjoining natural grasslands. Extremely rare and secretive; only three specimens have been collected since 1980. Difficult to detect owing to preference for areas with sandy soils and dense vegetation cover.

Period	Symbol	No. Rec.	% Rec.	No. QDSs	% QDSs
Undated records		0	0	0	0
pre-2015		0	0	0	0
2015 to present		6	85.71	4	0.2

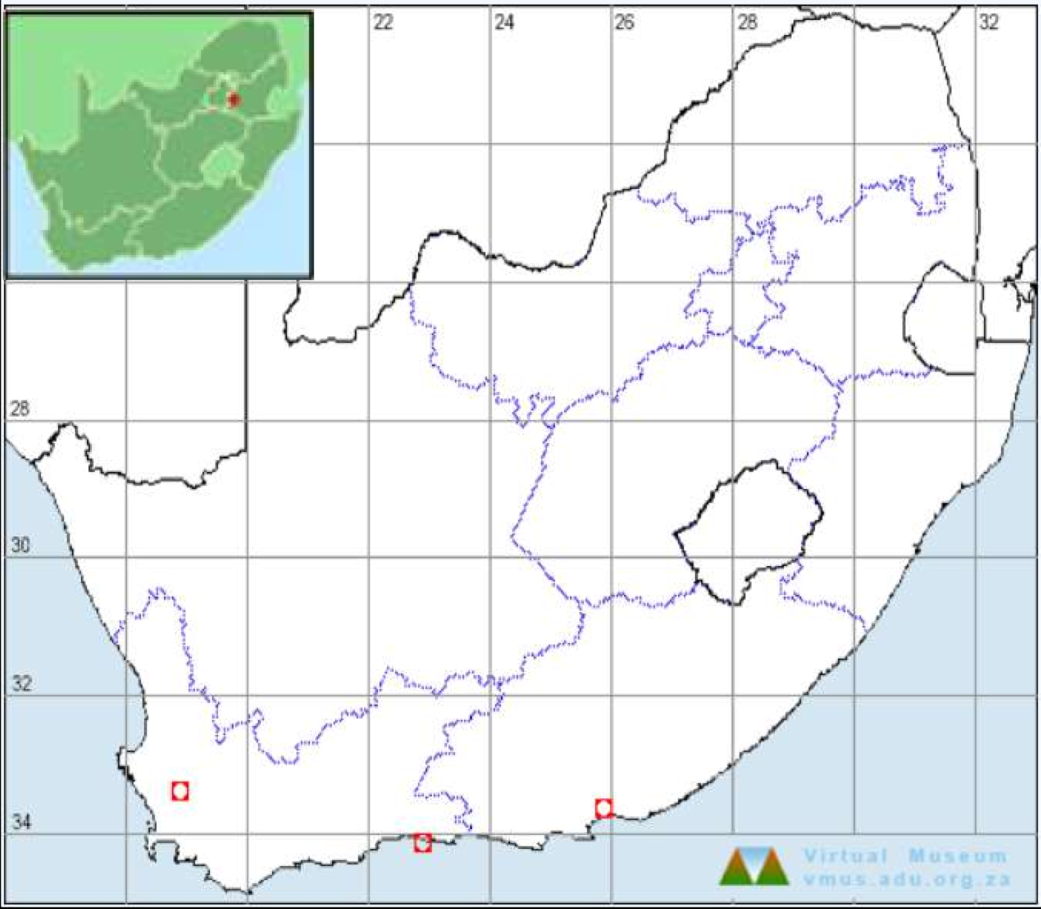

Figure 6: Current distribution of the Rough-haired golden mole from the virtual museum.

3.2.6 Dasymys robbertsii

African Marsh Rats are dependent on intact rivers and wetland ecosystems, as they have not been found in artificial or degraded wetlands and are thus patchily distributed. Wetlands are continuing to be lost with agricultural and human settlement expansion, which in turn increases wetland degradation from overgrazing, water abstraction, pollution, and invasive alien plant sprawl and as such, this species is classified as vulnerable. African Marsh Rats construct complex, intricately woven nests in holes along the banks of rivers and ponds (Pillay 2003). Nests extend into water and might serve as a bolt hole during attack from predators. Sub- and above-surface runways extend from the nest cavities and would serve as travel routes. These rodents are opportunistic omnivores, feeding predominantly on the succulent stems and fruiting heads of semi-aquatic grasses (Skinner and Chimimba 2005), supplementing their diets with insects, especially during reproduction (Pillay, 2003). They are good swimmers, adapted to living in very marshy habitats where they build runways and nests in dense ground cover (Monadjem & Cotterill, 2015). There is no distribution or recent sighting data for this species.

3.2.7 Hydrictis maculicollis (Vulnerable)

The Spotted-necked Otter is widespread within the assessment region, and may either be expanding westwards along the Orange River, or subpopulations here may have been overlooked. However, it is restricted to areas of permanent fresh water offering good shoreline cover and an abundant prey base (Figure 7).

They are particularly prevalent in the well-watered eastern regions of the country within the assessment region, north of Bushmans River in the Eastern Cape (Stuart 1981, Somers and Purves 1996), east of the escarpment and including the highlands of KwaZulu-Natal (Rowe-Rowe 1992a), Free State (Lynch 1983), Gauteng, and Mpumalanga (Rowe-Rowe 1997).

MammalMAP Database -- Species Summary information*

Species code:	217730
Scientific name:	Hydrictis maculicollis
English name:	Spotted-necked Otter
Family:	Mustelidae
Red Data Status:	Least Concern (IUCN 2008)
Number of records:	19
Number of grid cells:	15 (0.74%)

Period	Symbol	No. Rec.	% Rec.	No. QDSs	% QDSs
Undated records	☐	0	0	0	0
pre-2015	■	9	47.37	9	0.44
2015 to present	◘	10	52.63	8	0.39

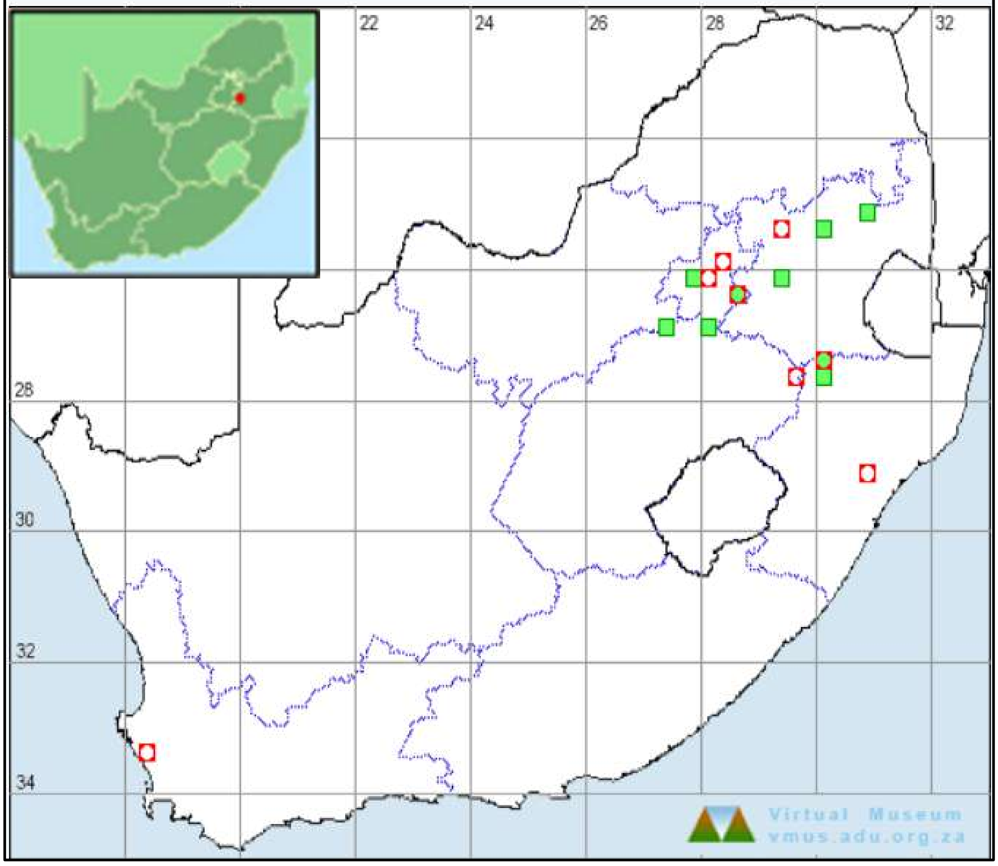

Figure 7: Current sighting of the Spotted-necked otter in South Africa from the virtual museum.

3.3 Protected animals.

Two species protected under the National Environmental Biodiversity Act (Act 10 of 2004): Threatened or Protected species regulations (South African Government, 2004) has current distribution records for the study site according to the virtual museum records (The Virtual Museum (adu.org.za)). These are the Cape porcupine (*Hystrix africaeaustralis*) and the South African hedgehog (*Atelerix frontalis*).

4 METHODOLOGY

The detailed methodology followed as well as the sources of data and information used as part of this assessment is described below.

4.1 Survey timing

The study commenced as a desktop-study followed by a site-specific field study on 9th February, 6th March and 27th March 2023. The site is within the grassland biome with a peak rainfall season in summer, which occurs from October to March (Figure 8). There is, however, a delay between rainfall and vegetation growth, which means the peak growing season is from November to April, with most perennial species characteristic of the vegetation being easily identifiable from January to March. The timing of the field survey was therefore ideal in terms of assessing the vegetation condition and flora composition of the site which in turn influences the distribution of animal species as breeding and foraging sites.

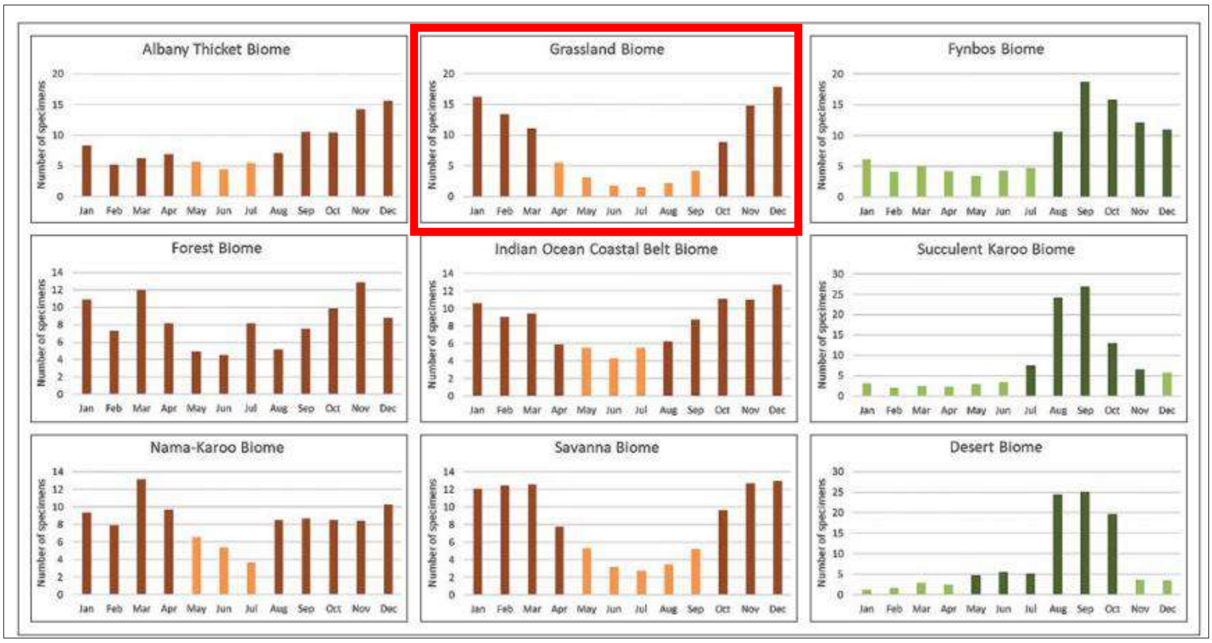

Figure 8: Recommended survey season for animal species assessment.

4.2 Field Survey Approach

During the field survey, all major natural variation on site was assessed and select locations were traversed on foot. A Geo tracking cell phone application was used to record a track within which observations were made. Aerial imagery from Google Earth was used to identify and assess habitats on site.

Patterns identified from satellite imagery were verified on the ground. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground during the search for animal species. From this ground survey, as well as ad hoc observations on site, a checklist of animal species occurring on site was compiled.

4.3 Sources of Information

Lists of animal species that have a geographical range that includes the study area were obtained from literature sources (Bates et al., 2014 for reptiles, du Preez & Carruthers 2009 for frogs, Mills & Hes 1997 and Friedmann and Daly, 2004 for mammals). This was supplemented with information from the Virtual Museum website (https://vmus.adu.org.za/) and iNaturalist online distribution information (ttps://www.inaturalist.org/observations).

4.4 Limitations, Assumptions and Uncertainties

The following assumptions, uncertainties and limitations apply to the Leandra site:

- Inventory surveys of animal species occurring on a site are difficult to achieve within the time-frames associated with an EIA. In order to compile a comprehensive site-specific list of the biota on site, studies would be required that would include different seasons and be undertaken over a much longer timeframe including extensive sampling. It is more important to know of fauna of value, as well as ecological processes. Therefore, the assessment attempts to identify threatened and other significant species, important habitats, and ecological processes.
- Compiling the list of species that could potentially occur on site is limited by the density of collection records for the area. The list of animal species that could potentially occur on site was therefore taken from a wider area (1 degree grid) and from recent literature sources .
- The assessment is based on a field survey conducted over three days. The current study is based on an extensive site visit as well as a desktop study of the available information. The time spent on site was adequate for understanding general patterns across affected areas. The seasons in which the fieldwork (peak summer flowering period) was conducted was ideal for assessing the composition and condition of the vegetation, which is also suitable for assessing habitat condition and suitability for animals.

5 ASSESSMENT OUTCOMES

5.1 Habitats on site

A map of the habitats within the study area is provided in Figure 9 The study area is found within typical mesic grassland with turf soil.

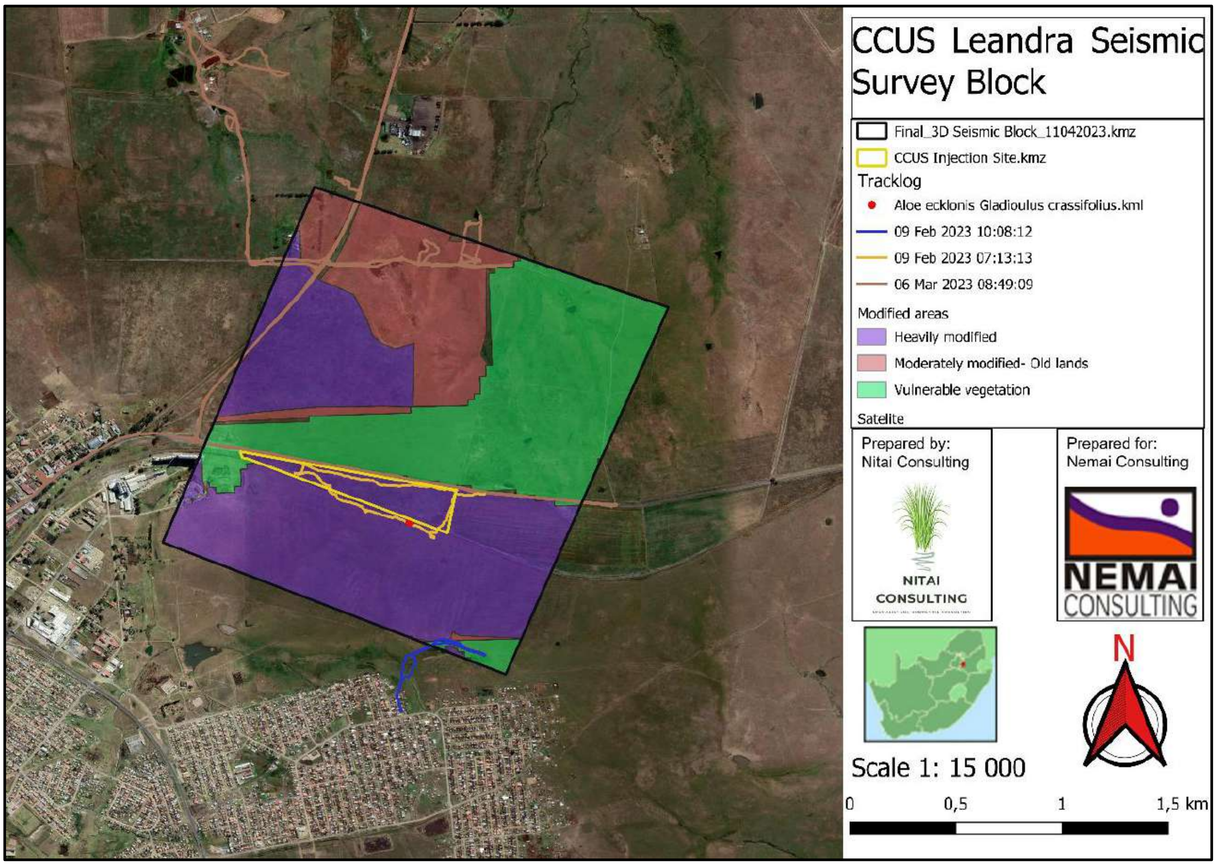

Figure 9: Habitat units found on the study site.

5.1.1.1 Vulnerable Habitat

This habitat type is characterised by natural vegetation with little disturbances. The vegetation structure ranges from short grassland vegetation on shallower soils to very tall grassland on deeper Arcadia soils (Figure 10).

Figure 10: General view of vegetation in vulnerable habitat.

The floristic composition of this habitat is dominated by true grassland species with virtually no trees or shrubs. The graminoid species found here include: *Digitaria eriantha, Hyparrhenia hirta, Cymbopogon caesius, Cynodon dactylon, Eragrostis trichophora, Setaria pumila, Aristida scabrivalvis, Themeda triandra, Urochloa mossambicensis, Sporobolus fimbriatus, Paspalum dilatatum, Setaria sphacelata var sphacelata, Brachiaria serrata, Elionurus muticus, Bulbostylis hispidula, Cyperus congestus, Juncus effusus.* The herbaceous layer comprise the following species: *Tagetes minuta, Arctotis arctotoides, Cotula anthemoides, Monsonia angustifolia, Taraxacum officinale, Kedrostis africana, Crabbea ovatifolia, Hermannia erodioides, Ocimum americanum, Euphorbia inaequilatera, Bidens bipinnata, Gomphocarpus fruticosa, Vernonia oligocephala, Berkheya zeyheri, Gladiolus crassifolius, Wahlenbergia caledonica, Crassula lanceolata, Scabiosa columbaria, Berkheya radula, Polygala hottentota, Rhynchosia minima, Lessertia stricta, Vernonia galpinii, Persicaria lapathifolia, Ipomoea crassipes, Gazania krebsiana, Aloe ecklonis, Ledebouria ovatifolia, Oxalis corniculata, Cirsium vulgare, Solanum elaeagnifolium, Hibiscus trionum, Galinsoga parviflora, Haplocarpa scaposa, Gerbera ambigua, Tragopogon dubius, Verbena bonariensis, Albuca tomentosa, Dianthus mooiensis, Euphorbia clavarioides, Habenaria falcicornis subsp. caffra, Asclepias eminens, Gomphrena celosioides, Felicia muricata, Trifolium africanum, Schkuhria pinnata, Bidens formosa.*

Three of the species found in this habitat are protected in terms of the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. These are *Gladiolus crassifolius* and *Aloe ecklonis.*

There were quite a few exotic species found spread out all over the study area, these are: *Schkuhria pinnata, Solanum elaeagnifolium, Verbena bonariensis, Tagetes minuta, Bidens formosa, Taraxacum officinale* and *Bidens bipinnata.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis:	1b
Cirsium vulgare	1b

5.1.1.2 Aquatic habitats

The wetlands were mapped and delineated by and aquatic specialist using various databases and ground truthing. There is one main wetland within the study area. This wetland has various condition ratings. There are exotic species found within the areas: *Solanum elaeagnifolium and Verbena bonariensis plants*. This habitat forms part of the Aquatic specialist report and is mentioned here mainly because of the habitat discussion (Figure 11).

The following vegetation was found: *Persicaria lapathifolia, Paspalum distichum, Heteropogon contortus, Panicum coloratum, Themeda triandra, Cymbopogon caesius, Digitaria monodactyla, Verbena bonariensis, Solanum elaeagnifolium, Eragrostis curvula, Bulbostylis hispidula, Cyperus congestus, Bothriochloa insculpta, Sporobolus pyramidalis, Sporobolus africanus, Paspalum dilatatum, Paspalum urvillei, Fingerhuthia africana, Dactyloctenium aegyptium, Juncus effusus, Crinum bulbispermum, Gladiolus crassifolius, Aloe ecklonis* and *Diclis reptans.*

Figure 11: General view of Aquatic habitats.

Three species found in this habitat is protected in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. This is *Gladiolus crassifolius, Aloe ecklonis.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis: 1b

5.1.1.3 Modified habitats (Moderate and Heavy)

These are areas that were previously ploughed for cultivation but have been left for an extended period without ploughing. Through natural succession processes, they generally develop a perennial cover of grasses (Figure 12), but these secondary grasslands are species poor and the original diversity of resprouting species is usually entirely absent. Non-grass species diversity usually consists of re-seeding and weedy species, and sometimes animal- and/or bird-dispersed woody species. On aerial photographs and satellite images with adequate resolution, these areas are often recognisable by the presence of residual plough lines and other structural features often present in cultivated fields.

Common graminoid found here are *Digitaria eriantha, Hyparrhenia hirta, Cymbopogon caesius, Cynodon dactylon, Eragrostis trichophora, Setaria pumila, Aristida junciformis, Themeda triandra, Urochloa mossambicensis, Bulbostylis hispidula, Sporobolus fimbriatus, Paspalum dilatatum, Setaria sphacelata var sphacelata.*

The herbaceous layer consist of a diverse species assemblage: *Tagetes minuta, Monsonia angustifolia, Conyza bonariensis, Verbena bonariensis, Bidens formosa, Kedrostis africana, Crabbea ovatifolia, Hermania erodioides, Chamaecrista mimosoides, Ocimum americanum, Euphorbia inaequilatera, Bidens pinnata, Gomphocarpus fruticosa, vernonia oligocephala, Berkheya zeyheri, Gladiolus crassifolius, Wahlenbergia caledonica, Tragopogon dubius, Crassula lanceolata, Scabiosa columbaria, Berkheya radula, Polygala hottentota, Tephrosia crassipes, Vernonia galpinii, Helichrysum nudifolium, Ipomoea crassipes, Gazania krebsiana, Aloe ecklonis, Oxalis corniculata, Cuscuta campestris, Cirsium vulgare, Hibiscus trionum, Galinsoga parviflora, Haplocarpa scaposa.*

In a general sense this area has a medium species richness and is dominated by medium to short graminoid species with herbaceous vegetation in between. The area has a high cover of plant species. There are clear indicators that this system is undergoing old land succession and has several pioneer plant species although the perennial species are well established and seems to propagate well.

Figure 12: General view of old land habitats.

Two species found in this habitat is protected in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 11 (Protected plants) to which section 69 (1) (a) applies. This is *Gladiolus crassifolius* and *Aloe ecklonis.*

There were quite a few exotic species found spread out all over the study area, these are: *Schkuhria pinnata, Tagetes minuta, Verbena bonariensis, Bidens formosa, Ocimum americanum, Bidens pinnata, Tragopogon dubius, Cuscuta campestris.*

The following species are listed as declared invasives under the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species lists 2020 Government Gazette 437216 (South African Governmnent, 2004). These species are prohibited must be controlled:

Verbena bonariensis: 1b

The following species is listed as invader weeds and plants in the Mpumalanga Nature Conservation Act (Act 10 of 1998) under Schedule 13 to which section 80 (1) (a) applies. This is: *Cuscuta campestris*.

6 Description of Potential Impacts

6.1 Potential sensitive receptors in the general study area

A summary of the potential ecological issues for the study area is as follows (issues assessed by other specialists, e.g. on birds and on wetland and hydrological function, are not included here):

- Possible presence of various listed animal species on site.
- Presence of important habitat on site for animal species.
- Importance of the site as a corridor through the landscape, primarily due to connected areas of wetlands and grasslands.

6.2 Survey phase Impacts

Direct impacts include the following:

1. Loss of faunal habitat;

2. Direct mortality of fauna due to machinery, construction and increased traffic.

6.3 Drilling phase Impacts

Direct impacts include the following:

1. Direct mortality of fauna through traffic, illegal collecting, poaching and collisions and/or entanglement with infrastructure.

A detailed assessment, as per the requirements of the protocol for the specialist assessment and minimum report content requirements of environmental impacts on terrestrial animal species for activities requiring environmental authorisation, (20 March 2020), of the significance of all impacts during all phases of the project (Survey and Drilling) is provided below. This also includes all proposed mitigation measures and provides assessment before and after the implementation of proposed mitigation measures.

The proposed site is identified by the national web-based environmental screening tool as being medium sensitivity for Animal Species, and the protocol therefore requires that the sensitivity be confirmed on site, and the level of assessment determined by the outcome of the sensitivity verification. If animal SCC are confirmed or suspected to occur on site then the results must be written up in a Terrestrial Animal Species Assessment Report. Detailed discussion of each impact, including justification for assigned scores, is provided below.

Impact 1	Loss of individuals/ Species of Conservation Concern due to clearing for construction, losing corridors of vegetation for faunal populations			
Problem	Clearing of natural habitat for construction and permanent disturbance of habitat during drilling and survey phase.			
Type	Direct			
Nature	Negative			
Phases	Drilling and Surveying			
	Drill site		**Seismic Survey Site**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	2	2	3	2
Duration	3	3	3	3

Reversibility	3	2	3	2
Severity	3	2	3	2
Probability	3	1	3	1
Significance	33 Low	9 Low	36 Low	9 Low
Mitigation actions				
Recommendations	1. Prior to construction commencing, undertake a detailed walk-through survey of footprint areas that are within habitats where SCC are likely to occur. 2. Where significant populations of SCC are found, collect the data for any fauna permits or micro-siting of infrastructure that may be required. 3. Prior to construction commencing, compile an Animal Rescue Plan, including monitoring specifications (timeframe, frequency etc). 4. Undertake monitoring (as per the Animal Rescue Plan specifications) to evaluate whether further measures would be required to manage impacts 5. No driving of vehicles off-road outside of construction areas. 6. Apply mitigation measures recommended in the Terrestrial Biodiversity Assessment to minimize loss of natural vegetation.			
Monitoring	As per management plans			
Recommendations	As per management plans			

Impact 2	Direct mortality of fauna due to presence of traffic and heavy machinery
Problem	Construction activities will require use of heavy machinery and vehicles, as well as placement of various obstructions that may be hazardous

Type	Direct			
Nature	Negative			
Phases	Drilling and Survey			
	Drill Site		**Seismic Survey Site**	
Criteria	Without mitigation	With mitigation	Without mitigation	With mitigation
Extent	2	2	3	2
Duration	3	3	3	3
Reversibility	3	2	3	2
Severity	3	2	3	2
Probability	3	2	3	1
Significance	33 Low	18 Low	36 Low	9 Low
Mitigation actions				
Recommendations	1) It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project. 2) Conduct a pre-construction walk-through of natural habitat within the development footprint, undertaken where possible (considering all administrative and legal processes and requirements) in the correct season (October to March, as in Figure 4), prior to construction activities commencing in order to move any individual animals, such as tortoises, where required. Personnel on site should undergo environmental induction training, including the need to abide by speed limits, the increased risk of collisions with wild animals on roads in rural areas. 3) Proper waste management must be implemented as per the conditions stipulated in the EMPr, ensuring no toxic or dangerous substances are accessible to wildlife. This should			

	also apply to stockpiles of new and used materials to ensure that they do not become a hazard. 4) No collecting, hunting or poaching of any plant or animal species. 5) During construction, personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species. 6) Appropriate lighting should be installed to minimize impacts on nocturnal animals, as per visual specialist assessment.
Monitoring	As per management plans
Recommendations	As per management plans

6.4 Summary of mitigation measures

The following mitigation measures are recommended to address known potential impacts:

- No driving of vehicles off-road outside of construction areas.
- It is a legal requirement to obtain permits for specimens or protected species that will be lost due to construction of the project.
- Conduct a pre-construction walk-through of natural habitat within the development fooprint, undertaken in the correct season where possible (considering all administrative and legal processes and requirements) (October to March, as in Figure 4), prior to construction activities commencing in order to move any individual animals, such as tortoises, where required.
- Personnel on site should undergo environmental induction training, including the need to abide by speed limits, the increased risk of collisions with wild animals on roads in rural areas.
- Proper waste management must be implemented as per the conditions stipulated in the EMPr, ensuring no toxic or dangerous substances are accessible to wildlife. This should also apply to stockpiles of new and used materials to ensure that they do not become a hazard.
- No collecting, hunting or poaching of any plant or animal species.
- During construction and operation, personnel to be educated about protection status of species, including distinguishing features, to be able to identify protected species.
- Appropriate lighting should be installed to minimize impacts on nocturnal animals, as per visual specialist assessment.

7 Discussion and Conclusions

There are several threatened animal species that are flagged for the site, as well as others not directly flagged that may occur there. These animals may make use of various habitats available on site, which consists mostly of grassland vegetation types and wetlands within shallow drainage valleys. The project planned for the site has been located primarily in areas of disturbance although some parts are classified as vulnerable ecosystems while large parts of the area have natural vegetation. If the project is limited only to footprint the impact should be low depending on mitigation and follow up monitoring of impacts.

The main concern in terms of threatened animal species is direct loss of habitat, but this will be limited for this project if mitigation measures are followed. Fragmentation of habitat is assessed but can be minimised by sustainable mitigation measures and environmental engineering through smart placement of infrastructure as well as existing patterns of transformation on site. There may also be direct mortality of individual animals, but this is not likely if mitigation measures are followed.

An assessment of these impacts indicates that they will have a low significance.

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APPENDIX 1 – LIST OF ANIMAL SPECIES FOUND ON SITE

Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern (2016)
Bovidae	*Damaliscus pygargus phillipsi*	Blesbok	Least Concern (2016)
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)
Chrysochloridae	*Amblysomus septentrionalis*	Highveld Golden Mole	Near Threatened (2016)
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened (2016)
Felidae	*Leptailurus serval*	Serval	Near Threatened (2016)
Felidae	*Panthera leo*	Lion	Least Concern (2016)
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern (2016)
Herpestidae	*Suricata suricatta*	Meerkat	Least Concern (2016)
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern
Leporidae	*Lepus sp.*	Hares	
Molossidae	*FAMILY Molossidae*	Unidentified Molossidae	
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	Least Concern (2016)
Muridae	*Otomys auratus*	Southern African Vlei Rat (Grassland type)	Near Threatened (2016)
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern (2016)

Mustelidae	*Aonyx capensis*	African Clawless Otter	Near Threatened (2016)
Sciuridae	*Xerus inauris*	South African Ground Squirrel	Least Concern
Soricidae	*FAMILY Soricidae*	Unidentified Soricidae (Shrew)	
Soricidae	*Crocidura mariquensis*	Swamp Musk Shrew	Near Threatened (2016)
Soricidae	*Myosorex varius*	Forest Shrew	Least Concern (2016)
Vespertilionidae	*Neoromicia capensis*	Cape Serotine	Least Concern (2016)
Viverridae	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern (IUCN, 2016)
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern
Hyperoliidae	*Semnodactylus wealii*	Rattling Frog	Least Concern
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern (IUCN 2020)
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern (2017)
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern (2013)
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	Least Concern

HESPERIIDAE	*Afrogegenes sp.*		
HESPERIIDAE	*Metisella meninx*	Marsh sylph	Least Concern (SABCA 2013)
HESPERIIDAE	*Spialia asterodia*	Star sandman	Least Concern (SABCA 2013)
HESPERIIDAE	*Spialia mafa mafa*	Mafa sandman	Least Concern (SABCA 2013)
LYCAENIDAE	*Aloeides henningi*	Hillside russet	Least Concern (SABCA 2013)
LYCAENIDAE	*Azanus jesous*	Topaz babul blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lampides boeticus*	Pea blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Lycaena clarki*	Eastern sorrel copper	Least Concern (SABCA 2013)
LYCAENIDAE	*Zizeeria knysna knysna*	African grass blue	Least Concern (SABCA 2013)
LYCAENIDAE	*Zizula hylax*	Tiny grass blue	Least Concern (SABCA 2013)
NYMPHALIDAE	*Catacroptera cloanthe cloanthe*	Pirate	Least Concern (SABCA 2013)
NYMPHALIDAE	*Danaus chrysippus orientis*	African plain tiger	Least Concern (SABCA 2013)
NYMPHALIDAE	*Junonia hierta cebrene*	Yellow pansy	Least Concern (SABCA 2013)
NYMPHALIDAE	*Junonia orithya madagascariensis*	African blue pansy	Least Concern (SABCA 2013)

NYMPHALIDAE	*Telchinia rahira rahira*	Marsh telchinia	Least Concern (SABCA 2013)
NYMPHALIDAE	*Vanessa cardui*	Painted lady	Least Concern (SABCA 2013)
PIERIDAE	*Belenois aurota*	Pioneer caper white	Least Concern (SABCA 2013)
PIERIDAE	*Eurema brigitta brigitta*	Broad-bordered grass yellow	Least Concern (SABCA 2013)
PIERIDAE	*Pontia helice helice*	Southern meadow white	Least Concern (SABCA 2013)
Agamidae	*Agama aculeata distanti*	Distant's Ground Agama	Least Concern (SARCA 2014)
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped Snake	Least Concern (SARCA 2014)
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern (SARCA 2014)
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)
Lacertidae	*Pedioplanis burchelli*	Burchell's Sand Lizard	Least Concern (SARCA 2014)
Lamprophiidae	*Homoroselaps lacteus*	Spotted Harlequin Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	Least Concern (SARCA 2014)
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern (SARCA 2014)
Leptotyphlopidae	*Leptotyphlops sp.*		

Leptotyphlopidae	*Leptotyphlops scutifrons conjunctus*	Eastern Thread Snake	
Pelomedusidae	*Pelomedusa galeata*	South African Marsh Terrapin	Not evaluated
Scincidae	*Acontias gracilicauda*	Thin-tailed Legless Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis capensis*	Cape Skink	Least Concern (SARCA 2014)
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern (SARCA 2014)
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	Least Concern (IUCN 2022)

	Hamerkop	Scopus	umbretta
	Quailfinch	Ortygospiza	atricollis
	Secretarybird	Sagittarius	serpentarius
Barbet	Black-collared	Lybius	torquatus
Barbet	Crested	Trachyphonus	vaillantii
Bishop	Southern Red	Euplectes	orix
Bishop	Yellow-crowned	Euplectes	afer
Bulbul	Dark-capped	Pycnonotus	tricolor
Buzzard	Common	Buteo	buteo
Canary	Black-throated	Crithagra	atrogularis
Canary	Yellow	Crithagra	flaviventris
Canary	Yellow-fronted	Crithagra	mozambica
Chat	Ant-eating	Myrmecocichla	formicivora
Cisticola	Cloud	Cisticola	textrix
Cisticola	Levaillant's	Cisticola	tinniens
Cisticola	Pale-crowned	Cisticola	cinnamomeus
Cisticola	Wing-snapping	Cisticola	ayresii
Cisticola	Zitting	Cisticola	juncidis
Coot	Red-knobbed	Fulica	cristata
Cormorant	Reed	Microcarbo	africanus
Cormorant	White-breasted	Phalacrocorax	lucidus
Crow	Cape	Corvus	capensis
Crow	Pied	Corvus	albus
Cuckoo	Diederik	Chrysococcyx	caprius
Darter	African	Anhinga	rufa
Dove	Cape Turtle	Streptopelia	capicola
Dove	Laughing	Spilopelia	senegalensis
Dove	Red-eyed	Streptopelia	semitorquata
Dove	Rock	Columba	livia
Duck	African Black	Anas	sparsa
Duck	White-backed	Thalassornis	leuconotus
Duck	White-faced Whistling	Dendrocygna	viduata
Duck	Yellow-billed	Anas	undulata
Egret	Intermediate	Ardea	intermedia
Egret	Little	Egretta	garzetta
Egret	Western Cattle	Bubulcus	ibis
Falcon	Amur	Falco	amurensis
Finch	Cuckoo	Anomalospiza	imberbis
Finch	Red-headed	Amadina	erythrocephala
Fiscal	Southern	Lanius	collaris
Flamingo	Greater	Phoenicopterus	roseus
Francolin	Orange River	Scleroptila	gutturalis
Goose	Egyptian	Alopochen	aegyptiaca
Goose	Spur-winged	Plectropterus	gambensis
Grebe	Little	Tachybaptus	ruficollis
Guineafowl	Helmeted	Numida	meleagris
Gull	Grey-headed	Chroicocephalus	cirrocephalus
Harrier	Black	Circus	maurus
Heron	Black	Egretta	ardesiaca
Heron	Black-headed	Ardea	melanocephala
Heron	Goliath	Ardea	goliath
Heron	Grey	Ardea	cinerea
Heron	Purple	Ardea	purpurea
Heron	Striated	Butorides	striata
Hoopoe	African	Upupa	africana
Ibis	African Sacred	Threskiornis	aethiopicus
Ibis	Glossy	Plegadis	falcinellus
Ibis	Hadada	Bostrychia	hagedash
Kestrel	Greater	Falco	rupicoloides
Kestrel	Rock	Falco	rupicolus
Kingfisher	Pied	Ceryle	rudis
Kite	Black-winged	Elanus	caeruleus
Korhaan	Blue	Eupodotis	caerulescens
Lapwing	African Wattled	Vanellus	senegallus
Lapwing	Blacksmith	Vanellus	armatus
Lapwing	Crowned	Vanellus	coronatus
Lark	Red-capped	Calandrella	cinerea
Lark	Spike-heeled	Chersomanes	albofasciata
Longclaw	Cape	Macronyx	capensis
Martin	Brown-throated	Riparia	paludicola
Martin	Rock	Ptyonoprogne	fuligula

Moorhen	Common	Gallinula	chloropus
Mousebird	Red-faced	Urocolius	indicus
Mousebird	Speckled	Colius	striatus
Myna	Common	Acridotheres	tristis
Ostrich	Common	Struthio	camelus
Owl	Marsh	Asio	capensis
Pigeon	Speckled	Columba	guinea
Pipit	African	Anthus	cinnamomeus
Plover	Kittlitz's	Charadrius	pecuarius
Plover	Three-banded	Charadrius	tricollaris
Pochard	Southern	Netta	erythrophthalma
Prinia	Black-chested	Prinia	flavicans
Quail	Common	Coturnix	coturnix
Quelea	Red-billed	Quelea	quelea
Robin-Chat	Cape	Cossypha	caffra
Sandpiper	Common	Actitis	hypoleucos
Sandpiper	Wood	Tringa	glareola
Shoveler	Cape	Spatula	smithii
Snipe	African	Gallinago	nigripennis
Sparrow	Cape	Passer	melanurus
Sparrow	House	Passer	domesticus
Sparrow	Southern Grey-headed	Passer	diffusus
Sparrow-Weaver	White-browed	Plocepasser	mahali
Spoonbill	African	Platalea	alba
Spurfowl	Swainson's	Pternistis	swainsonii
Starling	Cape	Lamprotornis	nitens
Starling	Wattled	Creatophora	cinerea
Stilt	Black-winged	Himantopus	himantopus
Stonechat	African	Saxicola	torquatus
Stork	White	Ciconia	ciconia
Swallow	Barn	Hirundo	rustica
Swallow	Greater Striped	Cecropis	cucullata
Swallow	South African Cliff	Petrochelidon	spilodera
Swallow	White-throated	Hirundo	albigularis
Swift	African Palm	Cypsiurus	parvus
Swift	Little	Apus	affinis
Swift	White-rumped	Apus	caffer
Teal	Cape	Anas	capensis
Teal	Red-billed	Anas	erythrorhyncha
Thick-knee	Spotted	Burhinus	capensis
Thrush	Groundscraper	Turdus	litsitsirupa
Thrush	Karoo	Turdus	smithi
Thrush	Sentinel Rock	Monticola	explorator
Wagtail	Cape	Motacilla	capensis
Warbler	Icterine	Hippolais	icterina
Warbler	Lesser Swamp	Acrocephalus	gracilirostris
Warbler	Willow	Phylloscopus	trochilus
Waxbill	Common	Estrilda	astrild
Weaver	Southern Masked	Ploceus	velatus
Wheatear	Capped	Oenanthe	pileata
Wheatear	Mountain	Myrmecocichla	monticola
White-eye	Cape	Zosterops	virens
Whydah	Pin-tailed	Vidua	macroura
Widowbird	Fan-tailed	Euplectes	axillaris
Widowbird	Long-tailed	Euplectes	progne
Widowbird	Red-collared	Euplectes	ardens
Widowbird	White-winged	Euplectes	albonotatus
Wryneck	Red-throated	Jynx	ruficollis

APPENDIX 2 – SPECIALIST CURRICULUM VITAE

Personal Particulars

Profession:	Biodiversity Specialist
Date of Birth:	13 March 1987
Name of Firm:	Nitai Consulting
Name of Staff:	Elzet Human
Nationality:	RSA
Membership of Professional Societies	SACNASP (Pr. Sci. Nat. 147031)

Education:

M-Tech Nature Conservation, (Plant DNA Barcoding and phylogenetics), TUT, South Africa, 2021

B-Tech Nature Conservation, (Resource Management, Vegetation ecology and rehabilitation) TUT, South Africa, 2011

N. Dip Nature Conservation, TUT, South Africa, 2008

Employment Record:

2022 – Present Biodiversity Specialist, Nitai Consulting

Conduct Biodiversity Impact Assessments.

Conduct Plant Ecological Assessments.

Conduct Animal Ecological Assessments

Biodiversity monitoring programs; and,

GIS Mapping

2013 – 2022 Lecturer: Nature Management, Centurion academy

Lectured various subjects for undergraduate students in Nature Management:

Botany and Vegetation Ecology, Zoology, Animal Health, Conservation Development, Ecology, Game Ranch Management, Biostatistics, Research Methodology, Genetics, Soil Science

2009 – 2013 HOD Rangers Department, Zebula Gold Estate and Spa

Ecological Monitoring, Reserve Maintenance, Animal Husbandry, Neonatal care of Endangered carnivore species, Zoological display, and permit compliance

2008 – Conservation Student, Ann van Dyk Cheetah Research Centre

Neonatal Care of Carnivore species,

Veterinary assistance work – vaccine, diets, Endo scoping, pregnancy tests, health monitoring, quarantine care of species, emergency c-sections, bleeding procedures on vultures

Enclosure Maintenance

Tracking wild cheetahs

Rewilding cheetahs

Anatolian Shepard project assistance

Selected Consultancies

Ecological assessment for Victorius Game farm, Visgat, Ellisras, Limpopo

2018, Ecologist, Ecological condition assessment and game carrying capacity for game farm. Habitat evaluation and rehibition program for problem areas

Elephant impact study on Mabula Game Reserve, Bela-Bela, Limpopo,

2019, Ecologist, Ecological impact study on Private Nature reserve to see extent of elephant utilisation and impact. Woody species analysis – structure classification and net primary production. Elephant movement patterns and carrying capacity. Identification of vulnerable habitats and management program.

Faan Meintjies Municipal Nature Reserve, Matlosana, North West

2018-2022, Ecologist, Habitat assessments, game carrying capacities, ecological condition assessments, game counts and game recommendations, ecological rehabilitation programs, white rhino monitoring, anti-poaching programs, Environmental Education programs.

Kroonstad Solar PV Facilities

2022, Biodiversity Specialist. Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the three solar PV facilities as well as perform aquatic biomonitoring of the Vals River.

Kroonstad South Solar PV Facilities

2022, Biodiversity Specialist. Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Assess and map all wetlands associated with the five solar PV facilities as well as perform aquatic biomonitoring of the Blomspruit.

Proposed Nketoana Regional Bulk Water Scheme Project

2023, Biodiversity Specialist. Nketoana Local Municipality is experiencing severe water shortages in its towns Reitz/Petsana/ Petrus Steyn/ Mamafubedu/ Arlington/ Leratswana and Lindley. Solutions to the water shortages are the proposed Nketoana Regional Bulk Water Scheme Pipeline, South Africa, Assess and map all biodiversity, plant and animal features associated within the footprint of the bulk water scheme project.

Rustenburg Solar PV Facilities

2023, Biodiversity Specialist. Development of three Solar PV facilities near Rustenburg, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the three solar PV facilities.

Grootvlei Solar PV Facility

2023, Biodiversity Specialist. Development of three Solar PV facilities near Carletonville, North West Province, South Africa, Assess and map all biodiversity, plant and animal features associated with the one solar PV facility.

Paulputs 400 kV Strengthening (Transmission Line Loop in Loop Out) Project

2023, Biodiversity Specialist. Proposed Paulputs 400kv Strengthening Project (Transmission Line Loop In Loop Out From Aries – Kokerboom Transmission Line), South Africa, Assess and map all biodiversity, plant and animal features within the power line footprint as well as perform biodiversity monitoring.

400kV Transmission and 132kV distribution power lines for the Apollo-Lepini-Mesong Project

2023, Biodiversity Specialist. Proposed development of a 400kV transmission and 132kV power lines for the Apollo-Lepini-Mesong Project, Gauteng Province, South Africa, undertake assessments and map all biodiversity, plant, and animal features along the proposed routes for the 400kV and 132kV power lines.

Languages:

English - excellent speaking, reading, and writing

Afrikaans – excellent speaking, reading and writing

APPENDIX 3: DECLARATION OF INDEPENDENCE

I, **Helena Elizabeth Human**, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

___________________________________	**19/03/2023**
Helena Elizabeth Human (Pr. Sci. Nat. 147031)	**Date**
Terrestrial Biodiversity Specialist	

Appendix M3: Heritage Impact Assessment

COUNCIL FOR GEOSCIENCE

CARBON CAPTURE UTILISATION AND STORAGE (CCUS) PROJECT: 3D SEISMIC SURVEY AND DRILLING, LEANDRA, MPUMALANGA PROVINCE

HERITAGE IMPACT ASSESSMENT

26 APRIL 2023

Submitted to : Nemai Consulting (Pty) Ltd

Prepared by:

Jennifer Kitto

Nitai Consulting (PTY) Ltd

147 Bram Fischer Drive

Ferndale

2194

NITAI CONSULTING

SPECIALIST ENVIRONMENTAL CONSULTING

The heritage impact assessment report has been compiled considering the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

Requirements of Appendix 6 – GN R326 EIAs Regulations (2014, amended 2017)	**Relevant section in report**
1.(1) (a) (i) Details of the specialist who prepared the report	Section 1.1.3 of Report
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.1.3 and of Report and **Appendix 2**
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page iii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
(cA) An indication of the quality and age of base data used for the specialist report	N/A
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 6
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 7
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5.4 and 5.5, Section 6
(g) An identification of any areas to be avoided, including buffers	Section 6
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	**Appendix 1**
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Sections 6, 11
(k) Any mitigation measures for inclusion in the EMPr	Section 8, 11
(l) Any conditions for inclusion in the environmental authorisation	N/A
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	N/A
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 13
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 8, 12
(o) A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process will be handled as part of the SEIA and EMPr process.

