



## TETRA4 CLUSTER 2 GAS PRODUCTION PROJECT ENVIRONMENTAL IMPACT ASSESSMENT PHASE



# Applicant and EIA Team Details

- **Applicant:** Tetra4 (Pty) Ltd – wholly owned subsidiary of Renergen.
- **EAP:** Environmental Impact Management Services (Pty) Ltd (EIMS) – Brian Whitfield (EAPASA Ref: 2022/4496)
- **Specialists:** Specialist Studies as follows:

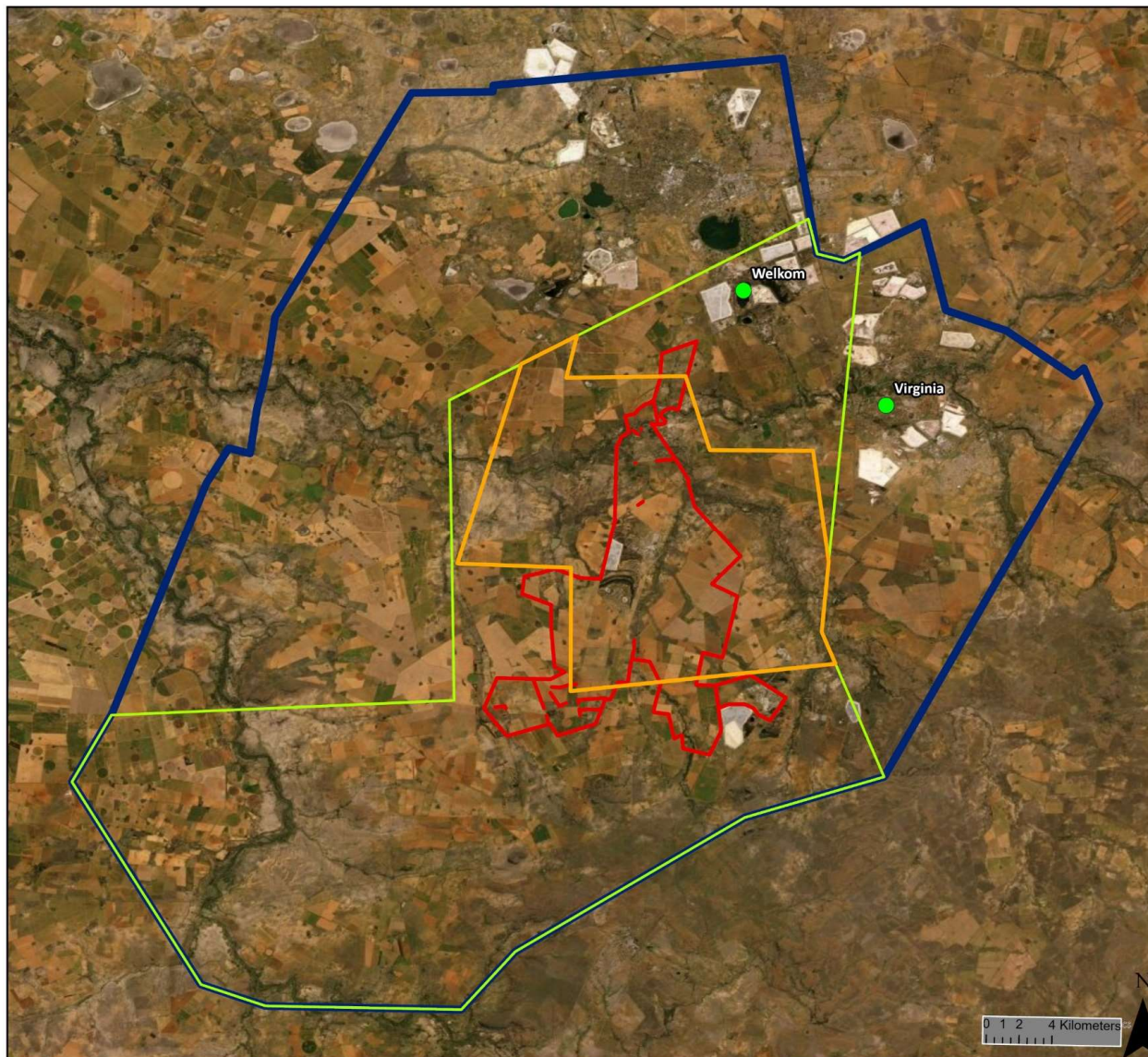
Specialist Discipline	Company/Organisation
Agriculture and Hydropedology	The Biodiversity Company
Air Quality, Health Risk, GHG and Climate Change	Airshed Planning Professionals
Economic	Strategy4Good
Geohydrology	Gradient Groundwater Consulting
Heritage and Palaeontology	PGS Heritage
Hydrology and Floodlines	SMEC South Africa
Noise	Airshed Planning Professionals
Social	Equispectives Research and Consulting Services
Terrestrial Biodiversity	The Biodiversity Company
Visual	Environmental Planning and Design
Wetland and Aquatic	The Biodiversity Company