Requirements of Appendix 6 – GN R326 EIAs Regulations (2014, amended 2017)	**Relevant section in report**
(p) A summary and copies if any comments that were received during any consultation process	Not applicable. To date no comments have been raised regarding heritage resources that require input from a specialist.
(q) Any other information requested by the competent authority.	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 38(3) of the NHRA

Declaration of Independence

The report has been compiled by Nitai Consulting (Pty) Ltd, an appointed Heritage Specialist for Nemai Consulting for the Proposed CCUS Seismic Survey & Drilling Project, Leandra, Mpumalanga Province. The views contained in this report are purely objective and no other interests are displayed during the Heritage Impact Assessment Process.

I, Jennifer Kitto, declare that –

General declaration:

- *I act as the independent heritage specialist*
- *I will perform the work in an objective manner, even if this results in views and findings that are not favourable to the project;*
- *I declare that there are no circumstances that may compromise my objectivity in performing such work;*
- *I have expertise in conducting heritage impact assessments, including knowledge of the National Heritage Resources Act, No 25 of 1999 (NHRA), associated Regulations and any guidelines that have relevance to the proposed activity;*
- *I will comply with the NHRA, associated Regulations and all other applicable legislation, specifically the National Environmental Management Act, No 107 of 1998 (NEMA);*
- *I will take into account, to the extent possible, the matters listed in section 38 of the NHRA;*
- *I have no, and will not engage in, conflicting interests in the undertaking of the activity;*
- *I undertake to disclose to the project proponent and the competent authority all material information in my possession that reasonably has or may have the potential of influencing -any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;*
- *I will ensure that information containing all relevant facts in respect of the project is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;*
- *I will provide the competent authority with access to all information at my disposal regarding the project, whether such information is favourable to the project or not*
- *All the particulars furnished by me in this form are true and correct;*
- *I will perform all other obligations as expected of a heritage specialist in terms of the NHRA and NEMA, associated Regulations, the constitutions of my affiliated professional bodies; and*
- *I realise that a false declaration is an offence in terms of regulation 71 of the NEMA Regulations and is punishable in terms of section 24F of the NEMA.*

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the NEMA Regulations;

HERITAGE CONSULTANT - Nitai Consulting (Pty) Ltd

PRINCIPAL HERITAGE PRACTITIONER – Jennifer Kitto

CONTACT PERSON - Jennifer Kitto

Tel - +27 (0) 633316606

Email – jenniferK@nitaiconsulting.co.za

SIGNATURE - ______________________________ JKitto

ACKNOWLEDGEMENT OF RECEIPT

CLIENT - Nemai Consulting

CONTACT PERSON - Donavan Henning

Tel - +27 (0) 11 781 1730

Fax - +27 (0) 11 781 1731

Email - donavanH@nemai.co.za

SIGNATURE - ______________________________

Executive Summary

South Africa (SA) has a coal-based energy economy and emits carbon dioxide (CO_2) into the atmosphere at approximately 400 million tonnes per year. In recognising its contribution to climate change, the country has committed itself to undertake steps to minimise such emissions. Carbon Capture Utilisation & Storage (CCUS) has been acknowledged by SA as one of the technologies to mitigate the emissions of CO_2 into the atmosphere and forms one of the Nationally Appropriate Mitigation Actions (NAMA). It is also one of the national flagship projects. CCUS forms part of a just transition to a future low-carbon energy economy.

The Council for Geoscience (CGS) is undertaking a geoscientific research project for the piloting of CCUS in Leandra in Mpumalanga, where it is proposed to inject CO_2 into deep suitable geological formations, approximately 1km below the surface. The Government of SA has received funding from the World Bank's (WB) International Bank for Reconstruction and Development to finance the CCUS Project and intends to apply part of the proceeds for conducting Geological Characterisation comprising, amongst others, of drilling exploration boreholes and undertaking a high-resolution 3D seismic survey at the proposed injection site. This document only focuses on the Geological Characterisation component of the overall CCUS (i.e., the proposed 3D seismic survey and sampling drilling).

<u>Methodology/ Significance Assessment</u>

A literature review / historical desktop study was undertaken which has shown that various archaeological and historical resources could be expected to occur in the project area. The examination of the earliest edition (1965) of the 1:50 000 topographical maps produced by overlying the maps with satellite Imagery (Google Earth) has shown that a large number of heritage features are depicted within the project footprint, many being structures comprising the town of Leslie/Leandra.

The subsequent site survey fieldwork undertaken confirmed the findings of the desktop study as 36 heritage resources were identified as occurring within the greater project area footprint (seismic survey area).

NOTE: subsequent to this HIA report being compiled, the footprint area for the 3D seismic survey was reduced substantially from the footprint that was provided originally and which was assessed at the desktop and field- survey level. Therefore, the number of heritage resources affected by the proposed Geological Characterisation is now less and the impact of the proposed project on the identified heritage resources has been adjusted accordingly.

<u>Identification of Activities, Aspect and Impacts</u>

The project area that will be impacted by the proposed Carbon Capture Underground Storage project – Geological Characterisation component is situated over various portions of two farms: Farm

Goedehoop 308IR (Portions 2, 6, 12, 13, 25, 29, 31, 35, 42 and RE/9), and Farm Grootlaagte 311IR (Portions RE/3 and 25). As noted above, the area earmarked initially for the 3D seismic survey encompassed most of the town of Leandra, as well as rural areas to the east and north-east and the south-west; however, this footprint area has since been reduced substantially. The proposed drilling sampling site is located outside (to the east) of the town, between the R29 road from Leandra to Kinross and the railway line from Secunda to Springs.

Subsequent to the reduction of the footprint area for the 3D seismic survey, only a few of the heritage resources identified initially will now be affected and the impact of the proposed seismic survey and drilling sampling on the heritage resources has been adjusted accordingly.

The impact of the proposed project on protected historical structures has been reduced from medium-high to low as the reduced project footprint now excludes the town of Leandra where most of the identified historical structures or structure remains are located. Therefore, only the two historical stone railway culverts (CCUS 03 and CCUS 33), three structure or homestead remains (CCUS 06 to CCUS 07 and CCUS 30), three possible but not certain structure or homestead remains (CCUS 01, CCUS 04 and CCUS 08) as well as a potential grave (CCUS 02).

As noted above, the impact significance of the project on graves and cemeteries has been reduced from medium to low as the three community cemeteries (one being Muslim) and one farmworker graveyard identified initially now fall outside the reduced project footprint. However, the potential grave (CCUS-02) identified within the drill site footprint could still be affected.

The impact significance of the project on intangible and living heritage resources remains low as the informal church site identified is located within the Lebohang township and well outside the reduced seismic survey footprint area.

The impact significance of the proposed project on archaeological resources is low as no archaeological sites or material were identified.

Mitigation Measures

As noted above, the HIA study for the proposed CCUS seismic survey and drilling project initially identified a large number of heritage resources (36 in total) within or immediately adjacent to the originally provided project footprint. However, subsequent to undertaking the field survey, the footprint area for the 3D seismic survey was reduced substantially. Therefore, the impact on heritage resources is reduced as only nine heritage resources are located within the reduced footprint area.

The recommendations below are provided to mitigate the potential impact of the proposed project on the nine identified heritage resources:

Historical structures and demolished structures

- **The two Historical Railway Culverts (CCUS 03 and CCUS 33)** are protected by section 34 of the NHRA and must be demarcated and avoided as “no-go” areas with a 30m buffer.

- **The demolished structure remains (CCUS 06 to CCUS 07) and possible homestead (CCUS 30)** are protected by section 34 of the NHRA. If any negative impact is anticipated on either of these resources,, a permit will be required for the destruction/clearance of these resources (from MPHRA or SAHRA).
- The three possible but not certain structure or homestead remains (CCUS 01, CCUS 04 and CCUS 08) are not protected or considered to be conservation worthy and therefore no mitigation is required.

Graves and Cemeteries

- **The potential grave at CCUS-02**, that may be located within or on the south-eastern boundary of the proposed drilling site, is protected by section 36 of the NHRA. Therefore, any site clearance activities for the proposed drilling site within 30m of the approximate location, should be monitored by a heritage specialist/archaeologist. If a burial or human remains are uncovered during site clearance or construction activities, a buffer of at least 30m must be placed around the site to ensure that, the burial/human remains are not damaged. In addition, all site clearance or construction activities in the immediate vicinity of the burial/human remains must be suspended. The heritage specialist/archaeologist will then need to apply for a permit for a rescue exhumation of the burial/human remains, in compliance with section 36 of the NHRA.

Living / Intangible Heritage

- As noted above, the **informal community church site (CCUS-11)** would not be affected as it is situated outside the reduced footprint for the seismic survey. *Palaeontological Heritage*

Palaeontological Heritage

- A palaeontological assessment is not expected to be required by SAHRA for the seismic survey component as this is anticipated to impact only the ground surface and not the underlying geology of the project area footprint which is indicated as of Insignificant to Zero fossil sensitivity on the SAHRIS Palaeontological Sensitivity Map.
- However, as the drilling site is intended to sample the underlying geology, and as SAHRA has required such studies for past HIAs for the surrounding area, it is recommended that at least a desktop palaeontological assessment of the drill site footprint must be undertaken and submitted to SAHRA for comment.

<u>Conclusion</u>

Taking all of the above into account, the considered opinion of the heritage specialist is that no fatal flaws with respect to heritage resources have been identified during this HIA study. Therefore, there are no objections from a heritage perspective provided that the recommendations and mitigation measures contained in this report and in the recommended palaeontological assessment are implemented where necessary.

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List of Abbreviations

APHP	Association of Professional Heritage Practitioners
ASAPA	Association of Southern African Professional Archaeologists
BGG	Burial Grounds and Graves
CGS	Council for Geoscience
CRM	Cultural Resources Management
CCUS	Carbon Capture Utilisation & Storage
DALRRD	Department of Agriculture, Land Reform & Rural Development
DFFE	Department of Fisheries Forestry and Environment
EHS	Environmental, Health and Safety
EAP	Environmental Assessment Practitioner
EIA	Early Iron Age
EMPr	Environmental Management Programme
ESA	Early Stone Age
ESIA	Environmental and Social Impact Assessment
GIS	Geographic Information System
ha	Hectare
HIA	Heritage Impact Assessment
IAIAsa	International Association for Impact Assessment South Africa
IBRD	International Bank for Reconstruction and Development
IFC	International Finance Corporation
km	Kilometre (1 000m)
LIA	Late Iron Age
LSA	Later Stone Age
MPHRA	Mpumalanga Provincial Heritage Resources Authority
MSA	Middle Stone Age
NAMA	Nationally Appropriate Mitigation Actions
NEMA	National Environmental Management Act (No. 107 of 1998)
NHA	National Health Act, (No. 61 of 2003)
NHRA	National Heritage Resources Act (No 25 of 1999)
PCSP	Pilot CO_2 Storage Project
PHRA	Provincial Heritage Resources Authority
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

1 INTRODUCTION

South Africa (SA) has a coal-based energy economy and emits carbon dioxide (CO_2) into the atmosphere at approximately 400 million tonnes per year. In recognising its contribution to climate change, the country has committed itself to undertake steps to minimise such emissions. Carbon Capture Utilisation & Storage (CCUS) has been acknowledged by SA as one of the technologies to mitigate the emissions of CO_2 into the atmosphere and forms one of the Nationally Appropriate Mitigation Actions (NAMA). It is also one of the national flagship projects. CCUS forms part of a just transition to a future low-carbon energy economy.

The Council for Geoscience (CGS) is undertaking a geoscientific research project for the piloting of CCUS in Leandra in Mpumalanga, where it is proposed to inject CO_2 into deep suitable geological formations, approximately 1km below the surface. The Government of SA has received funding from the World Bank's (WB) International Bank for Reconstruction and Development to finance the CCUS Project and intends to apply part of the proceeds for conducting Geological Characterisation comprising, amongst others, of drilling exploration boreholes and undertaking high-resolution 3D seismic survey at the proposed injection site. This document forms the Heritage Impact Assessment (HIA) component of the Environmental and Social Impact Assessment for the project (ESIA) and only focuses on the Geological Characterisation component of the overall CCUS.

1.1 Scope & Terms of Reference for the HIA report

1.1.1 Summary of Key Issues & Triggers Identified

In terms of the National Heritage Resources Act, No 25 of 1999 (NHRA), the following proposed activities trigger the need for a Heritage Impact Assessment (HIA):

- Potential occurrence of heritage resources, graves and structures older than 60 years within the Project’s footprint.
- Proposed development that is more than 5000m^2.
- Proposed development where an impact assessment is triggered in terms of National Environmental Management Act, No 107 of 1998 (NEMA).

1.1.2 Approach

- Undertake a Heritage Impact Assessment in accordance with the NHRA.
- Identify and map all heritage resources in the area affected, as defined in Section 2 of the NHRA, including archaeological sites on or near (within 100m of) the proposed developments.
- Assess the significance of such resources in terms of the heritage assessment criteria as set out in the regulations.
- Assess the impacts of the Project on such heritage resources.
- Prepare a heritage sensitivity map (GIS-based), based on the findings of the study.

- Identify heritage resources to be monitored.
- Comply with specific requirements and guidelines of Mpumalanga Provincial Heritage Resources Authority (MPHRA) and SAHRA.
- Comply with specific requirements and guidelines of the World Bank (WB).

1.1.3 Nominated Specialist Details

Organisation:	Nitai Consulting
Name:	Jennifer Kitto
Qualifications:	BA Archaeology and Social Anthropology; BA (Hons) Social Anthropology
No. of years' experience:	24
Affiliation (if applicable):	Association of Southern African Professional Archaeologists (ASAPA) - Technical member No.444 International Association for Impact Assessment (IAIAsa) – Member No. 7151

1.2 Project Description

The northern portion of the Highveld coalfields presents unique geology, which affords the potential storage of CO_2. The proposed site for the piloting of CCUS project is situated near Leandra in the Govan Mbeki Local Municipality, which falls within the Mpumalanga Province of SA. The R29 runs through the central part of the overall project area (see Figure 1 below).

The proposed drilling site is located along the R29 from Leandra to Kinross and is bounded to the south by the railway line from Secunda to Springs. The area earmarked for the 3D seismic survey footprint originally encompassed most of the town of Leandra, as well as rural areas to the east and north-east. However, this footprint was subsequently reduced substantially. Refer to the map contained in **Figure 2** below.

2 LEGISLATION

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by various pieces of legislation, including the National Heritage Resources Act, 25 of 1999 (NHRA) and associated Regulations, National Environmental Management Act, Act 107 of 1998 (NEMA) and associated Regulations (as amended) as well as the National Health Act, Act No. 61 of 2003 (NHA), and associated specific Regulations governing human remains.

However, since the finance for the CCUS project was received from the World Bank's International Bank for Reconstruction and Development (IBRD), the project must also comply with the requirements of World Bank's Policies as well as the International Finance Corporation (IFC) Performance Standards observed by most large international financial institutions.

2.1 South African Legislation

2.1.1 National Heritage Resources Act (Act No 25 of 1999; NHRA)

The NHRA is the legislation that defines cultural heritage resources (section 3), provides protection to specific types of heritage resources (sections 34, 35, 36) and also requires an impact assessment of such resources for specific development activities (section 38(1)). Section 38(8) further allows for cooperation and integration of the management of such impact assessment between the national South African Heritage Resources Agency (SAHRA) or provincial heritage resources authority (SAHRA or a PHRA) and the national Department of Forestry, Fisheries and Environment (DFFE).

In terms of section 38(1)(a) of the NHRA, the specific types of development activity that may require a Heritage Impact Assessment (HIA) include: the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length. As the proposed project area is larger than 5000m^2, this study falls under s38(8) and requires comment from the relevant heritage resources authority. (SAHRA and/or the Mpumalanga Provincial Heritage Authority - MPHRA).

Sections 34-36 of the NHRA further stipulate the protections afforded to specific types of heritage resources, *i.e.*, structures older than 60 years (s34); archaeological, palaeontological, meteorites (s35); graves and burial grounds (s36)), as well as the mitigation process to be followed if these resources need to be disturbed. The operation of the 3D seismic survey component and the undertaking of the drilling activities for the CCUS project may result in impacts to any of these types of heritage resources.

2.1.2 National Environmental Management Act (Act 107 of 1998; NEMA)

NEMA states that Environmental Management Programme (EMPr) should, (23 -2 (b)) "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage". In addition, the NEMA and associated Regulations GNR 982 (Government Gazette 38282, 14 December 2014, amended 2017) state that, "the objective of an environmental impact assessment process is to, … identify the location of the development footprint within the preferred site … focussing on the geographical, physical, biological, social, economic, *cultural and heritage aspects* of the environment" (GNR 982, Appendix 3(2)(c), emphasis added).

The EIA Regulations, 2014 (as amended), published in GNR 982 (Government Gazette 38282, 14 December 2014, amended 2017) promulgated under the NEMA contain specific requirements to be addressed in the different types of impact assessment reports (Regulations 19, 21 and 23) as well as requirements for Specialist Reports (Appendix 6).

2.1.3 The National Health Act (Act No. 61 of 2003; NHA) and associated Regulations (2013)

In the case of graves and/or burial grounds that could be impacted by a proposed development, and which are identified through an impact assessment, specific Regulations relating to the Management of Human Remains (GNR 363 of 2013 in Government Gazette 36473) address the exhumation and reburial of human remains: Regulations 26, 27 and 28.

2.1.4 Mineral and Petroleum Resources Development Act (Act No. 28 of 2002; MPRDA)

This MPRDA defines mining as “any operation or activity for the purposes of winning any mineral on, in or under the earth, water or any residue deposit, whether by underground or open working or otherwise and includes any operation or activity incidental thereto.”

The geological investigations that form part of the proposed CCUS 3D seismic survey and drilling activities do not relate to exploration for mineral and petroleum resources. In this regard, the following definitions contained in the Mineral and Petroleum Resources Development Regulations (Published under GN R527 in Government Gazette 26275 dated 23 April 2004, as amended) are noted:

- “Exploration well” means “a well drilled for the purpose of obtaining specific geological and geophysical information to prove, define and assess the existence and commerciality of petroleum by conducting any type of pressure tests”. From this definition, the borehole proposed for the CCUS drilling is not regarded as an exploration well.
  “Stratigraphic well” means “a well or hole drilled only for the purpose of obtaining information pertaining to specific geological, structural and stratigraphic information that might lead towards the discovery of petroleum with no intent to produce from such a well”. This definition is linked to the borehole proposed for the CCUS drilling.

2.2 <u>International Requirements</u>

The regulatory aspects dealt with above relate solely to the South African laws and regulations and would usually be the only requirements for an Environmental and Social Impact Assessment (ESIA). However, since the finance for the CCUS project was received from the World Bank's IBRD, the project must comply with the requirements of World Bank Policies & Environmental, Health and Safety (EHS) Guidelines as well as the International Finance Corporation (IFC) Performance Standards observed by most large international financial institutions. Summaries of these requirements are set out below.

2.2.1 World Bank Policies & Environmental, Health and Safety Guidelines

In addition to the above IFP requirements, the World Bank’s Safeguard Policies and Environmental, Health and Safety (EHS) Guidelines were put in place to prevent or mitigate adverse impacts of its projects on people and the environment. As the proposed project is considered a Category A project but was onboarded prior to 2018 it is thus subject to the Safeguards Policies (OPs), specifically with regard to cultural heritage OP/BP 4.11 - Physical Cultural Resources. This Operating Policy specifically requires that the physical cultural resources component of the Environmental Assessment includes (a) an investigation and inventory of physical cultural resources likely to be affected by the project; (b) documentation of the significance of such physical cultural resources; and (c) assessment of the nature and extent of potential impacts on these resources. This OP also requires that when the project may have adverse impacts on physical cultural resources, the ESIA includes appropriate measures for avoiding or mitigating these impacts.

2.2.2 The International Finance Corporation

The IFC Performance Standards (PS) are an international benchmark for identifying and managing environmental and social risk and have been adopted by many organizations as a key component of their environmental and social risk management. The IFC's Environmental, Health, and Safety (EHS) Guidelines provide technical guidelines with general and industry-specific examples of good international industry practice to meet the IFC's PS.

In many countries, the scope and intent of the IFC PS are addressed or partially addressed in the country's environmental and social regulatory framework. The IFC PS encompass eight topics of which PS 7 and PS 8 have direct relevance to heritage resources. PS 7 and PS 8 relate to Indigenous Peoples and Cultural Heritage respectively.

Standard (PS) 8 – Paragraph 9 (Consultation) (2012) refers to the need for consultation with affected communities to identify cultural heritage of importance and involve affected communities and the relevant national or local regulatory authorities in the decision-making processes.

Standard (PS) 8 – Paragraph 12 (Removal of Non-Replicable Cultural Heritage) (2012) states that the removal of cultural heritage must only be considered when no other alternative is available.

3 Assumptions and Constraints

This assessment assumes that all the information provided by the client and the Environmental Assessment Practitioner (EAP) regarding the project footprint is correct and current.

The large area of the project footprint provided originally meant that it was not feasible to undertake a pedestrian survey of the whole area and the fieldwork, therefore, comprised a combination of vehicle and pedestrian investigation. The extremely dense and long vegetation in several areas meant that archaeological and heritage visibility was low in those areas. Therefore, there is a possibility that some heritage resources have not been identified, specifically, informal graves or burial sites and demolished building remains.

4 PROJECT DESCRIPTION

4.1 Location

The project site is situated near the town of Leandra in the Mpumalanga Province of South Africa (SA). The R29 runs through the central part of the overall project area. The project site falls in the Gert Sibande District Municipality (GSDM) and is located within Wards 1, 2, 3 and 6 of the Govan Mbeki Local Municipality (GMLM).

The R29 runs through the central part of the overall project area. Leandra town is situated adjacent to the major gold and coal mining areas of Evander and Secunda respectively, about 120 km to the east of Johannesburg (see Figure 1 below).

The proposed drilling site is located along the R29 from Leandra to Kinross and is bounded to the south by a railway line from Secunda to Springs. The area earmarked for the 3D seismic survey originally encompassed most of the town of Lebohang, as well as rural areas to the east and north-east. However, this footprint has since been reduced substantially and is now located outside the town of Leandra. A gravel access road leading to the drilling site would be available for use by the contractor. Refer to the map contained in **Figure 2** below.

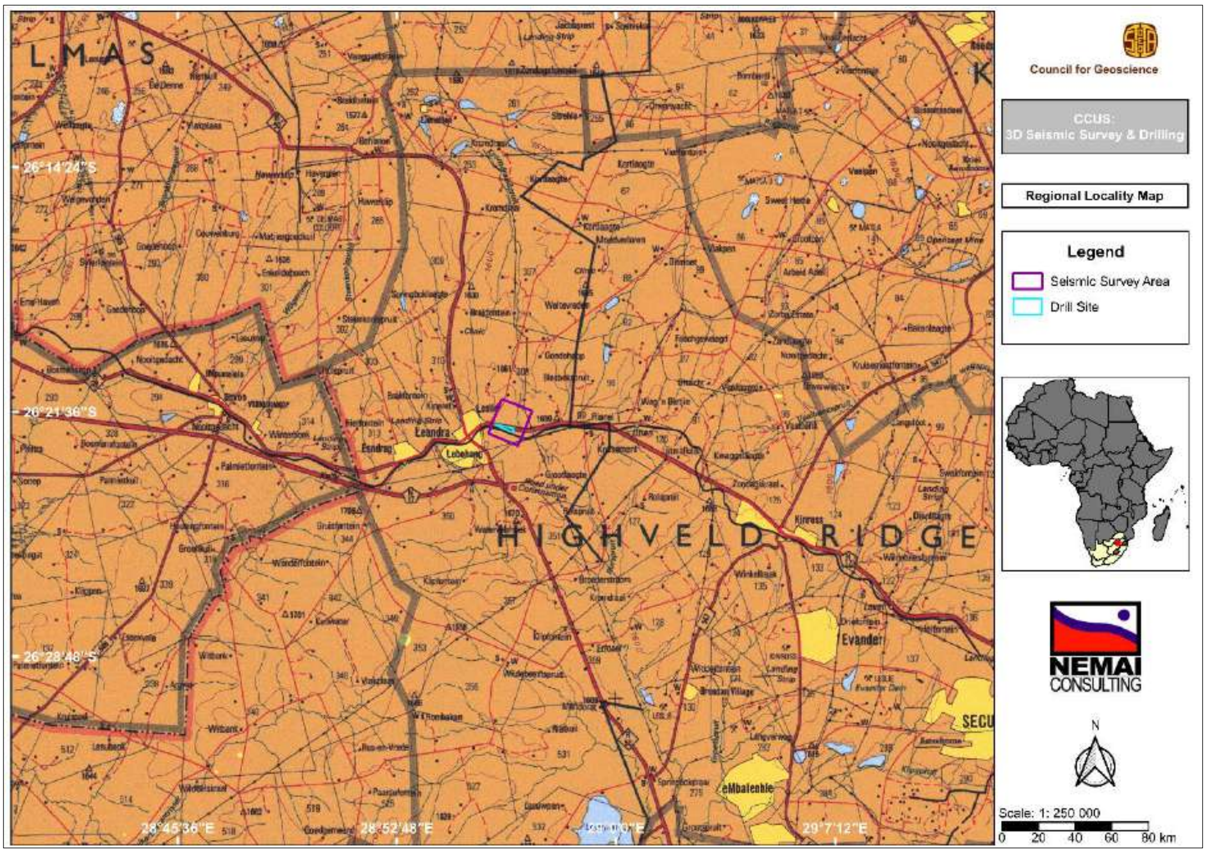

Figure 1: Regional Locality (purple polygon)

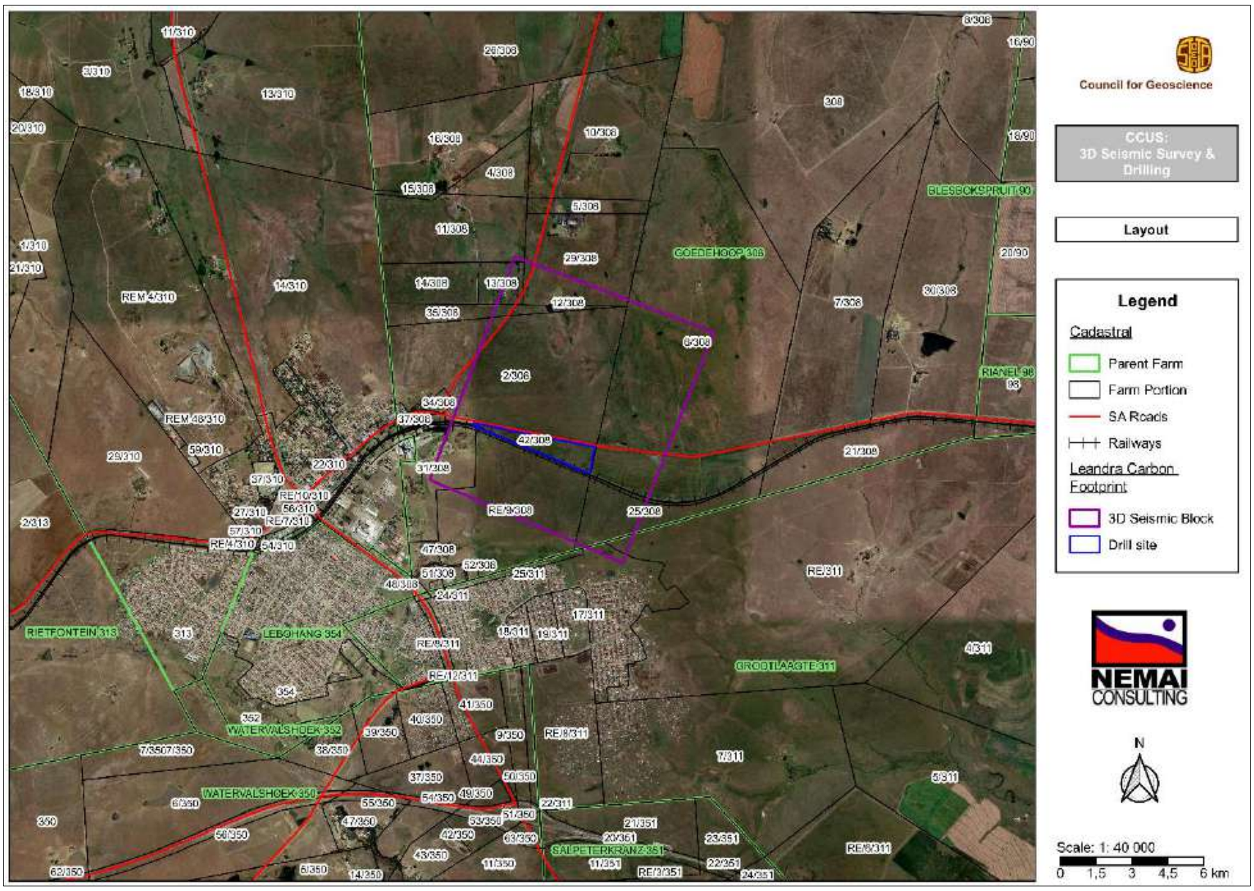

Figure 2: Layout of Proposed Seismic Survey Area and Drill Site

4.2 Project Technical Details

4.2.1 Carbon Capture Utilisation & Storage (CCUS)

CCUS reduces the release of anthropogenic CO_2 emissions into the atmosphere by capturing CO_2 at the source (e.g., point-source emitters such as coal-fired plants) and transporting and storing the captured CO_2 in suitable deep geological formations. Some of the captured CO_2 may then be used in additional downstream industries.

Basaltic rocks, which are rocks rich in iron, calcium, magnesium, and aluminium silicate minerals, are regarded as very promising CO_2 storage reservoirs. This is largely because basaltic rocks are globally voluminous, have unique trapping mechanisms linked to their multi-phase geodynamic emplacement; and have a chemical composition that is highly susceptible for mineral carbonation on a large scale and which is several orders of magnitude faster than in classical siliciclastic reservoirs (Nemai 2023).

An assessment of available geological data undertaken by the CGS identified the availability of deep coal seams and potential CO_2 storage reservoirs that can support CCUS development in the Mpumalanga Province (Nemai 2023).

The purpose of the Project is to demonstrate the application of CCUS technology to SA conditions. The overall Project comprises the following two components:

- *Component 1:* Pilot CO_2 Storage Project (PCSP) for the investigation and characterization of a suitable CO_2 storage site and the subsequent injection, storage and monitoring of between 10,000 and 50,000 tonnes of CO_2 into deep suitable geological formations.
- *Component 2:* A CO_2 Capture Pilot Project (CCPP) Front-End Engineering Design (FEED) for the preparation of a FEED study for a capture pilot plant at the Eskom Kusile Power Station.

Note that the scope of this HIA is the Geological Characterisation under of the PCSP (part of component 1 above) comprising, amongst others, of drilling a stratigraphic borehole and undertaking high-resolution 3D seismic survey at the proposed injection site.

4.2.2 Proposed Drilling Activities

4.2.2.1 Overview

The drilling and associated borehole construction of a 2,000m deep narrow hole is proposed for geological characterisation and to support the pilot CO_2 injection and monitoring project. The proposed drill site is located along the R29 from Leandra to Kinross and is bounded to the south by the railway line from Secunda to Springs.

The dimensions of the proposed drill area will be approximately 50m x 30m. A well pad will be constructed at the location to accommodate a drilling rig, associated equipment and support services. The drilling rig and support services are transported to site, typically in modules and assembled. A typical drill site is shown in **Figure 3** below. A schematic of the proposed drill site is provided in **Figure 4** below.

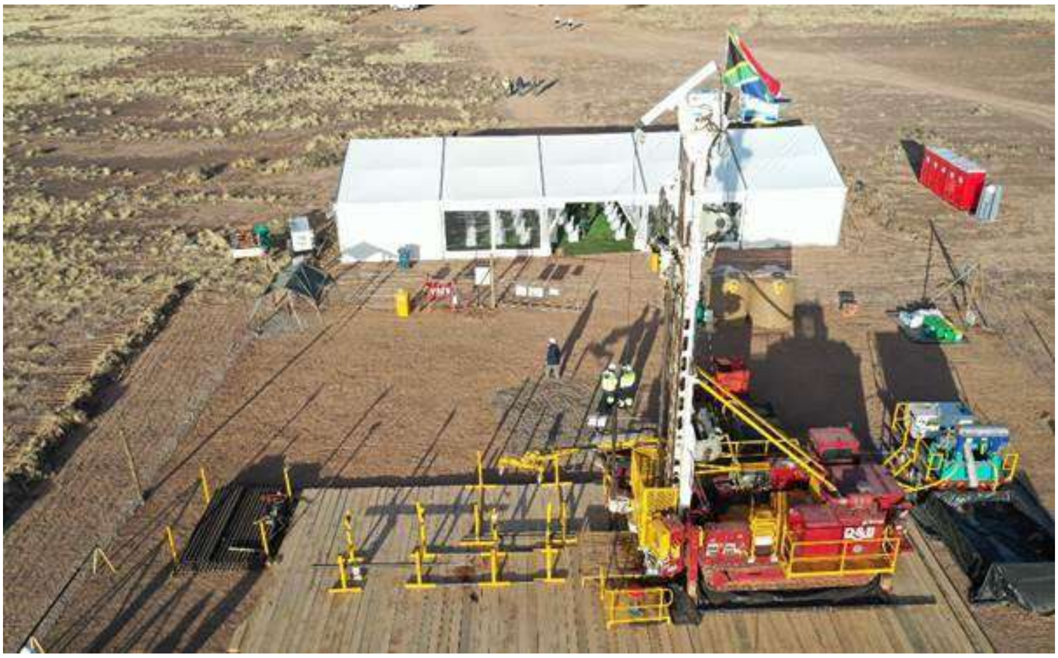

Figure 3: Photograph of a typical drill site (Nemai, 2023)

Figure 4: Schematic of proposed drill site (Nemai, 2023)

The boreholes will be cored from the top of the bedrock to total depth with a minimum hole diameter of c. 95mm. At various intervals during the drilling, suites of geophysical instruments will be installed in the borehole to obtain geophysical information. In addition, tests to determine the presence and quantity of gasses, e.g., hydrocarbons/light gasses, and tests to determine hydrological information will be conducted at systematic horizons, e.g., where water strikes are intersected, in the borehole. The drilling of these slim holes will be to acquire core and wireline logs to assist in undertaking high-resolution geological characterisation.

4.2.2.2 Plant, Equipment and Goods

Plant, equipment and goods associated with the CCUS drilling shall include (amongst others):

- Drill rigs including masts or derricks;
- Drilling fluid mixing, pumping and recycling equipment;
- Grouting pumps, mixers and all other equipment necessary for grout casing of the borehole, when necessary;
- Lighting plants and other equipment necessary to allow safe and efficient 24-hour operation;
- Adequate power supply unit for the drilling operation and the staff camp;
- Water supply for drilling and potable water for project workers;
- Shared facilities between drilling activities and seismic survey –
    - Site office, accommodation for security personnel, stores, workshops and kitchen facilities at the site, which will be fenced off;

- Office for CGS representatives;
- Adequate vehicles to allow completion of the work, including suitable transport to safely transport contractor personnel to and from the drill site;
- Adequate, approved temporary ablution and latrine facilities;
- A reliable communication system; and
- All spare parts and back-up plant and equipment to ensure safe and efficient completion of the work.

4.2.2.3 Borehole Completion

On completion, the borehole will be securely capped with a concrete sanitation block and a lockable metal cap with a clear sign to avoid potential hazards to people and animals. The drill site will also be suitably rehabilitated. New facilities will be created for the injection phase.

4.2.3 3D Seismic Survey

4.2.3.1 Overview

The area earmarked for the 3D seismic survey originally encompassed most of the town of Leandra, as well as rural areas to the east and north-east. However, this has been reduced subsequently and the total area of the survey now is approximately 360 hectares in extent with the perimeter close to 7.60km.

A seismic survey is a method of investigating subterranean structure. The technique is based on determining the time interval that elapses between the initiation of a seismic wave at a selected shot point (i.e., location where the seismic wave is generated) and the arrival of reflected or refracted impulses at one or more seismic detectors (https://www.britannica.com/science/seismic-survey).

The purpose of the high-resolution 3D survey for the CCUS Project is to map the structures, reservoir and seal rocks in detail over the identified potential injection site. The 3D survey will also establish the baseline for future time-lapse CO2 monitoring activities. 3D seismic surveys must be conducted over a large area in order to provide sufficient data for accurate interpretation of the subsurface geology.

For the Project, the seismic waves will be induced by vibrating truck-mounted heavy plates on the ground. These specialised trucks are known as “Vibroseis” (see example in **Figure 5** below). By analysing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped. 3D surveys are acquired by laying out energy source points (vibroseis) and receiver points (geophones) in a grid over the area to be surveyed (see **Figure 6** below).

Figure 5: Example of a Vibroseis truck (Nemai, 2023)

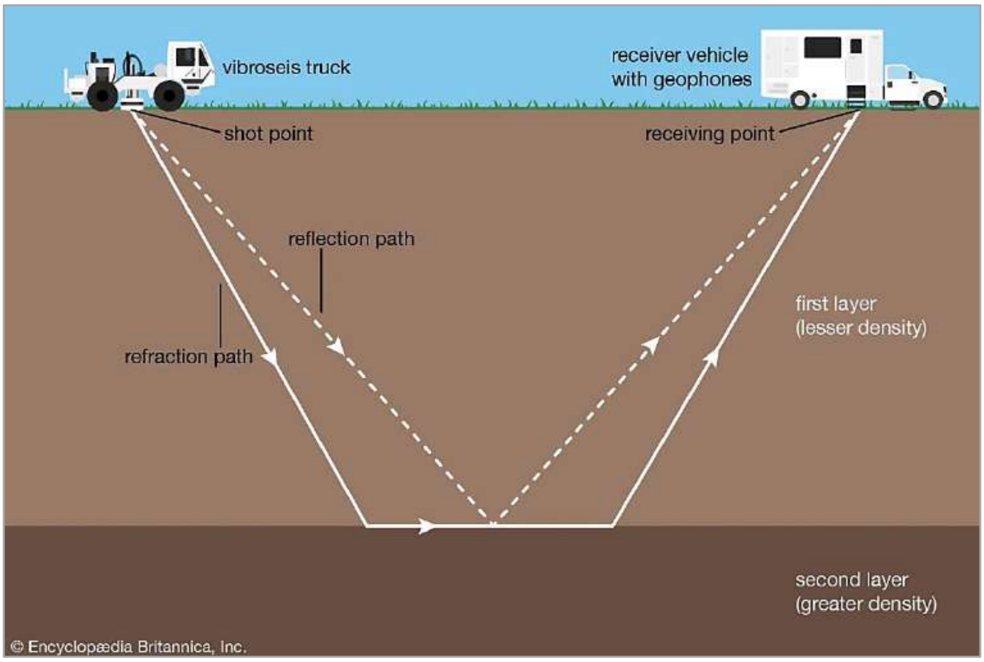

Figure 6: Simplified diagram of seismic data acquisition (https://www.britannica.com/science/seismic-survey#/media/1/532921/61754)

The 3D seismic data for the Project will be processed using pre-stack time/depth migration and post-stack time migration approaches for comparison purposes. The information from the existing legacy and borehole data will be utilised to provide constraints on the designs of the seismic surveys and processing of the seismic data.

The wireless geophones will be deployed on foot by the survey crew and from support vehicles at pre-determined locations, based on the final grid design. At the end of each day the geophones will be recovered and returned to the camp site to allow the collected data to be downloaded and the batteries to be recharged. The source and receiver lines will be deployed perpendicular to each other according to predefined survey parameters, as shown in **Figure 7** below. Geophones will be placed at regular intervals along the receiver line. The source line consists of shot points marked at regular intervals along which the vibroseis trucks will travel.

The 3D seismic survey over the identified injection area will be undertaken at 20 m receiver and source line spacing and 5 m receiver and source spacing. The survey needs to provide high resolution from shallower depth of 100m to a maximum depth of 2km.

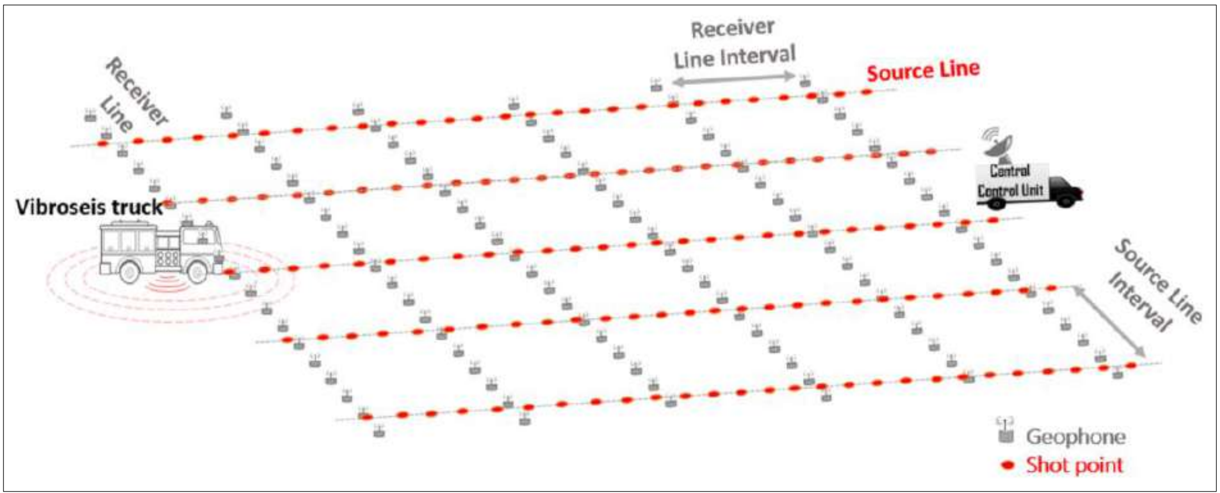

Figure 7: Wireless geophone network orthogonal geometry (Nemai 2023)

The proposed CCUS seismic survey will comprise the following key activities:

- Determine seismic line coordinates and conduct survey to develop 3D seismic survey grid;
- Prepare vehicle access routes;
- Lay receiver nodes along access routes;
- Undertake seismic acquisition (generation of an acoustic signal) using two vibroseis trucks; and
- Demobilise, rehabilitate and close vehicular access to seismic lines, and undertake monitoring as required of rehabilitation works.

4.2.3.2 Survey Parameters

Additional parameters for the CCUS 3D seismic survey are provided in Table 1 below.

Table 1: Seismic survey parameters for the 3D survey (subject to wave testing of applicable parameters)

Survey area	360 hectares
Receiver line separation	20m
Source line separation	20m
Minimum depth of investigation	100m
Maximum depth of investigation	2km (below ground surface)
Receiver spacing	5m
Source	Vibroseis (x 2) (28-ton vehicles)
Source spacing	5m
Geophone type	Wireless

Survey area	360 hectares
Sampling rate	0.5 ms (depending on field tests)
Sweep	16-24 s, + 4s listen (final decision will depend on soil response and site tests)
Sweep Frequency	Up to 200 Hz

4.2.3.3 Survey Design

The survey design will be developed by the Contractor appointed to undertake this work. This will include determining the seismic line transects. In addition, the Contractor will need to provide the following information:

- Project plan;
- Logistical plan;
- List of equipment that will be used to carry out the survey;
- Estimated time required to mobilise to the site from the time the contract has been awarded;
- Estimated time for survey set up (i.e., geophone set up);
- Estimated length time of data acquisition; and
- Project Safety, Health and Environment Plan.

4.2.3.4 Plant, Equipment and Goods

Equipment and goods required for the survey shall include (amongst others):

- Two vibroseis trucks;
- Geophones;
- Other equipment necessary to allow safe and efficient 24-hour operation; and
- Shared facilities between drilling activities and seismic survey (see Section 4.2.2.2 above).

4.2.3.5 Temporary Facilities

A site camp (approximately 50m x 50m) and parking area (approximately 60m x 10m) (see Figure 4 above) will be established in the fenced area of the drill site. The following temporary facilities will be required at the site camp to support the 3D seismic survey and drilling activities:

- Site offices;
- Materials storage area (including oils and chemicals);
- Workshop;
- Basic services, including water, sanitation, electricity, and health care;
- Waste management facilities (non-hazardous and hazardous waste storage areas);
- Kitchen facilities; and
- Security.

The site camp will comply with industry best practices and will adhere to municipal bylaws. All environmental and social impacts associated with the temporary facilities will be managed through control measures contained in the Environmental and Social Management Plan (ESMP).

The vibroseis trucks and support vehicles will depart from and return daily to the site camp.

At this stage, it is assumed that onsite accommodation will not be provided to the project workers, apart from site security personnel.

Following the completion of the 3D seismic survey and drilling activities, the temporary facilities will be dismantled and removed. The waste generated from the dismantling of these facilities will be reuses, recycled, or disposed of as general or hazardous waste at licenced disposal facilities. Certain temporary facilities may be retained for use during the injection phase of the overall project.

5 STATUS QUO ANALYSIS

5.1 General Existing Condition of Receiving Environment

The dominant land uses in the general region include mining and agriculture, with scattered towns.

The general project area terrain is situated over various portions of two farms: Farm Goedehoop 308IR (Portions 2, 6, 12, 13, 25, 29, 31, 35, 42 and RE/9), and Farm Grootlaagte 311IR (Portions RE/3 and 25).

It should be noted that although the original footprint for the 3D seismic survey included the whole town of Leandra and the township of Lebohang (which together contain a large number of historical residential and other buildings) this footprint has been reduced. The reduced footprint is planned over mainly semi-rural areas located just outside Leandra town to the north-east that are vacant or used for agricultural purposes. The areas surrounding the town are characterised by terrain that varies from relatively flat to undulating.

The proposed drill site is currently vacant land, except for the railway that bounds it to the south. The drill site will be fenced for safety and security purposes.

Although the town of Leandra is now not included in the reduced seismic survey footprint, some photographs of the historical structures situated in the town have been included below as a matter of interest.

Figure 8: View of the drill site footprint area, showing the long dense grass, and the recently graded road

Figure 9: General View of the Southern section of the seismic survey area, looking south from the drill site

Figure 10: View over the southern seismic survey area looking west to the town of Leandra from the drill site

Figure 11; View of the south-east section of the seismic survey area, looking east

Figure 12: View of the Northern section of the seismic survey area, looking southwest to Leandra town

Figure 13: View of two historical houses on the north side of the Leandra Main road/R29 (Google earth Streetview)

Figure 14: View of historical police station building on north side of Leandra Main Road/R29 (R29 (Google earth Streetview)

Figure 15: View of historical police station building on north side of Leandra Main Road/R29 (R29 (Google earth Streetview)

5.2 Cultural-Heritage Receiving Environment

5.2.1 DFFE Screening Tool

The DFFE National Web Based Environmental Screening Tool was accessed for information on the cultural-heritage sensitivity of the general region. The following is noted in terms of the sensitivity of the project area:

- The archaeological and cultural heritage combined sensitivity is low (for both the original and reduced seismic survey footprints - **Figure 16** and **Figure 17**); and
- The palaeontology combined sensitivity for the project area is mainly medium, apart from a small area in the north of the original seismic survey footprint (**Figure 18**) where features with a Very High paleontological sensitivity may occur. However, this northern area is excluded from the reduced footprint of the seismic survey area (see **Figure 19**).

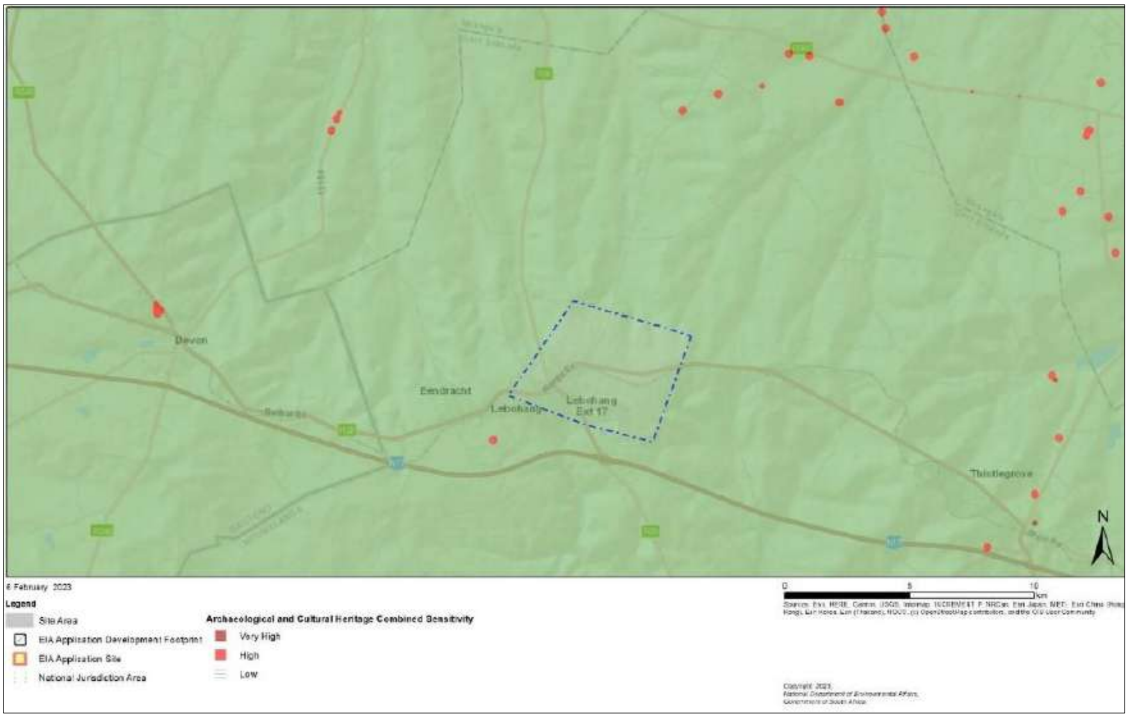

Figure 16: Map of relative Archaeological and Cultural heritage sensitivity for the original seismic survey footprint (DFFE Screening Tool, 2023)

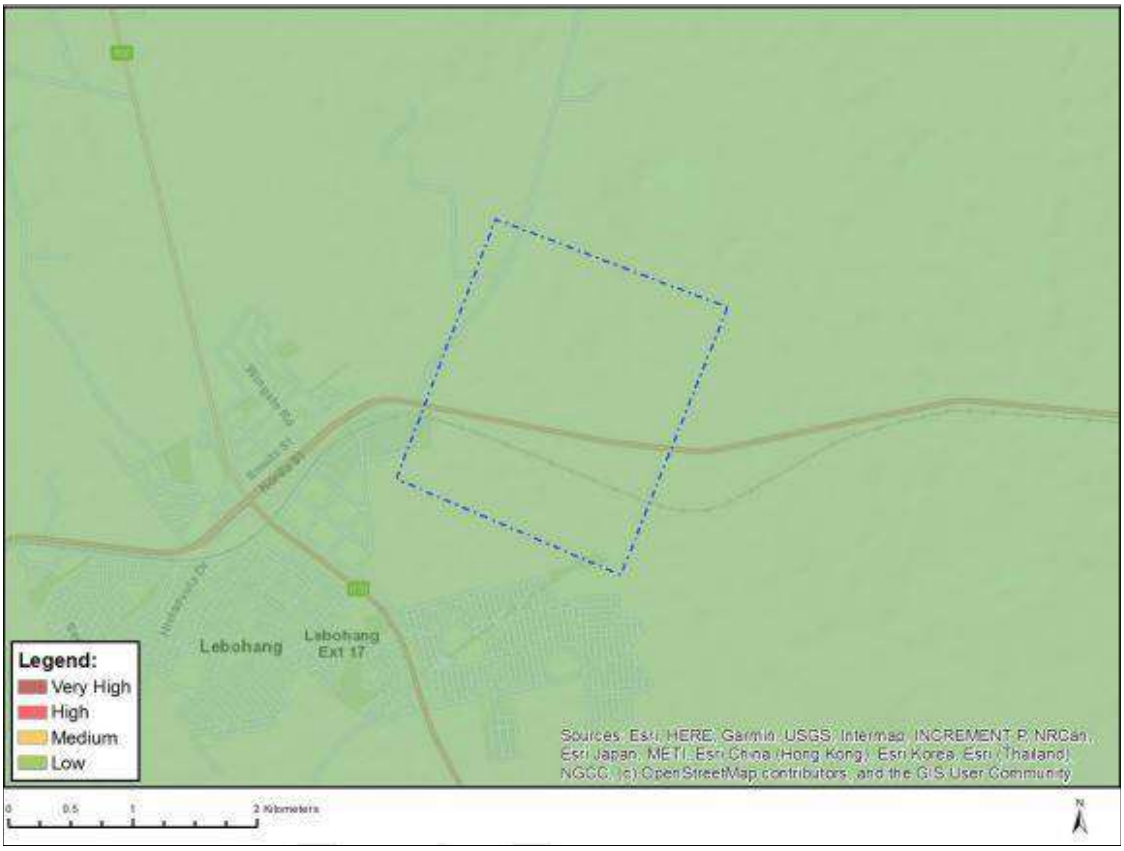

Figure 17: Map of relative Archaeological and Cultural heritage sensitivity for the reduced seismic survey footprint (DFFE Screening Tool, 2023)

Figure 18: Map of relative palaeontology theme sensitivity for the original seismic survey footprint (DFFE Screening Tool, 2023)

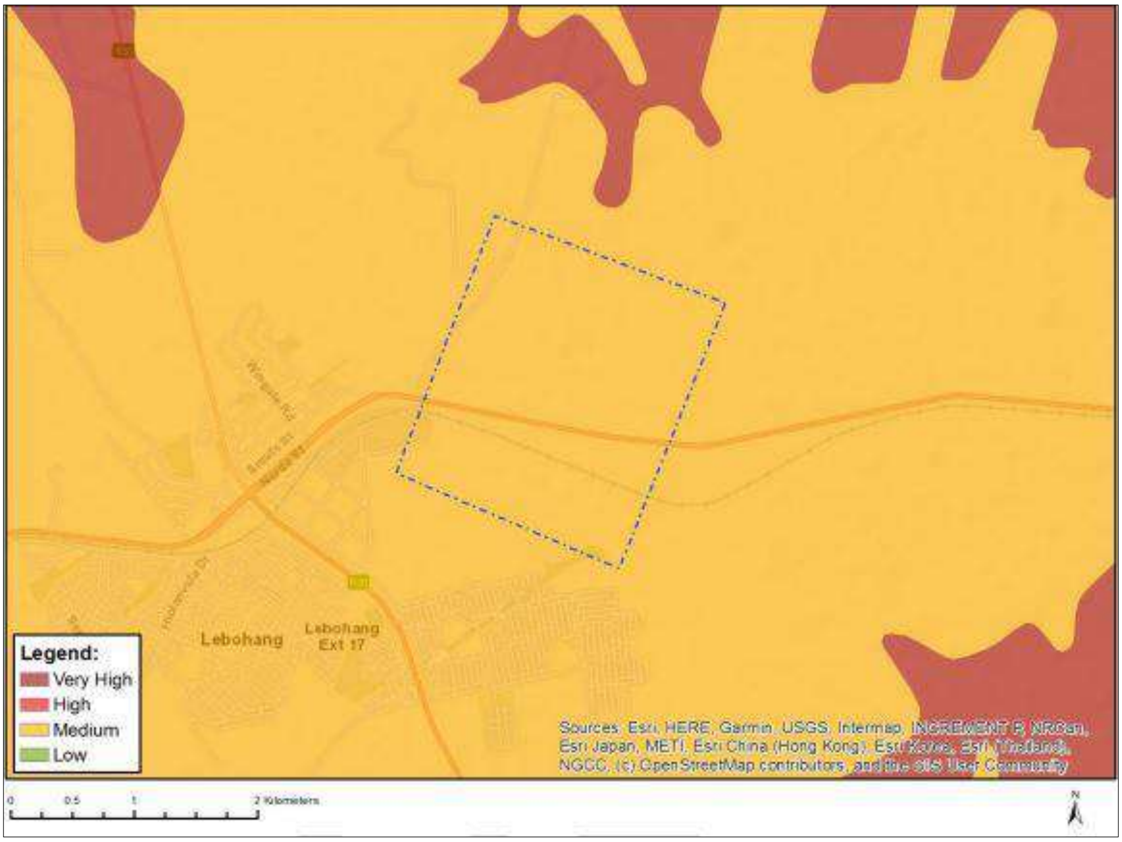

Figure 19: Map of relative Archaeological and Cultural heritage sensitivity for the reduced seismic survey footprint (DFFE Screening Tool, 2023)

5.2.2 Historical Background of Surrounding Region (archaeological and historical literature survey)

The archaeological history of the area can broadly be divided into a Stone Age, Iron Age and Historic or Colonial Period. An archaeological and historical overview of the general region is presented below.

The Stone Age

In South Africa the oldest archaeological period is referred to by archaeologist as the Earlier Stone Age (ESA). The ESA dates from about 2 million to 250 000 years ago. The ESA comprises two technological phases. The earliest of these is known as Oldowan, after Olduvai Gorge in Tanzania where the stone tools were first recognised in the 1960s (Esterhuysen and Smith, 2007). This phase is associated with simple flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian (named after a site in France where they were first discovered in the 1800s), which comprises more specialised stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates to approximately 1.5 million years ago.

The Middle Stone Age (MSA) is associated with a definite change in the technique used to produce stone tools from *circa* 250 000 years ago. The new technique produced flakes, points and blades from a prepared core. The attaching of stone tools onto bone or wood shafts to produce spears, knives or axes is also associated with the MSA (Esterhuysen and Smith, 2007). This phase is also associated with modern humans and complex cognition (Wadley, 2013). Although not much research has been undertaken on the MSA in Mpumalanga, the Bushman Rock Shelter (BRS) on the farm Klipfonteinhoek in the Ohrigstad District is a well-known site with occupation layers dated to between c.40 000 years ago to c.27 000BP (Esterhuysen and Smith, 2007). No Early Stone Age sites are known in the direct vicinity of the study area.

The Later Stone Age (LSA) is the third archaeological phase, which occurred from about 20 000 years ago, and is marked by further technological changes and social transformations. The technological changes include the production of very small stone tools called microliths; the bow and the link-shaft arrow; stones with holes bored through the middle which were used as digging-stick weights; polished and decorated bone tools; ostrich eggshell beads and the production of rock paintings and engravings. Evidence of ritual practices and complex societies is also significant (Deacon & Deacon 1999). This period is associated with both hunter-gatherers (San) and early pastoralists (Khoekhoe). It continued until the arrival of Iron Age farming groups and European settlers (including a period of interaction). Two LSA sites are known on the farm Honingklip near Badplaas in the Carolina District. They are located on opposite sides of a bend in the Nhlazatshe River, in the foothills of the Drakensberg (Esterhuysen and Smith, 2007; Delius (ed) 2006). No Middle Stone Age sites are known in the direct vicinity of the study area.

Rock Art

Several rock painting sites are known from the greater region: including Carolina (10), Ermelo (8), Middleburg (1) and Witbank (4). No engraving sites are known (Smith and Zubieta, 2007). A recent research study by Maseko (2020) has identified 31 rock painting sites in the area around the towns of Hendrina, Breyten, Lake Chrissie and Carolina.

The Iron Age

The Early Iron Age (EIA) in South Africa begins from c.AD 500 until c.AD1100. This period is associated with the migration of Bantu-speaking farming communities into the Mpumalanga region and the continued movement of such communities between the Lowveld and Highveld of Mpumalanga until the 12th century (Esterhuysen and Smith, 2007). These people practised a mixed farming economy and had the technology to work metals like iron and copper.

The Late Iron Age in South Africa (AD 1600 – AD 1840) is associated with pre-colonial farming communities (both agricultural and pastoralist), who lived in distinctive and often extensive stone-walled settlements (to which Huffman has given the label, 'Central Cattle Pattern') (Delius 2006; Huffman, 2007). The general area between Carolina and Lydenburg contains a large number of LIA settlements which indicates a substantial increase in population or movement of people into the area from the 15th century (Esterhuysen and Smith 2007).

Two main groups or periods (distinguished by ceramic styles) have been identified by Huffman (2007) as occurring in the general region: Uitkomst and Buispoort. The Uitkomst subgroup (facies) of the Blackburn Branch of the Urewe Ceramic Tradition represents the first Iron Age period to be identified in this general area. The decoration The decoration on the ceramics seems to be combine characteristics associated with both Nguni-speaking and Sotho-speaking groups. This subgroup is thought to date between AD 1650 and AD 1820. The Buispoort facies of the Moloko branch of the Urewe Ceramic Tradition is the next phase that has been identified in this area. It is thought to date between AD 1700 and AD 1840. (Huffman, 2007). However, no sites associated with either ceramic style is known from the study area.

Historical/ Colonial period

Esterhuysen (2008) and Skhosana (2010) both note that according to the earliest researchers (Van Warmelo and Jackson) the Transvaal Ndebele were understood as descended from an Nguni group that originated in what is now KwaZulu-Natal where they formed part of the Hlubi people. The group that became known as the Transvaal Ndebele was formed from the descendants of the same ancestral chief, commonly known as Musi or Msi. Some branches of the main group moved away sometime during the period 1650 to 1700 and subsequently settled in the area north of present-day Pretoria, in the vicinity of Bon Accord. Skhosana (2010) states that a subsequent succession struggle between Musi's five or six sons around the turn of the 19th century resulted in the original group splitting into two main groups, known as the Northern Ndebele and the Southern Ndebele, respectively, which then fragmented further. Nzunza and his brother Mthombeni, together with their followers, moved eastwards before settling in an area in the vicinity of the present-day town of Belfast, in the then Transvaal. Mthombeni and his followers subsequently moved northwards towards Zebediela where they eventually settled. Another son, Manala and his group occupied the land northeast of Pretoria which is now known as Wallmansthal.

During the 18th and 19th century the existing groups in the general region were disrupted by the expansion of the Zulu Kingdom and subsequent displacement of the population, which became known as the Difaqane/Mfecane (Makhura, 2007). In the north-eastern area, the Pedi under King Thulane, became dominant, until they were defeated by the Ndebele group of Mzilikazi. This resulted in the existing Sotho tribes moving out of the area (Kitto, 2015).

Historical/Colonial Period

The vacuum resulting from the Difaqane/Mfecane was subsequently filled by Swazi groups under the reign of King, Sobhuza, who established various small chiefdoms in the Mpumalanga area (Bonner, 1983; Makhura, 2007).

The earliest traveller who came to the area was Robert Scoon in 1836; while the earliest Voortrekker party to cross over the Vaal River was the one under the leadership of Louis Trichardt and Johannes Jacobus Janse van Rensburg. Between 1841-1850, there was an increasing presence of Voortrekkers in the general vicinity of the study area (Bergh, 1999). This resulted in Mswati II of the Swazi/Swati people ceding the southern Transvaal to the colonial system (Bonner 1983).

In 1845, both the district and town of Lydenburg were established (Bergh, 1999). The district of Lydenburg was extremely large and it seems that the study area fell just within this district.

The South African War (1899 – 1902) was fought between the Boer Republics of the Transvaal and Free State on the one side and Great Britain on the other, but the victims and participants of the war were not limited to British or Boer citizens alone. No events or activities during the war can be associated with the Leandra area. However, at least one battle from the surrounding landscape is known. This was an engagement between a British force under the command Lieutenant-General J.D.P. French and a Boer commando of some 1 000 men on 23 July 1900. The main component of this engagement occurred a short distance to the east and south-east of the present-day town of Delmas, which is located some 35km northwest of Leandra (Changuion, 2001). The local Boer families in the area, as well as the African population, were also affected by the policy of the British which resulted in their removal from their farms to one of the two concentration camps establishment at Middelburg and Standerton (https://www2.lib.uct.ac.za/mss/bccd/).

The present-day town of Leandra/Lebohang was formed from the almalgamation of the former villages of Eendrag and Leslie. The name is a combination of Leslie and Eendrag (Raper 2014; Erasmus 2014). The village of Leslie was originally laid out on the farm Brakkefontein and proclaimed in December 1939. A later extension was proclaimed in December 1957. Raper states that the name is thought to be taken from a town called Leslie in Scotland, UK. The small village of Eendrag, was formerly called by the Dutch/Afrikaans name Eendracht, which means 'unity' and apparently relates to the motto, "Eendrag maak mag" or "Unity is strength"(Raper 2014).

Recent/ Modern History

The Manala and Nzunza Ndebele groups, lived separately until the late 1970s, when the so-called "bantustan" of KwaNdebele was created under the "homeland system" of the apartheid government This caused extreme disruption to the local African communities in the area (Skhosana 2010; SA History online).

During the 1980s, Leandra became a symbol of defiance against the forced removals policies of the previous *apartheid* administration. Since the 1970s, there had been many attempts to forcibly move the residents of

Leandra to the so-called "independent homeland" of KwaNdebele. Although the attempt in the early 1980s was to move a portion of its residents, the majority of the people of Leandra stood up to halt these forced removals. Under the leadership of the Leandra Action Committee (LAC), the community demanded that the entire population be allowed to remain. On 7 June 1984, the Leandra Community and LAC received a letter through their lawyers from the Ministry of Co-operation and Development which stated that the 116 families who had been threatened with removal would be reprieved and would not be expected to move to KwaNdebele. (TRAC 1985).

5.2.3 Cartographic findings

An assessment of available historical topographical maps was undertaken to establish a historic layering for the study area. Overlays of the maps were made on Google Earth. These historic maps are valuable resources in identifying possible heritage sites and features located within the study area. It should be noted that the earliest edition of the map sheets for this area dates to the 1960s (see **Figure 20** below). As the first edition of this sheet dates to 1965, it was not considered necessary to examine the later edition map sheets. Any heritage resources that are 60 years or older would be depicted on the 1965 edition sheet. The topographical maps were obtained from the Department of Agriculture Land Reform and Rural Development (DALRRD) in Cape Town.

The following 1:50 000 map sheet was assessed for the CCUS footprint: 2628BD Leslie Edition 1 1965. The map was surveyed in 1965 and drawn in 1966 by the Trigonometrical Survey Office of the Republic of South Africa from aerial photographs taken in 1948.

As can be seen in **Figure 20**, the 2628BD Ed 1 1965 map sheet depicts a large number of heritage features within the original larger CCUS seismic survey footprint (pink polygon). Most of these features are buildings or structures, including two prisons and a mill. Several homestead clusters or single homesteads are depicted in the area to the east of the town, as well as two grave sites (red circles). One of these grave sites is depicted within the drill site (orange polygon).

However, **Figure 21** shows that fewer heritage features (red circles) are depicted within the reduced seismic survey footprint. Most of these features are single homesteads (huts). But it should be noted that the grave depicted at the eastern boundary of the original drill site footprint on the previous figure is still depicted as located within the updated drill site (pink polygon).

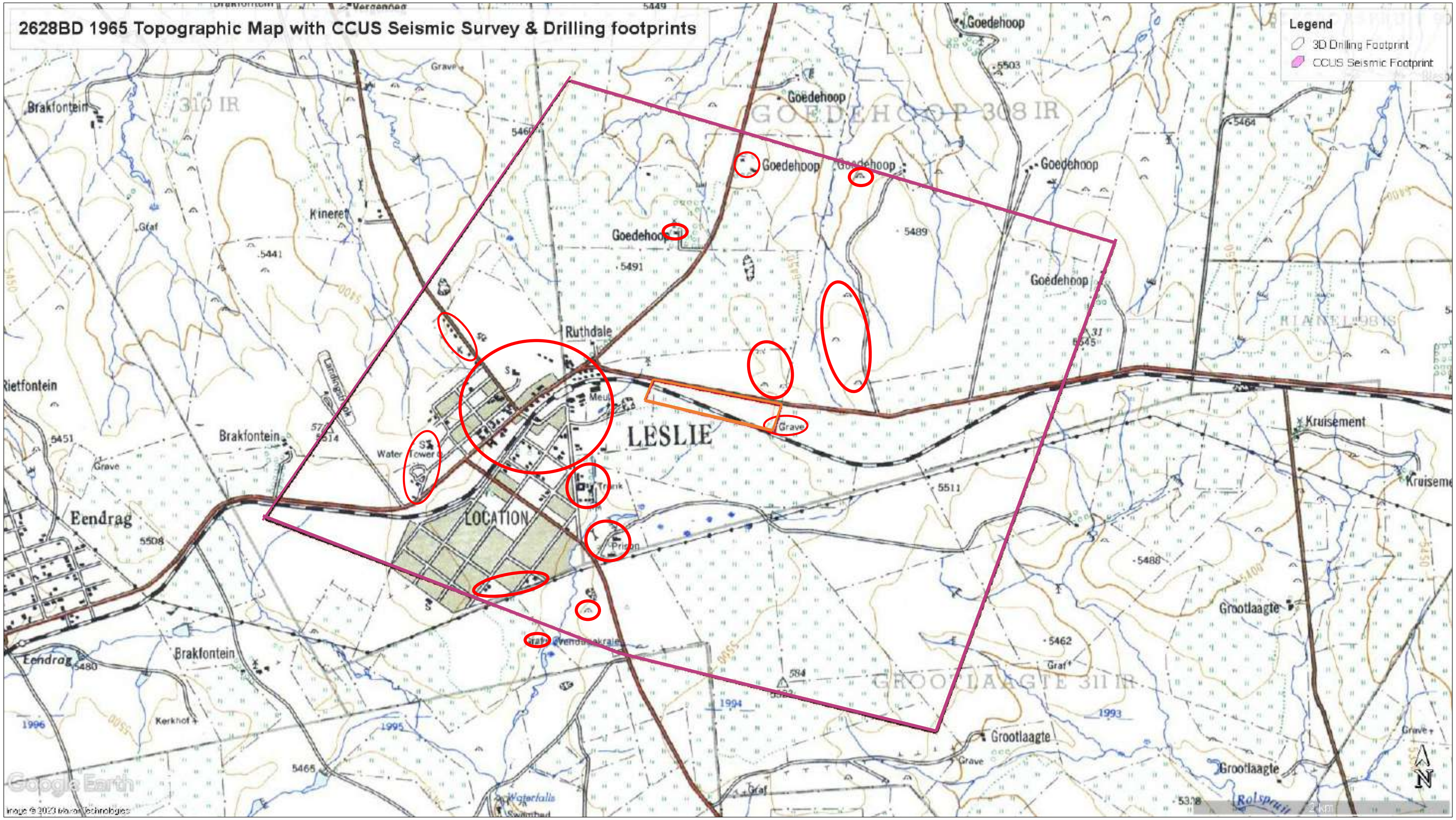

Figure 20: Enlarged view of topographic map 2628BD Ed 1 1965, depicting a large number of heritage features within the original CCUS seismic survey footprint (pink polygon). Most of these features are buildings or structures, including two prisons and a mill. Several homestead clusters or single homesteads are depicted in the area to the east of the town as well as two grave sites (red circles). One of these grave sites is depicted within the drill site (orange polygon)

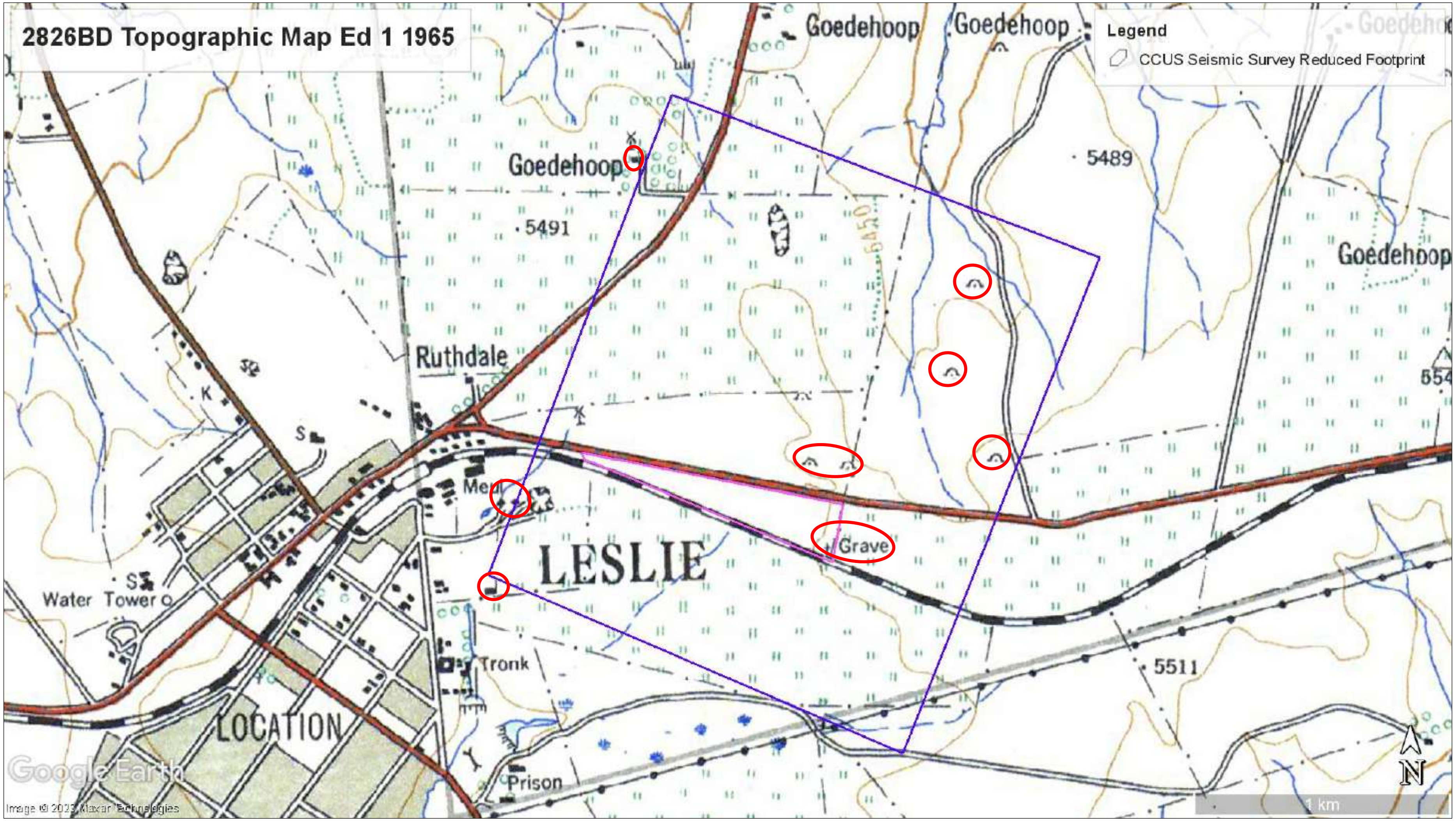

Figure 21: Enlarged view of topographic map 2628BD Ed 1 1965, depicting several heritage features (red circles) within the reduced CCUS seismic survey footprint (purple polygon). Most of these features are single homesteads (huts). Note that the grave depicted on the previous figure is still depicted as located within the updated drill site (pink polygon)

5.3 Previous HIA reports in the area

A search on the South African Heritage Resources Information System (SAHRIS) has identified several Heritage Impact Assessments conducted in and around the study area. The project area of three of these reports covered areas in the immediate vicinity of the town of Leandra: Kusel 2011, Pistorius 2016 and Smeyatsky & Fourie 2018. Other HIA reports contained information on the general surrounding region.

Kusel, U. 2011. *Cultural Heritage Resources Impact Assessment For Portion 29 of the Farm Goedehoop 308IR Govan Mbeki Local Municipality Mpumalanga Province.* The HIA study was for the proposed development of a truck yard. The survey did not identify any heritage resources on the property. A modern farmhouse and new infrastructure for large trucks, workshops and offices as well as a diesel depot had been constructed.-

Pistorius, JCC. 2016. *A Phase I Heritage Impact Assessment (HIA) Study for Anglo Operations (Pty) Ltd.'s Proposed Leslie 2 Project (near Leandra) in the Gauteng Province*. The survey identified two historical farmstead complexes and six informal graveyards (each containing approx. 20 -40 graves), as well as one possible grave.

Smeyatsky I and W Fourie, 2018. *Heritage Impact Assessment: Proposed Leslie Coal Mine near Leandra, Mpumalanga Province.* The HIA study identified 31 sites consisting of 22 burial sites (with a total of approximately 315 graves), one (1) living heritage (initiation) site and eight (8) historical structures.

Van der Walt, J. 2021. *Heritage Impact Assessment (Required under Section 38(8) Of The NHRA (No. 25 of 1999) for the Proposed Leandra Gravel Mine on a Portion of Portion 4 of the Remaining Extent of the Farm Brakfontein, Mpumalanga Province.* The study found no heritage features of significance (archaeological, built environment or graves).

Pistorius, J. 2020. *A Phase I Heritage Impact Assessment Study for the Shondoni and Middelbult Mining Areas near Secunda in the Mpumalanga Province.* The Sasol Project Area stretches from Leandra in the northeast towards Secunda and Trichardt and in the south-east incorporating the Sasol petro-chemical complex near eMmbalenhle. This study found a large number of historical remains consisting of farmstead complexes, houses and other historical structures, graveyards, and commemorative beacons.

Pistorius, J.2013. *A Phase I Heritage Impact Assessment (HIA) Study for a Proposed Raw Water Supply Pipeline For Kipower (Pty) Ltd Near Delmas on the Highveld and Eastern Highveld in the Gauteng and Mpumalanga Provinces of South Africa*. This study investigated the proposed pipeline between Delmas Coal to the south of the R50 on the farm Haverklip 256IR and Eendrag, close to Leandra. The study identified four graveyards and an historical house that dated to the 1940s

5.4 Palaeontological sensitivity

Note that this section was compiled by the author and not by a palaeontological specialist. A basic palaeontological sensitivity was determined using the SAHRIS database South African Fossil Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo). This map indicates that the original larger seismic survey footprint (pink polygon) falls within an area where the underlying geology has mainly Insignificant to Zero fossil sensitivity (grey), with a small area of High sensitivity (see **Figure 22** below). It should be noted that the reduced footprint for the seismic survey (purple polygon) falls completely within the area shown as grey. This should indicate that SAHRA would not require a palaeontological assessment for the seismic survey footprint area.

However, during the SAHRIS database search it was noted that SAHRA had requested either a desktop or a field Palaeontological assessment for several previous projects proposed for the surrounding region. Since this component of the project will involve drilling test holes to sample the underlying geology for suitability regarding the future injection of CO_2 into the existing bedrock, it is recommended that a desktop palaeontological study should be undertaken for the drilling site specifically (small pink polygon).

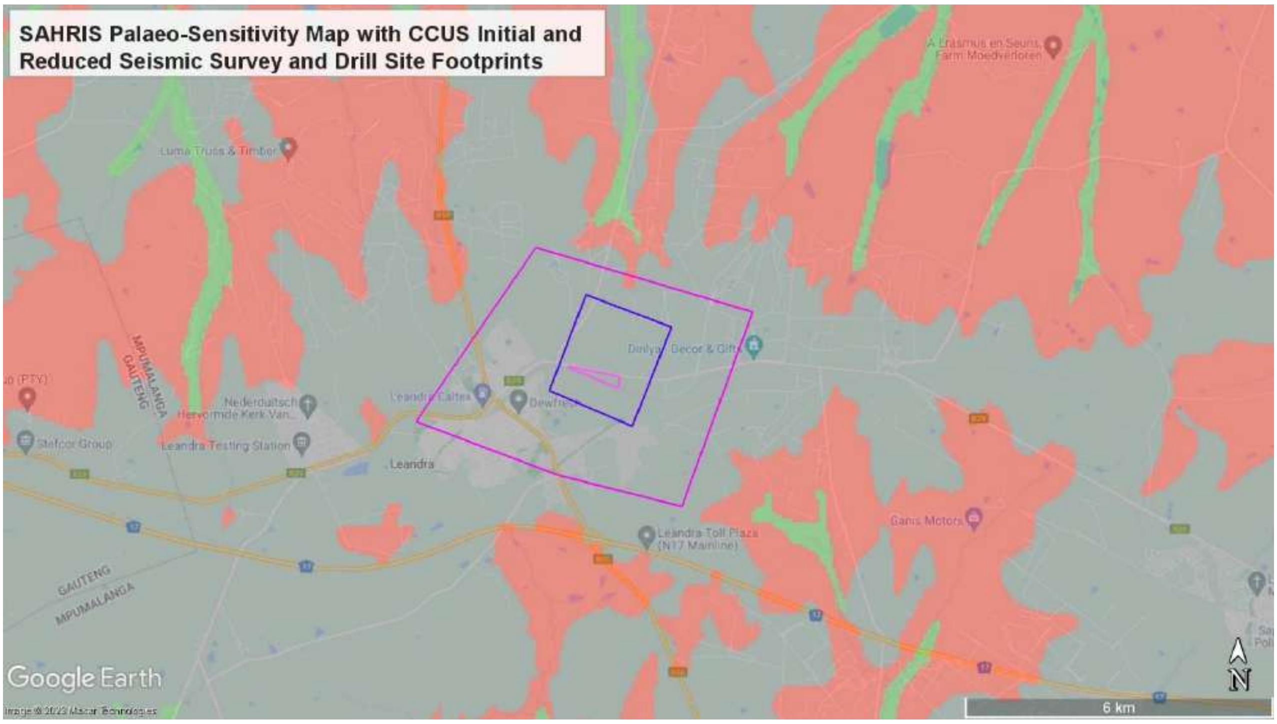

Figure 22: SAHRIS Palaeo sensitivity map overlain on the original (pink polygon) and reduced project footprint (purple polygon). The underlying geology is shown as mostly of Insignificant to Zero fossil sensitivity (grey). A very small section of High sensitivity is shown on the northern boundary of the original footprint

Table 2: SAHRIS Fossil Map Palaeontological Sensitivity Ratings and Required Actions

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required.
ORANGE/ YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely to be requested.
GREEN	MODERATE	Desktop study is required.
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required.
GREY	INSIGNIFICANT /ZERO	No palaeontological studies are required.
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information becomes known, SAHRA will continue to populate the map.

5.5 Findings of the Historical Desktop Study

The general overview from the historical desktop study has shown that various archaeological and historical resources can be expected to occur in the seismic survey footprint area. The examination of the earliest edition (1965) of the 1:50 000 topographical maps produced by overlying the maps with satellite Imagery (Google Earth) has shown that a large number of heritage features are depicted within the original seismic survey footprint, many being historical structures comprising the town of Leslie/Leandra.

The Site Survey fieldwork confirmed the findings of the desktop study as it identified 36 heritage resources occurring within the original footprint (seismic survey area). As noted, above, this original footprint has been reduced substantially with a corresponding reduction in the number of heritage resources affected.

6 SITE SURVEY/FIELDWORK RESULTS

The field survey of the CCUS seismic survey original larger footprint (and original drill site footprint) took place over four separate days (9 and 22 February; 6 and 27 March 2023) by the author (heritage specialist) in association with other specialists and occasionally with an assistant. A vehicle was used to access the footprint area and the survey was conducted by both vehicle and on foot (at selected areas). The survey covered as much of the project footprint area as was feasibly accessible, given the long and dense grass and other vegetation covering several areas, as well as the fact that most of the existing town of Leandra was included in the original larger footprint area. It should be noted that sections of the originally provided seismic survey footprint area are located on private farm property and access was restricted on some of these farms.

The author used a Global Positioning System (GPS) application to navigate access roads in the study area and for recording the tracklog of the survey and waypoints of the identified heritage resources. The camera on a Samsung mobile phone was used for photographic recording of identified heritage resources and general images of the project study area.

The survey aimed to find and identify archaeological and other heritage resources such as burial grounds and graves (BGG), archaeological material or sites, historic built environment and landscape features of cultural heritage significance. The inspection of the area that was surveyed identified a total of 36 heritage resources within the original larger seismic survey footprint (**Figure 117**). It should be noted that all heritage resources identified have been retained in this HIA report for information purposes and for future reference. However, within the reduced seismic survey area, a total of nine heritage resources was identified: two historical stone railway culverts (CCUS 03 and CCUS 33), three structure or homestead remains (CCUS 06, CCUS 07 and CCUS 30) and three possible but not certain structure or homestead remains (CCUS 01, CCUS 04 and CCUS 08). This includes a potential grave (CCUS-02) depicted on the 1965 historical topographical map sheet that was not identified during the field survey but which could be located within the drill site footprint (**Figure 118** and **Figure 119**).

It should also be noted that the heritage resources identified within the proposed drilling site have been listed separately from those heritage resources identified within the original seismic survey footprint area.

Identified Heritage Sites – Proposed Drilling Site

Site Name	CCUS-01
GPS Coordinates	26°22'13.09"S ; 28°56'34.33"E
Site Description	Possible homestead?
Approximate Age	Unknown. Nothing is marked at this location on the maps from 1965, up to 2010
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	The site comprises a clear, open area with much shorter grass and vegetation and contains various scattered clusters of stones. It is located immediately south of the railway line which forms the southern boundary of the proposed drilling site, approx. 27m away from the railway line.
Site Density	Unclear
Uniqueness	Low
Heritage Significance	Low- GP.C/ NCW
Mitigation	No mitigation is required.

Figure 23: CCUS-01, open area that could indicate a past homestead

Site Name	CCUS-02
GPS Coordinates	26°22'11.10"S ; 28°56'36.14"E
Site Description	Grave depicted on 1965 map in a location just north of the railway line.
Approximate Age	If still extant, at least 58 years or older
NHRA, No. 25	Section 36
Field Grading and Ratings	
Site context and description	No signs of a grave were visible on the ground surface in the approximate location of the grave, except for an isolated stone. However, it was observed that a road had been graded immediately adjacent to the eastern boundary of the drilling site which may have obscured any signs of a grave in this location. The potential grave is located within the adjusted drill site footprint.
Site Density	At least one grave could be present, below the ground surface.
Uniqueness	Low
Heritage Significance	High - GP.A/ IIIA
Mitigation	The approximate location of the grave must be monitored during any further site clearance and preparation activities for the proposed drilling site. This is important as the Drilling Site schematic provided by the client shows the drill pad is proposed to be sited in the approximate position of the possible grave.

Figure 24: CCUS-02, View of the ground surface in the approximate location of the possible grave

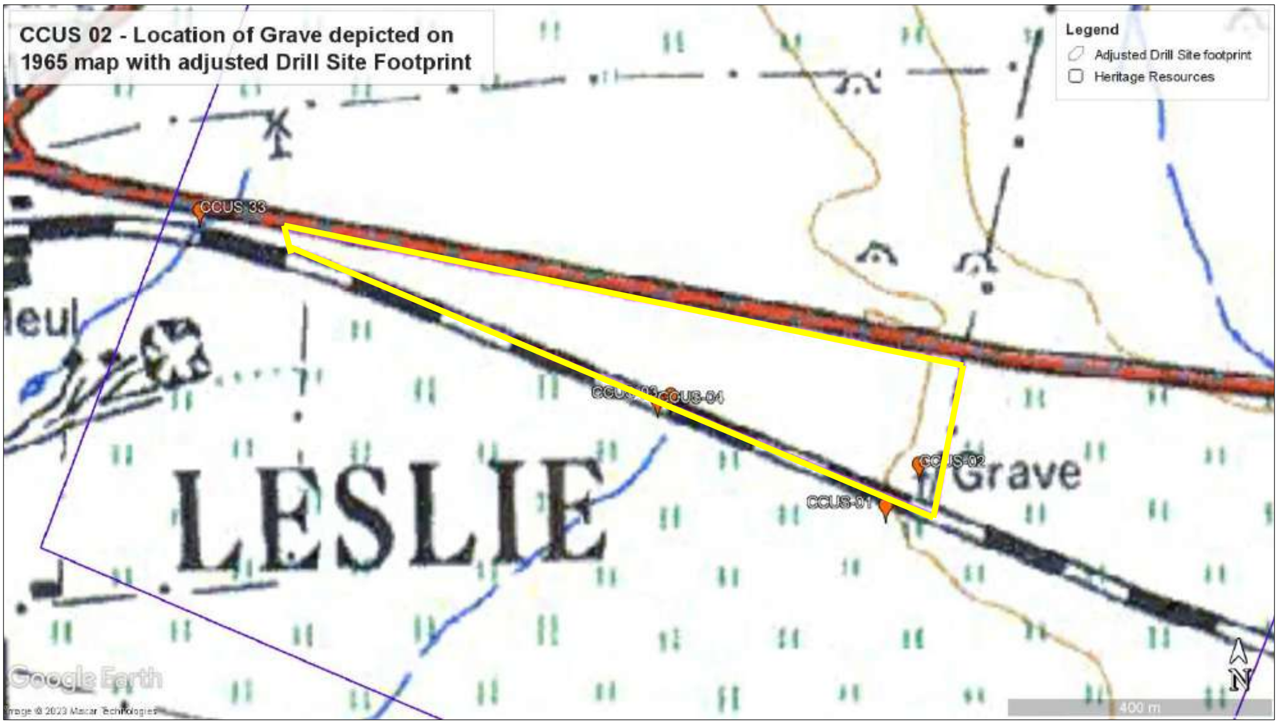

Figure 25: Enlarged view of Map sheet 2628BD Ed 1 1965, showing grave depicted at CCUS-02 and adjusted drill site footprint (yellow polygon)

Figure 26: Proposed Drilling Site updated Schematic showing position of drill pad close to the approximate location of the possible grave CCUS-02

Site Name	CCUS-03
GPS Coordinates	26°22'7.76"S ; 28°56'22.71"E
Site Description	Stone culvert under railway line
Approximate Age	At least 58 years or older, the railway is depicted on the 1965 map
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The site is a stone drainage culvert located under the railway line. The culvert is located just outside the adjusted drill site. It is visible on satellite imagery as well as on the ground.
Site Density	One
Uniqueness	Rare
Heritage Significance	High – Such structures have been rated as Grade II of Provincial Heritage Significance in Fisher and Clarke's (2016) extensive survey of extant NZASM structures.
Mitigation	Structure to be avoided with a buffer of at least 10-20m, especially on the northern side of the railway, where the adjusted drill site is proposed to be located.

Figure 27: Satellite imagery showing location of CCUS-03 historical railway culvert just outside the adjusted drill site

Figure 28: View of the stone culvert under the railway line at CCUS-03. This seems to be an example of a flat lintel or box culvert.

Figure 29: Close-up satellite view of the location of CCUS-03

Site Name	CCUS-04
GPS Coordinates	26°22'8.01"S ; 28°56'22.01"E
Site Description	Possible remains of structure.
Approximate Age	Unknown. No structure is depicted on the 1965 map
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	The site is the possible remains of a structure and consists of scattered building rubble with an old cement post.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure* 30*: View of the building rubble at CCUS-04

Site Name	CCUS-05
GPS Coordinates	26°22'40.07"S ; 28°56'28.63"E
Site Description	Old stone wall around recent structure
Approximate Age	Unknown, no wall is marked on the 1965 map or later sheets
NHRA, No. 25	Possibly section 34
Field Grading and Ratings	
Site context and description	An old stone wall surrounding a more recent structure/s, situated on the eastern edge of the township of Lebohang. The wall seems to have been constructed in two phases, with later additions added to an original lower section.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C / IIIC
Mitigation	If 60 years or older it is protected from damage under section 34 of the NHRA. It should be avoided with at least a 10-20m buffer.

Figure 31: View of the old stone wall enclosing modern/recent structures

Site Name	CCUS-06
GPS Coordinates	26°22'35.45"S ; 28°56'31.07"E
Site Description	Possible structure remains.
Approximate Age	Unknown. No structures are depicted on the 1965 map
NHRA, No. 25	Possibly Section 34
Field Grading and Ratings	
Site context and description	Possible structure remains comprised of a cluster of large rocks and smaller stones. There is also a possible midden nearby. The whole site is extremely overgrown with dense grass and thorny shrubs. The remains are located just outside the reduced seismic survey footprint.
Site Density	Unknown
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	The remains could be 60 years or older and may require a permit if any impact is anticipated by the proposed seismic survey. No other mitigation is required.

Figure 32: View of stone cluster at CCUS-06

Figure 33: View of another group of stones at CCUS-06

Site Name	CCUS-07
GPS Coordinates	26°22'32.89"S ; 28°56'34.90"E ; 26°22'32.72"S , 28°56'40.72"E
Site Description	Structure Remains
Approximate Age	Unknown. Not marked on 1965 map or later editions. However, the stone pillar may indicate a date of around 60 years or older.
NHRA, No. 25	Section 34 may be applicable
Field Grading and Ratings	
Site context and description	The site consists of several stone clusters, some forming square or rectangular lines. There is also a circular shaped stone pillar located in the immediate vicinity, as well as a water trough. Several sections of concrete pipes were also identified in the area. The extent covered by these remains is approx. 0.84ha. It should be noted that the satellite view of the site shows several walls that were not visible on the survey, due to the very dense and long grass and other vegetation cover. The remains are located within the reduced seismic survey area.
Site Density	Unknown
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	The remains could be 60 years or older and may require a permit if any impact is anticipated by the proposed seismic survey. No other mitigation is required.