# Legal Framework

- Gas Production Right (Ref: 12/4/1/07/2/2) granted in 2011 covering ~187 000 hectares.
- Cluster 1 Environmental Authorisation (Ref: 12/04/07) granted in 2017 for production wells, pipelines, LNG Plant and associated infrastructure within the PR.
- Cluster 2 Environmental Authorisation is being applied for to increase gas production within the Production Right. This application will include a MPRDA Section 102 revision of the EMPr to include Cluster 2 specific infrastructure as well as amendments or additions of mitigation measures where necessary.



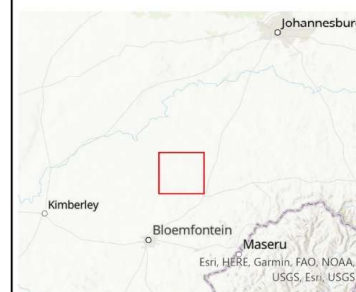


## Project History and Mineral Tenure

1473 Tetra4 Cluster 2

### Legend

-  Production Right Boundary (2010 EMP) ... 1
-  Approved 2011 Study Area
-  Cluster 1 Approved Area (2017)
-  Cluster 2 Application Area (2022)
-  Places



### Data Sources:

CSG; ESRI  
 Coord System: GCS WGS 1984  
 Datum: WGS 1984  
 Units: Degree  
 Ref: Project History and Mineral Tenure