Figure 34: View of one of the stone clusters forming lines

Figure 35: View of another cluster of large stones/rocks

Figure 36: View of stone pillar situated among the stone clusters

Figure 37: View of large trough, covered in cement

Figure 38: View of one of several concrete pipe sections noted at CCIS-07

Figure 39: Satellite view of area around CCUS-07 showing other structures not visible on the ground (red arrows)

Site Name	CCUS-08
GPS Coordinates	26°22'34.95"S ; 28°56'43.45"E
Site Description	Two to three piles of rocks and soil
Approximate Age	Unknown
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	Two to three piles of rocks and soil are located on the edge of an existing dam/pond. They could comprise rubble from demolished structures. The site is located a short distance from CCUS-07 and may be associated with those structure remains. It is located within the reduced seismic survey footprint.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure 40: View of pile of building material situated next to farm dam

Site Name	CCUS-09
GPS Coordinates	26°22'44.27"S ; 28°57'28.92"E (09.1); 26°22'46.76"S; 28°57'28.53"E (09.2)
Site Description	Possible homestead.
Approximate Age	Unknown.
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	Large open area with sandstone outcrops but also sandstone structure remains. This is a possible homestead. A similar open area with stone scatters was noted a short distance away.
Site Density	Two possible homestead areas. Unknown number of structure remains
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure 41: View of Stone cluster from CCUS-09

Figure 42: General view of possible homestead area

Figure 43:view of the second possible homestead area at CCUS-09

Site Name	CCUS-10
GPS Coordinates	26°22'51.60"S; 28°57'28.69"E
Site Description	Old dam wall / weir structure
Approximate Age	At least 58 years, as a dam is marked on the 1965 map
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	An old stone dam wall/weir structure situated at the inlet/outlet channel to an existing dam
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure 44: View of the stone dam wall/weir structure

Site Name	CCUS-11
GPS Coordinates	26°23'0.51"S ; 28°56'31.22"E
Site Description	Open air church
Approximate Age	Unknown. Probably recent/modern. An open area in this location is marked on the 2010 map.
NHRA, No. 25	Section 3(2)(b) and 3(3)(g) - Living heritage – spiritual importance
Field Grading and Ratings	
Site context and description	Open air church area formed by square arrangement of white painted stones in an open area in Lebohang township. The site is fenced off and looks well-used.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Medium -High- GP.B / IIIB Intangible/living heritage site
Mitigation	The site must be avoided with a 20-30m buffer and the community consulted on mitigation measures if any impact is anticipated.

Figure 45: View of the informal church site at CCUS-11

Figure 46: Satellite view of CCUS-11

Figure 47: Enlarged view of 2020 Ed 4 map, showing an open area in the location of CCUS-11

Site Name	CCUS-12
GPS Coordinates	26°23'4.96"S; 28°56'14.04"E
Site Description	Large community cemetery
Approximate Age	Less than 60 years. Appears on 2010 map but not on earlier maps
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	Large community cemetery, situated on the southern boundary of Lebohang township. The southern boundary of the original seismic survey footprint cuts through the cemetery diagonally.
Site Density	Probably several hundred graves
Uniqueness	Low
Heritage Significance	High - GP.A/ IIIA
Mitigation	The Cemetery must be avoided with a buffer of 20-30m and the community must be consulted about mitigation measures if any impact is anticipated.

Figure 48: Satellite view of the cemetery situated at CCUS-12, showing the southern boundary of the original seismic survey area (Pink line)

Figure 49: View of the cemetery from the gravel road

Site Name	CCUS-13
GPS Coordinates	26°22'39.52"S; 28°55'51.73"E
Site Description	Historical sandstone “prison” buildings
Approximate Age	60 years or older. Structures depicted on 1965 map as “Prison”
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The dilapidated remains of three historical building constructed of sandstone and/or dolerite. The structures are situated in the approximate location of structures labelled as a “Tronk” (prison) on the 1965 map. The buildings have been fenced. The buildings are of different sizes. One is constructed of sandstone, one is constructed of dolerite with sandstone detailing (quoins) and one is constructed of both sandstone and dolerite. This may indicate an extension to the original building. Some demolished material was also noted.
Site Density	Three buildings
Uniqueness	Medium
Heritage Significance	Medium - GP.B/ IIIB
Mitigation	To be avoided with a buffer of 20-30m.

Figure 50: General View of the three buildings at CCUS-13

Figure 51: View of the smaller sandstone building

Figure 52: The building built with dolerite stone and sandstone details at the corners and windows, note the demolished material in the foreground

Figure 53: View of the larger building, one section of which is constructed sandstone

Figure 54: View of the other section of the larger building, which is partially constructed of dolerite

Site Name	CCUS-14
GPS Coordinates	26°22'42.87"S; 28°55'49.70"E
Site Description	Sandstone house with date of 1933
Approximate Age	Older than 60 years (Date of 1933 = 90 years old)
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Sandstone house with a date of 1933 now used as creche. Exterior in very good condition. Surrounded by a dolerite stone wall constructed with pillars in the same/similar style as the pillars at sites CCUS-07 and CCUS-15. Both the main house and the associated outhouse have unusual circular features constructed at the sides (also of dolerite).
Site Density	Main house, outbuilding and surrounding wall.
Uniqueness	Medium
Heritage Significance	Medium – GP.B/ IIIB
Mitigation	To be avoided with a buffer of 20-30m.

Figure 55: Close-up view of the main entrance, showing the date of 1933

Figure 56: View of the historical sandstone house at CCUS-13, showing the north and west elevations

Figure 57: View of the front (west) elevation of the house, note the associated outbuilding visible on the south side.

Figure 58: View of the south elevation of the house, showing the sandstone outbuilding on the south side

Figure 59: Closer view of the Sandstone outbuilding, showing two circular features next to the west and east ends of the building

Figure 60: View of the surrounding wall, built from dolerite stone, showing one of the circular pillars

Figure 61: View of the entrance in the surrounding wall with the circular pillars

Site Name	CCUS-15
GPS Coordinates	26°22'39.89"S ; 28°55'42.73"E
Site Description	Remains of old stone bridge and stone pillar
Approximate Age	At least 58 years . Marked on 1965 map.
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The remains of an old stone bridge over the river with an associated stone pillar similar to the ones noted at CCUS-14 and CCUS-07. The bridge remains are situated next to the tar road that runs parallel to the R50 road.
Site Density	Bridge remains (3 sections) and circular pillar
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	The remains are likely to be 60 years or older and may require a permit if any impact is anticipated by the proposed seismic survey. No other mitigation is required.

Figure 62: View of the remains of the historical stone bridge at CCUS-15

Figure 63: View of the circular pillar associated with the bridge remains

Site Name	CCU-16
GPS Coordinates	26°22'4.32"S ; 28°55'30.73"E
Site Description	Demolished remains of railway houses
Approximate Age	At least 58 years. Five structures are depicted in this location on the 1965 map
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The site contains the demolished remains of at least five houses and associated outbuildings, situated immediately north of the railway line. These were likely to have been railway houses. The surviving construction materials include both red bricks and yellow and blue/purple bricks which are typical of such houses that were built c.1930s-1920s and c1940s-1950s. One of the remains was constructed with stone walls.
Site Density	The remains of at least five houses with associated outbuildings.
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	If any impact is anticipated that would require the remains to be completely demolished then a permit is required to be obtained from the MPHRA. No further mitigation is required.

Figure 64: View of the foundation remains of one house built from red brick at CCUS-16

Figure 65: View of the foundation remains of another house with a piece of stone wall surviving

Figure 66: View of the foundation remains of another house with a piece of brick wall surviving

Figure 67: View of another of the demolished houses with a piece of brick wall remaining

Figure 68: View of one of the foundations with piece of wall in red brick

Figure 69: Example of red brick with partial inscription

Figure 71: Example of blue-purple bricks in situ

Figure 70: Example of yellow bricks

Site Name	CCUS-17
GPS Coordinates	26°21'53.25"S ; 28°55'42.55"E
Site Description	Two old and dilapidated buildings
Approximate Age	Possibly 60 years or older, structures are depicted in this location on the 1965 maps and later editions.
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Two dilapidated buildings: one long, rectangular building and one small square one. The rectangular building could have been a school. They are situated to the north of the N17 road.
Site Density	Two buildings
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	If any impact is anticipated that would require the remains to be completely demolished then a permit is required to be obtained from the MPHRA. No further mitigation is required.

Figure 72: View of the two old and dilapidated buildings at CCUS-17

Figure 73: View of the long rectangular structure, showing a brick cistern or cellar in the foreground

Figure 74: View of the small square structure

Site Name	CCUS-18
GPS Coordinates	26°22'28.49"S ; 28°55'11.48"E
Site Description	Old stone water channel
Approximate Age	Likely to be 60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	This is an old stone-built water channel running along and parallel to the railway line in the north-western section of Lebohang township. The approx. length is 61m (from Satellite imagery)
Site Density	N/A
Uniqueness	Medium
Heritage Significance	Low - GP.C/ NCW
Mitigation	If any impact is anticipated that would result in damage to the water channel, then a permit is required to be obtained from the MPHRA. No further mitigation is required

Figure 75: View along the stone water channel at CCUS-18

Site Name	CCUDS-19
GPS Coordinates	26°22'31.70"S ; 28°54'29.87"E
Site Description	Old railway arched culvert
Approximate Age	60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Old sandstone double arched culvert under the railway line. Situated close to a large community cemetery at CCUS-20.
Site Density	N/A
Uniqueness	Medium
Heritage Significance	High - Such structures have been rated as Grade II of Provincial Heritage Significance in Fisher and Clarke's (2016) extensive survey of extant NZASM structures
Mitigation	Structure to be avoided with a buffer of at least 10-20m.

Figure 76: View of the double-arched railway culvert at CCUS-19

Site Name	CCUS-20
GPS Coordinates	26°22'32.10"S ; 28°54'29.04"E
Site Description	Community cemetery
Approximate Age	Recent/modern
NHRA, No. 25	Section 36
Field Grading and Ratings	
Site context and description	Large community cemetery located at the north-west corner of Lebohang township and within the south-west section of the seismic survey footprint. There was no access due to bad road conditions.
Site Density	Unknown but likely to be several hundred
Uniqueness	Low
Heritage Significance	High- GP.A / IIIA
Mitigation	The Cemetery must be avoided with a buffer of 20-30m and the community must be consulted about mitigation measures if any impact is anticipated.

Figure 77: Satellite view of the cemetery at CCUS-20, showing its location within the south-west corner of the original Seismic Survey footprint

Site Name	CCUS-21
GPS Coordinates	26°22'27.11"S ; 28°55'24.58"E
Site Description	Ruins of at least two structures
Approximate Age	Unknown
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	The site consists of the ruins of two-three structures.
Site Density	At least two ruined structures
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure 78: View of the ruined structures at CCUS-21

Figure 79: Another view of the ruined structures

Site Name	CCUS-22
GPS Coordinates	26°22'22.28"S ; 28°55'28.73"E
Site Description	Historical house, occupied
Approximate Age	60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The site is an historical house, located in the residential area north of the R50 road.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C
Mitigation	Structure to be avoided with a buffer of at least 10-20m.

Figure 80: View of historical house at CCUS-22

Site Name	CCUS-23
GPS Coordinates	26°22'11.62"S ; 28°55'37.42"E
Site Description	Dilapidated remains of historical mill buildings
Approximate Age	60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The extremely ruined, half demolished remains of the Godrich Flour Mills and van der Walt Se Meule mill buildings. The remains are situated south of the railway line and west of the existing modern Pride Mills complex.
Site Density	At least three extremely dilapidated large buildings and three foundations.
Uniqueness	Medium
Heritage Significance	Low - GP.C/ NCW
Mitigation	To be avoided with a buffer of 20-30m.

Figure 81: View of the remains of one of the historical mill buildings, showing the names of Godrich Flour Mills and Van Der Walt se Meules, looking south from the railway line

Figure 82: View of the remains of one of the mill buildings

Figure 83: View of another of the dilapidated historical mill buildings

Figure 84: View of a third historical mill building, with foundations in the foreground

Figure 85: View of the foundations with the remains of the mill buildings in the background

Site Name	CCUS-24
GPS Coordinates	26°22'15.95"S; 28°55'41.05"E
Site Description	Historical house
Approximate Age	60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Historical house, which seems to have been altered in the past. Currently used as a creche. It located in the residential area north of the R50 road.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C
Mitigation	To be avoided with a buffer of 20-30m. No additional mitigation is required.

Figure 86: View of house at CCUS-24, taken from the road

Site Name	CCUS-25
GPS Coordinates	26°22'18.65"S ; 28°55'40.67"E
Site Description	Historical house
Approximate Age	60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	An historical house located in the residential area north of the R50. It is constructed of yellow brick with detailing in blue/purple brick which dates it to c.1940s-1950s. The house is occupied.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	To be avoided with a buffer of 20-30m. No additional mitigation is required.

Figure 87: View of historical house at CCUS-25

Site Name	CCUS-26
GPS Coordinates	26°22'22.36"S; 28°55'41.12"E
Site Description	Two historical stone buildings and a corrugated iron shack.
Approximate Age	60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Two buildings constructed of stone located in the approximate position depicted as a "prison" on the 1965 map. The larger building has very small windows located at the top of the walls. A circular feature similar to the ones noted at the1933 building is also present. The buildings are situated in the residential area north of the R50 road.
Site Density	2 buildings and a corrugated iron structure
Uniqueness	Medium
Heritage Significance	Medium - GP.B/ IIIB
Mitigation	To be avoided with a buffer of 20-30m. No additional mitigation is required.

Figure 88: View of the two stone buildings at CCUS-26, note the circular feature at the side

Figure 89: Closer view of the larger stone building, showing the very small window at the top of the walls

Site Name	CCUS-27
GPS Coordinates	26°22'25.14"S ; 28°55'41.42"E
Site Description	Two historical houses, c.1950s and three other buildings, also c. 1950s
Approximate Age	60 years or older
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Two historical houses, and three other buildings, all situated in the residential area north of the R50. They are all built of yellow brick in the style of the c.1950s, with detailing in blue/purple brick. They are all occupied.
Site Density	At least 5 buildings
Uniqueness	Low
Heritage Significance	Low - GP.C / IIIC
Mitigation	To be avoided with a buffer of 20-30m. No additional mitigation is required.

Figure 90:View of the one of the two historical houses at CCUS-27

Figure 91: View of the other historical houses

Figure 92: View of one of the three other buildings at CCUS-27, showing the blue/purple brick detailing

Figure 93: View of the second building

Figure 94: View of the third building

Site Name	CCUS -28
GPS Coordinates	26°22'28.60"S ; 28°54'51.96"E
Site Description	Demolished building
Approximate Age	Modern/recent. A structure is depicted in this location on the 2010 map.
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	Demolished remains of single building, mainly concrete. Situated in the open area in the south-west corner of the original seismic survey footprint.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure 95: View of demolished remains of building at CCUS-29

Figure 96: Another view of the demolished remains

Site Name	CCUS-29
GPS Coordinates	26°22'29.65"S ; 28°54'50.42"E
Site Description	Two demolished buildings
Approximate Age	Unknown. Nothing is indicated on the 1965 map or later editions.
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	The foundation remains of two demolished buildings, rectangular and constructed from concrete and brick. Situated in the same area as CCUS-28.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No mitigation is required.

Figure 97: View of one of the foundation remains at CCUS-29

Figure 98: View of the other foundation

Site Name	CCUS-30
GPS Coordinates	26°21'25.94"S, 28°56'29.58"E; 26°21'22.72"S, 28°56'28.30"E
Site Description	Possible homestead
Approximate Age	Unknown
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	Large open area with scattered stones and pieces of brick. Two lower grindstone rocks were noted in this area. The site is located within the northwest corner of the reduced seismic survey footprint.
Site Density	Unknown
Uniqueness	Low
Heritage Significance	Low - GP.C/ IIIC
Mitigation	No mitigation is required.

Figure 99: View of one of the lower grindstones

Figure 100: View of the second lower grindstone

Figure 101: View of the homestead area at CCUS-30

Figure 102: View of one of the stone clusters

Site Name	CCUS-31
GPS Coordinates	26°20'55.94"S , 28°56'16.87"E
Site Description	Informal Graveyard
Approximate Age	Unknown
NHRA, No. 25	Section 36
Field Grading and Ratings	
Site context and description	This is a graveyard, probably of African farmworkers. Approx. 32 graves are visible, mainly stone packed. A few have headstones, but only one has a legible name and date, (Name: Mbonani, Date of death: 2010). The graves occur both inside and outside of a fenced area. The graveyard is located just inside the northern boundary of the original seismic survey footprint.
Site Density	Approx. 32 graves are visible
Uniqueness	Low
Heritage Significance	High - GP.A/ IIIA
Mitigation	The graveyard must be avoided and the community must be consulted about mitigation measures if any impact is anticipated.

Figure 103: General view of the graveyard at CCUS-31

Figure 104: View of the only headstone with a legible name and dates

Figure 105: View showing some of the informal stone graves outside the fenced area

Site Name	CCUS-32
GPS Coordinates	26°21'8.68" , 28°56'1.19"E
Site Description	Ruins of several demolished buildings
Approximate Age	60 years or older. A ruin is depicted in this location on the 1965 map
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Ruins of several demolished buildings and metal structure. One large brick and cement and stone. Others of smaller stones and yellow and blue bricks. Situated in the northern section of the original seismic survey footprint.
Site Density	Unknown
Uniqueness	Low
Heritage Significance	Low - GP.C/ IIIC
Mitigation	If any impact is anticipated that would require the remains to be completely demolished then a permit is required to be obtained from the MPHRA. No further mitigation is required.

Figure 106: General view showing metal structure and building remains at CCUS-32

Figure 107: View of building remains

Figure 108: View of metal structure

Site Name	CCUS-33
GPS Coordinates	26°21'58.78"S, 28°55'57.26"E
Site Description	Historical stone railway culvert
Approximate Age	At least 58 years or older, the railway is depicted on the 1965 map
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	The site is a stone drainage culvert located under the railway line. This seems to be an example of a flat lintel or box culvert. The culvert is located within the reduced seismic survey footprint. It is visible on satellite imagery as well as on the ground.
Site Density	N/A
Uniqueness	Rare
Heritage Significance	High - Such structures have been rated as Grade II of Provincial Heritage Significance in Fisher and Clarke's (2016) extensive survey of extant NZASM structures.
Mitigation	Structure to be avoided with a buffer of 20-30m.

Figure 109: View of historical stone culvert under railway line at CCUS-33

Figure 110: closer view of the stone culvert

Site Name	CCUS-34
GPS Coordinates	26°21'37.33"S, 28°55'27.41"E; 26°21'34.49"S, 28°55'21.56"E
Site Description	Homestead area
Approximate Age	Unknown
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	Large clump of Sisal plants over cairn of stones and bricks. Large open area on top of plateau, with several clusters of stones and a long linear feature comprised of stones and earth (possible boundary). Located in the northern section of the original seismic survey footprint.
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C / IIC
Mitigation	No mitigation is required.

Figure 111: General view of the homestead area at CCUS-34

Figure 112: View of the linear feature that seems to define the edge of the homestead area

Site Name	CCUS-35
GPS Coordinates	26°21'6.58"S , 28°57'13.40"E
Site Description	Ruined building
Approximate Age	60 years or older. Marked on the 1965 map
NHRA, No. 25	Section 34
Field Grading and Ratings	
Site context and description	Ruined remains of multi-room building, constructed with stone, brick and cement. This is located outside the northern boundary of the original seismic survey footprint
Site Density	N/A
Uniqueness	Low
Heritage Significance	Low - GP.C/ NCW
Mitigation	No impact is anticipated and no mitigation is required.

Figure 113: View of the foundation remains of the historical house at CCUS-35

Figure 114: Closer view of the building materials

Site Name	CCUS-36
GPS Coordinates	26°22'31.55"S , 28°54'56.00"E
Site Description	Muslim cemetery
Approximate Age	Modern/recent
NHRA, No. 25	N/A
Field Grading and Ratings	
Site context and description	This is a Muslim cemetery located immediately south of the R29 road and north of the railway line. It is assumed that it serves the Lebohang community. It is located within the original seismic survey footprint.
Site Density	Unknown, possibly 100+ graves
Uniqueness	Low
Heritage Significance	High– GP.A/ IIIA
Mitigation	The Cemetery must be avoided with a buffer of 20-30m and the community must be consulted about mitigation measures if any impact is anticipated.

Figure 115: General view of the Muslim Cemetery at Lebohang (CCUS-36)

Figure 116; View of the entrance to the Muslim cemetery with a sign written in Arabic

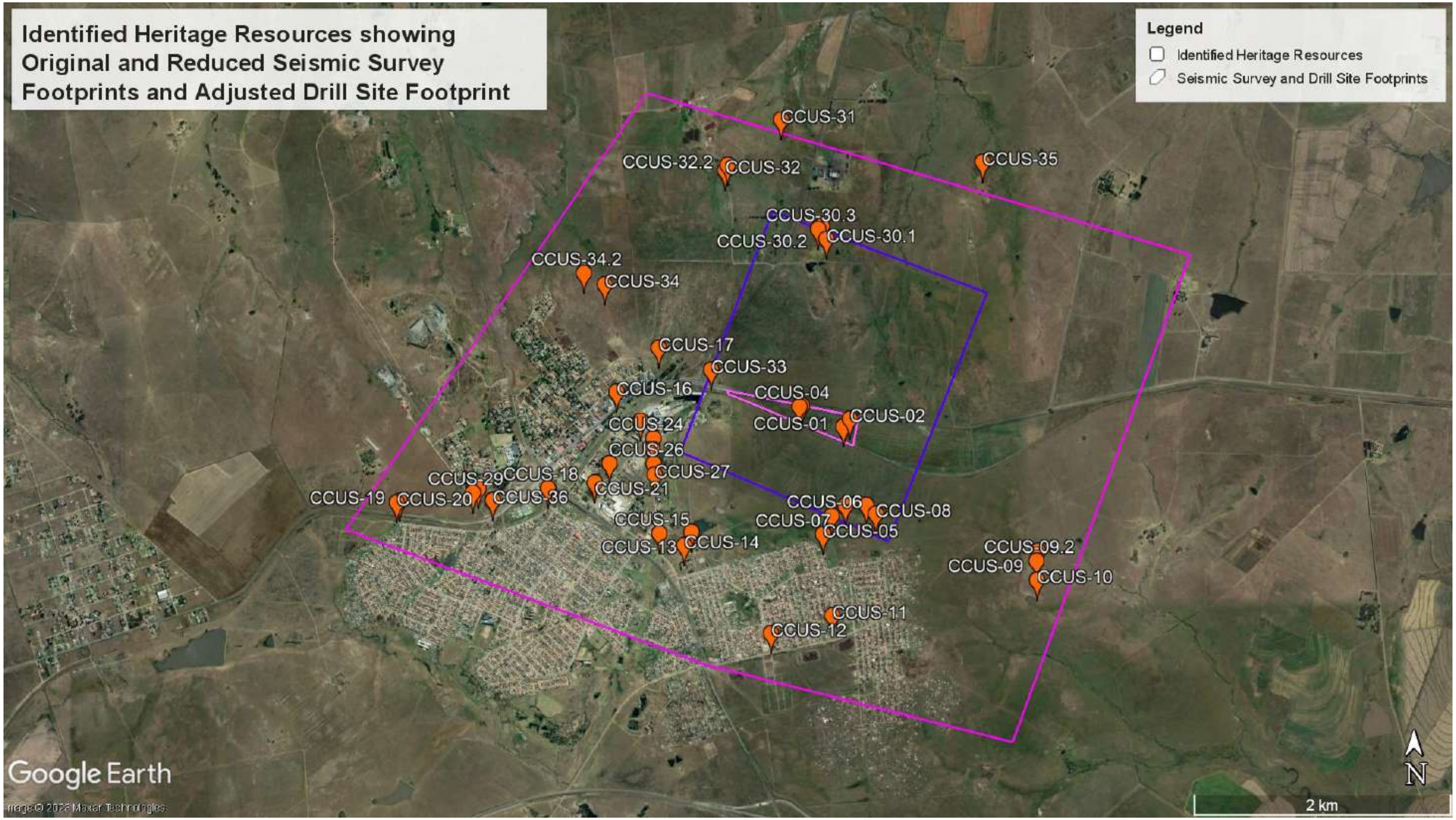

Figure 117: Identified Heritage Sites overlaid on satellite imagery showing the CCUS Seismic Survey Original and Reduced Footprints. The survey identified 36 heritage resource sites within the Original Survey footprint. The original footprint is pink, the reduced footprint is purple and the adjusted drill site footprint is pink. The orange icons indicate the identified heritage resources.

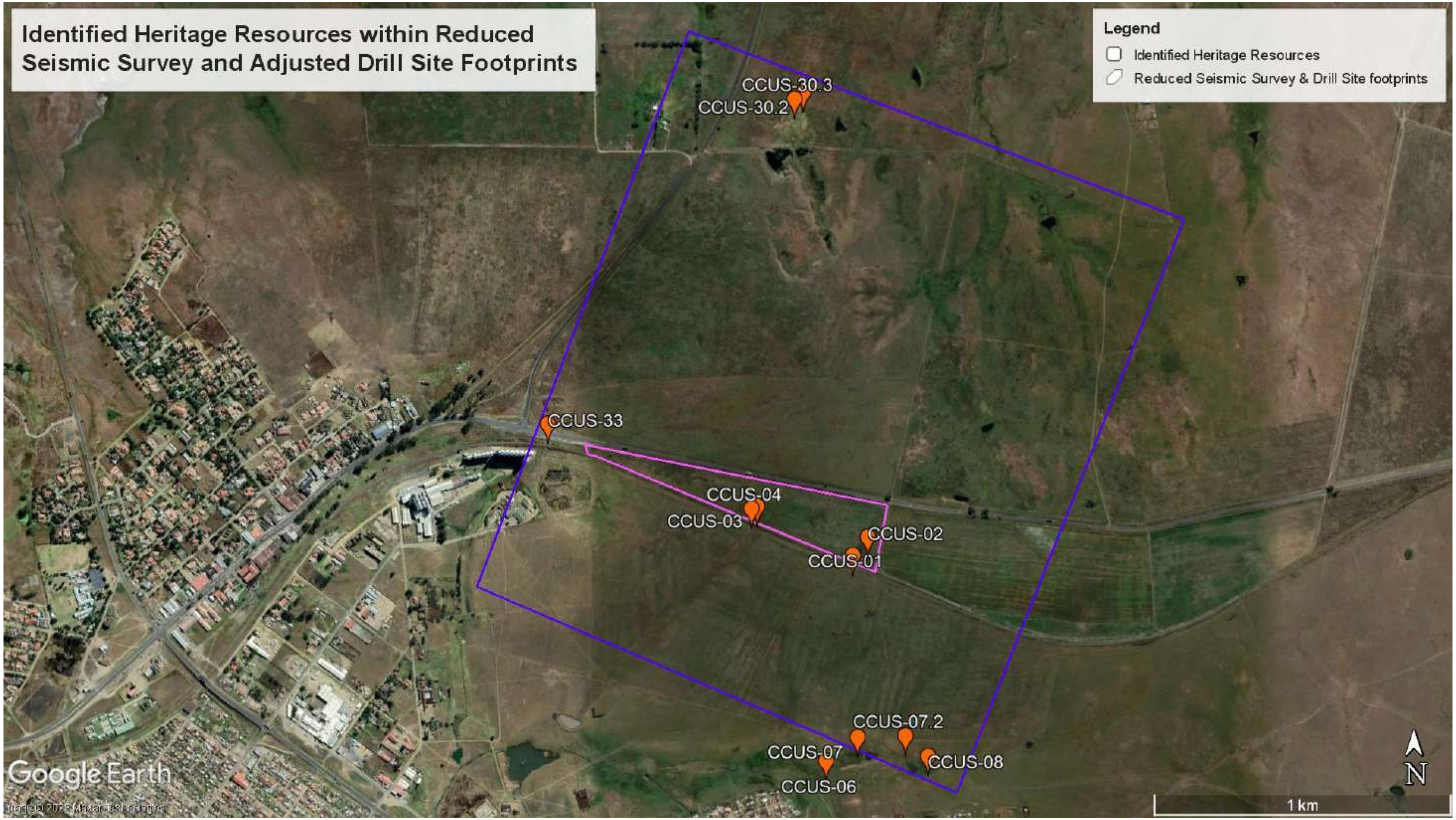

Figure 118: Identified Heritage Sites overlaid on satellite imagery showing the CCUS Seismic Survey Reduced Footprint (purple polygon). Nine heritage resource were identified within the Reduced footprint. The adjusted drill site footprint is pink. The orange icons indicate the identified heritage resources.

Figure 119: Enlarged satellite view of the proposed Reduced Drill Site footprint (pink polygon) with Identified Heritage Resources (orange icons)

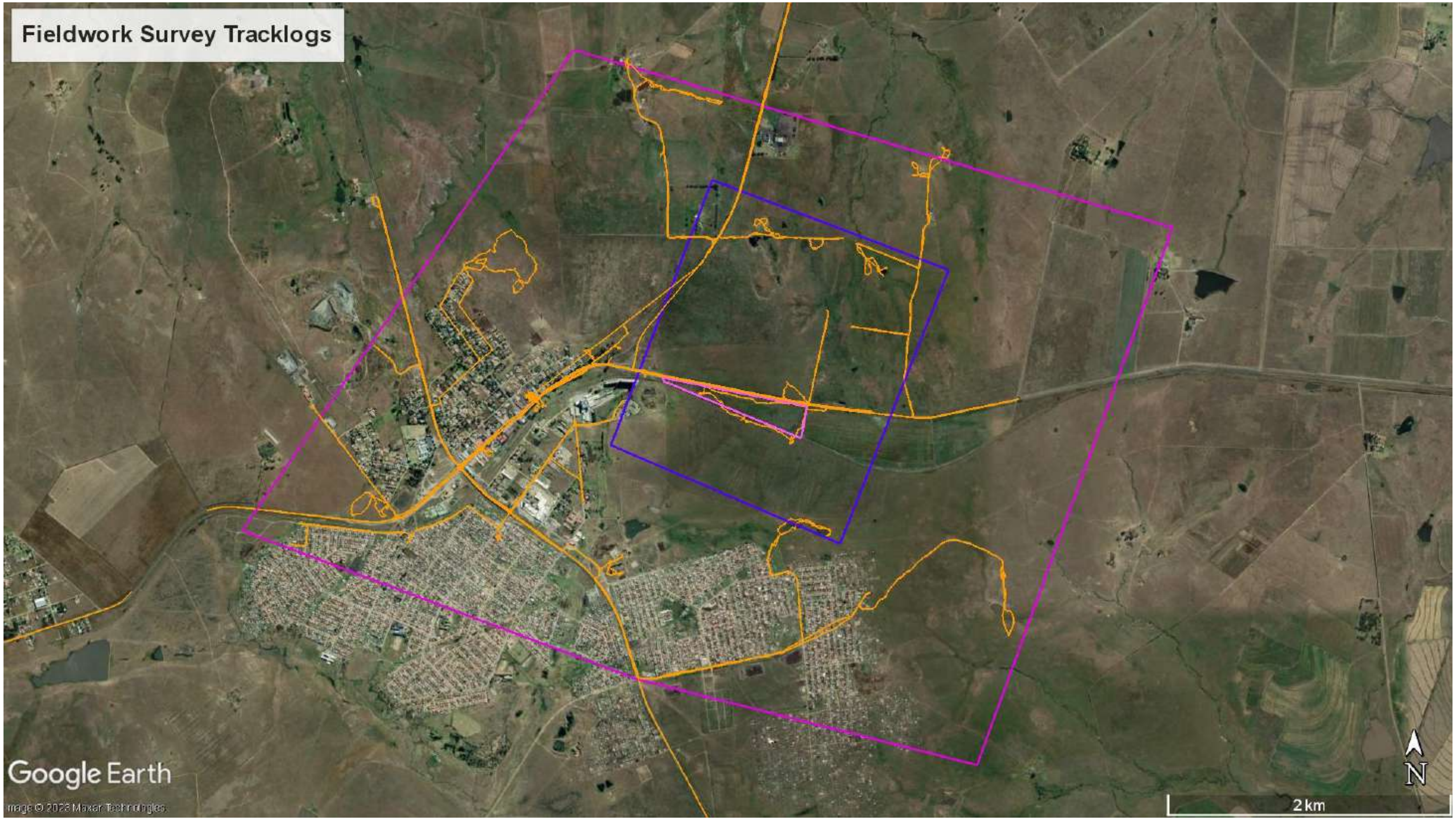

Figure 120: Site Survey Tracklogs (orange lines) overlaid on the CCSU Seismic Survey Original and Reduced footprints.

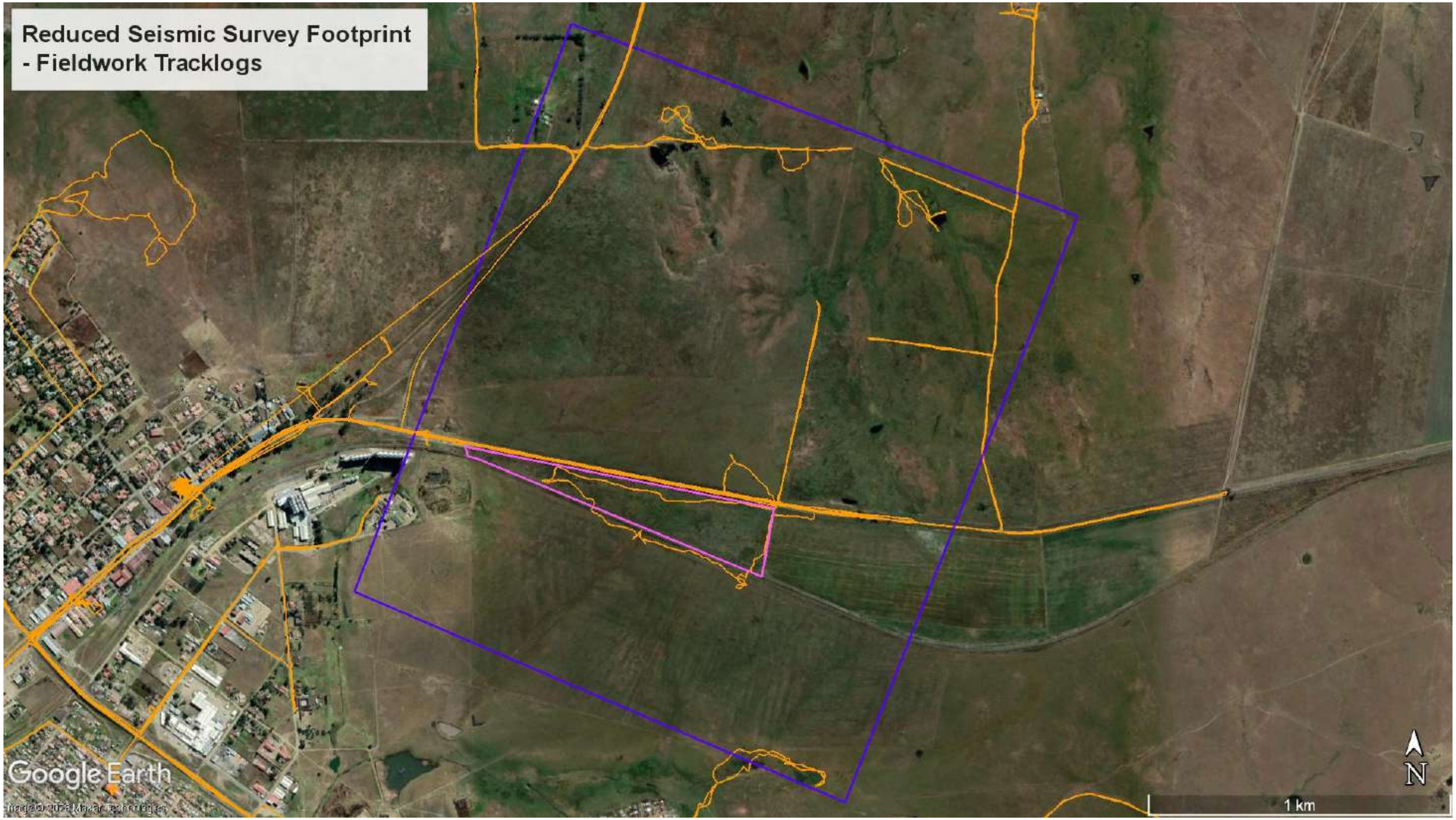

Figure 121: Site Survey Tracklogs (orange lines) overlaid on the CCSU Seismic Survey Original and Reduced footprints

7 SIGNIFICANCE ASSESSMENT

Methodology for Assessing Heritage Site Significance

The applicable maps, tables and figures are included, as stipulated in NHRA and NEMA. The HIA process consists of three steps:

Literature Review

The desktop literature review provided information on the Heritage Background of the general region and project area. This included investigating published and unpublished sources as well as past HIA studies conducted for the project area and surrounding region. An examination of historical 1:50 000 topographical maps and/or archival maps (if available) was also undertaken. The relevant early editions of the 2628BD topographical map sheets were obtained from the Department of Agriculture, Land Reform & Rural Development (DALRRD), Cape Town. A number of internet sites were also accessed for information.

Literature resources accessed are listed in Table 3.

Table 3: Literature sources accessed

Source	Information
Background Information Document - Nemai	Project location and description details
Literature Review of Published and Unpublished Sources and Past HIAs	Historical and archaeological background on Mpumalanga and Leandra/Leslie as well as surrounding region
Directorate: National Geo-spatial Information of the Department of Agriculture, Land Reform & Rural Development, Cape Town	Historical topographic maps, 1:50 000 2628BD Leslie Edition 1 1965

Field Survey

A physical Site Inspection or Field Survey was conducted, predominantly by vehicle with selected areas traversed on foot, through the project area by an experienced heritage specialist, sometimes with an assistant. This focussed on identifying and documenting heritage resources situated within and immediately adjacent to the proposed project area footprint, such as graves, historical structures or remains and archaeological sites or material.

HIA Report

The final step involved the recording and documentation of the identified heritage resources, the assessment of such resources in terms of heritage significance and impact assessment criteria, producing a heritage sensitivity map and compiling the heritage impact assessment report with constructive recommendations for mitigation, if required.

Impacts on these sites by the development will be evaluated as follows:

Site Significance

Site significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. The update classification and rating system as developed by Heritage Western Cape (2021) is implemented in this report.

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016), were used for the purpose of this report **Table 4** and **Table 5**).

Table 4: Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 5: Rating system for built environment resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by Provincial Heritage Authority.	Exceptionally High Significance
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that	High Significance

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
	These are heritage resources which are significant in the context of an area.	any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they should receive maximum protection at local level.	
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context of a townscape, neighbourhood, settlement or community.	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples. They would receive less stringent protection than Grade IIIA buildings and sites at local level.	Medium Significance
IIIC	Such a resource is of contributing significance to the environs These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e., in large part due to its contribution to the character or significance of the environs. These buildings and sites should, as a consequence, only be regulated if the significance of the environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant and approved by the authority. Section 34 can even be lifted by the PHRA for structures in this category if they are older than 60 years.	Not Conservation worthy – no research potential or other cultural significance

Table 6: Site significance classification standards as prescribed by SAHRA.

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	Very High - of National Significance	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	Very High – of Provincial Significance	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)		High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)		Medium Significance	Recording before destruction
Generally Protected C (GP.A)		Low Significance	Destruction

8 IDENTIFICATION OF IMPACTS

8.1 Impacts and Mitigation Framework

All impacts are analysed in the section to follow with regard to their nature, extent, magnitude, duration, probability and significance.

ISO 14001-2004 defines impacts as “any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s environmental aspects”.

When considering an assessment of the impacts and their mitigation, the following definitions as per Table 7 apply.

Table 7: Impact and Mitigation Quantification Framework

Nature	The project could have a positive, negative or neutral impact on the environment.
Extent	**Local** – extend to the site and its immediate surroundings. **Regional** – impact on the region but within the province. **National** – impact on an interprovincial scale. **International** – impact outside of South Africa.

Magnitude	Degree to which impact may cause irreplaceable loss of resources: **Low** – natural and socio-economic functions and processes are not affected or minimally affected. **Medium** – affected environment is notably altered; natural and socio-economic functions and processes continue albeit in a modified way. **High** – natural or socio-economic functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	**Short term** – 0-5 years. **Medium term** – 5-11 years. **Long term** – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. **Permanent** – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	**Almost certain** – the event is expected to occur in most circumstances. **Likely** – the event will probably occur in most circumstances. **Moderate** – the event should occur at some time. **Unlikely** – the event could occur at some time. **Rare/Remote** – the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- **0** – Impact will not affect the environment. No mitigation necessary. **1** – No impact after mitigation. **2** – Residual impact after mitigation. **3** – Impact cannot be mitigated.
Mitigation	Information on the impacts together with literature from socio-economic science journals, case studies and field work will be used to provide mitigation recommendations to ensure that any negative impacts are decreased and positive benefits are enhanced.
Monitoring	Monitoring usually involves developing and implementing a monitoring programme to identify deviations from the proposed action and to manage any negative impacts. The recommended mitigation measures will also include monitoring measures.

Table 8: Impact Methodology Table

Nature			
Negative	Neutral	Positive	
-1	0	+1	
Extent			
Local	Regional	National	International
1	2	3	4
Magnitude			
Low	Medium	High	
1	2	3	
Duration			
Short Term (0-5yrs)	Medium Term (5-11yrs)	Long Term	Permanent
1	2	3	4

Probability				
Rare/Remote	Unlikely	Moderate	Likely	Almost Certain
1	2	3	4	5

Significance			
No Impact/None	No Impact After Mitigation/Low	Residual Impact After Mitigation/Medium	Impact Cannot be Mitigated/High
0	1	2	3

8.2 Identification of Activities and Aspects

An "Activity" is defined as a distinct process or risks undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation (International Organization for Standardization, 2011).

An aspect is defined as elements of an organisation's activities or products or services that can interact with the environment.

In order to capture the impacts associated with the proposed infrastructure, an activity – aspect – impact table was created refer to 9 below.

Table 9: Activity, Aspects and Impacts of the Project

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Drilling Site clearance/ construction camp			Damage to potential / unidentified grave/s
Drilling Site Construction / Operation			Damage to possible fossils in the bedrock
3D Seismic Survey			Damage to remains of historical structures

8.3 Impact and Mitigation Assessment

The impact of the proposed project on protected historical structures has been reduced from medium-high to low as the reduced project footprint now excludes the town of Leandra where most of the identified historical structures or structure remains are located. Therefore, the only significant heritage resources affected are the two historical stone railway culverts (CCUS 03 and CCUS 33) and three structure or homestead remains (CCUS 06 to CCUS 07 and CCUS 30).

As noted above, the impact significance of the project on graves and cemeteries has been reduced from medium to low as the three community cemeteries (one being Muslim) and one farmworker graveyard identified previously now fall outside the reduced seismic survey footprint. However, the potential grave (CCUS-02) identified within the drill site footprint could still be affected.

The impact significance of the project on intangible and living heritage resources remains low as the informal church site identified is located within the Lebohang township and well outside the reduced seismic survey footprint area.

The impact significance of the proposed project on archaeological resources is low as no archaeological sites or material were identified.

8.4 Impacts During the Planning, Construction and Operation Phase

As a result of the analysis above,**Error! Reference source not found.** the following impact/mitigation t able has been generated.

Table 10: Heritage Resources – Historical Structures Mitigation Table

Environmental Feature	Heritage resources – Historical structures					
Project life cycle	3D Seismic Survey – Planning and Operation					
Potential Impact	Proposed Management Objectives / Mitigation Measures					
Possible damage to or destruction of extant historical structures	N/A to the reduced seismic survey footprint area					
Possible destruction of demolished remains of historical structures	If any negative impact is anticipated on any of these resources, a permit will be required for the destruction/clearance of these resources (from MPHRA or SAHRA)					
	Nature	Extent	Magnitude	Duration	Probability	Significance
Before Mitigation	Negative	Local	Medium	Permanent	High	3
After Mitigation	Negative	Local	Low	Short-term	Low	2
Significance of Impact and Preferred Alternatives	N/A. This is a pilot project and the purpose of the seismic survey is to confirm the suitability of the underlying geology for the proposed Carbon Capture Underground Storage project.					

Table 11: Heritage Resources – Historical Graves and Unidentified Graves Mitigation Table

Environmental Feature	Heritage resources – Graves and burial grounds (CCUS-02)
Project life cycle	3D Seismic survey and Drilling Site – Planning and Operation
Potential Impact	Proposed Management Objectives / Mitigation Measures

<table>
<tr><td colspan="2">Possible damage to or destruction of identified historical graves</td><td colspan="5">N/A to the reduced seismic survey footprint area</td></tr>
<tr><td colspan="2">Potential unidentified graves (CCUS-02)</td><td colspan="5">At the onset of any site clearance activities for the proposed drill site construction, a walk-down of the area must be undertaken by a heritage specialist to monitor any unidentified grave sites
If an unidentified grave site is uncovered during site clearance or construction activities, a buffer of at least 30m must be placed around the site to ensure that during construction, the grave/s are not damaged</td></tr>
<tr><td></td><td>Nature</td><td>Extent</td><td>Magnitude</td><td>Duration</td><td>Probability</td><td>Significance</td></tr>
<tr><td>Before Mitigation</td><td>Negative</td><td>Local</td><td>High</td><td>Permanent</td><td>Moderate</td><td>4</td></tr>
<tr><td>After Mitigation</td><td>Negative</td><td>Local</td><td>Medium</td><td>Long- term</td><td>Unlikely</td><td>2</td></tr>
<tr><td>Significance of Impact and Preferred Alternatives</td><td colspan="6">The possible grave at CCS-02 requires that any site clearance activities for the proposed drill site construction, should be monitored by a heritage specialist. If human remains are uncovered, then a grave relocation process may be considered, in compliance with the requirements of SAHRA</td></tr>
</table>

8.5 Cumulative impacts

The project area and surrounding region has been affected by impacts of activities occurring in the past, current activities and proposed future developments. These will be discussed below.

Past impacts: several development and other activities in the past would have disturbed the heritage resources which occur in the area. This includes the initial establishment and development of the town of Leslie/Leandra and the associated township of Lebohang, the construction of the railway and R29 regional road and the R50 road, as well as historical agricultural activities. The past HIA reports recovered from the SAHRIS database also indicate that the CCUS project footprint and surrounding region has been affected by. These include coal, gold and gravel mining activities as well as the development of the existing quarry and golf course.