Date: 2022/06/29

EIMS Ref: Project History

Compiled: CM

Reviewed: BW

Approved: LW



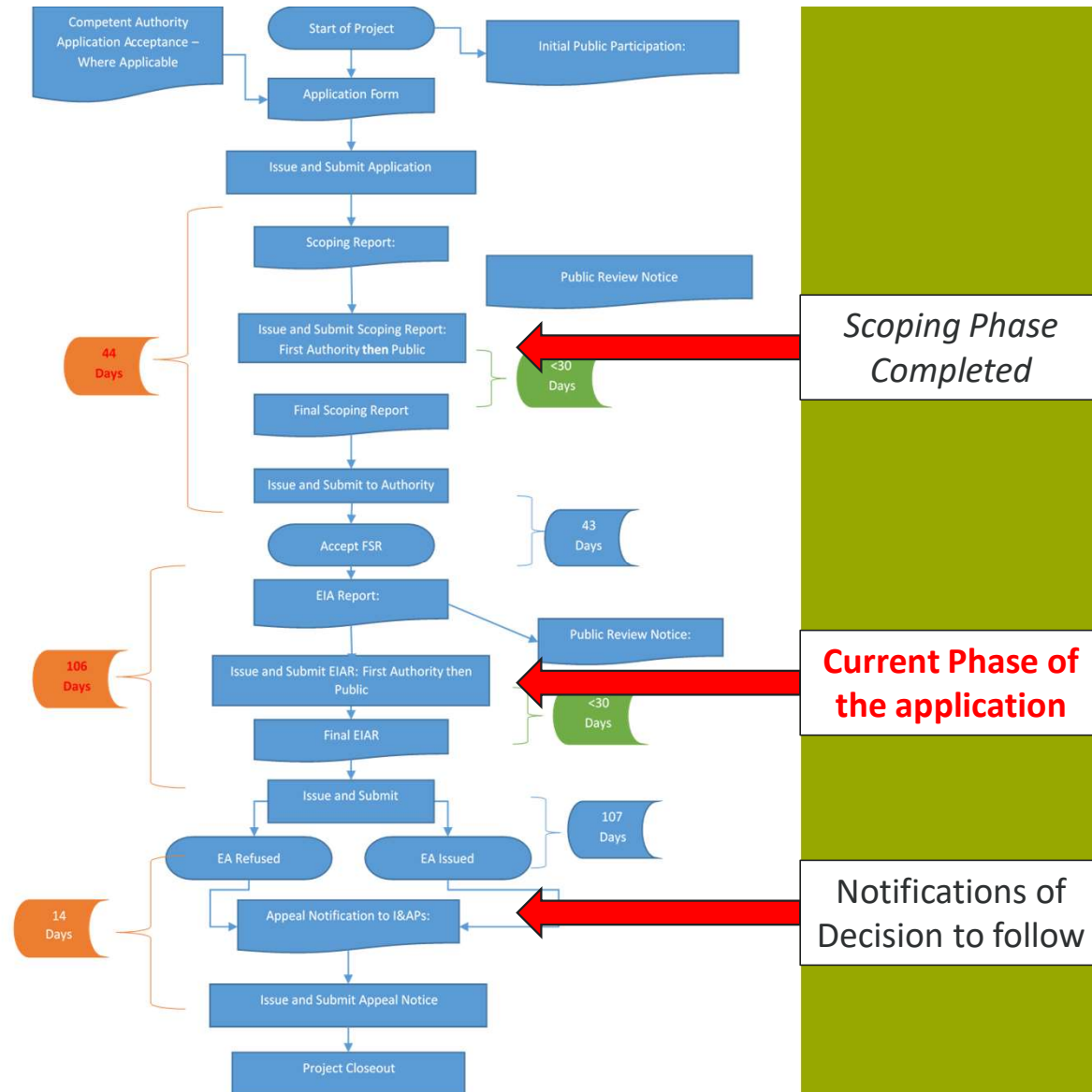


# EIA Process and Public Participation

- Full EIA process comprises of : Scoping and EIA Phases, each with prescribed public participation requirements
- Cluster 2 currently in the EIA Phase:
  - Preliminary impacts identified in Scoping phase have been fully assessed.
  - Feedback from I&APs has been considered and addressed where relevant in EIA report.
- Public Participation Process:
  - Affected & adjacent landowners, legal occupiers, communities, relevant organs of state, NGOs, etc.
  - Presenting findings in the EIA Report (report availability and public open day / focus group meetings).
  - Soliciting final comments for inclusion in the submission to the PASA for decision making.



# NEMA Scoping & EIA Flow Diagram



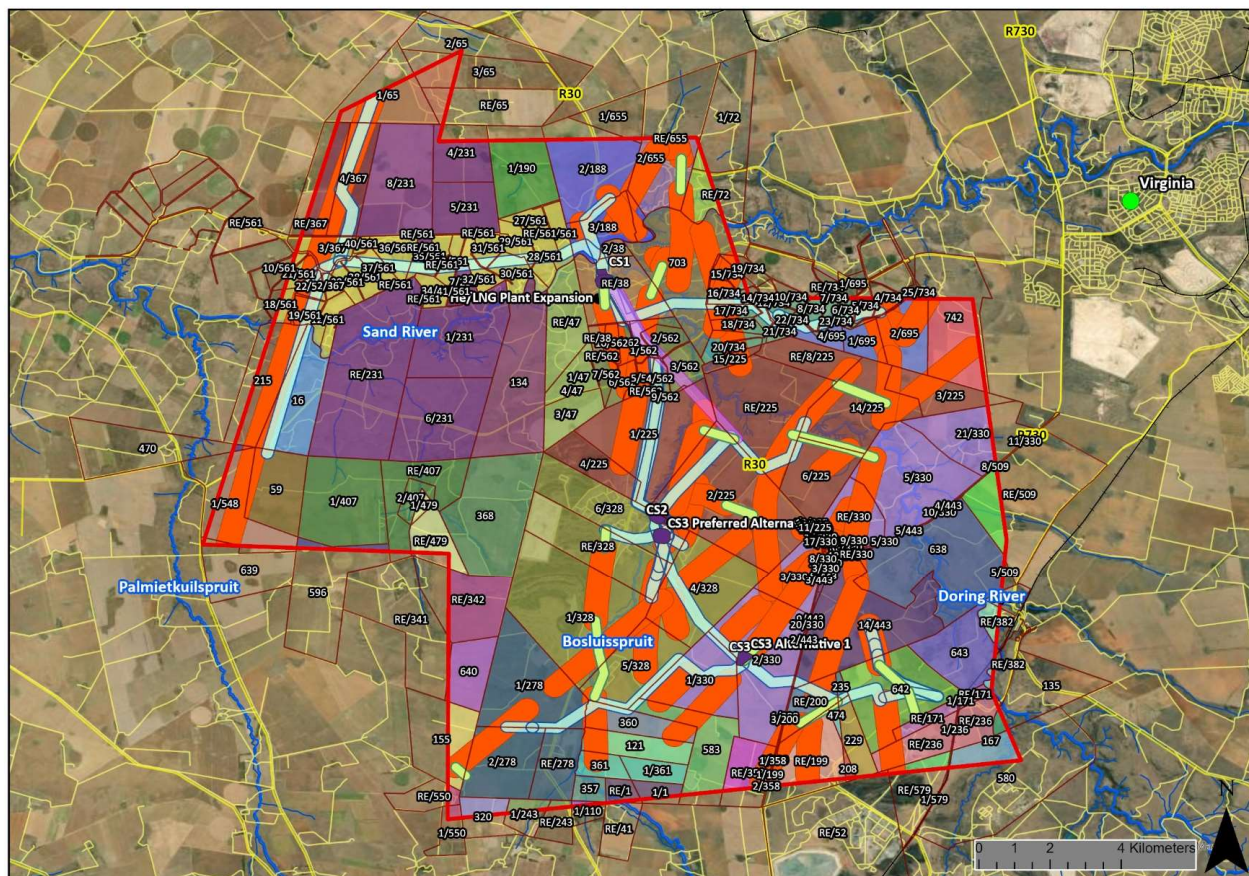
## Project Location

- The application and study area covers 284 farm portions within the Masilonyana and Matjhabeng Local Municipalities and includes ~27 500 hectares.
- The site boundary is ~5km southwest of Virginia, ~9km south of Welkom and ~16km north of Theunissen.









Legend

Adamsons Vley No. 655	Cabriere No. 215	Grusde No. 229	Klein Pan No. 320	Mooivlei No. 357	Vaalbank No. 190
Annex Glen Ross No. 562	Carlo No. 596	Hakkies No. 695	Kleinbegin No. 134	Nortier No. 361	Vlakan No. 358
Annex Grusde No. 474	Damplaats No. 341	Hakkies No. 695	Kovno No. 235	Palmietkui No. 548	Welgelegen No. 382
Annex Mooivlakte No. 208	Dankbaarheid No. 16	Hakkies No. 742	Langlaagte No. 110	Palmietkui No. 328	Weltevrede No. 638
Blaauwdrift No. 188	De Klerks Kraal No. 231	Harmonie No. 579	Leeuwaarden No. 171	Paulina No. 470	Weltevreden No. 443
Bloemhoek No. 509	Die Mond No. 479	Helpmekaar No. 47	Leeuwvult No. 52	Richelieu No. 135	Zoetendal No. 243
Boschluis Spruit No. 278	Digito No. 642	Jonkers Rust No. 72	Leeuwvult No. 580	Rondehoek No. 200	Zonderzorg No. 342
Braklaagte No. 41	Doorn River No. 330	Jordaan No. 1	Lekkerlewe No. 643	Siberia No. 464	Zonderzorg No. 640
Brakspruit No. 121	Doorndeel No. 236	Jordaans Rust No. 59	Middelplaas No. 583	Spoorleggerswoning 54 No. 167	
Bruintjes Hoogte No. 367	Enkeldoorn No. 360	Mond Van Doornrivier No. 38	Mooifontein No. 639	Stille Woning No. 703	
Bruintjes Hoogte No. 367	Frisgewaag No. 550	Kalkoekrans No. 225	Mooivlakte No. 199	Terra Blanda No. 155	
Bryan No. 561	Glen Ross No. 734	Klein Palmiet Kuil No. 407		Toulon No. 368	

284 farm portions

## Cadastral / Infrastructure

1473 Tetra4 Cluster 2 Project

### Legend

- Study Area
- Places
- Railway
- Roads
- Rivers
- Infrastructure**
  - Compressor Stations
  - LNG/LHe Plant
- Project Footprint Buffer Zones**
  - Pipeline (300m)
  - Wells Tansects (600m)
  - Transmission Loop Buffer (300m)
  - Extensions



### Data Sources:

CSG; ESRI, SANBI, DHSWS  
 Coord System: GCS WGS 1984  
 Datum: WGS 1984  
 Units: Degree  
 Ref: Cadastral Infrastructure

Date: 2022/08/12

EIMS Ref: Cad Infrast.