Current impacts: the immediate area of the project footprint is affected by existing residential and business/commercial built environment as well as farming activities.

The baseline impacts for the project area are considered to be moderate to high for Heritage resources, and additional project impacts (if no mitigation measures are implemented) will not increase the significance of the existing baseline impacts, where the cumulative unmitigated impact will probably be of a moderate significance. The impact is going to happen and will be short-term in nature, therefore the impact risk class will be Low to Moderate. However, with the implementation of the recommended management and mitigation measures this risk class can be minimized to a Low rating.

9 Analysis of Alternatives

This project is intended to be a research project for the piloting of CCUS in South Africa and the study area was identified specifically due to the suitability of the geological formations that exist in the Leandra area. Therefore, no site alternatives are proposed.

10 ALTERNATIVES

10.1 Introduction

Alternatives are the different ways in which the Project can be executed to ultimately achieve its objectives. Examples could include carrying out a different type of action, choosing an alternative location or adopting a different technology or design for a project.

10.2 Site Alternatives

CGS identified the currently proposed drill site for the following reasons:

- Geology – based on available boreholes, the CGS needed to find adequately thick and deep basaltic sequences that combine a deep and thick, porous and permeable rock layer confined between two impermeable, non-porous layers (to restrict the movement and possible escape of the injected CO_2). This region satisfies this requirement;
- Availability of land – the CGS needed to find a piece of land that could be zoned for research and was not currently being used; and
- Landownership – The land where the dill site is proposed was highly suitable as it was the only state-owned, un-zoned piece of land, and it could thus be secured for long-term research.

No other site alternatives for the CCUS pilot project were considered.

10.3 Layout / Design Alternatives

No information on layout/design alternatives was provided. However, the original planned seismic survey footprint has been reduced to exclude the town of Leandra.

10.4 Technology Alternatives

10.4.1 Subsurface Modelling

A seismic survey was identified by CGS as the only alternative for the subsurface modelling to ensure safe and sustainable piloting. This survey allows for any structures or features that may result in migration of the injected CO_2 to be adequately mapped and accounted for.

10.4.2 Acoustic Source Technologies

The Vibroseis technology is a state-of-the-art technology that is widely used to carry out seismic surveys worldwide. The only other alternative to Vibroseis is using a dynamite shot-hole.

Vibroseis is generally preferred over dynamite shot-holes for the following reasons:

- Vibroseis is cheaper than explosives as a seismic energy source;
- Vibrator settings can be adjusted in the field and can thus greatly improve the results of the seismic survey;
- Vibroseis source points can easily be recorded again if for some reason the reflected signals are not of the required quality; and
- Vibroseis trucks contain energy over a known bandwidth and produce relatively low levels of ground vibrations.

10.4.3 Seismic Data Recording Equipment

Conventional seismic acquisition systems relied on cables connected to each sensor. The preferred option for the project entails using a wireless seismic acquisition system, which consists of deploying geophone units equipped with wireless transceivers over the survey area (Nemai 2023).

The benefits of a wireless seismic acquisition system include the following:

- It enables a greater trace density;
- It avoids the placement of considerable lengths of cables over the survey area, which complicates survey logistics; and
- It increases productivity during the survey;

10.5 Drilling Fluid System Alternatives

10.5.1 Types of Drilling Fluids

Liquid drilling fluids can be broadly classified as follows:

1. Water Based Mud (WBM) – Most basic water-based mud systems begin with water, then clays and other chemicals are incorporated into the water to create a homogeneous blend;
2. Oil Based Muds (OBM) – This consists of a mud where the base fluid is a petroleum product such as diesel fuel; and

3. Synthetic Based Muds (SBM) – Environmentally-friendly organic-based muds using a base fluid produced from natural gas or processed base oil or natural (non-petroleum) oils which are nontoxic and quickly biodegradable, such as the synthetic-based mud.

10.5.2 Management of Drilling Fluids and Waste

Drilling fluids are routed to a solids control system at the surface facilities, where fluids can be separated from the cuttings. Examples of methods used to separate cuttings from drilling fluids include mud pits and storage tanks. The drilling fluids are then recirculated downhole leaving the cuttings behind for disposal.

Alternatives for the treatment and disposal of drilling fluids and cuttings may include one, or a combination of, the following:

- Injection of the fluid and cuttings mixture into a dedicated disposal well;
- Injection into the annular space of a well;
- Storage in dedicated storage tanks or lined pits prior to treatment, recycling, and / or final treatment and disposal;
- On-site or off-site biological or physical treatment to render the fluid and cuttings non-hazardous prior to final disposal; and
- Recycling of spent fluids back to the suppliers for treatment and re-use.

Alternatives for the treatment and disposal of drilling fluids and cuttings will be evaluated during the planning and design of the drilling operations.

10.6 No-Go Option

Under the “no-go option”, the project does not go ahead and the status quo remains. The option of not proceeding needs to be considered in light of the need and desirability of the Project.

Some key considerations in this regard include:

- CCUS has been acknowledged by SA as one of the technologies to mitigate the emissions of carbon dioxide into the atmosphere and forms one of the NAMA. It is also one of the national flagship projects and forms part of a just transition to a future low-carbon energy economy. The purpose of the project is to demonstrate the application of CCUS technology to SA conditions.
- It is noted that this HIA covers the initial phase of the pilot project, which entails data acquisition that will enable evaluation of the proposed CCUS drill site. Without the geological characterisation that will be provided by the 3D seismic survey and stratigraphic drilling, the injection phase of the pilot project will not the able to proceed.

The “no-go option” is not preferred, as the objectives of the CCUS pilot project will not be met, and the associated benefits will not materialise. Although not proceeding with the activities associated with the geological characterisation would avoid the adverse environmental impacts, these impacts are considered to be manageable through the provisions contained in the HIA Report and ESMP.

11 STATEMENT OF IMPACT SIGNIFICANCE

The project area that will be impacted by the proposed Carbon Capture Underground Storage project – Geological Characterisation component is situated over various portions of two farms: Farm Goedehoop 308IR (Portions 2, 6, 12, 13, 25, 29, 31, 35, 42 and RE/9), and Farm Grootlaagte 311IR (Portions RE/3 and 25). As noted above, the area earmarked originally for the 3D seismic survey encompassed most of the town of Leandra, as well as rural areas to the east and north-east and possibly the south-west; however, this footprint area has since been reduced substantially. The proposed drilling sampling site is located outside (to the east) of the town, between the R29 road from Leandra to Kinross and the railway line from Secunda to Springs.

Subsequent to the reduction of the footprint area for the 3D seismic survey, only a few of the heritage resources identified initially will now be affected and the impact of the proposed seismic survey and drilling sampling on the identified heritage resources has been adjusted accordingly.

The impact of the proposed project on protected historical structures has been reduced from medium-high to low as the reduced seismic survey footprint now excludes the town of Leandra where most of the identified historical structures or structure remains are located. Therefore, the only significant heritage resources affected are two historical stone railway culverts (CCUS 03 and CCUS 33) and three structure or homestead remains (CCUS 06 to CCUS 07 and CCUS 30) and a potential grave located within the adjusted drilling site (CCUS 02). In addition, three possible but not certain structure or homestead remains (CCUS 01, CCUS 04 and CCUS 08) will be affected. These are considered to be Not Conservation worthy.

As noted above, the impact significance of the project on graves and cemeteries has been reduced from medium to low as the three community cemeteries (one being Muslim) and one farmworker graveyard identified previously now fall outside the reduced project footprint. However, the potential grave (CCUS-02) identified within the drill site footprint could still be affected.

The impact significance of the project on intangible and living heritage resources remains low as the informal church site identified is located within the Lebohang township and well outside the reduced footprint area.

The impact significance of the proposed project on archaeological resources is low as no archaeological sites or material were identified.

12 HERITAGE MANAGEMENT GUIDELINES

12.1 General Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-
   a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
   b) the construction of a bridge or similar structure exceeding 50m in length;
   c) any development or other activity which will change the character of a site-
   d) exceeding 5 000 m^2 in extent; or
   e) involving three or more existing erven or subdivisions thereof; or
   f) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
   g) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
   h) the re-zoning of a site exceeding 10 000 m^2 in extent; or
   i) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the SAHRA needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

   This survey and evaluation must include:
   a) The identification and mapping of all heritage resources in the area affected;
   b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;
   c) An assessment of the impact of the development on such heritage resources;
   d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
   e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:
   a. Heritage;
   b. Graves;
   c. Archaeological finds; and
   d. Historical Structure remains and Homestead remains

   This module must be tailor made to include all possible finds that could be expected in that area of construction. Possible finds include:
   a. Unidentified graves
   b. Historical /archaeological artefacts or material
   c. Remains of historical structures and homestead remains
   d. Palaeontological deposits

4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified heritage specialist/archaeologist contacted.

5. The heritage specialist/archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.

6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA/MPHRA.

7. After mitigation, an application must be lodged with SAHRA/MPHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.

8. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist/heritage specialist.

9. In the event that human remains are uncovered, or previously unknown graves are discovered, a specialised archaeologist (forensic archaeology/ human remains) needs to be contacted to conduct an evaluation of the finds.

10. If the remains are to be exhumed and relocated, the relocation procedures required by SAHRA need to be followed. This includes an extensive social consultation process.

13 RECOMMENDATIONS AND CONCLUSION

As noted above, the HIA study for the proposed CCUS seismic survey and drilling project identified a large number of heritage resources (36 in total) within or immediately adjacent to the originally provided project footprint. However, subsequent to undertaking the field survey, the footprint area for the 3D seismic survey was reduced substantially. Therefore, the impact on heritage resources is reduced as only nine heritage resources are located within the reduced footprint area.

The recommendations below are provided to mitigate the potential impact of the proposed project on the nine identified heritage resources:

Historical structures and demolished structures

- **The two Historical Railway Culverts (CCUS 03 and CCUS 33)** are protected by section 34 of the NHRA and must be demarcated and avoided as "no-go" areas with a 30m buffer.
- **The demolished structure remains (CCUS 06 to CCUS 07) and possible homestead (CCUS 30)** are protected by section 34 of the NHRA. If any negative impact is anticipated on either of these resources, a permit will be required for the destruction/clearance of these resources (from MPHRA or SAHRA) .
- The three possible but not certain structure or homestead remains (CCUS 01, CCUS 04 and CCUS 08) are not protected or considered to be conservation worthy and therefore no mitigation is required.

Graves and Cemeteries

- **The potential grave at CCUS-02**, that may be located within or on the south-eastern boundary of the proposed drilling site, is protected by section 36 of the NHRA. Therefore, any site clearance activities for the proposed drilling site within 30m of the approximate location, should be monitored by a heritage specialist/archaeologist. If a burial or human remains are uncovered during site clearance or construction activities, a buffer of at least 30m must be placed around the site to ensure that, the burial/human remains are not damaged. In addition, all site clearance or construction activities in the immediate vicinity of the burial/human remains must be suspended. The heritage specialist/archaeologist will then need to apply for a permit for a rescue exhumation of the burial/human remains, in compliance with section 36 of the NHRA.

Living / Intangible Heritage

- As noted above, the **informal community church site (CCUS-11)** would not be affected as it is situated outside the reduced footprint for the seismic survey. *Palaeontological Heritage*

Palaeontological Heritage

- A palaeontological assessment is not expected to be required by SAHRA for the seismic survey component as this is anticipated to impact only the ground surface and not the underlying geology of the project area footprint which is indicated as of Insignificant to Zero fossil sensitivity on the SAHRIS Palaeontological Sensitivity Map.
- However, as the drilling site is intended to sample the underlying geology, and as SAHRA has required such studies for past HIAs for the surrounding area, it is recommended that at least a desktop palaeontological assessment of the drill site footprint must be undertaken and submitted to SAHRA for comment.

Conclusion

Taking all of the above into account, the considered opinion of the heritage specialist is that no fatal flaws with respect to heritage resources have been identified during this HIA study. Therefore, there are no objections from a heritage perspective provided that the recommendations and mitigation measures contained in this report and in the recommended palaeontological assessment are implemented where necessary.

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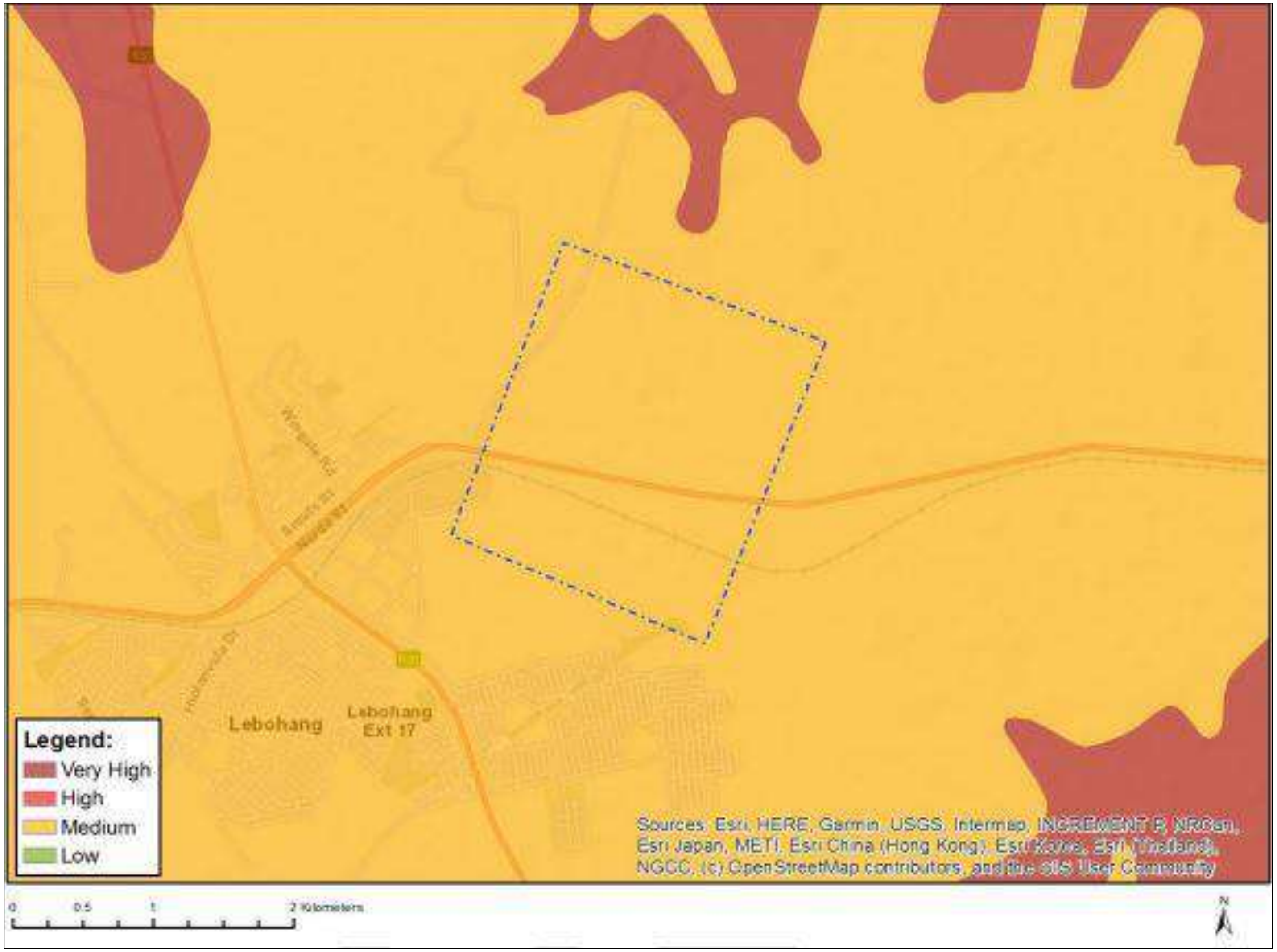
APPENDIX 1: HERITAGE SENSITIVITY MAP/S

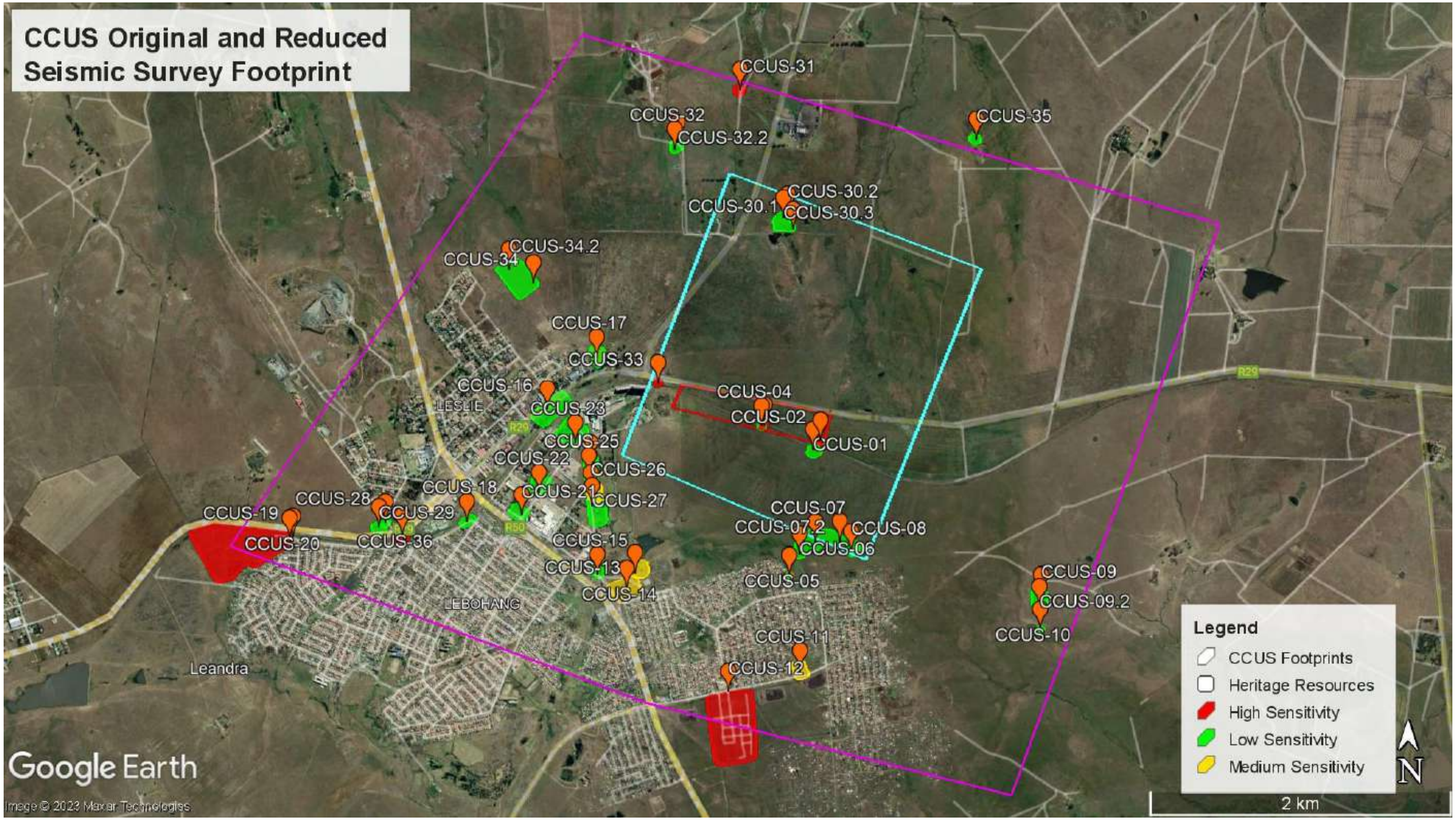
1. **Cultural Heritage Sensitivity map from DFFE screening tool – Reduced Seismic Survey Footprint**

2. Palaeontological Sensitivity map from DFFE screening tool – Reduced Seismic Survey Footprint

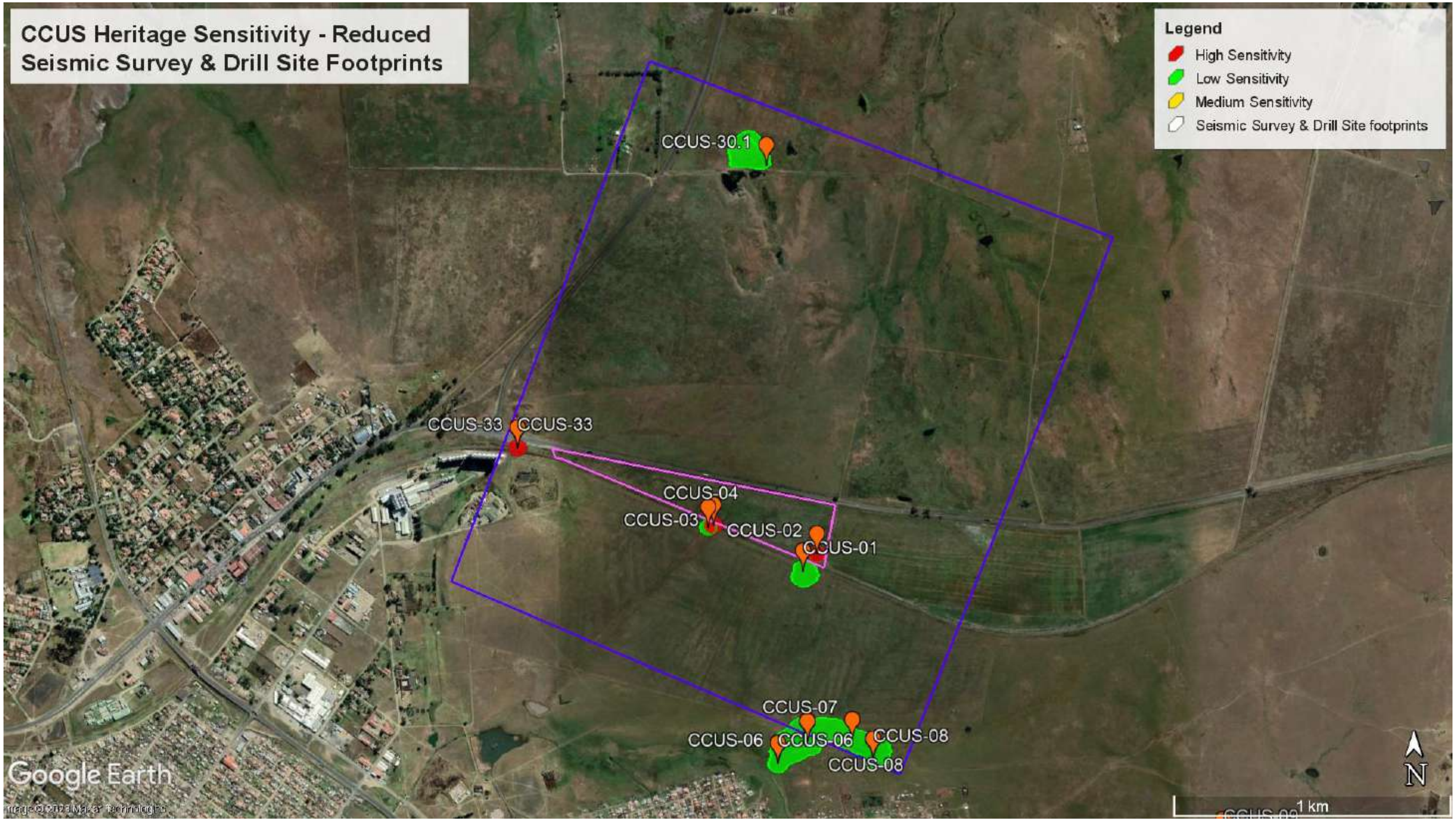


3. Heritage Sensitivity Map based on the Site Inspection / Field survey

3.1 Sensitivity Map showing Original (pink polygon) and Reduced (blue polygon) Seismic Survey Footprints



3.2 Sensitivity Map showing Reduced Seismic Survey Footprint (purple) and Adjusted Drill Site Footprint (pink)



3.3 Sensitivity Map showing Adjusted Drill Site Footprint (pink polygon)

APPENDIX 2: CURRICULUM VITAE OF HERITAGE SPECIALIST

1 Personal Particulars

Profession:	Heritage Specialist
Date of Birth:	11 September 1966
Name of Firm:	Nitai Consulting
Name of Staff:	Jennifer Kitto
Nationality:	RSA
Membership of Professional Societies	Association of Southern African Professional Archaeologists - ASAPA (444); International Association for Impact Assessment - IAIAsa (7151)

2 Education:

BA Hons Social Anthropology, WITS, South Africa, 1994

BA. Archaeology and Social Anthropology, WITS, South Africa, 1993

Higher National Diploma, Practical Archaeology, Dorset Institute for Higher Education (now Bournemouth University), UK, 1989

3 Employment Record:

2022 – Present *Heritage Specialist, Nitai Consulting*

Conduct Heritage Impact Assessments;

2012 – 2021 *Heritage Specialist, PGS Heritage (Pty) Ltd*

Conduct Heritage Impact Assessments

Compile Desktop Historical Research

Compile Heritage Audit and Management Plans

Compile and submit permit applications to National and Provincial Heritage Authorities for Section 34 building alterations and demolitions (under National Heritage Resources Act, 25 of 1999)

Compile and submit permit applications to Provincial and Municipal Health Authorities for Section 36 relocations of graves and burial grounds (under National Heritage Resources Act, 25 of 1999 and National Health Act, No 61 of 2003)

2008 – 2011 *Cultural Heritage Officer (National), Burial Grounds and Graves Unit: South African Heritage Resources Agency (SAHRA)*

Review and assessing permit applications for relocation of historical graves and burial grounds.

1998 – 2008 *Cultural Heritage Officer (Provincial), Provincial Office – Gauteng: SAHRA*

Review and comment on heritage and archaeological impact reports

Research for the nomination and grading process for related to the declaration of specific heritage resources as National Heritage Sites

Monitoring of certain archaeological and built environment National Heritage Sites (e.g., The Cradle of Humankind World Heritage Site)

4 Selected Consultancies

4.1 GDID East Corridor, OHS Implementation, Tambo Memorial Regional Hospital (as sub-contractor to PGS Heritage (Pty) Ltd

2022 Independent Heritage Specialist, Compile Historical Archival Report of Tambo Hospital Boksburg, Gauteng for PGS Heritage (Pty) Ltd, Finalise HIA Report and submit HIA report to Gauteng Provincial Heritage Resources Authority

4.2 GDID East Corridor, OHS Implementation, Tembisa Regional Hospital (as sub-contractor to PGS Heritage (Pty) Ltd

2022 Independent Heritage Specialist, Compile Historical Archival Report of Tembisa Hospital, Ekurhuleni, Gauteng for PGS Heritage (Pty) Ltd, Finalise HIA Report and submit HIA report to Gauteng Provincial Heritage Resources Authority.

4.3 Kroonstad Solar PV Facilities

2022/2023 Heritage Specialist, Development of three Solar PV facilities near Kroonstad, Free State Province, South Africa, Identify, assess and map all heritage resources associated with the three solar PV facilities

4.4 Kroonstad South Solar PV Facilities

2022/2023 Heritage Specialist, Development of five Solar PV facilities near Kroonstad, Free State Province, South Africa, Undertake Heritage Impact Assessment of all heritage resources associated with the five solar PV facilities

4.5 Rustenburg Solar PV Facilities

2022/2023 Heritage Specialist, Development of three Solar PV facilities near Rustenburg, North-West Province, South Africa, Undertake Heritage Impact Assessment all heritage resources associated with the three solar PV facilities.

4.6 Seelo Solar PV Facilities

2022/2023 Heritage Specialist, Development of three Solar PV facilities near Carletonville, North-West Province, South Africa, Undertake Heritage Impact Assessment all heritage resources associated with the three solar PV facilities.

4.7 Decommissioning of Komati Power Station

2023, Heritage Specialist, Proposed Decommissioning of the Komati Power Station, Middelburg, Mpumalanga, Undertake Heritage Impact Assessment of all heritage structures within the power station

5 Languages:

English - excellent speaking, reading, and writing

Afrikaans –fair speaking, reading and writing

Appendix M4: Social Impact Assessment

NEMAI CONSULTING (PTY) LTD

PROPOSED DRILLING AND 3D SEISMIC SURVEY ACTIVITIES OF THE PROPOSED CARBON CAPTURE UTILISATION & STORAGE PROJECT IN LEANDRA, MPUMALANGA

Social Impact Assessment

21 April 2023

Prepared by:
Caroline Tanhuke
NEMAI Consulting (PTY) Ltd
147 Bram Fischer Drive
Ferndale
2194

And:
Justin Dunacn
NEMAI Consulting (PTY) Ltd
147 Bram Fischer Drive
Ferndale
2194

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1 Introduction

1.1 Background

The team of Ciaran Chidley, Justin Duncan, and Caroline Tanhuke of Nemai Consulting have been appointed to undertake the Social Impact Assessment (SIA) as part of Environmental and Social Impact Assessment Studies for the Drilling and 3D seismic survey activities of the Proposed Carbon Capture Utilisation & Storage (CCUS) Project in Leandra, Mpumalanga.

1.2 Qualifications and Experience of the Practitioners

Ciaran Chidley has obtained bachelor's degrees in civil engineering, economics and philosophy, and holds a Master of Business Administration. His experience over the past 26 years includes economic and social assessments for a wide variety of linear and site-based infrastructure and industrial projects. Justin Duncan holds a master's degree in Anthropology and has five years' experience conducting social research across a wide array of industries and topics, including organisational development and structural planning in the NGO space, product development, policy research, and ethnographic fieldwork. Caroline Tanhuke holds a bachelor's degree in environmental management with a major in geography and has three years of experience. Her experience covers assessing social impacts of infrastructure projects including powerlines and pipelines. She has conducted social facilitation projects throughout South Africa.

1.3 Purpose and Scope of the Report

The terms of reference for the study are as follows:

- Describe the social baseline conditions that may be affected by the project;
- Describe the approach proposed for assessing the potentially significant issues that should be addressed by the SIA during the EIA phase;
- Determine the specific local social impacts of the project;
- Identify the potential social issues associated with the project;
- Suggest suitable mitigation measures to address the identified impacts; and
- Make recommendations on preferred options from a social perspective.

1.4 Structure of the Report

The report takes the following structure.

Section 2: Legislation – A description of the statutory and regulatory requirements that informed this report.

Section 3: Project Description – This section provides an introduction and motivation to the project. It includes a description of the study area.

Section 4: Methodology – Outline the methodology used to determine the social impacts of the proposed project.

Section 5: Situational Analysis – A desktop analysis of the baseline situation in the study area. The section includes a discussion on the findings that resulted from community engagement, site visits and stakeholder participation.

Section 6: Impact Variables – The identification of the project activities and their likely impacts.

Section 7: Assessment of Impacts – A discussion of the context and consequence of the impacts, before and after mitigation.

Section 7: Conclusion and Recommendations – Decision making with regards the preferred project alternatives from a social perspective.

1.5 Specialist Declaration

Nemai Consulting operates as an independent consultant conducting Environmental and Social Impact Assessments and associated specialists' studies. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget).

2 Legislative Background

2.1 The Constitution of South Africa

The Constitution of the Republic of South Africa, 1996, is the preeminent legislative framework for the country. It deals with the rights and responsibilities of all citizens who live in the country, as well as of any overarching institutions charged to care for said citizens.

Human Dignity

Section 10 of the Constitution provides that the dignity of all citizens of the country should be respected and protected.

Environment

Section 24 of the Constitution deals with the environment and clearly outlines the condition that must always characterise it so that it remains beneficial for citizens. It states:

“Everyone has the right:

(a) To an environment that is not harmful to the health or wellbeing; and
(b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
    i. Prevent pollution and ecological degradation;
    ii. Promote conservation; and
    iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development”

Access to Information

Section 32 of the Constitution provides that all citizens have equal right to information, particularly as it relates to them in their exercising of protection of any rights.

Just Administrative Action

Section 33 of the Constitution provides that all citizens have the right to administrative action that is lawful, reasonable, and procedurally fair. Any administrative action that goes against the aforementioned right, is cause for written justification to any enquiring citizen.

Enforcement of Rights

Section 38 of the Constitution provides for the right to approach a court, citing the infringement or threat of a citizen’s rights, and to expect the court to provide appropriate relief.

2.2 National Framework for Sustainable Development in South Africa

The National Framework for Sustainable Development in South Africa was published in July 2008 by the Department of Environmental Affairs and Tourism. It seeks to make South Africa’s attempts to achieve the SDGs more intentional. It identifies five strategic focus areas that are envisioned to assist in the achievement of South Africa's sustainable development. These areas are relative to the CCUS project in specific ways, such as by sustaining ecosystems and the equitable use of natural resources, creating human settlements that are sustainable, and having an appreciation for human development, economic, and environmental challenges.

The relevance of this document for the project is in the guidance that it provides for how to align work with South Africa's commitment to achieving the SDGs. Furthermore, the nature of the project explicitly undertakes to promote the SDGs and South Africa's commitment to mitigating its climate change contributions.

2.3 Climate Change Bill

The Climate Change Bill was published in the Government Gazette, issue number 45299, in October 2021, by the Department of Forestry, Fisheries, and the Environment. Its purpose is to enable a legislative environment that promotes the creation of conditions that allow for a sustainable and effective response to climate change in South Africa. The Bill stipulates the alignment of policies and the institutional arrangements that facilitate these, the provincial and municipal climate change response mechanism, the national adaptation to climate change impacts, the approach to dealing with greenhouse gas emissions and removals, as well as general matters that pertain.

Climate Change Response

Section 15 of the Bill provides for the responsibilities of the MEC and mayor of a metropolitan or district municipality in designing a focused and effective climate change needs and response assessment that seeks to mitigate the effects of climate change, within its constitutional mandate.

The Bill is clearly relevant to the project. The CCUS is chiefly undertaken to mitigate carbon emissions by injecting it into the Earth, which produces a wonderful array of by-products after some time. The Bill provides clear guidance for how the municipal arm can play its role in promoting the project.

2.4 National Environmental Management Act

The National Environmental Management Act, No 107 of 1998, was published in the Government Gazette, issue number 19519, volume 401. The Act provides for the establishment of principles and institutions that promote co-operative, environmental governance, that guide decision-making and the co-ordinating of environmental functions, as exercised by organs of state. NEMA, as it's called, serves to ensure that the environment is protected and that all parties engaging in activities that rely upon it are compliant with the agreed principles.

The Act has specific relevance to the project, helping to ensure that all processes are aligned with the standards and legal expectations for environmental work.

2.5 Occupational Health and Safety Act, 85 of 1993

The Occupational Health and Safety Act, 85 of 1993, was published on the 2nd of July 1993, in the Government Gazette, issue number 14918, volume 337. The Act stipulates its function, which is to provide for the health and safety of persons at work, including as related to health hazards arising out of work, and in operation of plant and machinery. It also provides for the establishment of an advisory council with regards to health and safety.

2.6 Spatial Planning and Land Use Management Act, 16 of 2013

The Spatial Planning and Land Use Management Act, 16 of 2013, was published on the 5th of August 2013, in the Government Gazette, issue number 36730, volume 578. The Act provides a framework to guide the spatial planning and land use management in South Africa. Generally, it serves to ensure that spatial planning and land use are designed equitably and efficiently by using the framework to guide policies, principles, norms, and standards, providing for greater consistency and uniformity in the application of procedures and facilitating and enforcing compliance therewith.

2.7 Labour Relations Act

The Labour Relations Act, 66 of 1995, was published on the 25th of July 2002, in the Government Gazette, issue number 23611, volume 938. This may be useful to consider if people from the area are being employed to assist in the project. The Act provides for all aspects relating to the employment of labour in South Africa and takes effect from the Constitution. Its relevance to the project lies in the necessity for individuals to be employed to conduct and facilitate the study. Thus, it is important to remain relevant of these legislative requirements.

2.8 National Water Act, 36 of 1998

The National Water Act, 36 of 1998, was published on the 26th of August 1998, in the Government Gazette, issue number 19182, volume 398. The Act provides legislative reform for the fundamentals of water resources in South Africa. It provides for water management strategies, protection of water resources, and the promoted uses of water. Furthermore, and in relation to this study, it accounts for:

- Ensuring that the basic humans needs of present and future generations are met
- Ensuring equitable access to water
- Working to redress the consequences of past racial and gender discrimination
- Ensuring the efficient, sustainable, and beneficial use of water in the public interest
- Eliminating the pollution and degradation of water resources
- Aligning with international obligations and best practices

2.9 Protection of Personal Information Act, 4 of 2013

The Protection of Personal Information Act, 4 of 2013, was published on the 26th of November 2013, in the Government Gazette, issue number 37067, volume 581. The Act provides for the protection of personal information that may be processed by public or private bodies. Essentially, there are principles that guide how personal information can be collected and used. Its relevance to the project pertains to the collection of personal information from participants whose opinions will influence the social understanding of the environment. In ensuring that this information is treated with respect, it validates the intention of the project to protect the environment and the people who live there.

3 Project Description

The CCUS project is planned to be undertaken in Leandra, as part of an initial survey of the potential for future such projects to capture and store carbon underground. The project is hugely important for the role it plays in helping South Africa to mitigate its contributions to climate change, which is part of its agreement with the Paris Accords in 2016. The Department of Energy has committed to support the research and development of tools to assess such environments as the current project, which aligns with the Paris Accords and with the Sustainable Development Goals. Overall, the project holds potentially great benefits; thus, the assessment of its impacts is vital.

3.1 Project locality

The Project is located within the Govan Mbeki Local Municipality, in the town of Leandra. The initial project area was designed to fall within Ward 1, Ward 2, Ward 3, and Ward 6. The eventual project area was significantly reduced, eventually excluding Ward 3. At its initial stage, the project encompasses the township of Lebohang and the adjacent informal settlements. Although these are now excluded, the impacts of the seismic survey must be considered for their potential to have an effect on these residents.

Figure 1 Govan Mbeki Locality Map

At its current coordinates, the project cuts through the town of Leslie and is takes place mainly on farmland. A railway track runs through the project area and alongside the drill site.

3.1.1 Carbon Capture, Utilization and Storage Project Site

The CCUS's drilling and seismic survey constitute the main elements of the project. The following map depicts the layout of the proposed CCUS borehole drilling site.

Figure 2 Borehole Drilling Site Layout

Source: Council of Geoscience Website

The map below shows the location of the farms on which the #D Seismic survey will take place.

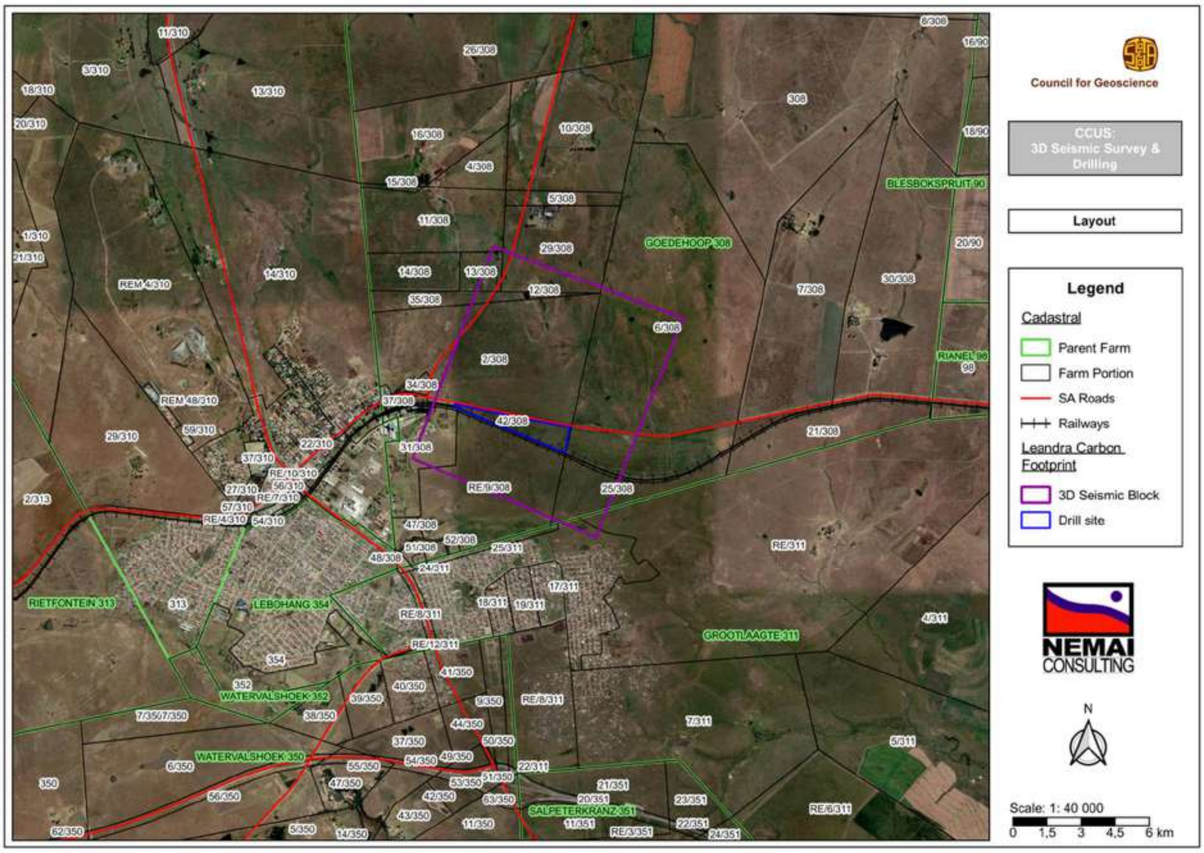

Figure 3 3D Survey Farm Boundaries

The larger polygon, shown in purple, is the area in which the survey will be conducted. The blue polygon shows the location of the borehole drilling area.

3.1.2 Profiles of the Surrounding Farms

The 3D Seismic Survey will directly affect some of the farms closer to the project area. Agricultural activities that are dominant on most farms are crops and livestock farming. The table below provides a description of landownership.

The 3D seismic survey will likely not cause any long-term impacts on farm and grazing land.

Table 1: Farmers/ Landowners directly affected by the project

Farm Details	21-digit Surveyor General No.	Landowner
Project Site		
Farm Goedehoop 308 RE of Portion 48	T0IR00000000030800048	Govan Mbeki Local Municipality
Seismic Footprint		

Farm Details	21-digit Surveyor General No.	Landowner
Farm Goedehoop 308 Portion 2	T0IR00000000030800002	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 4	T0IR00000000030800004	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 5	T0IR00000000030800005	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 6	T0IR00000000030800006	Mr Bart Harmse / Barwou Boerdery Trust
Farm Goedehoop 308 Portion 7	T0IR00000000030800007	Gideon Van Wyk
Farm Goedehoop 308 Portion 9	T0IR00000000030800009	Nu-Way Housing Developments Pty Ltd
Farm Goedehoop 308 RE of Portion 9	T0IR00000000030800009	Nu-Way Housing Developments Pty Ltd
Farm Goedehoop 308 Portion11	T0IR00000000030800011	Payne Charles William
Farm Goedehoop 308 Portion12	T0IR00000000030800012	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion13	T0IR00000000030800013	Swiegers Louisa Antoinetta Susanna Magdelena
Farm Goedehoop 308 Portion14	T0IR00000000030800014	Payne Charles William
Farm Goedehoop 308 Portion15	T0IR00000000030800015	Wallin Farming Cc
Farm Goedehoop 308 Portion 25	T0IR00000000030800025	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 30	T0IR00000000030800030	Piet Streiger
Farm Goedehoop 308 Portion 34	T0IR00000000030800034	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 35	T0IR00000000030800035	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 51	T0IR00000000030800051	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 52	T0IR00000000030800052	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 47	T0IR00000000030800047	Govan Mbeki Local Municipality
Farm Goedehoop 308 Portion 31	T0IR00000000030800031	Govan Mbeki Local Municipality
Adjacent Properties.		
Remainder Portion 310	T0IR00000000031000016	Michael Katz
Farm Grootlaagte 311 Portion 7	T0IR00000000031100007	Pfuka Africa Business Channel Cc

3.2 Project Components

The components of the project are those features intrinsic to the work that are considered to have an impact and are, therefore, important to describe at the inception of the study.

The main components are the 3D seismic study and the drilling activities that will follow.

3.2.1 3D Seismic Survey

The 3D seismic survey will be conducted using vibroseis. Vibroseis is a seismic method in which a vibrator is used as an energy source to generate a controlled wavetrain which is directed underground. The vibrating plate is hydraulic actuated, and acts against the hold-down mass created by the vehicle containing the equipment. The vibrations are pulses of energy with a duration of approximately ten seconds at a time. By analysing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, the formations can be mapped. Vibroseis entails three elements – the vibrator truck (see Figure 4 below), the geophones, and the receiver truck. The vibrator truck is positioned over a predetermined coordinate and a hydraulic arm attached to a baseplate is used to generate a vibration, usually between 5Hz and 150Hz.

Figure 1: Vibrator Truck

The elongated seismic wave that is generated reflects off subsurface formations and is returned to geophones placed on the surface of the Earth, which captures the signals and sends them to the receiver truck. Once at the receiver truck, an analysis creates a 3D rendering of the subsurface. The 3D seismic data for the project will be processed using pre-stack time/depth migration and post-stack time migration approaches for comparison purposes. The information from the existing legacy and borehole data will be utilised to provide constraints on the designs of the seismic surveys and processing of the seismic data.

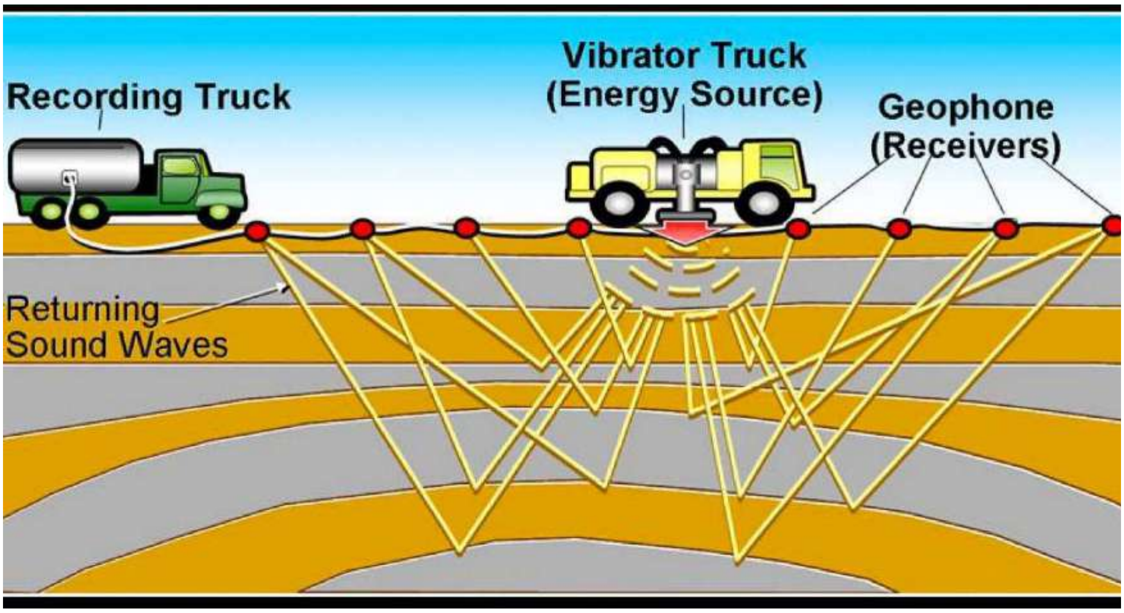

Figure 4: Vibroseis process

Source: https://cem.utexas.edu/content/vibroseis-research

The purpose of the high-resolution 3D seismic survey for the CCUS Project is to map the structures, reservoir and seal rocks in detail over the identified potential injection site. The 3D survey will also establish the baseline for future time-lapse CO_2 monitoring activities. 3D seismic surveys must be conducted over a large area to provide sufficient data for accurate interpretation of the subsurface geology. For the project, the seismic waves will be induced by vibrating truck mounting heavy plates which are placed on the ground as an energy source.

3.2.2 Drilling Activities

One borehole will be drilled for the project. The borehole will be cored from the top of the bedrock to total depth of approximately 2 000 meters, with a minimum hole diameter of approximately 95 mm.

At various intervals during the drilling, suites of geophysical instruments will be installed in the borehole to obtain geo-physical information. In addition, tests to determine the presence and quantity of hydrocarbons or light gasses, and tests to determine hydrological information will be conducted at systematic horizons. An example of such tests are recording where water strikes are intersected in the borehole.

Plant, equipment, and goods associated with the drilling shall include:
• Drill rigs including masts or derricks;

Plant, equipment, and goods associated with the drilling shall include:
• Drilling fluid mixing, pumping and recycling equipment;
• Grouting pumps, mixers and all other equipment necessary to grout casing of the secure the borehole when necessary;
• Lighting plants and other equipment necessary to allow safe and efficient 24-hour operation;
• Adequate power supply unit for the drilling operation and the staff camp;
• Water supply for drilling and potable water for workers;
• Site office accommodation, stores, workshops and kitchen facilities at the site;
• Office for CGS representatives;
• Adequate vehicles to allow completion of the work, including suitable transport to safely transport contractor personnel to and from the drill site;
• Adequate, approved temporary ablution and latrine facilities;
• A reliable communication system; and
• All spare parts and back-up plant and equipment to ensure safe and efficient completion of the work.

The figure below shows the layout of a typical borehole drilling site.

Figure 5 Typical Borehole Drilling Site

On completion, the borehole will be securely capped with a concrete sanitation block and a lockable metal cap with a clear sign to avoid potential hazards. The drill site will also be suitably rehabilitated. New facilities will be created for the injection phase.

3.3 Social Stimulus

The potential for creating value within the regional study area and into the broader Mpumalanga economy depends on the level of development of the carbon mitigation initiatives.

The toxic air produced by coal production industries, mining plants, and chemical manufacturers have social, health and economic impacts in the province and on the globe at large. As per World Bank, "the absence of well-designed and inclusive policies, climate change mitigation measures can place a higher financial burden on poor households. For example, policies that expand public transport or carbon pricing may lead to higher public transport fares which can disproportionately impact poorer households". The need to mitigate global warming impacts is on the rise, from a socio-economic perspective.

The proposed project can be expected to greatly contribute to South Africa's commitment to mitigating its carbon emissions. By playing its role in this initiative, there are expected benefits on the global stage, such as attracting foreign investments, which would help to alleviate the burden felt by citizens over the long term. Depending on the success of the project, more such sites may be established, which would create further jobs and require the development of specific skills, feeding into the country's skills development initiative.

3.3.1 Job Creation

According to StatsSA, the total number of persons employed in the construction industry in 2020 was 473 214. Alarmingly, this number is down from the 2017 figure, 592 125. This implies either that jobs became unavailable or that there were not enough qualified individuals to fill roles. Projects such as the CCUS will help to address this challenge in the construction industry.

The project is estimated to create twenty-five jobs for the duration of the project. Approximately ten jobs will be created for the 3D seismic survey and fifteen for the borehole drilling. These jobs would be specialised in nature and would require high levels of skill. Lower skilled jobs arising from the project would include labour, security guards and flag people.

The direct jobs mentioned above would are supplemented by indirect jobs created through the economic activity generated by the project. These jobs would range from the delivery of materials and the monitoring of the site throughout the lifecycle of the project, thus making contributions across the value chain. Furthermore, the potential beneficial by-products from the CCUS will offer employment opportunities into the future.

A job localisation programme would be implemented for the projects and some of the expected targets are:

- Job creation for SA citizens – a minimum of 50% and a target of 80%; and
- Local content for SA manufactures – a minimum of 45% and a target of 65%.

The Department of Energy reports that of the 33 019 job years were created for the entire renewable energy procurement programme, 18 253 job years were attributable to people from the local community, this is a proportion of 55%. This proportion can be attributed to the proposed project. The Department of Energy also cites figures that 8% of employment was female and 41% was from the youth category (Department of Energy, 2019). These proportions can also be attributable to the project.

3.3.2 Economic Value Creation

The value of the project is estimated at R50 million, and these funds will be expended within the project duration of six months.

3.3.3 Project Phase Activities

The borehole project site will be established and will include temporary offices, ablutions and an eating area. There will be a small hard standing for project vehicles. The drilling vehicle will be established on site, along with two support trucks. The project site camp will resemble a small construction site camp.

The vehicles needed for the borehole drilling portion of the project will not exceed ten, with three of these being trucks exceeding ten tons in gross vehicle mass. Most of the vehicles to be used for this segment of the project will be light delivery vehicles.

The vehicles needed for the 3D seismic survey portion of the project will also not exceed ten, with two of these being specialised trucks exceeding ten tons in gross vehicle mass. Most of the vehicles to be used for this segment of the project will also be light delivery vehicles.

3.3.4 Duration of the Stimulus

The duration of the project is expected to be twelve months, including all planning and data analysis functions.

The site spent on site by the drilling team will be 158 days, or five months, including mobilisation and demobilisation.

The site spent on site by the 3D seismic survey team will be 54 days, or two months, including mobilisation and demobilisation.

4 Methodology

The information presented in this report was obtained through the following data collection methods.

4.1 Sourcing of Information and Data Analysis

The Socio-Economic Impact Assessment sets out the socio-economic baseline of the study area; predicts social and economic impacts and makes recommendations for mitigation of negative social and economic impacts and measures which can be taken to enhance the positive social and economic impacts.

The baseline study is based on both primary and secondary data. Primary data was collected directly from engagements with community members, landowners, and business owners. Secondary data was accessed through South African economic and social databases. Articles and internet searches were also used and are referenced in the text and in the reference sections of this report.

The profile of the baseline conditions includes describing the current status quo of the community; including information on a number of social and economic issues such as:

- Demographic data.
- Socio-economic factors such as income and population data.
- Access to services.
- Institutional environment.
- Social Organization (Institutional Context); and
- Statutory and Regulatory Environment.

4.2 Primary Data

4.2.1 Public Participation

The Public Participation Process (PPP) granted Interested and Affected Persons (I&APs) an opportunity to comment on the project during the project announcement phase. Comments and Responses used during this process have been included into this report and have formed one of the bases of the analysis of the socio-economic impacts considered in this report.

Further primary data was collected for the purposes of the study; these were collected using the following approaches:

- Rapid Rural Assessment: A survey was conducted to capture visual observations on the social dynamics, community proceedings, community resources and infrastructure.
- Stakeholder Engagement procedures: Engagements with the affected communities carried out by members of the project team along each project component to discuss the proposed project and to gather their concerns and feedback on the project; and
- Key Informant Interviews: Informal discussions with the IAP's to help inform the baseline were conducted during site visits and as well as during the scoping phase. These included community members and authority members.

4.3 Secondary Data

An assessment of the SIA was conducted to provide an understanding of the project detail, location, and possible impacts.

The required information was collected using different sources, these included Statistics South Africa Census data as well as a review of relevant municipal, district and other literature. The discussion of the demographics and the development profile of the study area is carried out using Census 2011 data produced by Statistics South Africa (StatsSA). The Census 2011 data is the most comprehensive dataset available for the subject areas, and it is currently the best data at hand. The ward and municipal data have been extracted using the project Geographic Information System, and the data for the affected areas will be presented in tables and figures throughout the report.

4.4 Geographic Information System

A Geographic Information System (GIS) was used to conduct an analysis of the area. The use of GIS brings together the demographic and socio-economic data to enable a thorough analysis of the project area.

4.5 Impact Assessment

The determined impacts are clustered around a common-issue and are assessed before and after mitigation. The identification of the socio-economic impacts associated with the project is issues-based, with the main headings referring to a common theme addressing several related impacts. Under each of these issues, the specific impacts and potential mitigation strategies are discussed for planning, drilling and the 3D seismic survey.

4.6 Assumptions and Limitations

The following assumptions and limitations underlie this socio-economic impact assessment:

- The information obtained during the public participation phase provides a comprehensive account for the community structure and community concerns for the project.
- The study was done with the information and the time frames available to the specialist at the time of executing the study. The specialist took an evidence-based approach in the compilation of this report and did not intentionally exclude information which is relevant to the assessment.

5 Description of the Area

The study area is located in the Gert Sibande District Municipality, in the province of Mpumalanga. The town of Leandra falls in the Local Municipality of Govan Mbeki. This section gives an overview of the local study area and its receiving environment within a 100m buffer from the 3D seismic survey area as the study radius. The project area initially included large portions of the town of Leandra, which covered the entirety of the neighbourhood of Leslie and a great extent of the township of Lebohang, but has since been reduced to only include farmland surrounding the drill site. The map below provides an overview of the area to be included.

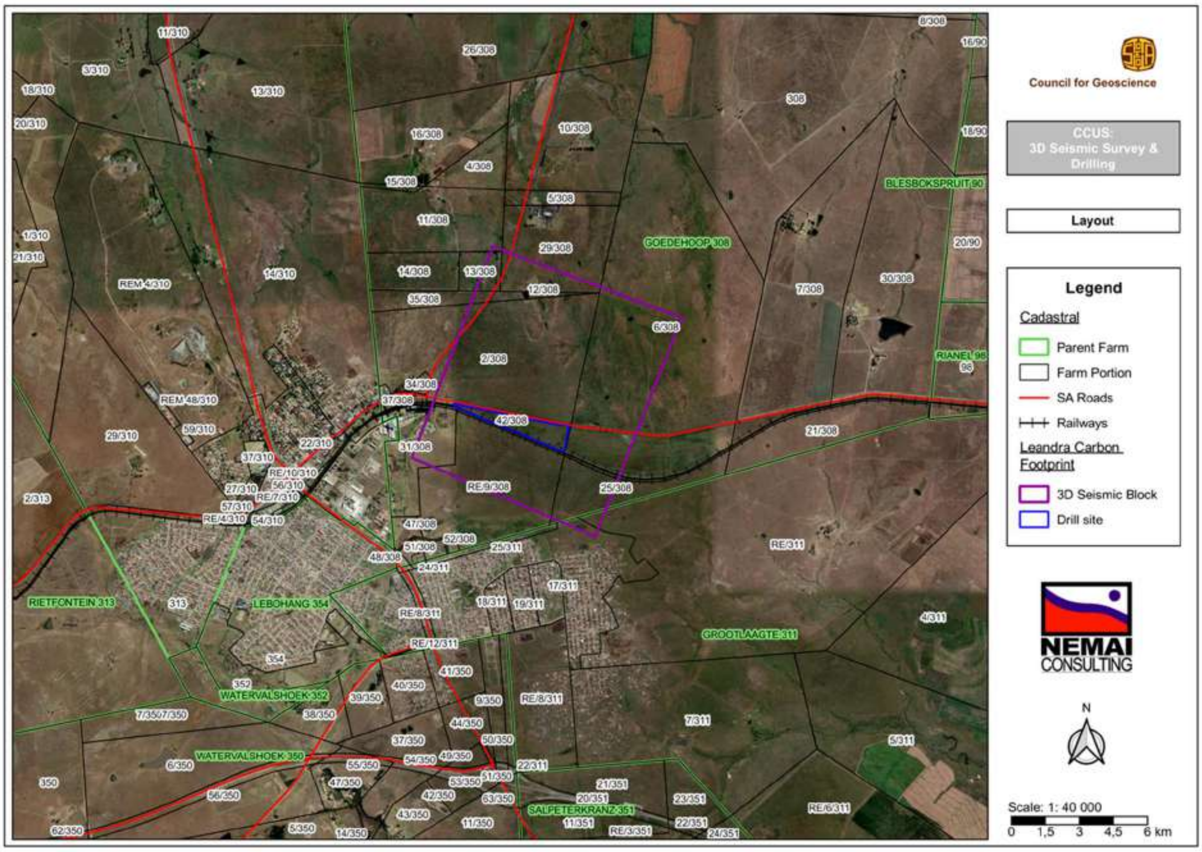

Figure 6 ocal Study Area

It is necessary to still consider the communal areas of Leandra to account for the likelihood of seismic activity having an effect.

5.1 Context of Leandra

The name Leandra is a portmanteau of Leslie and Eendracht, two of the neighbourhoods found there. There is a sprawling township named Lebohang, and two informal settlements named Marikana and Ekuthuleni. According to StatsSA, which categorises Leandra and Lebohang separately, the total population of the area of Leandra is 2 023, with the majority (67.2%) composed of working age individuals; whereas the total population of Lebohang is 31 553, with the majority (65.1%) composed of working age individuals.

5.1.1 Leslie

Leslie is comprised of residential housing and an industrial area. It is located approximately one kilometre from the project direct site. The images below depict the residential and the industrial area of Leslie. The area is also characterised by free standing houses, such as government subsidised houses, commonly known as RDP houses, and private houses.

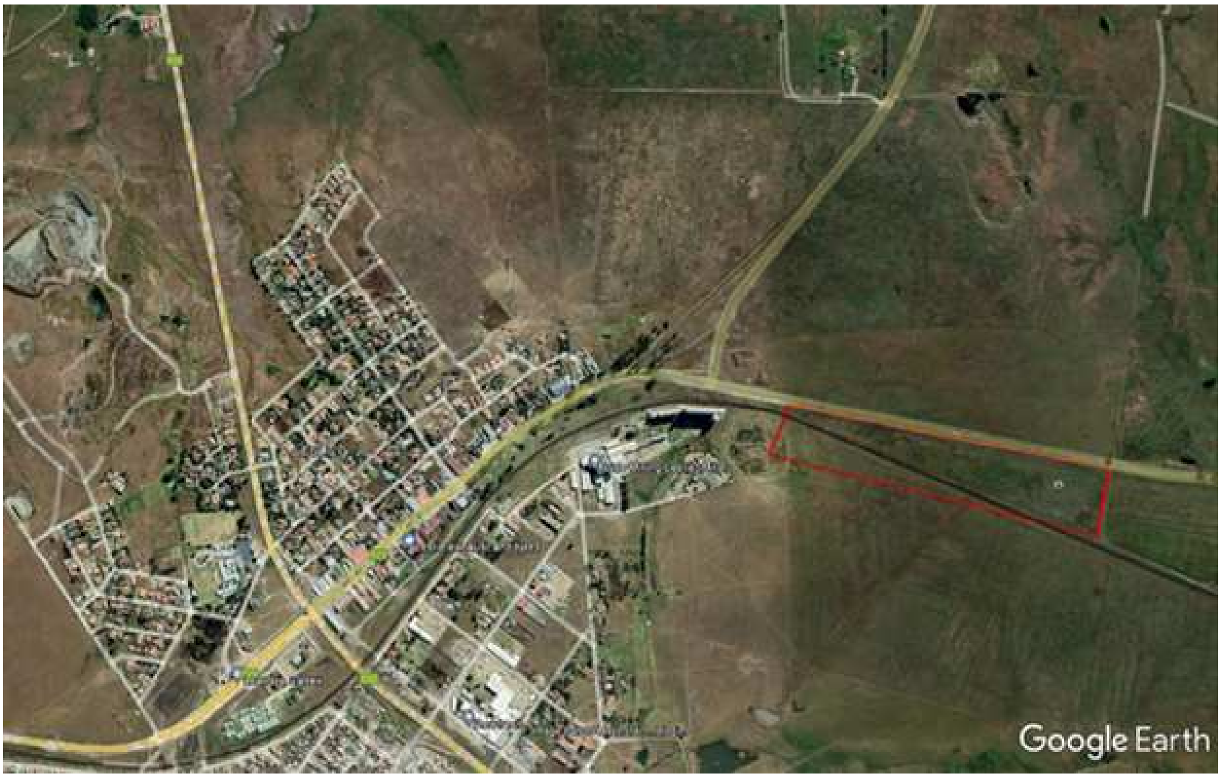

Figure 7 Google Earth Image of the 3D Seismic Area

There are government administration offices, restaurants, and companies, such as the Afgri Silo Leandra / Leslie, Dewfresh, Pride Milling, and many more existing in this vicinity.

<table>
<tr>
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<tr>
<td>Agri-Silo Leandra</td>
<td>Dewfresh Factory Outlet</td>
</tr>
</table>

Figure 8 Leslie neighbourhood

5.1.2 Lebohang

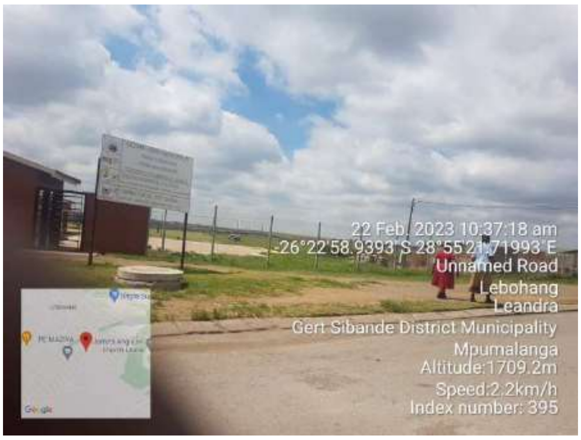
The sprawling neighbourhood of Lebohang forms part of Leandra. It is located twenty kilometres west of Kinross, between the N17 and the R50 roads. Figure 4 illustrates the size of Lebohang. The township will be indirectly affected by the project.

Figure 9 Lebohang township

The dwellings are characterised by clustered government/RDP houses and informal dwellings. There are schools, worship centres, a cemetery, clinics, community facilities, and community businesses, such as spaza shops, car wash places, informal street traders etc

Isolomuzi Day Care

Leandra Car Wash



Lebehang Stadium

Lebohang Community facilties road

Figure 10 Various Facilities in Lebohang

5.1.3 The Marikana and Ekuthuleni Informal Settlements

Ekuthuleni and Marikana informal settlements are located towards the southeast of Lebohang. The settlements are directly opposite each other, separated by the R50 road. According to key informants, the settlements are continuously expanding, and their occupancy is illegal, as the land is owned by either the government or private institutions. The settlements will be indirectly affected by the project.

Figure 11 Marikana and Ekuthuleni Informal Settlements

5.1.4 Eendracht Community

Eendracht community is located approximately five kilometres from the project area and roughly one and a half kilometres from Leslie. The area of each plot is about two thousand square metres in size. Private houses and businesses are popular in the vicinity. The neighbourhood will be indirectly impacted by the project.

Figure 12 Eendracht Community

5.2 Transport Infrastructure

There are two main roads in the proposed site area. There is the R29, which passes through Leandra, coming from Devon to the east and extending to Kinross at the west. The R29 meets with the R50, which carries traffic directly from the N17. This intersection is controlled by stop signs. Without traffic lights, this intersection can potentially become congested during peak hours. T

There is also a railway that runs parallel to the R29 along the length of Leandra. The railway road is mainly utilised for commercial purposes, such as the transportation of grains by the AFGRI-Silo and coal mines. The line forms part of the links that connects to major nodes, such as Swaziland and northern KwaZulu Natal, as well as the Secunda development node within Mpumalanga.

Leandra has an aerodrome. It is accessed from the R29 and lies approximately half a kilometre from the proposed 3D seismic footprint area. The seismic truck movement will likely not cause any impacts to this facility.

5.3 Land Use and Infrastructure

The area is rich in mineral and natural resources, coal deposits and gold minerals from Leandra, which contributes significantly to the mining industry. Commercial and non-commercial agricultural activities are the main activities in the area, and therefore utilise considerable land area. The land use and infrastructure features of the area are:

- Unsurfaced gravel roads joining the main roads of the R29, and R50. The R29 runs past Leslie and parallel to the railway line. The R50 runs directly through Leandra, linking Delmas in north and Standerton in the south. The N17 is not directly related to Leandra, however it runs south of the study area and will carry traffic onto the R50.
- The site area is located over Kiejane's Butchery, which sits south of Afgri Silo.
- The site area is adjacent to the formal and informal communities of Leandra and Lebohang.
- There is an existing railway and roads that are functional. These are universally used by the public, mining and agricultural industries.
- There is an aerodrome facility about 1km from the proposed seismic footprint area.

5.4 Commercial Farms

The commercial farms in the project area raise a combination of grain crops and cattle. The farms are fenced and access is provided through farm gates.

5.5 Communal Land

Communal land in the project is easily accessible, being generally unfenced. Livestock herders and informal settlers utilise this land. Local people have indicated concerns for the mushrooming of informal settlements on communal lands and if the local government does not intervene, the socio-economic challenges will increase.

Uncontrolled land pollution, such as communal illegal dumping, is also prevalent in this area.

5.6 Socio-economic baseline of the 3D Seismic Survey Area

The initial project area encompassed the majority of the town of Leandra. The re-sized project area now only covers farmland and only will only indirectly affect housing and high density urban areas. The closest urban area, Leandra, is categorised by a central business district, an industrial area, schools, worship centres, small scale businesses, open-air churches, NPO organizations, and several other relevant features. Institutional facilities, such as a clinic, police station, and the local Home Affairs office offer services to the whole of Leandra. The biggest and closest hospitals are in Evander and Bethal.

At the proposed project site itself, community members' livestock roams freely within the area and grazes on the open access land near the project area. Community farmers in this area keep cattle, pigs, chicken and goats for economic and traditional purposes.

Figure 13 Community Livestock on the Project Site

There are a high number of unskilled labourers in the area. Based on the engagements with the local people, the community lacks skills empowerment initiatives. The COVID-19 pandemic had a drastic impact on the community, with a tremendous increase in unemployment through retrenchments and job loss through a reduction of economic activity. Most of the population in this area rely on grants for economic needs and are thus economically vulnerable. Other observed economic activities in the area include spaza shops, informal trading establishments, car wash areas, and a taxi rank, which creates its own economic microsystem. Furthermore, the Expanded Public Works Programme is a positive initiative that provides partial work opportunities to local jobseekers.

Drugs and substance abuse are prevalent amongst the youth and constitute a growing problem. According to local representatives, the rate of unemployment is the major contributing factor to this challenge. Moreover, the area does not have rehabilitation centres that can assist youth and others who are grappling with personal challenges. Crime is also experiencing an upsurge; the local people iterated the spate of hijackings and heist activities that have plagued the community.

There are places of spiritual significance in the nearby project area. There are burial sites and religious congregations, such as mosques, churches, and traditional places of worship. The sanctity of these areas must be respected to ensure the dignity of the community members is not threatened.

A lack of municipal service delivery is a challenge, particularly in terms of water supply. The ongoing load shedding by Eskom has affected the ability for water to be adequately pumped to households, as the municipality purchases its water from Rand Water, which has been experiencing consequent challenges. In addition to this, the lack of infrastructure development has continued to have a negative impact on the residents. Though most households have flush toilets, some rely on pit latrine toilets, which poses its own unique set of dangers. According to residents, waste is collected once per week; however, this has not prevented communal dumping from becoming a challenge. The town has one public clinic and a police station, the demand for their services tend to exceed supply, with a consequent impact upon the community.

Noise impacts are generated from various economic activities in this area. The R29 and R50 routes are utilised by heavy duty vehicles, trucks, industrial vehicles. The movement of the train, activities from industrial companies such as Pride Mill, Dew fresh, AFGRI and other local small-scale companies generate an reasonably high level of noise. According to the local people, there are no land vibration activities that are currently taking place.

5.7 Stakeholder Engagement and Public Participation

The World Bank's Environmental and Social Framework (2017) defines the stakeholder engagement process as a "process that is inclusive and conducted throughout the project life cycle" (p. 97). The procedure further supports the development of strong, constructive, and responsive relationships that are important for successful management of a project's environmental and social risks. At this stage of the project stakeholder engagement was conducted to determine view and attitudes towards the project.

The following stakeholder engagement and public participation methodologies were carried out in accordance with the Stakeholder Engagement Plan that was compiled as per the standards set by the World Bank Standards. The SEP document followed processes of identifying stakeholders, building a communication plan, mapping interested and affected stakeholders as well as creating ways of providing feedback through a grievance mechanism process.

5.7.1 Comments Made by the Public

The process of collating the responses from stakeholders was undertaken according to the stakeholder engagement plan, which was specifically created for the project. Significant effort was taken to alert the I&APs to the project so that they would be adequately sensitised to the forthcoming activities. A database was created of the potentially affected parties and community elected representatives were sent email and SMS notifications, which included a Background Information Document (BID). This document provided an overview and description of the proposed project. The overall socio-economic comments received during the commenting period have been collated and form part of this report. A summary of these findings is presented in Table 8. *See Appendix I* for the questionnaire used to gather inputs.

5.7.2 Primary Data Collection Report

A baseline study of the area's infrastructure was conducted on Google Earth prior to the site visit. The analysis of properties and infrastructures were observed within a 100m radius around the 3D seismic footprint. *See Appendix II*

5.7.3 Rapid Rural Assessment Process.

A site visit was conducted. The purpose of the visit was to compile primary data on the receiving social environment and to understand the expectation of the local people with reference to the proposed project. During the site visit tour, the below socio-economic needs were observed in the receiving environment.

Table 2: Summary of the Community's Needs

Key needs / Issues Identified	Mitigation methods
Livelihood economic opportunities	• There is a need to create more economic opportunities that will benefit marginalised communities with special emphasis on the empowerment of women and the youth with special skills. • There is a need to implement diverse economic activities and radically drive communities to be fully involved. • Create broad based economic activities.
Development of skills for the youth.	• Introduce skills development programmes that will target matriculants, school leavers and the unemployed as this will curb the rate of employment expectations from the seasonal jobs available in this area. • Create technology and sustainable innovations that will further develop skills for the youth. • Implement training programmes that will maximise employment opportunities for the local community.
Roads Development	• There is a need to improve and implementing maintenance services of the inner roads and major routes. In addition, solar powered traffic control lights can be implemented to help in managing the influx of vehicle traffic in the area.
Land Pollution Mitigation Measures	• The municipality can partner up with local cleaning companies to mitigate the challenges of illegal dumping on open-access land and within local areas in local communities.
Drugs / Substance Abuse amongst the youth.	• Rehabilitation centres are necessary to mitigate the challenge of drug and substance abuse.
Public health facilities	• There is a need for an additional public health facility that will service the growing population. Health challenges such as asthma due to high pollution levels are dominant especially amongst the infants and the old.

5.7.4 Stakeholder Engagement and Public Participation Processes

Barrow, CJ (2000) suggests that the purpose of conducting random interviews is to provide the diverse public an opportunity to share their insights, thereby involving varied opinions in decision-making, even from those who are reluctant or marginalised. Focus group sessions and key informant interviews were conducted and formed an integral part of the stakeholder participation.

The purpose of engaging with stakeholders in the direct study area was to establish and record unbiased views and or comments of the proposed project, to ensure that all comments and issues raised during the stakeholder engagement processes are included in the final ESIA report and the information about the project has been properly disseminated to the local community. The below table summarises the activities and timeframes of engagement.

Table 3: Summary of the applied stakeholder engagement processes.

No	Activity	Date
1	Site Notices	8 March 2023
2	Distribution of Background Information Documents (BID)	3 March 2023
3	Newspaper notices	7 to14 March 2023
4	Radio Announcement	3 March 2023
	Focus Group Meetings / Key Informant Interviews ▪ District Municipality ▪ Local Municipality ▪ Leandra Community Structure ▪ NPOs/NGOs ▪ Business Forums ▪ Health, safety and security officials and representatives. ▪ Landowners/Farmers and Associations of the Farming Community. ▪ Heritage/Cultural / Worship Centres ▪ Academic Institutions within Leandra ▪ Marginalised communities (The poor, refugees, the elderly, informal settlements etc)	6 to 15 March 2023
3	Administering of questionnaires	14 to 15 March 2023
4	Public Meeting	15 March 2023

The following were the aims of engagements:

- To communicate the objectives and scope of the drilling and seismic survey phase of the CCUS project;
- To gather inputs, contributions, and concerns of the Interested and Affected Parties in Leandra on the proposed project;
- To conduct and document a socio-economic baseline of the proposed project area that could be impacted by the project's activities; and
- To engage and understand the possible impacts that could result from the drilling and seismic survey of the proposed project as well as to suggest mitigation measures that will ensure a positive outcome of the project without interfering with the social environment.

5.7.5 Summary of the Overall Comments received.

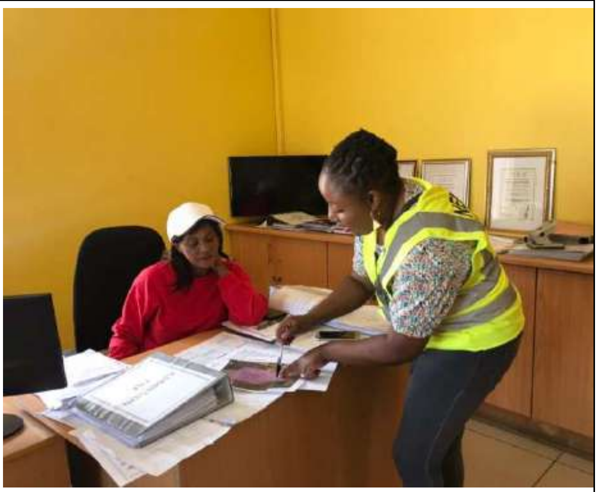
The overall comments that were received from the engagements were positive. The local people are looking forward to the project. Table 8 below provides a summarised account of the received inputs:

Table 4: Summary of the overall comments received.

Concerns/ Contribution / Request	Collective Summary
Communication Clarity	A request was made for the proponent to be transparent about statistical data (i.e., number of people that will be required in the project, expected financial expenditure of the project to the local economy); project information; inception dates to the provincial, district and local authorities as well as IAPs. It is understood that this will assist in planning for the anticipated impacts that may result from the proposed activities.
Public Safety and Security	Security and public safety concerns were noted. Impacts of the 3D seismic survey are still unknown and, therefore, misunderstood by the community. Though the revised project area means that the movement of the vehicles will no longer be within neighbourhoods, CGS should, however, remain vigilant to ensure that safety and security measures are adequate. Moreover, Leandra's South African Police and the Community Police Forum do not have sufficient capacity to manage additional impacts, as they are currently under-resourced.
Skills Development	The stakeholders raised their concerns on the current skills shortage in the area. It was understood that the nature of the current project would require specially skilled workers, for which the community may be found wanting. However, this provides a useful opportunity to provide a skills development impetus for the local community.
Local Empowerment	The importance of empowering local businesspeople was emphasised by the community. The project proponent should ensure localisation of material supplies, labourer, and services for activities, such as setting up the site camp and drilling activities. Most young people indicated their desire to be involved in the 3D seismic survey activities.

Concerns/ Contribution / Request	**Collective Summary**
Socio-economic status of Leandra	The majority of the inputs categorised Leandra as a poverty-stricken community, which needs intervention in areas, such as service delivery (i.e. health facilities) and security services that will assist the local police and economic stimulation. Drug and substance abuse were noted impacts, due to the high unemployment levels in the area.

Table 5: Images taken during Stakeholder Engagements

	
Meet and Greet Meeting at Gert Sibande	Public meeting at Difa Nkosi Hall
	
Administering of questionnaires	Key informant Interview session at Osizwe Primary School

	
Administering of questionnaires	Leandra Community Focus groups

6 Identification of Impacts

6.1 Impacts and Mitigation Framework Identification of Activities and Aspects

Socio-economic impacts are expected to arise because of a proposed project. All impacts discussed in this section will follow a context of nature, extent, magnitude, duration, probability, and significance.

ISO 14001-2004 defines impacts as “any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization’s environmental aspects”.

When considering an assessment of the impacts and their mitigation, the following definitions as per Table apply.

Impact and Mitigation Quantification Framework

Nature	The project could have a positive, negative, or neutral impact on the environment.
Extent	**Local** – extend to the site and its immediate surroundings. **Regional** – impact on the region but within the province. **National** – impact on an interprovincial scale. **International** – impact outside of South Africa.
Magnitude	Degree to which impact may cause irreplaceable loss of resources: **Low** – natural and socio-economic functions and processes are not affected or minimally affected. **Medium** – affected environment is notably altered; natural and socio-economic functions and processes continue albeit in a modified way.

	High – natural or socio-economic functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.
Duration	**Short term** – 0-5 years. **Medium term** – 5-11 years. **Long term** – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention. **Permanent** – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability	**Almost certain** – the event is expected to occur in most circumstances. **Likely** – the event will occur in most circumstances. **Moderate** – the event should occur at some time. **Unlikely** – the event could occur at some time. **Rare/Remote** – the event may occur only in exceptional circumstances.
Significance	Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows- **0** – Impact will not affect the environment. No mitigation necessary. **1** – No impact after mitigation. **2** – Residual impact after mitigation. **3** – Impact cannot be mitigated.
Mitigation	Information on the impacts together with literature from socio-economic science journals, case studies and field work will be used to provide mitigation recommendations to ensure that any negative impacts are decreased, and positive benefits are enhanced.
Monitoring	Monitoring usually involves developing and implementing a monitoring programme to identify deviations from the proposed action and to manage any negative impacts. The recommended mitigation measures will also include monitoring measures.

A well-designed, well implemented, professionally managed project can bring socio-economic benefits to the communities that it serves. If configured or operated in a way that ignores significant socio-economic needs or potential impacts, the proposed project may create socio-economic costs or liabilities for the stakeholders and affected communities.

Therefore, assessing socio-economic impacts is a complex process due to the multi-dimensional nature of the human interactions. This occurs in situations where a particular impact affects a group of stakeholders differently. An inter-connection of impacts can also be encountered whereby several impacts are related and when assessed cumulatively; their impacts may be of significance.

The impact assessment scores both before and after mitigation were arrived at by the specialist team engaging in a modified version of the Delphi technique, where the team discussed the scores, and through a process of iteration arrived at a consensus for each of the values. Where additional information was needed to decide, the technique would be halted, the necessary information would be uncovered and included in the report, and the technique would be recommenced.

An “Activity” is defined as a distinct process or risks undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organisation (International Organization for Standardization, 2011).

An aspect is defined as elements of an organisation’s activities, products, or services that can interact with the environment.

To capture the impacts associated with the proposed infrastructure, an activity – aspect – impact table was created refer to Table 6**Error! Reference source not found.** below.

Table 6: Activity, Aspects and Impacts of the Project

Activity	Aspect	Potential Impact – Positive	Potential Impact – Negative
Land and Servitude Rights Acquisition	Access Rights	No impact	No impact, use of the land is for a short duration
Scheme Operations	No operational phase, this project is an assessment for a potential future project	No impact	No impact
Implementation Phase	Access onto properties		Security Concerns
	Survey and Borehole – test equipment deployment, borehole drilling	Sourcing of equipment, machinery, and services locally	
			Noise, Dust and Vibration
			Risk of HIV
		Employment of local people	Influx of people seeking work
	Transport of goods to site and employment of staff		Increased traffic
			Noise

7 Impact Variables

Vanclay (2002) provides a useful framework for assessing the social environment for a project. The framework is composed of a list of seven social impact variables and these will be used to structure the formulation of the impacts specific to the CCUS project. The full list of variables are:

1. Health and social well-being impacts
2. Quality and the living environment (liveability) impacts
3. Economic and material well-being impacts
4. Cultural impacts
5. Family and community impacts
6. Institutional, legal, political, and equity impacts
7. Gender relations impacts

Each of these variables are discussed below in the context of the proposed project and in light of the project's anticipated social stimulus.

7.1 Health and Social Well-Being Impacts

The health and social well-being impacts expected to have an effect are:

- Noise and dust pollution
- Presence of construction workers
- Increased risk of HIV

7.1.1 Noise, Vibration and Dust Pollution

The project components will create noise that may affect nearby communities. Noise can be expected during the implementation phase of the project from the borehole drilling as well as from the 3D Seismic Survey.

Noise from the 3D seismic survey will be limited to the operations of the vehicles, and for those near the Vibroseis truck, will experience a ground vibration along with the noise generated by the truck. These impacts will occur for the 54 days of the survey and at ground level are very limited in scope. The process of going systematically across the survey grid is protracted and the noise from the truck will be noticeable but will be no more than the noise of a heavy-duty vehicle. When the truck places its baseplate onto the floor to send the seismic shock into the Earth, there is a momentary increase in noise while the vibrating mechanism is in action.

The second component of the project, which is the borehole drilling, will also create noise over the drilling period. This noise will be more noticeable than the Vibroseis truck but will be limited in area. Furthermore, a requirement is provided for the detection of flammable gases and hydrogen sulphide. If such gases are detected during drilling, it is mandatory that an alarm be sounded to alert the drill crew.

Noise generated by the increase of traffic on both the R29 and the R50 will contribute additional noise to these roads, however, these roads are in constant use and the additional noise from these sources will be negligible.

It is expected that dust will be created in the process, too. During the seismic study, the vibration from the baseplate on the truck is in motion for a consistent period, enough to disrupt the surface soil. As the truck moves across the grid, dust creation will be expected, particularly because of the farmland environment in the area. Dust can be expected to be created by the drilling activity, too. This dust will be of very limited scope and for a short duration.

7.1.2 Presence of Construction Workers

The project will draw in workers, both from the local community and most likely from outside, to undertake the project. According to the StatsSA census of Leandra, those with a Matric qualification and who are older than 20 years constitute 37.5% of the local population, while those with a higher education constitute 18.3%. Lebohang is described by StatsSA, which suggests that Matric qualifications in the area constitute 23.7%, with higher education constituting only 3.3%. This makes it likely that external project staff will be recruited for construction of the project.

A concern of the community is the necessity for employment opportunities to be made available to local youth. As a result, it taken into account that the presence of unfamiliar labourers at the various sites may rouse particular interest, which could impact both the well-being of the community and the project.

7.1.3 Increased risk of HIV

The nature of the project is such that its footprint will remain rather small. However, it is important to remain aware of the potential for risk behaviours, particularly around HIV. According to StatsSA, the population in Mpumalanga stands at 4 039 939, while the total number of people living with HIV there, recorded in 2020 and as reported on the official provincial website, was 746 915. This implies an HIV prevalence in the province of 18,5%, making it one of the provinces with the highest levels of HIV in the country.

The additional workers for the project can create an increased risk of unsafe behaviours. There is a considerable portion of the local population who are impoverished; thus it is important to remain aware of the likelihood of prostitution and related activities. In addition to the construction workers, those who are engaging in transportation services for the project as well as security services will likely face the same risks.

7.2 Quality of the Living Environment Impacts

The impacts expected from effects on the quality of the living environment are:

- Quality of housing
- Social and community infrastructure disruption
- Affects to daily life

7.2.1 Quality of Housing

The area in Leandra is composed of differing housing structures. The most vulnerable during this project are those in the township of Lebohang and in the informal settlements of Marikana and Ekuthuleni. Many of the houses in Lebohang are not permanent structures, and most of the houses in the information settlements are shack dwellings, of the which the principal building materials are corrugated iron.

The impermanence of the foundations suggest that any significant subsurface vibrations, if extending far enough, could have an impact.

It is anticipated however, that any vibration impacts will be limited to the immediate proximity of the Vibroseis truck and the borehole drilling and it is not expected that houses or people will be impacted.

7.2.2 Social and Community Infrastructure Disruption

The change to the project area means that less of the social and community infrastructure will be affected by the project implementation. However, the nature of the seismic survey and borehole drilling must be considered for its potential impacts to reach beyond the projected area.

That being said, the infrastructure that may be most directly affected by the activity are the two industrial businesses at the South-West of the project area – Kiejane's Butchery and Afgri Silo. Both businesses are important economic contributors and disruption to their processes may carry implications. Kiejane's Butchery is a meat processing facility, which processes animals and sells directly to the public. Afgri Silo is a large grain and seed oil handling and storage facility. A consideration must be given to these operations.

7.2.3 Affects on Daily Life

There are being two roads in and out of Leandra, and the intersection of these two roads, the R29 and R50, could become congested if the project generates significant additional traffic. The increase in traffic due to the influx of heavy vehicles to the project site is not expected to noticeably affect the daily life of the local community.

The impacts on landowners who host the Vibroseis equipment will be impacted through having to allow access to additional vehicles. The conditions of access would have been negotiated with landowners as part of their access agreements.

7.3 Economic and Material Well-Being Impacts

The impacts expected to influence economic and material well-being are:

Employment opportunities

7.3.1 Employment Opportunities

Youth unemployment in the area is a concern for the community. StatsSA suggests that in Leandra, the dependency ratio is 48.9% and in Lebohang it is 53.6%. Considering those demographics that fall outside of the working age, these figures suggest the need for increased employment in the local community.

Thus, the project should offer employment opportunities to the local community. Specialised work may require external contractors, which will pose a challenge to community engagement; however, the recognition by the community of the needs for skills development may be supported by the activity in the area.

There is an understanding, too, of the impact that the project will have on the livelihoods of the workers at the businesses affected by the project. Both in the case of the local farmers who use the land and at the industrial premises that border the project area, employment may be affected.

7.4 Cultural Impacts

The impacts expected to have an effect on culture are:

- Population increase
- Foreign work culture

The population increase due to the project is limited to twenty-five people for a three-month duration. This level of population change will not impact upon cultural aspects of the project – either though a change in population dynamics or in terms of foreign work cultures being imported into the area.

7.5 Family and Community Impacts

The impacts expected to have an effect on family and community are:

- Disruption of routine
- Development of relationships

The population increase due to the project is limited to twenty-five people for a three-month duration. A maximum of twenty vehicles will be added to the area over the period. This level of impact will not disrupt the routines of existing residents and will not result of noticeable changes in community relationship over the project implementation period.

7.6 Institutional, Legal, Political, and Equity Impacts

The impacts expected to influence this domain are:

Corruption

Extortion

7.6.1 Corruption

Corruption is a scourge upon the dignity of our Nation and its citizens. A lack of integrity and accountable leadership has led to unethical behaviour across the levels of government. It is worth considering that there may be corrupt elements that come into play during the project. This may present itself in the form of nepotistic appointments or kickbacks for subpar work. This negatively impacts the project and the community because the work that may be able to benefit those who most need it in the community will likely not reach them.

7.6.2 Extortion

There has been a rise in an insidious mechanism employed by criminal elements across the country. Gangs have begun extorting "protection money" from construction companies and demanding that their own members be employed on the sites. Known as "construction mafias", these criminal groups threaten to halt construction if their demands are not met. There are numerous reports of such activity, yet no definitive resolution has been found. Granted these sorts of situations have been restricted to larger construction projects, it is a factor to remain aware of.

7.7 Gender Relations Impacts

The impacts expected to have an effect on gender relations are:

Disparities in workforce

7.7.1 Disparities in Workforce

According to the Quarterly Labour Force Survey for quarter two of 2018, released by StatsSA, construction constituted 1 431 000 jobs across the country. Of those, only 174 000 went to women workers. The rest, a figure of 1 318 000, were held by men. The disparity is large, which could be attributed to several factors. For this reason, there can be an expectation that the majority of workers on the project site will be men, and it is anticipated that women will not be adequately represented. For both Leandra and Lebohang, which are individuated on the StatsSA website, the proportion of men and women is almost equal. These expected disparities will play a role in inequality of opportunities for women; however, the reality of spread of skills across the genders suggests that this is consequential.

8 Assessment of Impacts

8.1 Health and Social Well-Being Impact

Potential Impact	Mitigation Measure
Noise, vibration and dust pollution	Ensure that there are mitigation measures accounted for in the EMPr
	Ensure that when noise is unavoidable, that there is considerable effort taken to inform the community of a schedule
Presence of construction workers	Ensure that considerable effort is taken to include the community in the appointment of construction workers through the ward councillors and traditional leaders
	Ensure that there is a list made available to the ward councillors of those who are employed to work on the site, to accommodate community safety
Increased risk of HIV	Ensure an HIV policy is devised for the project site
	Make information readily accessible
	Make condoms readily available
	Promote counselling options to account for risk behaviour
	Ensure site manager has HIV training certificate

	Impacts	Extent	Magnitude	Duration	Probability	Significance
Seismic Study						
Before mitigation	Negative	Local	Medium	Short term	Likely	2
After mitigation	Negative	Local	Low	Short term	Less likely	1
Drilling Activity						
Before mitigation	Negative	Local	Medium	Short term	Likely	2
After mitigation	Negative	Local	Low	Short term	Less likely	1
Cumulative impact	The health and social well-being of the community remains the most important concern when undertaking the work. Of course, the work must continue; however, it must be facilitated in such a way as to not unnecessarily impact negatively on the community. Noise, vibtration and dust					

	pollution cannot be helped, and its effect on the community will be minimal. The presence of construction workers needn't be a concern for the community, especially if consideration is taken for employing local workers. An increased risk of HIV must be adequately prepared for so as not to create risk for either workers or the local community.

8.2 Quality of Living Environment Impacts

Potential Impact	Mitigation Measure
Quality of housing	Ensure that community housing or other buildings are not within the surface vibration radius of the Vibroseis truck and the borehole drilling rig, to ensure that the quality of housing and other buildings in the communities is not negatively impacted
Social and community infrastructure disruption	Ensure that there is adequate and timely information made available to businesses likely to be affected by project activity
Affects to daily life	Ensure that all effort is taken to prevent substantial impacts on the daily lives of the community

	Impacts	Extent	Magnitude	Duration	Probability	Significance
Seismic Study						
Before mitigation	Negative	Local	Low	Short term	Likely	1
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Drilling Activity						
Before mitigation	Negative	Local	Low	Short term	Likely	1
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Cumulative impact	Particularly in the settlements where housing is impermanent, there is concern for how the project may have impacts. Caution should be taken to not cause damage to property in the community. The cumulative impact of the project on the quality of living environment will likely be negligible.					

8.3 Economic and Material Well-Being Impacts

Potential Impact	Mitigation Measure
Employment opportunities	There should be a concerted effort made to work with ward councillors to create equitable opportunities for local employment

	Where possible, ward councillors should be engaged on the importance of utilising the project to educate youth about careers in the project industry

	Impacts	Extent	Magnitude	Duration	Probability	Significance
Seismic Study						
Before mitigation	Negative	Local	Low	Short term	Likely	1
After mitigation	Negative	Local	Low	Short term	Less likely	1
Drilling Activity						
Before mitigation	Negative	Local	Low	Short term	Likely	1
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Cumulative impact	Employment opportunities may bring hope to the community if work remains local.					

8.4 Cultural Impacts

Potential Impact	Mitigation Measure
Population increase	No appreciable impact
Foreign work culture	No appreciable impact

	Impacts	Extent	Magnitude	Duration	Probability	Significance
Seismic Study						
Before mitigation	Negative	Local	Low	Short term	Less Likely	1
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Drilling Activity						
Before mitigation	Negative	Local	Low	Short term	Less Likely	1
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Cumulative impact	There will be no appreciable cultural impact created by the project.					

8.5 Family and Community Impacts

Potential Impact	Mitigation Measure
Disruption of routine	No appreciable impact
Development of relationships	No appreciable impact

	Impacts	Extent	Magnitude	Duration	Probability	Significance
Seismic Study						
Before mitigation	Negative	Local	Low	Short term	Less Likely	1
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Drilling Activity						
Before mitigation	Negative	Local	Low	Short term	Less Likely	1
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Cumulative impact	There will be no appreciable family and community impact created by the project.					

8.6 Institutional, Legal, Political, and Equity Impacts

Potential Impact	Mitigation Measure
Corruption	Strictly follow the employment policy for the project
	Report irregular processes
Extortion	Ensure that there is a policy to deal with situations such as these
	Ensure that construction workers know to report to the most senior member of the project if such a situation arises
	Ensure that construction workers are protected and that they feel that they are

	Impacts	Extent	Magnitude	Duration	Probability	Significance
Seismic Study						

Before mitigation	Negative	Local	Medium	Short term	Likely	2
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Drilling Activity						
Before mitigation	Negative	Local	Medium	Short term	Likely	2
After mitigation	Negative	Local	Low	Short term	Less Likely	1
Cumulative impact	Corruption must be something that the project managers remain aware of, as its prevalence is not unfamiliar. Particularly the extortion of money by gangs is a growing element that construction work must be prepared for. The cumulative impact of the project on these factors is the increased risk for criminal elements to engage on the project area.					

8.7 Gender Relations Impacts

Potential Impact	Mitigation Measure
Disparities in workforce	Ensure that a fair policy is designed to account for opportunities being made available to women workers
	Ensure that women who do work on the project feel and are protected at all times
	Ensure that there are separate toilet facilities for women and that the separation is respected

	Impacts	Extent	Magnitude	Duration	Probability	Significance
Seismic Study						
Before mitigation	Negative	Local	Medium	Short term	Likely	2
After mitigation	Positive	Local	Low	Short term	Less likely	1
Drilling Activity						
Before mitigation	Negative	Local	Medium	Short term	Likely	2
After mitigation	Positive	Local	Low	Short term	Less likely	1
Cumulative impact	Disparities in the workforce remain a reality in the construction industry. There may be many reasons but this should not inhibit attempts to offer equal opportunities to those who are qualified, regardless of gender. The cumulative impact will likely be that women will be present on the project site, which could contribute to the development of relationships with other construction workers. Precautions should be taken to educate and protect all workers.					

9 Conclusions and Recommendations

9.1 Analysis of Alternatives

The initial project area included the majority of the community areas of Leandra but has since been reduced to encompass mainly farmland. Thus, the need for an alternative that seeks to reduce the impact on the community has already been incorporated by the project.

9.2 No-Go Alternative

The No-Go alternative will present the following implications:

- There will be no contribution of employment and skills development to the local community;
- The local economy will remain unchanged, as the area will not attract new economic investment;
- The opportunity for Leandra to make a positive contribution to climate change initiatives, particularly on an international level, will be missed; and
- The economic stimulus presented by the project will be forgone.

There will be less economic development , as there will be no opportunities for SMMEs and local labourers.

Having taken into consideration the project aims of electricity generation using renewable power sources and considering the assessment above, which does not indicate any fatal social flaws, the benefits from the project going ahead, from a social perspective, will be larger than not proceeding. The No-Go option is not supported by this study.

9.3 Technical Alternatives

There are no technical areas associated with this project.

9.4 Site Sensitivity Verification

The site sensitivity was verified by means of the methodology and findings of this report. There is no social theme for this project in the screening tool, hence this report conforms with the Environmental Impact Assessment regulations requirements.

The methodology establishes existing land use and includes motivation and evidence of such land use. The nature of this study and its impacts dictate that a larger study area than the immediate site and its adjoining properties be assessed. In this sense, the precise nature of the land development on the site is not relevant in this case.

9.5 Impact Statement

An impact statement is required as per the NEMA regulations with regards to the proposed development.

The regional study area is a rural economy with a narrow base. The project site has several social receptors surrounding the site, however the scale of the project in terms of staffing and duration is such that it is unlikely to create a significant footprint on the social environment. The social impacts of the project are expected to be positive in the sense that the local skills will be transferred and broadened. The negative impacts are limited in nature and scope and can be successfully mitigated by management rules and practises. It is therefore found that the project, once the recommended mitigation measures have been implemented, has a nett positive impact on the social environment of the study area.

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11 Appendix I | CCUS – Leandra Questionnaire

SOCIAL SURVEY FOR THE CARBON CAPTURE, UTILISATION AND STORAGE (CCUS) PROJECT, IN TOWN OF LEBOHANG (LEANDRA) WITHIN GOVAN MBEKI MUNICIPALITY

(A) Background

Nemai Consulting was appointed by the Council for Geoscience to conduct an Environmental and Social Impact Assessment for the proposed research project. The geoscientific research project is mainly for the piloting of Carbon Capture Utilisation and Storage (CCUS), where carbon dioxide (CO2) will be injected into deep suitable geological formations, approximately 1km below the surface.

As part of the ESIA, Nemai Consulting will be undertaking a social survey of the communities in the vicinity of the proposed project to establish any concerns and/or opportunities that the project may present. You are under no obligation to participate in the study or to provide your contact information.

The questionnaire will take 15 minutes to complete and will be done in your language of preference.

(B) Consent to be Part of the Survey

Are you willing to be part of the survey?

If yes, please be aware of the following:

- You will not be paid to be part of the survey.
- We confirm that your contact information will not be shared with anyone outside of the organisation.
- We assure you that the discussion will be anonymous and confidential. The data collected will contain no information that would allow your responses to be linked to specific statements or to you.
- Please do not hesitate to let me know if you would like feedback on how your input will be used in the report and to have access to the environmental and social impact assessment report.
- Please do not hesitate to recommend any other person who you believe could contribute to the study.
- Please note that you have an option of remaining anonymous.

If you understand and accept the conditions and consent to be part of the survey, then we can commence.

(C) Questionnaire

For Office Use

Stakeholder		Unique ID	
Interviewer		Date	
Data Capturer		Date	

Respondent's Information

1.1	Name and Surname	
1.2	Mobile No	
1.3	Email Address	

1. Have you heard about the Proposed Carbon Capture, Utilization and Storage Project?

Yes	
No	

1.1 If your answer is yes, when did you hear about it and how did you hear about it.

2. How do people utilise the open-access land, especially closer to the project site?

•

3. Are there a lot of people currently moving into this area?

4. Apart from livestock farming, are there any wild or game animals around here?

5. Have you ever experienced any land vibrations/ earthquakes around here?

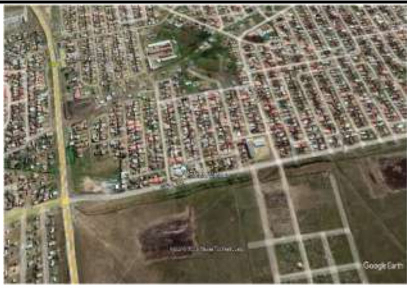
6. Where do you get your drinking water from? (Is it from a borehole water/ tap water / river water?)

7. Do you have any further contributions on what we have discussed now?

If you require feedback on the status of the research and/or have any queries please do not hesitate to contact Ms Caroline Tanhuke on carolinet@nemai.co.za or on 011 781 1730

12 Appendix II | Census of Project Impacts

	Description	**Coordinates**	**Satellite Image**	
1	Project Site	26°22'02.35" S 28°56'32.31" E		
2	Silos/ Afgri Silo Leandra / Leslie -	26°21'56.00" S 28°55'50.09" E 26°22'02.45" S 28°55'45.42" E 26°21'16.22" S 28°54'45.84" E 26°21'27.41" S 28°56'16.10" E		
3	Linhlo Wood Masters/ Jungle Inn - Restaurant	26°21'57.11" S 28°55'37.47" E		
4	Leslie community	26°22'13.76" S 28°55'14.95" E		

5	Leandra Mosque. Open edge church and Pentecostal church	26°23'05.56" S 28°56'05.18" E	 	 
6	Isolomuzi Day Care Centre	26°22'39.88" S 28°55'49.94" E		
7	Internal roads	26°22'40.53" S 28°55'52.08" E		
8	Local car- wash	26°23'03.14" S 28°55'55.21" E		

9	Local Business	26°23'06.31" S 28°55'58.31" E		
10	Dewfresh Outlet	26°22'29.26" S 28°55'28.29" E		
11	Difa Nkosi community Hall	26°22'34.91" S 28°55'19.94" E		
12	Entrance to the Lebogang Cemetry	26°22'31.80" S 28°54'28.31" E		
13	Thuthuka Day Care is located at approximately 1km from the project site.	26°22'24.71" S 28°55'43.50" E		

14	Community Livestock Farming Place	26°22'15.08" S 28°55'41.96" E	   
15	Four- way stop areas	26°22'24.28" S 28°55'16.13" E	 
16	Farm adjacent to the project site	26°22'04.75" S 28°56'39.16" E	 

APPENDIX N

PROOF OF STAKEHOLDER ENGAGEMENT

Appendix N1: Stakeholder Database

AUTHORITIES

Organisation	Contact Name
NATIONAL GOVERNMENT	
Department of Forestry, Fisheries and the Environment (DFFE)	Millicent Solomans
DFFE	Dee Fischer
DFFE: Integrated Environmental Authorisations (IEA)	Masina Morudu
DFFE	Muhammad Essop
DFFE	Coenrad Agenbach
DFFE	Mlungiseleli Vimbani
DFFE	Mmamohale Kabasa
DFFE: IEA	Samkelisiwe Dlamini
DFFE: Climate Change and Air Quality Management	Tlou Ramaru
DFFE: Climate Change and Air Quality Management	Patience Gwaze
DFFE: Climate Change and Air Quality Management	Peter Lukey
DFFE: Climate Change and Air Quality Management	Mashudu Mundalamo
DFFE: Land Remediation	Dr Mpho Tshitangoni
DFFE: Hazardous Waste	Mishelle Govender
DFFE: Biodiversity Conservation	Mmatlala Rabothata
DFFE: Biodiversity Conservation	Aulicia Maifo
DFFE: Biodiversity Conservation	Portia Makitla
DFFE: Biodiversity Conservation	Seoka Lekota
DFFE	Surprise Zwane
Department of Water & Sanitation (DWS)	Piet Ackerman
DWS	Nemukula Masala
DWS	Roets Wietsche
DWS	Valerie Kilian
DWS	Musa Lubambo
DWS	Mafuza Leshego
DWS	Siboniso Mkhaliphi
DWS	Thokozani Mazibuko
DWS	Sipho Skosana
DWS	Kobus Bester
National Treasury	Lindiwe Mnisi
Department of Energy	Ompi Aphane
Department of Energy	Mokgadi Mathekgana
Department of Energy	Pheladi Masipa
Department of Energy	Mthetheleli Maphinda
Department of Agriculture, Land Reform and Rural Development (DALRRD)	Anneliza Collett
DALRRD	Lesley Shadung
DALRRD	Mr. S. Ogunronbi
DALRRD	Lesley Shadung
DALRRD	Annette Geertsema
South African Heritage Resource Agency (SAHRA)	Dr Ragna Redelstorff
SAHRA	Natasha Higgitt
SAHRA	Nokukhanya Khumalo
SAHRA	Phillip Hine
National Dept of Finance	Malcolm Pautz
National Dept of Tourism	Palesa Kadi
National Dept of Tourism	Kingsley Makhubela
National Dept of Public Enterprises	Caroline Richardson / Joan Arrikum
South African Chamber of Commerce and Industry	
Department of Cooperative Governance	Elroy Africa
South African Local Government Association (SALGA)	William Moraka
SALGA	I Chauke
National Energy Regulator of South Africa	Andile Gxasheka
National Energy Regulator of South Africa	Bongi Masemola
COGTA	Zandile Zondi
Department of Trade, Industry and Competition	Inze Neethling
Department of Public Enterprises	Phumzile Maseko
Department of Public Enterprises	Esther Nenungwi

Organisation	Contact Name
PROVINCIAL GOVERNMENT	
Mpumalanga Department: Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA)	B.P. Shiba
DARDLEA	C.M. Chunda
DARDLEA	N.S. Masoka
DARDLEA	Pamela Ntuli
DARDLEA	Thobile Hlaka
DARDLEA	Charity Mthimunye
DARDLEA	Dineo Tswai
DARDLEA	Mandlenkosi Mahlalela
DARDLEA	Sibusiso Langa
DARDLEA	Dudu Sibiya
DARDLEA	Margaret Mothiba
DARDLEA	Jan Venter
DARDLEA	Robyn Luyt
DARDLEA	Sindisiwe Mbuyane
DARDLEA	Surgeon Marebane
Mpumalanga Tourism and Parks Agency (MTPA)	Thulani Nzima
MTPA	Mervyn Lotter
MTPA	Frans Krige
MTPA	Celia de Waal
MTPA	Nomaswazi Shangu- Mndawe
MTPA	Johannes Nobunga
MTPA	Xolani Mthethwa
MTPA	Fhatuwani Mugwabana
MTPA	Absalom Mahlangu
MTPA	Celia de Waal
MTPA	Frans Krige
MTPA	Khumbelo Malele
DFFE: Mpumalanga Region	Rhulani Chavalala
MP Heritage Resources Authority	Benjamin Moduka
MP Department of Cooperative Governance and Traditional Affairs	S Ngubane
COGTA	SS Kunene
COGTA	H Magagula
COGTA	Flora Ramahuma
COGTA	Tiaan Kleynhons
COGTA	SG Shube
COGTA	LT Sibiya
MP Department of Mineral Resources & Energy (DMRE)	David Msiza
DMRE	Bongwe Khorommbi
DMRE	Adv Mmadikeledi Malebe
DMRE	Buyisiwe Faith Ntokozo Ngcwabe
DMRE	Mashudu Maduka
DMRE	Sipho Chiume
DMRE	Aubrey Tshivhandekano
DMRE	L. Maphopha
Department of Water and Sanitation (DWS)	Mhlongo Gugu Portia
DWS	Nompumelelo Mandlazi
DWS	Mulaudzi Masala
DWS	O Nkosi
DWS	Makam Andiswa
DWS	Siwele Seneliso
DWS	Kheva Silo
DWS	Piet Ackerman
DWS	Roets Wietsche
DWS	Valerie Kilian
DWS	Musa Lubambo
DWS	Mafuza Leshego
DWS	Siboniso Mkhaliphi
DWS	Thokozani Mazibuko
DWS	Sipho Skosana
DWS	Kobus Bester
Department of Economic Development and Tourism	N Sebitso
DEDT	IBH Simelane
Department of Economic Development and Tourism	A Mkhabela
Department of Economic Development and Tourism	J.D Mdluli
Department of Economic Development and Tourism	L Mdluli
Department of Economic Development and Tourism	PS Mohlala
Department of Community Safety, Security and Liaison	SS Lefifi
Department of Community Safety, Security and Liaison	Acee Dlamini
Department of Education	Lucy Moyane
Department of Labour	Julia Mahlangu
Department of Human Settlements (DHS)	Haizel Zitha
Culture, Sport & Recreation	GS Ntombela
Culture, Sport & Recreation	V Gana
SALGA	Decia Matumba
Office of the Premier	Makhukhu Mampuru
Office of the Premier	Jermina Marakala
Provincial Treasury	G. Mashiteng
Department of Social Development	S.M. Mtshweni
Department of Health	Savera Mohangi
Department of Public Works, Roads and Transport	MC Morolo
Department of Public Works, Roads and Transport	Fikile Sengwayo

Organisation	Contact Name
LOCAL GOVERNMENT	
Gert Sibande District Municipality (GSDM)	Cllr Walter Mngomezulu
GSDM	Cllr. Nhlakanipho Zuma
GSDM	Ms Marinda Booth
GSDM	Mr Cijimpi Absenia Habile
GSDM	Phiwo B. Nkosi
GSDM	Silindile Nyandeni
GSDM	Immi Simelane
GSDM	Mosotho Kgaka
GSDM	Tebogo Mogakabe
GSDM	Lindokuhle
GSDM	
Govan Mbeki Local Municipality (GMLM)	Sandiso M
GMLM	Kamesh Rohan
GMLM	Getrude Shabalala
GMLM	Henry Masango, Mr
GMLM	Lindi Masina, Cllr
GMLM	Lolo Dube/ Zama Khumalo
GMLM	SOL
GMLM	Sibusiso Maseko/ Mangaliso R Mashiane
GMLM	Sabelo Vilakazi
GMLM	GSDM
GMLM	Ms Nompumelelo Nkosi
GMLM	Office of the speaker
GMLM	Mxolisi Fakude
GMLM	Maseko Mfanafuthi
GMLM	China
GMLM	Bheki Kubheka
GMLM	T. Phungwayo
GMLM	Khosi Jezile
GMLM	NG Zuma
GMLM	MA Ramoleta
GMLM	Themba Phithungwayo
GMLM	Desmond Maake
GMLM	Hendrik Vand Der Merwe
GMLM	Cllr SI Sibanyoni
GMLM	Chairperson MPAC & Ward 6
GMLM	Cllr Solomon V Mahlangu
GMLM	Cllr Joseph M Maseko
GMLM	Cllr Mlungisi D Mnyukana
GMLM	Ward 2 Councillor
GMLM	SMM Councillor
GMLM	Cllr Ward 06
GMLM	EFF Councillor
GMLM	Cllr Vusi Peterson

STAKEHOLDERS

Organisation	Contact Name
Mineral Council South Africa	Carla Hudson
Mpumalanga Green Cluster Agency	Mr Nkosinathi Nkonyane
Vukani Environmental Justice Movement in Action	Thembisile Mbethe
groundWork	Peek Bobby
groundWork	David Hallowes
groundWork	Euripidou Rico
groundWork	Michelle Cruywagen
groundWork	Robby Mokgalaka
groundWork	Thomas Mnguni
groundWork	Yegeshni Moodley
Centre for Environmental Rights (CER)	Michell Sithole
CER	Michelle Koyama
CER	Linda Dlamini
CER	Nicole Loser
CER	Ntombi Maphosa
Centre for Environmental Rights NPC	Brandon Abdinor
Natural Justice	Allan Basajjasubi
Natural Justice	Dean Palmer
Natural Justice	Melissa Groenink
Life After Coal	Victor Munnik
	Eugene Cairncross
Middleburg Environmental Justice Network	Hlatshwayo Bafana
Middleburg Environmental Justice Network	Sibande Bernard
Greater Middleburg Residents Association	Mnguni Thomas
Middelburg Collective Unemployment Forum	Walter Sunboy Thombeni
Middelburg Chamber of Commerce and Industry	Anna-Marth Ott
DBSA	Chucheka Mhlongo
GreenCape	Jack Radmore
MCCI	Anna-Marth Ott
MWCB	Carla Hudson
Minerals Council South Africa	Alex Khumalo
Minerals Council South Africa	Herbert Modupi
Minerals Council South Africa	Alexandra Lugagne
CanPRO	Liesel Kirsten
Exxaro	Tebogo Leepile
Afsol Petroleum	Stephen Wee
Ward Committee	Sindi Mbewe
Mgugwana Investment	Sindile Ndlovu
Thapo Access Specialists	Jeremiah Mabuza
Johnson Crane Hire	Janet Barnes
Johnson Crane Hire	Susan Beausont
KSB Pumps and Valves	Shona Smith
Effective Human Intervention	Callie Kruger
NKM2 Engineering Construction	Khatu Nthaethuni
Kgolane Business Enterprise	Glibert Sedibeng
Cesar-Avante Guard Engineering	Shaka Malogwa
Dirotech Trading	Hector Mabogoane
Dirotech Trading	Nokuthula Mabogoanev
Techlam Projects	Puto Duma
JV Entities Trading and Projects	Mpho Ntimeng
F Menge Presentations and Signs	Jan Menge
TUV Sud South Africa Pro-Tec	Michelle Van Niekerk
Vega Controls SA	Frikkie Streicher
Vega Controls SA	Chris van den Heever
IME-SA	Hendry Woest
Buckman Laboratories	Stephan Steenekamp
Farmbelt	Thulani Nkosi
Green Cape	Reshmi Joseph Wolwers

Organisation	Contact Name
Impact Catalyst	Rory Baker
Impact Catalyst	Charl Harding
Thungela Resources	Marcia Mabuza
Thungela Resources	Faith Mashego
Thungela Resources	Marcia Mabuza
Thungela Resources	Bontle Mfolo
	Nomsa Dlamini
	Thabisile Sibanyoni
Thembalompmarathi	Elijah Mkhuma
The Shaft Pub & Grill	Lidia Tladi
ESA	Michael HO
B&K Unemployment	Othaniel Sibembo
The Shaft Pub & Grill	Thabo Mashigo
MCCI	Anna-Marth Ott
MWCB	Carla Hudson
Minerals Council South Africa	Herbert Modupi
Minerals Council South Africa	Alexandra Lugagne
SANBI	Constance Mafuwane
SANBI	Joyce Punkie Ntuli
SANBI	Muzi Mashabane
SANBI	Hellen Nonyane
SANBI	Kristal Maze
WESSA Lowveld	
The Endangered Wildlife Trust (EWT)	Dr Ian Little
EWT	Constant Hoogstad
WESSA	Delana Eksteen
WESSA	Morgan Griffiths
WESSA	Suzanne Erasmus
Birdlife South Africa	Hanneline Smit-Robinson
Birdlife South Africa	Daniel Marnewick
Birdlife South Africa	Simon Gear
Birdlife South Africa	Samantha Ralston
South African Bat Assessment Association	Kate MacEwan
Agricultural Research Council	Rosemary du Preez
University of Mpumalanga	Prof Dan Parker
University of Mpumalanga	Cebile Ntombela
CSIR	Kitessa Roro
UCT	Mark New
Development Dialogue (TIPS)	Daphney Mabuza
CRSES University of Stellenbosch	Prof Sampson Mamphweli Dr Bernard Bekker
University of Witwatersrand	Prof Paida Mhangara
Transnet	Andre Bodenstein
Transnet Pipelines	Thami Hadebe
Transnet Rail	Masindi Mmbadi
Transnet Rail	Nsumbulana Mtsenga
Eskom	John Geeringh
South African National Roads Agency SOC Ltd	Nicole Abrahams
South African National Roads Agency SOC Ltd	Nelis Brink
Openserve	Greg Green
Telkom	Ben Roestof
Telkom	Mantwa Aletta Gabaitumele
South African Weather Services	Enny Tsebe
Hlathilli	Patrick Sitsheke
Ward councillor/committee member	Edward Nyambi
National government	Mamabefu Modipa
Inter-governmental and international organisations	El Mekwad Khaled SA Representative
GreenCape	Jack Radmore, Reshmi Joseph Wolwers
Impact Catalyst	Rory Baker
Impact Catalyst	Charl Harding
Just Share	Annette Gibbs

Organisation	Contact Name
Centre for Environmental Rights	Lerato Balendran
Earthlife Africa	Makoma Lekalakala
Groundwork	Tsepang Molefe
NEDLAC	Nolwazi Mthembu-Makaula
South African Civil Aviation Authority (SACAA)	Lizell Stroh
SACAA	Cecile Marié Pretorius
SACAA	Gugulethu Khanyile
SACAA	
Air Traffic and Navigation Services (ATNS)	
DBSA	Chucheka Mhlongo
IDC	Kgakgamatso Mohutsiwa
AfDB	Leïla Farah Mokadem; Kennedy K Mbekeani
IFC Africa	Kevin Njiraini; Glenda Tapiwa Chikwaka
IFC Africa	Stella Isengingo
Green Climate Fund	Douglas Leys
Media24	Elise Tempelhoff
Black Royalty	Mirenda Moremedi
Anglo	Cindy Smith
Sustainable Energy Society of Southern Africa	Christoph Kausch
Southern African Alternative Energy Association	Alwyn Smith
South African Photovoltaic Industry Association (SAPVIA)	Niveshen Govender
SAPVIA	Wido Schnabel
SAPVIA	Kim Thomas
Eskom	Ms Jovita Juodaityte
Eskom	Mrs Sumaya Nassiep
Arcelor Mittal	Siegfried Spanig
Vanadium	Chika Edeh
Forvinny Holdings	Nhlakanipho Mathibele
Pretty Sportless Services (PTY)	Pretty Skosana
Gatshane Holdings	Zanele Masilela
Zamagoda M. Engineering	Isaac Mahlangu
Waroriwa Projects	Arthur Orapeleng
Isimiso Samandla Holdings	Ncamiso Dlamini
One River Band Blasting	Albert Mbonani
Mkutshwa Trading	Sipho Khoza
Gubevu Multi Task Projects	Sibusiso S. Maduna
Vathiri Construction & Projects (PTY) Ltd	John Mpane
Enzolwethu Trading And Projects	Hector Maziya
Emza Trading & Projects	Emelinah Mokotong
Owenqoba Trading	Phakamani Mahlangu
I K Mnguni	Z Mnguni
C Lwane Ndala (Pty) Ltd	Doctor Ntsuzi
Black Child Twiy (Pty) Ltd	Sihle Ngwenya
Inhlento Civil Engineering	S Z Nkadimeng
S M London Trading	Sibusiso Mbuli
Brainless Project Management	Takatso Masilela
Kuze Kuse Sky	Phillip Mtshwene
Indalo Water Technologies	Sivuyile Shabalala
Nawe Blapho Trading Enterprise	Percy Mahlangu
Siyakhuphulana Co-Operative	Maria Ntuli
Imvelo Kanabo Holdings	Kenny Nhlapho
Injabulo Electrical And Instrumentation Construction	Bafana Nhleko
Leandra Capital Dry Cleaners	Mr. S V Sibiya
SE And J Trading And Projects	Suster E Mpila
Amabhungane Holdings	Nkosinathi Radebe
Mzongo Logistics	Innocent Mahlangu
Abomalaza Trading And Projects	Nurse Methula
Vusikhaya Construction	Nikki Skosana
Leslie Local	
Siyasizana Co-Operative	Cyril Gwiji

Organisation	Contact Name
Green Continental Co-operative	Cyril Gwiji
Deealos Logistics And Projects	Sibusiso Nkosi
Lannies$apos Project$amp Services	Sipho Saraphina
Kuhle Ghoba Enterprise (PTY) Ltd	Thembinkosi Maseko
Ngcobo Investments	Sphiwe Nkabinde
Moponile Trading Enterprise	Hleziphi Mabaso
Mvulane Engineering Services	Mbalenhle Motha
Rebecca Health & Kuhlenothando Trading	Rebecca Dhlamini
Izazi Capital	Jabu Ximba
Busisiwe Karira (PTY) Ltd	Busi Mabhena
Gold Techindustries (PTY) Ltd	Moses Mtsweni
Engineering & Sizimele Services (PTY) Ltd	Sifiso Fakude
Elidio Transport Services	Thulisile Skosana
Likutu Holdings	Bafana Mtsweni
Dibza (PTY) Ltd	Aubrey Msiza
Makhopsongise Trading (PTY) Ltd	Makhosini Sihlali
Nyote Trading Projects	Sandile Maseko
Mbadawu Holdings	Samson Maseko
Tshazis Trading Enterprise	Thokozani Tshazibana
Seven S Catering & Projects	Dumisani Nkambule
NP & JM Trading	John Nkuna
KFC Leandra	
Pride Milling Leslie (Mill)	
Kiejane's Butchery - Meat processor	
Afgri Silo Leandra / Leslie - Corporate office	
Linhlo Wood Masters - Cabinet maker	Richman Sangwane
Jungle Inn - Restaurant	
Leslie exhaust and tyres - Tire shop	
Pick n Pay Local Leandra - Store	
Moolla's tiles - Tile store	
Dewfresh - Dairy	
Shell Garage Leandra - Gas station	
Eskom Lebohang Substation - Ele	
Leandra RDP Hall - Village hall	
Perseverance fx trader - Foreign exchange students organization	
Leslie, Leandra mpumalanga - Apartment building	
Leandra Caltex - Gas station	
2R5 RECORDS - Recording studio	
Da Fatz Kota - Fast food restaurant	
Endizeni - Bar & grill	
Nederduitsch Hervormde Kerk Van Afrika - Eendracht - Church	
Vukuqhakaze Secondary School - High school	
Senza Konke Multi Purpose Community Centre -	
Sidingulwazi Primary school - School	
Leandra Mosque - Mosque	
St Jame's Anglican church Leslie	
Lebohang Library - School	
Lebohang Clinic - Hospital	
Trinity Bible Church Leslie - Church	
Chief Ampie Mayisa Secondary School	
Kingdom Hall Of Jehovah's Witnesses - Jehovah's Witness	
The Ridge Times	Lizelle Grobler
Seskhona News	
Leandra FM	Duke
SAPS - Leslie (Leandra)	
PPC	Ms Millicent Siwele
Sephaku	Mr Pieter Fourie
Lafarge	Shalini Ammon
Afrisam	Mr Rob Wessels
Natal Portland Cement Company	Mr Kaziwe Kaulule

Organisation	Contact Name
Omnia Group	Mr Matias Cardarelli
Farmers Association	Jaco de La Rey
Farmers Association	PN Erasmus
Landowner	Gideon van Wyk
Landowner	Piet Streiger
Farm Manager	Mr Msiza
Landowner	BARWOU BOERDERY TRUST / Mr. Bart Harmse
Landowner	Barend Linde
Landowner	Michael Katz
Farmers Union Mpumalanga	Mr Robert Davel
Farmers Union Mpumalanga	Mr Hannie Laas
Leandra Residents	Mafika Shabalala
Leandra Residents	Ada Moll
Leandra Residents	Stanley Hadebe
Leandra Residents	Thulane Mahlangu Disability
Leandra Residents	Victor Mahlangu
Leandra Residents	Michael Mofekeng
Leandra Residents	Sesi Mokwape
Leandra Residents	Sonnyboy Dlongolo
Leandra Residents	Mpho Disthego
Leandra Residents	Sandile Malunga
Leandra Residents	Isaac Mahlangu
Leandra Residents	Onicah Kolobe
Leandra Residents	Siyabonga Sithole
Leandra Residents	Hleziphi Mabaso
Leandra Residents	Siyabonga Kubheka
Leandra Residents	Hleziphi Mabaso
Leandra Residents	Andile Mahlangu
Leandra Residents	Mpho Mpatlanyane
Leandra Residents	Papa Tsibela
Leandra Residents	Sipho Phiri
Leandra Residents	Mtungwa Mkhatshwa
Leandra Residents	Mathuthu Matona
Leandra Residents	Badanile Nkosi
Leandra Residents	Bafana Mtsweni
Leandra Residents	Sipho Mlange
Leandra Residents	Themba Zondo
Leandra Residents	Vusi Masilela
Kubheka Entity	Siyabonga Kubheka
Nawe Lapho Trading	Percy Mahlangu
GMM	Olivia Repinge
Ward Committee	Martha Shongwe
Ward Committee	Nomaswazi Masilela
Ward Committee	Jabulani Ntombela
Deealos Logistics	Vusi Masilela
Six Brothers	Mafika Shabalala
Zamaluka Enterprise	Mafika Shabalala
Sophie mtsepo	U. Ngathi
Injabulo Electrical	Ndikho Maseko
Injabulo Electrical	Bafana Nhleka
Dibza Pty Ltd	Aubrey Msiza
	Cyntia Mnguni
GMM	Sello Mphumi
	Nonozi Mbatha
Injabulo Electrical	Brian Makhanya
Christopher Pedora Mbattha	
CPF Member	Philemon Kubheka
	Bongani Mtshali
Manana Chem	Chief Manana
	Helta S

Organisation	Contact Name
LCC	Sonto Zwane
LCC	T. Sechaba
	Dabisile Game
Sakhi Sizwe	Philip Rose
Sipho Mabhena	
Talamba	Mhlola Mvunyelwa
Ward Committee	Senzeni Kubheka
Ward Committee	Ntombifuthi Nhlapho
	Mpho Mahlangu
Sakhaisizwe	Themba Zondo
Ward Committee	G. Hadebe
	Isaak Malunga
	Sipho Ngele
Isimo sikantuli	WM Ntuli
	Buti Makarini
	Mathuthu Majola
	Thabang Ditshego
	Andile Mahlangu
	Mtungwa Mkhwatswa Velebusa
Ingqungquthelo Projects	Kenny Nhlapho
Mohlakano	Papa Tsibela
Ward Committee	Buti Simelane
	Fredd Mokone
	Andile Mahlangu
Patience Gamede	Patience Gamede
Leandra Residents	Fortunate Matebwa
Leandra Residents	Hamisi Shauti
Leandra Residents	Busisiwe Maziya
Leandra Residents	Lebohang Matlanyane
Leandra Residents	Skhanyiso Dlamini
Leandra Residents	Mhlola Mvunyelwa
Leandra Residents	Thabang Ditshego
Leandra Residents	Thulani Thomas Mahlangu
Leandra Residents	Sipho Mhlangeni
Leandra Residents	P Tsibela
Leandra Residents	Tsepo Moloto
Leandra Residents	Vusi Masilela
Leandra Residents	Tsepo Morajane
Leandra Residents	Hleziphi Mabaso
Zamelani Abadala aged group	Jabulani D. Nkosi
Ward Committee	Lindi Mtsali
MTE	Ponie Given Mabaso
Legislature	Surprise
Art Creative Centre	Smancia Ngcongwane
Ward Committee	Giwi Makheta
Ward Committee	Michael Mtsheni
Ward 16	Nombuso Mhlongo
Ward 16	Vuyolwetho Godlimpi
Leandra Residents	Thomas Mthilule
Leandra Residents	Sonnyboy Khumalo
Leandra Residents	Thenjiwe Mquathi
Leandra Residents	Fortunate Mathebula
Leandra Residents	Gugu Mbonani
Leandra Residents	Andile Mdlushiwa
Leandra Residents	Sibongile Mquathi
Leandra Residents	Eunice S. Manana
Leandra Residents	Thimothy Nkosi
Leandra Residents	Dana Skosana
Leandra Residents	Daniel Wesipho
Leandra Residents	Vusi Peterson

Organisation	Contact Name
Leandra Residents	Kaizer Zwaide
Leandra Residents	Madoda Shobolola
Leandra Residents	Clement Nxoxo
Leandra Residents	Goodwill Mdletshe
Leandra Residents	Norman Khubeka
Leandra Residents	Kenny Dludla
Leandra Residents	Fanie Nkambule
Leandra Residents	Tshepo Moloto
Leandra Residents	Zinhle Mahlangu
Leandra Residents	Jabulile Mavimbela
Leandra Residents	N.Mkwanazi
Leandra Residents	R.Malesa
Leandra Residents	A.Zulu
Leandra Residents	M.Munarini
Leandra Residents	Nomvuyo Shongwe
Leandra Residents	Zanele Skosana
Leandra Residents	Thomas Mahlangu
Leandra Residents	Buti Simelane
Leandra Residents	Nomvula Vilakazi
Leandra Residents	Doctor Mavimbela
Leandra Residents	Lifa Sibeko
Leandra Residents	Happiness Bhanda
Leandra Residents	Johannes Matsose
Leandra Residents	Sanele Khumalo
Leandra Residents	Collen Malaza
Leandra Residents	Promise Kololos
Leandra Residents	Lukheke
Leandra Residents	Sandile Zama
Leandra Residents	Duduzile Nqina
Leandra Residents	Nkosi Bdanile
Leandra Residents	Thandolwethu
Leandra Residents	Mathuthu Matana
Sakhisizwe Community	Antonio Mathebula
ANCYL	Paulina Radebe
Ward Committee	Simpiwe Mazibuko
Leandra Residents	Zanele Masida
Ward Committee	Mathapelo Mahlangu
Ward Committee	Nokthula Memba
Ward Committee	Thabo Mokoena
Leandra Residents	Jacobeth
Leandra Residents	A.A. Mabena
Ward Committee	L.D. Mbonane
Resident (Ward 06)	Jan Mayisa
Resident (Ward 02)	Sophie Ntsepa
Resident (Ward 06)	R.Mbonani
Resident (Ward 06)	S.Madonsela
Resident (Ward 01)	M.Shongwe
Resident (Ward 01)	C.S Mahlangu
Resident (Ward 02)	F.L. Mitchell
Resident (Ward 01)	M.Mofokeng
Resident (Ward 03)	M.Mahlangu
Resident (Ward 02)	L.Maseko
Stakeholder	Bafana Mtsheni
Resident (Ward 03)	Lebogang Mpatlonyane
Resident (Ward 16)	Promise Shayi
Resident	Skanyiso Dlamini
Resident	Busisiwe Maziya
Resident	Zinhle Sibeko
Sakhisizwe Community Development	Prudence Mathebula
Resident (Ward 01)	Nomasonto Masida

Organisation	Contact Name
CPF	Nduduzi Mkhoza
Wings of Change	Sipho Ngoyi
Resident (Ward 01)	Philimon Khubeka
Resident (902ext7)	Thoko Ngobeni
LED	Sandile Maseko
Residant	Peter
Residant	Bafana Masego
Business Shareholder	Bafana Nhleko
Ward Committee	Lebo Tsotetsi
Ward Committee	Sbongile Nkosi
Abomamalaza Tranding & Project	Methula Ntombifuthi
Numus	A.Muwko
Residant	Nicholus Tsotstsi
Residant	Mxolisi Mbonane
Health	Thea Moabi
Health	Sbongile Sibeko
Resident (Ward 16)	Nthabiseng Maena
Residant	Morate Mmpilo
Resident (Ward 16)	Sizwe Thanjekwayo
Resident (Ward 16)	Siyabonga Ngxoni
Resident (Ward 16)	Thanbang Blaauw
Resident (Ward 16)	Stanley Radebe
Resident (Ward 03)	Koos Msiza
Resident (Ward 03)	Thomas Mahlangu
Resident (Ward 01)	Morafkane Ditsego
Health	Thabile Mahamba
Health	Neo
Deealos Logistics	Vusi Masilela
Logistics	L.Mbueni
Residant	Njabulo Mahlangu
Youth	S.A.Madonstia
Youth	T.Khanye
Youth	T.V.Ntusa
Youth	D.R.Masuku
NPO	T.L. Morajane
Jalamba PTY	D.Mvuyolwa
Brain	Makhanye
Prise	L.S.Mulauga
Youth	M.T.Sibonyani
Youth	S.Mnyekeni
Youth	N.Maseko
Youth	P.Matsweni
Youth	F.D Mtseweni
T.B.U	A.N. Mthembu
TAX	P.P.Shoba
TAX	K.Muuyelwa
	A.Munko
	Pearl
Youth	N.L. Mokoena
Uthini Ugathi	Sophie Mtsupa
Disability	Thulane Mahchoe
Agriculture	Sandile Mkhatswa
SYDP	Mfundo Maseko
SYDP	Mboneni Mahlangu
NPO	Thabang Ditshego
Skills Development	Andile Mahlangu
NPO	Mhlola Munyelwa
CPF	Sipho Mlangeni
LEandra Community Stakeholder (LCS)	Tshepo Moloto
Leandra Community Stakeholder (LCS)	Qolani

Organisation	Contact Name
Leandra Stakeholder Co-Cordinator	Bafana Mtsweni
LEandra Community Stakeholder (LCS)	Sesi Mokwape
Isfisosabadala O.A.H	Bandile Nkosi
NPO	Mathuthu Matoana
UN	Themba Zondo
NPO	Tshepo Morajane
Disability	Stanley
Health	Sodladla Moasi
Education	P.Tsibela
GMM	T.Phungwayo
Govan Mbeki Municipality	Desmond Maake
Council of GeoScience	Thabo Mosia
Council of GeoScience	Mbuyiseni Ngcobo
Council of GeoScience	Ngqondi Nxokwana
Council of GeoScience	Angel Monnakgotla
Council of GeoScience	Douglas Phakula
Council of GeoScience	Ngqondi Nxolana

Appendix N2: Newspaper Notices

Summer League set to deliver plenty of action

The Secunda action sports little league kids cricket summer finals saw Kosmos Cobras claim first place at the end of the season.

The Soaring Sixes placed second in the Secunda action sports little league kids cricket summer finals.

SECUNDA - Action Sports players are reminded of the finals that will take place this month.

This will bring to a close the Summer League, making way for the Autumn League games that will begin on April 3.

On the cricket pitch, the quarter-finals will take place from March 13 to 15, with the semis taking place from March 20 to 22.

It will be the battle of the best, with the finals on March 25.

The action netball and hockey quarter-finals will also take place from March 23 to 24, with the semis on March 27, 28 and 29.

The finals for netball and hockey will be held on April 1.

Registration for the men's, women's and mixed action cricket, action netball and action hockey season is open.

The men's-only soccer league registration is now open.

Captains are reminded that the closing date for team entries is March 20.

The mini league kids cricket finals are on March 17, and the kids netball finals run from March 15 to 16.

The little league kids cricket finals were played on February 25.

Congratulations to the Kosmos Cobras for taking first place in the summer league.

Claiming the second spot was the Soaring Sixes, with the Tarantulas Black ending the season in third place.

For more information, call Mariska Lubbe on 082 851 1797 or Bianca Lubbe on 071 427 7404.

Claiming third place was Tarantulas Black.

Fit-Black' aerobics marathon held in eMbalenhle draws 200 fitness fanatics from different clubs

eMBALENHLE - Different provinces gathered at the eMbalenhle Sasol Club to compete in an annual aerobics marathon organised by the Fit-Black ZN training club form Kinross on March 4. About 200 members of different aerobics clubs participated in the marathon and instructors were also showcasing their moves. According to Mongezi Ndwandwe, the Fit-Black ZN founder, this aerobics marathon is held annually and hosted in different provinces.

Different aerobics clubs took part in the annual aerobics marathon that was held at Sasol Club in eMbalenhle.

CARBON CAPTURE UTILISATION AND STORAGE (CCUS) PROJECT: 3D SEISMIC SURVEY AND DRILLING ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Project Background

Carbon Capture Utilisation and Storage (CCUS) has been acknowledged by South Africa (SA) as one of the technologies to mitigate the emission of CO_2 into the atmosphere and forms one of the Nationally Appropriate Mitigation Actions (NAMA) against climate change. It is also one of the national flagship projects. CCUS forms part of a just transition to a future low-carbon energy economy.

The Council for Geoscience (CGS) is undertaking a geoscientific research project for the piloting of CCUS in Leandra in Mpumalanga, where it is proposed to inject CO_2 into deep suitable geological formations, approximately 1km below the surface. The Government of SA has received funding from the World Bank's International Bank for Reconstruction and Development to finance the CCUS project and intends to apply part of the proceeds for conducting Geological Characterisation comprising, amongst others, of drilling exploration boreholes and undertaking high-resolution 3D seismic survey at the proposed site. This notice only focuses on the Geological Characterisation component of the overall CCUS.

3D Seismic Survey and Drilling

The proposed drilling site is located along the R29 from Leandra to Kinross and is bounded to the south by a railway line from Secunda to Springs. The area earmarked for the 3D seismic survey encompasses most of the town of Leandra, as well as rural areas to the east and north-east.

The boreholes will be cored from the top of the bedrock to total depth with a minimum hole diameter of c. 95 mm. At various intervals during the drilling, suites of geophysical instruments will be installed in the borehole to obtain geophysical information. In addition, tests to determine the presence and quantity of gasses, e.g., hydrocarbons/light gasses, and tests to determine hydrological information will be conducted at systematic horizons, e.g., where water strikes are intersected, in the borehole.

The purpose of the high-resolution 3D survey for the CCUS Project is to map the structures, reservoir and seal rocks in detail over the identified potential injection site. The 3D survey will also establish the baseline for future time-lapse CO_2 monitoring activities. The seismic waves will be induced by vibrating truck-mounted heavy plates on the ground. These specialised trucks are known as "Vibroseis". By analysing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped. 3D surveys are acquired by laying out energy source points (vibroseis) and receiver points (geophones) in a grid over the area to be surveyed.

Environmental and Social Impact Assessment

Nemai Consulting was appointed by the CGS to undertake the Environmental and Social Impact Assessment (ESIA) for the 3D seismic survey and drilling required as part of the CCUS Project.

The ESIA must satisfy the following:

- The World Bank Environmental and Social Framework, the General Environmental, Health and Safety (EHS) Guidelines, Industry specific EHS Guidelines and Good International Industry Practice (GIIP); and
- SA's environmental legal requirements.

Note that a separate consultant is undertaking the ESIA for the injection phase of the CCUS Project.

Stakeholder Engagement

Stakeholder engagement will be undertaken as part of the ESIA. The following public meeting will be held to provide a platform for project-related discussions and to obtain input from stakeholders:

Date: 15 March 2023
Time: 10:00 AM – 12:30 PM
Venue: Difa Nkosi Hall, Leandra (coordinates: 26°22'35.08"S, 28°55'19.72"E)

Please submit your contact information and any comments that you may have regarding the proposed CCUS: 3D seismic survey and drilling to the contact person below by 28 March 2023.

Contact Details of Environmental Assessment Practitioner:

Contact Person: Donavan Henning
Tel: (011) 781 1730
Fax: (011) 781 1731
Email: donavanh@nemai.co.za
Postal Address: PO Box 1673, Sunninghill, 2157

Appendix N3: Background Information Document

Background Information Document

Council for Geoscience

February 2023

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT FOR THE CARBON CAPTURE UTILISATION AND STORAGE (CCUS) PROJECT: 3D SEISMIC SURVEY AND DRILLING

PROJECT ANNOUNCEMENT

CONTENT

1. Purpose of this Document

The purpose of this **Background Information Document** (BID) is as follows:

1. It serves to provide an overview of the proposed 3D seismic survey and drilling in support of the Carbon Capture Utilisation and Storage (CCUS) Project (the “Project”);
2. It outlines the Environmental and Social Impact Assessment that will be undertaken for the proposed Project; and
3. It allows stakeholders to provide upfront comments regarding the proposed Project.

2. BACKGROUND & MOTIVATION

South Africa (SA) has a coal-based energy economy and emits carbon dioxide (CO_2) into the atmosphere at approximately 400 million tonnes per year. In recognising its contribution to climate change, the country has committed itself to undertake steps to minimise such emissions. CCUS has been acknowledged by SA as one of the technologies to mitigate the emissions of CO_2 into the atmosphere and forms one of the Nationally Appropriate Mitigation Actions (NAMA). It is also one of the national flagship projects. CCUS forms part of a just transition to a future low-carbon energy economy.

The Council for Geoscience (CGS) is undertaking a geoscientific research project for the piloting of CCUS in Leandra in Mpumalanga, where it is proposed to inject CO_2 into deep suitable geological formations, approximately 1km below the surface. The Government of SA has received funding from the World Bank's International Bank for Reconstruction and Development to finance the CCUS Project and intends to apply part of the proceeds for conducting Geological Characterisation comprising, amongst others, of drilling exploration boreholes and undertaking high-resolution 3D seismic survey at the proposed injection site. This document only focuses on the Geological Characterisation component of the overall CCUS.

3. PROJECT OVERVIEW

3.1 Location

The northern portion of the Highveld coalfields presents unique geology, which affords the potential storage of CO_2. The site is situated near Lebohang (Leandra) in the Govan Mbeki Local Municipality, which falls within the Mpumalanga Province of SA. The R29 runs through the central part of the overall project area. Refer to the map contained in **Figure 1** below.

The proposed drilling site is located along the R29 from Leandra to Kinross and is bounded to the south by a railway line from Secunda to Springs. The area earmarked for the 3D seismic survey encompasses most of the town of Lebohang, as well as rural areas to the east and north-east. Refer to the map contained in **Figure 2** below.

***Figure 1:* Regional locality map**

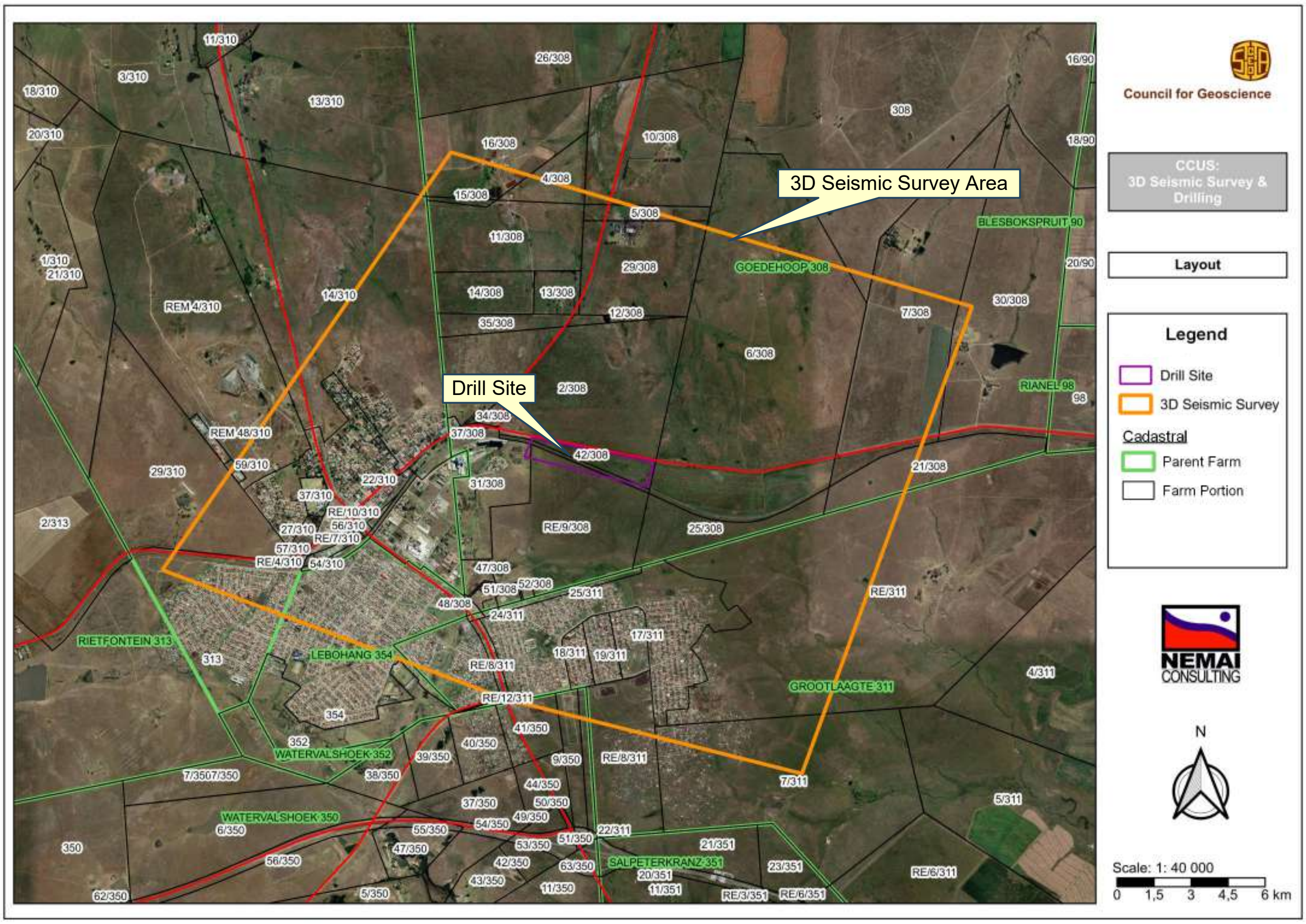


Figure 2: Proposed drilling site & seismic survey area

3.2 Drilling

The boreholes will be cored from the top of the bedrock to total depth with a minimum hole diameter of c. 95 mm. At various intervals during the drilling, suites of geophysical instruments will be installed in the borehole to obtain geophysical information. In addition, tests to determine the presence and quantity of gasses, e.g., hydrocarbons/light gasses, and tests to determine hydrological information will be conducted at systematic horizons, e.g., where water strikes are intersected, in the borehole.

Plant, equipment and goods associated with the drilling shall include (amongst others):

- Drill rigs including masts or derricks;
- Drilling fluid mixing, pumping and recycling equipment;
- Grouting pumps, mixers and all other equipment necessary for grout casing of the borehole, when necessary;
- Lighting plants and other equipment necessary to allow safe and efficient 24-hour operation;
- Adequate power supply unit for the drilling operation and the staff camp;
- Water supply for drilling and potable water for workers;
- Site office accommodation, stores, workshops and kitchen facilities at the site;
- Office for CGS representatives;
- Adequate vehicles to allow completion of the work, including suitable transport to safely transport contractor personnel to and from the drill site;
- Adequate, approved temporary ablution and latrine facilities;
- A reliable communication system; and
- All spare parts and back-up plant and equipment to ensure safe and efficient completion of the work.

On completion, the borehole will be securely capped with a concrete sanitation block and a lockable metal cap with a clear sign to avoid potential hazards to people and animals. The drill site will also be suitably rehabilitated. New facilities will be created for the injection phase.

3.3 3D Seismic Survey

A seismic survey is a method of investigating subterranean structure. The technique is based on determining the time interval that elapses between the initiation of a seismic wave at a selected shot point (i.e., location where the seismic wave is generated) and the arrival of reflected or refracted impulses at one or more seismic detectors (Source: https://www.britannica.com/science/seismic-survey).

The purpose of the high resolution 3D survey for the CCUS Project is to map the structures, reservoir and seal rocks in detail over the identified potential injection site. The 3D survey will also establish the baseline for future time-lapse CO_2 monitoring activities. 3D seismic surveys must be conducted over a large area in order to provide sufficient data for accurate interpretation of the subsurface geology.

For the Project, the seismic waves will be induced by vibrating truck-mounted heavy plates on the ground. These specialised trucks are known as "Vibroseis" (see **Figure 3**). By analysing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped. 3D surveys are acquired by laying out energy source points (vibroseis) and receiver points (geophones) in a grid over the area to be surveyed.

The 3D seismic data for the Project will be processed using pre-stack time/depth migration and post-stack time migration approaches for comparison purposes. The information from the existing legacy and borehole data will be utilised to provide constraints on the designs of the seismic surveys and processing of the seismic data.

Figure 3: Example of a Vibroseis

4. ENVIRONMENTAL ASSESSMENT

4.1 Environmental Governance Framework

Nemai Consulting was appointed by the CGS to undertake an Environmental and Social Impact Assessment (ESIA) for the 3D seismic survey and drilling required as part of the CCUS Project.

The ESIA must satisfy the following:

- The proposed Project will be supported by funding from the World Bank's International Bank for Reconstruction and Development (IBRD), and therefore it is to be executed to meet all related requirements, including the World Bank Environmental and Social Framework, the General Environmental, Health and Safety (EHS) Guidelines, Industry specific EHS Guidelines and Good International Industry Practice (GIIP).
- South Africa's environmental legal requirements, including the following (amongst others):
  - ◊ National Environmental Management Act (Act No. 107 of 1998) and the Environmental Impact Assessment (EIA) Regulations of 2014, as amended ("EIA Regulations");
  - ◊ National Environmental Management: Waste Act (Act No. 59 of 2008);
  - ◊ National Water Act (Act No. 36 of 1998); and
  - ◊ Mineral and Petroleum Resources Development Act (Act No. 28 of 2002).

There are also other pieces of legislation and mandated authorities governing specific environmental management topics (e.g., air quality) and features (e.g. biodiversity, heritage and cultural resources, etc.), which will be considered further as the ESIA process unfolds.

4.2 Specialist Studies

The following specialist studies will be undertaken as part of the ESIA to assess the impacts of the proposed 3D seismic survey and drilling on the receiving environment:

1. Socio-Economic Impact Assessment;
2. Heritage Impact Assessment;
3. Terrestrial Ecological Impact Assessment;
4. Aquatic Impact Assessment and Delineation; and
5. Health and Safety Assessment.

The findings of technical studies, such as geotechnical and hydrogeological studies undertaken by the CGS, will also be considered during the ESIA.

4.3 Stakeholder Engagement

4.3.1 Purpose of Stakeholder Engagement

The purpose of stakeholder engagement, which forms part of the ESIA, includes the following:

- To inform stakeholders about the Project;
- To allow stakeholders to express their views, issues, and concerns with regard to the Project;
- To grant stakeholders an opportunity to recommend measures to avoid or reduce adverse impacts and enhance positive impacts associated with the Project; and
- To enable the project team to incorporate the needs, concerns, and recommendations of stakeholders into the Project, where feasible.

4.3.2 Public Meeting

The following public meeting will be held to provide a platform for project-related discussions and to obtain input from stakeholders:

Table 1: Public Meeting Details

Date:	15 March 2023
Time:	10:00 AM – 12:30 PM
Venue:	Difa Nkosi Hall, Leandra (Coordinates: 26°22'35.08"S, 28°55'19.72"E)

4.3.3 Providing Comments

Please submit your contact information and any comments that you may have regarding the proposed CCUS: 3D seismic survey and drilling to the contact person below by 28 March 2023. The attached Reply Form can be used for commenting purposes.

5. Contact Details

For any queries or comments related to the proposed 3D seismic survey and drilling required as part of the CCUS Project, please contact the Environmental Assessment Practitioner below:

NEMAI CONSULTING

Contact Person: *Donavan Henning*
Tel: *(011) 781 1730*
Fax: *(011) 781 1731*
Mobile: *082 891 0604*
Email: *donavanh@nemai.co.za*
Postal Address: *PO Box 1673, Sunninghill, 2157*

Appendix N4: Public Meeting Presentation

Council for Geoscience

Proposed Carbon Capture Utilisation and Storage (CCUS) Project near Lebohang (Leandra) in the Govan Mbeki Local Municipality, Mpumalanga Province

Public Meeting

15 March 2023

NEMAI CONSULTING

Environmental, Social and OHS Consultants

P.O. Box 1673
Sunninghill
2157

147 Bram Fisher Drive
Ferndale
2194

Tel: 011 781 1730
Fax: 011 781 1731
Email: info@nemai.co.za

OPENING & WELCOME

AGENDA

AGENDA ITEMS	
1)	Opening and Welcome
2)	Attendance Register
3)	Purpose of and Rules for the Meeting
4)	**Project Overview**
	(4.1) Injection Phase
	(4.2) 3D Seismic Survey and Drilling Phase
5)	**Environmental Assessment Processes**
	(5.1) Injection Phase
	(5.2) 3D Seismic Survey and Drilling Phase
6)	Discussion
7)	Way Forward
8)	Close

(3) PURPOSE OF THE MEETING

- To provide an overview of the proposed CCUS Project.
- To provide an overview of the Environmental Assessment Processes for the phases of the CCUS Project.
- To allow stakeholders to raise questions and to provide a platform for project-related discussions.

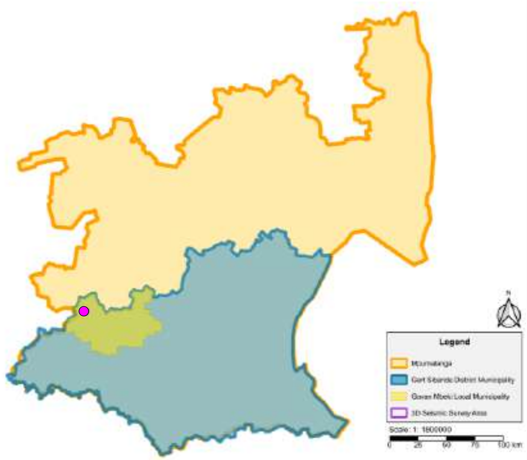
(3) RULES FOR THE MEETING

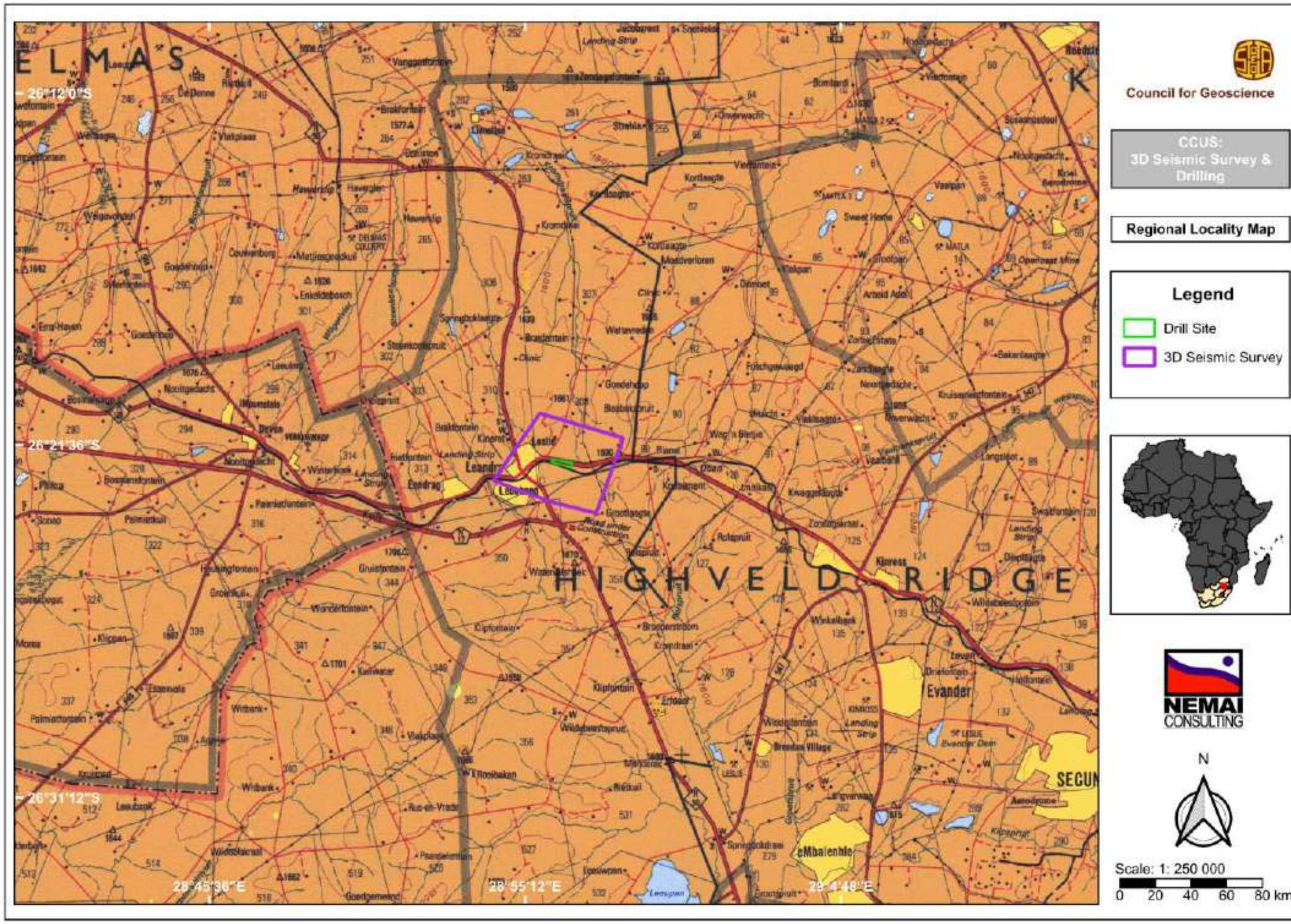
- ❑ Questions to relate to project at hand.
- ❑ Opportunities for seeking clarification at end of presentations.
- ❑ Address project team through Facilitator.
- ❑ Identify yourself before asking a question.
- ❑ Meeting closing time.
- ❑ Cell phones off, please.

(4) PROJECT OVERVIEW

(4.1) OVERVIEW - 3D Seismic Survey and Drilling Phase

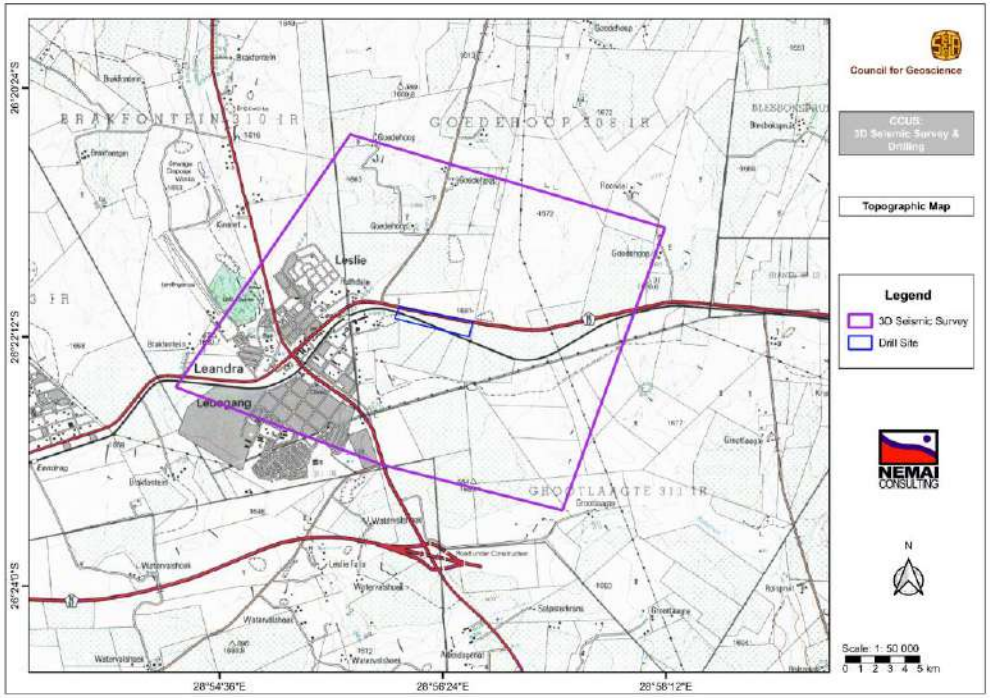
Location





(4.1) OVERVIEW - 3D Seismic Survey and Drilling Phase

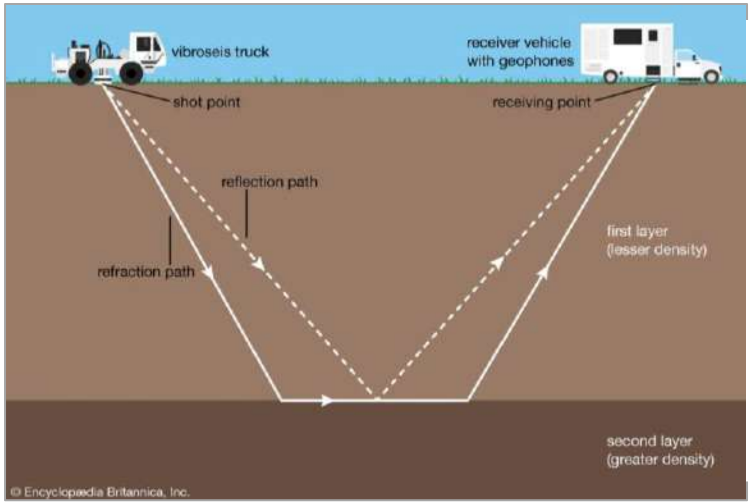
Location

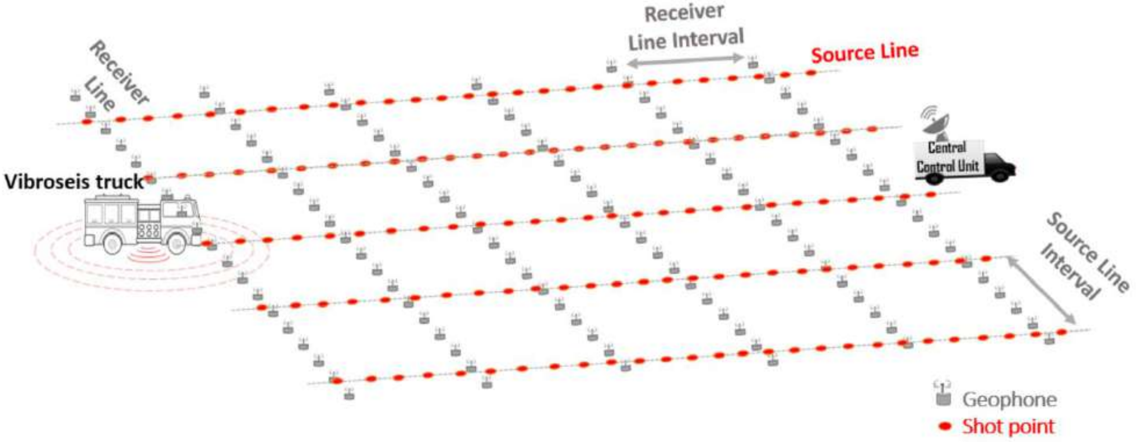


(4.1) OVERVIEW - 3D Seismic Survey and Drilling Phase

Proposed 3D Seismic Survey

- Seismic technology - reflection of sound waves to identify subsurface geological structures.
- Seismic waves generated by vibrating pad lowered to ground from vibroseis truck.
- Reflected seismic waves measured with series of sensors (geophones) laid out in series.
- Total area of the survey = 2000 hectares in extent and the perimeter is close to 18km.
- Grid: 20 m receiver and source line spacing and 5 m receiver and source spacing





(4.1) OVERVIEW - 3D Seismic Survey and Drilling Phase

Proposed Drilling Activities

- Drilling activities follow the analysis of seismic data.
- 2 X 2,000 m deep slim holes boreholes for geological characterisation for CCUS.
- Dimensions of proposed drill area = 50m x 30m. A well pad will be constructed at the location to accommodate a drilling rig, associated equipment and support services.
- Obtain geophysical information, determine presence and quantity of gasses & determine hydrological information.
- On completion, the borehole will be securely capped to avoid potential hazards to people and animals.

www.co2crc.com.au

(4.1) Overview - 3D Seismic Survey and Drilling Phase

Proposed Drilling Activities

(5) Environmental Assessment Processes

(5.2) ESIA - 3D Seismic Survey and Drilling Phase

Approach to the Abbreviated ESIA

Stakeholder Engagement

1. Establish the environmental and social baseline of the project's receiving environment
2. Determine the environmental governance framework for the project
3. Assess the potential environmental and social impacts and identify mitigation measures
4. Evaluate the project alternatives
5. Develop an ESMP

(5.2) ESIA - 3D Seismic Survey and Drilling Phase

Specialist Studies

- **Environmental & Social Specialist Studies:**
  - Socio-Economic Assessment
  - Heritage Impact Assessment
  - Terrestrial Fauna and Flora Assessment
  - Surface Water, Wetland and Aquatic Assessment
  - Waste Management Study
  - Health and Safety Assessment
- **Technical Studies:**
  - Geotechnical Investigation
  - Groundwater and Geo-hydrological
  - Noise and Vibration Assessment

(5.2) ESIA - 3D Seismic Survey and Drilling Phase

Stakeholder Engagement

- Public Participation: Announcement Phase – comments due by **28 March 2023**.
- Stakeholders to be notified of review of draft Abbreviated ESIA Report.
- All comments received from stakeholders will be included in the Comments and Responses Report, with feedback from relevant members of the project and environmental teams.

(6) Discussion

Thank you

NEMAI CONSULTING

Environmental, Social and OHS Consultants

P.O. Box 1673
Sunninghill
2157

147 Bram Fisher Drive
Ferndale
2194

Tel: 011 781 1730
Fax: 011 781 1731
Email: info@nemai.co.za

Appendix N5: Attendance Registers of Stakeholder Meetings

GERT SIBANDE DISTRICT MUNICIPALITY

21/02/2023

ATTENDANCE REGISTER

Meeting between CGS/NEMUS/NEMAI and Gert Sibande District and MP DEDT

Date: 21 February 2023 Time: 14:00 Venue: Industrial Boardroom L3 (GSDM Offices)

No.	INITIALS & SURNAME	EMAIL	CONTACT	SIGNATURE
1.	T.E. MOSIA	[redacted]	[redacted]	
2.	Mbuyiseni Ngcobo	[redacted]	[redacted]	
3.	IBH Simelane	[redacted]	[redacted]	I. Simelane
4.	P Nkosi	[redacted]	[redacted]	
5.	A Muwro	[redacted]	[redacted]	
6.	PEDRO BETTENCOURT	[redacted]	[redacted]	
7.	Caroline Tanhuke	[redacted]	[redacted]	C Tahuke.

GERT SIBANDA DISTRICT MUNICIPALITY 21/02/2023

MEETING ATTENDANCE REGISTER 21/02/2023

NR	NAME & SURNAME	COMPANY	EMAIL	CELL NUMBER	SIGNATURE
1	Phiwo Nkosi	GSDM	[redacted]	[redacted]	
2	IBH Simelane	DEDT	[redacted]	[redacted]	I Simelane
3	Mbuyiseni Ngwenya	CGS	[redacted]	[redacted]	
4	Thabo Mosia	CGS	[redacted]	[redacted]	
5	Douglas Phakula	CGS	[redacted]	[redacted]	
6	Caroline Tanuke	Nemai Consulting	[redacted]	[redacted]	
7	Pedro Bettencourt	NEMUS CONSULT.	[redacted]	[redacted]	
8	ANDRIES MUNRO	NEMUS	[redacted]	[redacted]	
9					
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25					

DiFA NKosi - TBC 22/02/2023

MEETING ATTENDANCE REGISTER 22/02/2023

NR	NAME & SURNAME	COMPANY	EMAIL	CELL NUMBER	SIGNATURE
1	Philemon Kutheka	Member CPF	[redacted]		[illegible]
2	Banyanda Mtshal	—	[redacted]		[illegible]
3	CHIEF MANANA	MANANA'S CHEM	[redacted]		[illegible]
4	Helta Seala	—	[redacted]		N.H. [illegible]
5	[illegible] Sewa	—	[redacted]		T. Sechaba
6	Santo Dwae	LCC	[redacted]		[illegible]
7	[illegible] Crane	LCC	[redacted]		[illegible]
8	Philip Roos	SAKHA ISIZWE	[redacted]		[illegible]
9	Sipho Mlangeni	Co-ordinator	[redacted]		[illegible]
10	Mkhola Mnyelwa	Talamba Tirans	[redacted]		[illegible]
11	Senzeni Kutheka	Ward Committee	[redacted]		Kutheka
12	Ntombifuthi Nhlapho	Ward Committe	[redacted]		Nhlapho
13	Mamafuthi Maseko	WARD 2 Councilor	[redacted]		[illegible]
14	Moss Manana	—	[redacted]		[illegible]
15	Thamba Zondo	Sakha Isizwe	[redacted]		[illegible]
16	Goodwill Hadebe	Word 6 Chairpers	[redacted]		[illegible]
17	DANIEL MOLOTO	Emm Cllr	[redacted]		[illegible]
18	Isaak Masuku	—	[redacted]		[illegible]
19	Sipho Ngele	—	[redacted]		[illegible]
20	W.M. Ntuli	Isimosikantl	[redacted]		[illegible]
21	BUTI MAKHARINI	— — —	[redacted]		[illegible]
22	JABU THWALA	WARD 6	[redacted]		[illegible]
23	Mabutha Malona	NPO	[redacted]		Mmmatona
24	Thabang Ditshego		[redacted]		[illegible]
25	Andile Mahlangu	Skills Developm	[redacted]		Mahlangu
26	MTUNGWA MKWATSWWA	VECEBUSA	[redacted]		[illegible]

DiFA NKosi - TBC 22/02/2023

MEETING ATTENDANCE REGISTER 22/02/2023

NR	NAME & SURNAME	COMPANY	EMAIL	CELL NUMBER	SIGNATURE
1	SIYABONGA KUBHEKA	KUBHEKA ENTITY	[redacted]	[redacted]	[illegible]
2	Percy Mahlangu	NAWE LAPHO TRADING	[redacted]	[redacted]	[illegible]
3	[illegible]	Memai	[redacted]	[redacted]	[illegible]
4	Olivia Repinge	G.M.M.	[redacted]	[redacted]	O.J Repinge
5	Martha Shongwe	world commitee	[redacted]	[redacted]	m. Shongwe
6	Nomaswazi Masilela	wardCommit	[redacted]	[redacted]	J.n Masilela
7	JABULANI Ntombela	ward Commit	[redacted]	[redacted]	[illegible]
8	Vusi Masilela	DEEALOS LOGISTI	[redacted]	[redacted]	[illegible]
9	MAFIKA SHABALALA	SIX BROTHERS	[redacted]	[redacted]	[illegible]
10	MAFIKA SHABALALA	ZAMALWKA ENTERPRIS	[redacted]	[redacted]	[illegible]
11	Sophie Mtsipa	UNIcthini Ngathi	[redacted]	[redacted]	[illegible]
12	Ndikho Maseko	Injabulo Electrical	[redacted]	[redacted]	[illegible]
13	Bafana Nhleko	Injabulo Electrical Cons	[redacted]	[redacted]	[illegible]
14	AUBREY MSIZA	DIBZA PTY (LT	[redacted]	[redacted]	[illegible]
15	Cynthia Mnguni		[redacted]	[redacted]	[illegible]
16	Sello Mabuni	G.M.M	[redacted]	[redacted]	[illegible]
17	NoNOZi mBatha	N/A	[redacted]	[redacted]	[illegible]
18	BRIAN Makhaye	Injabulo Electrical	[redacted]	[redacted]	[illegible]
19	Christopher Doctor Mbatha	N/A	[redacted]	[redacted]	BRIAN
20	Simon Moeng.	N/A	[redacted]	[redacted]	[illegible]
21	Vusi Sibhosana	N/A	[redacted]	[redacted]	[illegible]
22	Sindisiwe Nkambule	Six brothers	[redacted]	[redacted]	[illegible]
23	BAFANA MASEKO	WARD COMMITEE	[redacted]	[redacted]	[illegible]
24	Elias MALABOANE	T.E ENGINEERING	[redacted]	[redacted]	[illegible]
25	Mduduzi Khumalo	Traditional leader	[redacted]	[redacted]	[illegible]
	Mangoba Nkosi	N/A	[redacted]	[redacted]	[illegible]
	Mbongeni Mahlangu	N/A	[redacted]	[redacted]	[illegible]

DiFA NKosi - TBC 22/02/2023

MEETING ATTENDANCE REGISTER 23/02/2023

NR	NAME & SURNAME	COMPANY	EMAIL	CELL NUMBER	SIGNATURE
1	Lemmy Nhlapo	INGQUNGQUTHELA [redacted]			
2	Papa Tsibela	Mohlakoana/FA [redacted]			
3	Buti Simelane	A Simelane [redacted]			
4	Freddie Mokoka	[redacted]			
5	Andile Mahlangu	Reotional civil & [redacted]			
6	Vusi Petterson	gmvusi@gmail [redacted]			
7	Vusi Petterson	EFF CLLR [redacted]			
8	BAFANA MADWENI	STAKEHOLDERS [redacted]			
9	BAFANA NHLEKO	STAKEHOLDERS [redacted]			
10	Badanile Nkosi	Isfisosabadala [redacted]			
11					
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Lillian Ngoyi CENTRE (HALL C)

MEETING ATTENDANCE SHEET

Subject:	PILOT CARBON DIOXIDE STORAGE PROJECT
Venue:	GMM AND COUNCIL FOR GEOSCIENCE
Date:	23/02/2023 Moderator:

[redacted]

Attendees Name	Position / Title	Subordinate Units	Contact No
929 Mbuyiseni Ngcobo	Stakeholder Relations	Comms & SR	[redacted]
M. 24. Gwint Mayelo	Mun. Manager	M M Office	
Bheki Kubheka	SNR Manager	M M office	
T. Phungwayo	BB: IBP + WEB	PLANNING + ECO B	
Khosi Jezile	Chief of Staff	Office of the EM	
Douglas Phakula	Design Officer CCUS	minerals & Energy	
~~Lmosia~~ Thabo Mosia	CCUS: Energy	Mineral & Energy	
ANDRIES MUNRO	NEMUS	NEMUS SA.	
NG Zuma	Executive Mayor		
MH RAMOLETA	AD: Corporate	Corporate Service	
THEMBA PITHUYEWAYO	BB IBP/WEB	P & EB	
Hendrik vd Merwe	Acting Div Comm Servs		

NEMAI CONSULTING	Focus Group Meeting	Project Name:	Carbon Capture Utilisation and Storage Project	Queries:	Caroline Tanhuke ☎ +27 11 781 1730 📠 +27 11 781 1731 ✉ carolinet@nemai.co.za
		Project Number:			
Client	Council for Geoscience Applied Geoscience Solutions	Date:	08 MARCH 2023.	Time:	14H00
		Chairman:	CAROLINE TANHUKE	Venue:	DIFA HALL LEANORA.

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Postal / Street Address	Sign
CAROLINE TANHUKE	Nemai Consulting	Social Consult	[redacted]	[redacted]	C.T.
Sophie Mtsipa	(LAN) uthini ugathi	"LAN"	[redacted]	[redacted]	
THULANE MAHLANGU	DISABILITY	STAKEHOLDER	[redacted]	[redacted]	
Sandile Mhlatshwa	AGRICULTURE	Stakeholder	[redacted]	[redacted]	
Mfundo Masoko	SYDP	Stakeholder	[redacted]	[redacted]	Moeko
Mbongeni Mahlangu	SYDP	Stakeholder	[redacted]	[redacted]	
Thabang Ditshego	NPO	Stakeholder	[redacted]	[redacted]	
Andile Mahlangu	Skill & development	Stakeholder	[redacted]	[redacted]	
MHLOLA Mnunyelwa	NPO	Stakeholder	[redacted]	[redacted]	
SIPHO MLANGENI	CPF	Stakeholder	[redacted]	[redacted]	

NEMAI CONSULTING	Focus Group Meeting	Project Name:	Carbon Capture Utilisation and Storage Project	Queries:	Caroline Tanhuke ☎ +27 11 781 1730 +27 11 781 1731 ✉ carolinet@nemai.co.za
		Project Number:			
Client	Council for Geoscience Applied Geoscience Solutions	Date:	14H00	Time:	08/03/2023
		Chairman:	CAROLINE TANHUKE	Venue:	DIFA HALL LEANDRA

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Postal / Street Address	Sign
TSEPO MOLOTO	LCS	STAKEHOLDER	[redacted]		
Qaani	LEANDRA COMMUNITY STAKEHOLDER				
BAFANA MTSWENI	LEANDRA STA CO-ORDINATOR	CO-ORDINATOR			
SESI MOKWAPE	LEANDRA COMMUNITY STAKEHOLDER	STAKEHOLDER			
Badanile Nkosi	Isifisosaba dala O.A.H	STAKEHOLDER			
Mahuduhu Matona	NPO	Stakeholder			mmmatona
Themba Zondo	UN	stake Holder			
Tsepo Morojane	NPO	Stakeholder			
Stanley	Disability	Stakholder			Stanley
Saduelka Moseki	Health	Stakeholder			
P. Tsibela	Education	Stakeholder			

NEMAI CONSULTING	Focus Group Meeting	Project Name:	Carbon Capture Utilisation and Storage Project	Queries:	Caroline Tanhuke ☎ +27 11 781 1730 📠 +27 11 781 1731 ✉ carolinet@nemai.co.za
		Project Number:			
Client	Council for Geoscience Applied Geoscience Solutions	Date:	08 / 03 / 2022	Time:	11:00 am.
		Chairman:	CAROLINE TANHUKE	Venue:	Govan Mbeki Municipality

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Postal / Street Address	Sign
T. Phungwayo	GMM	SS	[redacted]	[redacted]	
C. Tanhuke	Nemai C	Social Cons	[redacted]	[redacted]	
DESMOND MAAKE	GOVAN MBEKI MUNICIPALITY	DIRECTOR: PLANNING & ECONOMIC DEVEL	[redacted]	[redacted]	
			☎ ✉		
			☎ ✉		
			☎ ✉		

NEMAI CONSULTING	**ATTENDANCE REGISTER** **Public Meeting**	**Queries:**	Donavan Henning ☎ +27 11 781 1730 📠 +27 11 781 1731 ✉ donavanh@nemai.co.za
Project Proponent:	**Council for Geoscience**	**Project Name:**	Proposed Carbon Capture Utilisation and Storage (CCUS) Project near Lebohang (Leandra) in the Govan Mbeki Local Municipality, Mpumalanga Province
Date:	15 March 2023	**Time:**	10:00 AM – 12:30 PM
Facilitators:	Mbuyiseni Ngcobo & Donavan Henning	**Venue:**	Difa Nkosi Hall, Leandra

Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Jabulani D Nkosi	Zamelani Abadala aged group		☎ [redacted]	
Lifa Ntshali	Ward Committee		☎ [redacted]	
Ponile Given Mabaso	MTE		☎ [redacted]	
Sunrise	Legislature		☎ [redacted]	
Smancia Nconcwane	Art Creative Centre		☎ [redacted]	
Gini Makhetha	Ward Com		☎ [redacted]	
Michel Mlsweli	Ward Comm.		☎ [redacted]	
Nombuso Mhlongo	Ward 16		☎ [redacted]	
Vuyowethu Gadlimpi	Ward 16		☎ [redacted]	

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Thomas Mahlule	01	N/A	[redacted]	
Sonnyboy Khumalo	01		[redacted]	
Thenjiwe Mgwetha		N/A	[redacted]	
Fortunate Mathebula	03		[redacted]	
Gugu Mboran	03	N/A.	[redacted]	
Andile Molushina	03		[redacted]	
Sibongile Mqwathi	03		[redacted]	
Eunice S Mahapa	06		[redacted]	
Thimothy Nkosi	01		[redacted]	
Dona Ekasapa	03	N/A	[redacted]	
Daniel Mkipho	01	N/A	[redacted]	

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Vusi Petterson	Cllr EFF		[redacted]	[signature]
Kaizer Zwane	SPORTS			[signature]
Madoda Shabalala	Sports			[signature]
Clement Mxoxo.	Ward 1	N/A		[signature]
[illegible]	Ward 06	-		[signature]
Norman [illegible]	Ward 01			[signature]
Henry Bludla	Ward 01			[signature]
Fanie Nkambule	Ward 6	N/A		[signature]
TSEPO MOLOTO	WARD 1			[signature]
ZINHLE MAHLANGU	Ward 3			Mahlangu
Jabulile Mavimbela	Ward 3			[signature]

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
W. Mthwanazi	Word 16		[redacted]	[illegible]
R. Malaza	Ward 16		[redacted]	malazan
A. Zulu	Ward 16		[redacted]	[illegible]
M Munarini	Word 16		[redacted]	[illegible]
Nomuyo Shongwe	Ward 16		[redacted]	[illegible]
Zanele Skosana	Ward 06	W/C Sec	[redacted]	[illegible]
Thomas Mahlangu	Ward 03 Stakeholder D P		[redacted]	[illegible]
Buti Simelane	Ward 03		[redacted]	[illegible]
Nomvula Vilakazi	Ward 06		[redacted]	[illegible]
Doctor Masimbela	Ward 06		[redacted]	[illegible]
Sifa Siteto	Ward 16	Kinross	[redacted]	[illegible]

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Happyness Blonde	03		[redacted]	[illegible]
JOHANNA MATSOSE	–	03.	[redacted]	Matsose
Sandile Khumalo	–		[redacted]	[illegible]
COLLEN MALTZA	–	–	[redacted]	[illegible]
Promise Kolobe	02	–	[redacted]	Kolobe
Lekhele	02	–	[redacted]	Lekhele
Sam Zulu	NGO	–	[redacted]	[illegible]
Belsile Mgeina	H.C.B	–	[redacted]	B.Mgesine
Nkosi Badani K	Lefisoseaba old age Hc	Director	[redacted]	[illegible]
Thandolwethu Seeta	Ward 6	–	[redacted]	T. Seeaba
Mathuthu Matong	NPO	–	[redacted]	Mmmatong

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Antonio F. Mathebeela	Sekhiscizwe Community D		[redacted]	
Polineh Rodebe	ANCYL		[redacted]	
Siphiwe Mazibuko	ward Committee		[redacted]	
Zanele Masilela	Stake holder		[redacted]	
Mathapelo mahlangu	ward community		[redacted]	
nokuthula Memba	ward community		[redacted]	
Thabo Motsoeneng	Community		[redacted]	
Jacos Lelako	Comittee	member	[redacted]	
Msiboni Mokwana	CSS	Scientist	[redacted]	
A.A Mabena			[redacted]	
LO Mbonane	ward Community		[redacted]	

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
JAN Mayisa	word 06		[redacted]	
Sophie Mtsepe	ward 02	UNI Uthini ngathi	[redacted]	
R. Mbonani	Ward 06		[redacted]	
S. Madonsela	ward 6.		[redacted]	MADONSELA
m. Shongwe	word 01		[redacted]	m. Shongwe
C-S. Mahlangu	word 01		[redacted]	
F.L Mitchell	word 02		[redacted]	
M.Mozokeng	Word 1		[redacted]	
M.Mahlangu	ward 3		[redacted]	
L. Masoko	ward 2		[redacted]	
BAFANA MSIWEN	STAKEHOLDER	COORDINATOR FOUNDER	[redacted]	

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Lebogang Mpatlanyane	Word 3		[redacted]	L.mahlangu
Promise Shai	Ward16			Shai
Sikhanyiso Dlamini				
Busisiwe Mazuya				
Zodwa Sibeko				Z.D.S
Prudence Mathebula	SAKHASIZWE Community Development			
Nomaswazi Masilela	ward 01 committee			J.N. Masilela
Nduduzi Mthombeni	CPF			
Sipho Mzozo	Winds of Change	Director		
Philmon Kubheka	Ward 1	C.P.F		
Thoko Ngobeni	902 ext 7			Ngobeni

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Sendile Masedo	LED	GMM	[redacted]	
Peter	Local Comm		[redacted]	
Bafana Maseko	S & Ref JC	GMM	[redacted]	
Bafana Nhleko	Business Stakeholder	Director	[redacted]	
Lebo Tsotetsi	Ward Committee	GMM	[redacted]	
Sbongile Nkosi	Ward Committee	GMM	[redacted]	
Methula Ntombifuthi	Abomalaza trading & Project	GMM	[redacted]	
Mbuyiseni Ngcobo	CGS	Stakeholder	[redacted]	
A. Mumbo	Nrumus	Nrumus	[redacted]	
Nicholus Tsotetsi			[redacted]	
Mxolisi Mbonane	Community	GMM	[redacted]	

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Lebohang Matlhonyane	Ward 3		[redacted]	L.M.
Thoko Ngobeni		Ward 3		T.H.

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
Theo Mooli	Health	Health Comm	[redacted]	
Sbongile Sibeko	Health	Health Con	[redacted]	
Pethisang Maeni	Ward 16		[redacted]	
MORAZE MMPILE			[redacted]	
Sizwe Tingekwayo	ward 16		[redacted]	
Siyabonga Mayoni	ward 16		[redacted]	
Thabang Blaauw	ward 16		[redacted]	
Stanley Radebe	Desbliti		[redacted]	STANLEY
KOOS MSIZA	WARD 3		[redacted]	
THOMAS MAHLANGU	WARD 3		[redacted]	
MORAKANE Aitseng	Ward 1		[redacted]	

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
ThabileMahamba	Health	N/A	[redacted]	
Neo	Health	N/A	[redacted]	
Vusi Masilela	Deealos Logistics	Director	[redacted]	
L. Mkweni	Logistic	N/A	[redacted]	
N Sabulo Mahlangu	22CSCUP	N/A	[redacted]	
S.A. MADONSELA	YOUTH	N/A	[redacted]	
T KHANYE	YOUTH	N/A	[redacted]	
T.V NTUSA	YOUTH	N/A	[redacted]	
D.R. MASUKU	YOUTH	N/A	[redacted]	
T.L MORAJANE	NPO	CHAIRPERSON	[redacted]	
D. Mvunyelwa	Jalamsa PTY	Director	[redacted]	

Representative Name and Surname	Name of Organisation	Designation	Contact Details	Sign
M A Khumalo	BRIAA	N/A	[redacted]	
L.S. Mhlanga	DWSA	N/A	[redacted]	
M.F Sibanyoni	Youth	N/A	[redacted]	
S. Muyeki	Youth	N/A	[redacted]	
N. Maseko	Youth	N/A	[redacted]	
P Mtsweni	Youth	N/A	[redacted]	
F.D Mtsweni	Youth	N/A	[redacted]	
A.N. Mthembu	T-B.L.P.	N/A	[redacted]	
P.P. Shoba	TAX	N/A.	[redacted]	
K Mnguyelwa	TAX	N/A	[redacted]	
N-L. Mohoena	Youth	N/A	[redacted]	