Compiled: CM

Reviewed: BW

Approved: LW



# Project Overview

- **Overview:**

- Cluster 2 development aims to produce a total of ~45 Million Standard Cubic Feet per Day (MMSCFD) of gas (Methane and Helium).
- The construction of the gas gathering network is planned to commence in ~May 2023 and be completed by ~October 2025.
- Construction of the LNG/LHe Plant is planned to commence in ~March 2023 and be completed by ~February 2026.
- The operational timeframe for the project is approximately 20 years (~2026 to ~ 2046).

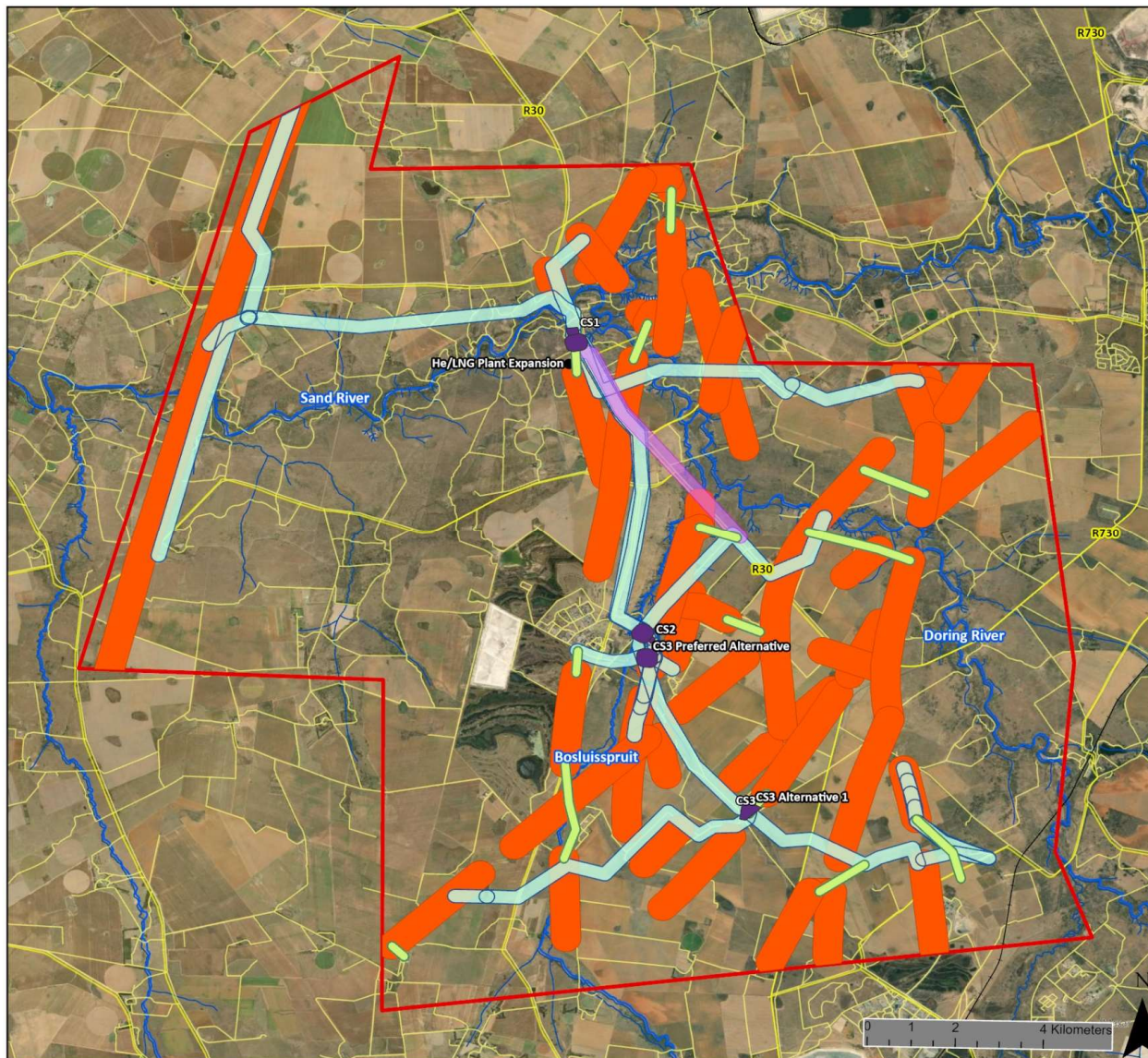


## Project Description

- ~400 exploration wells (each 50 m X 50 m = 250 m<sup>2</sup>)
- ~300 production wells (each 1,4 m x 1,1 m = 1.54 m<sup>2</sup>)
- ~480 km of gas transmission pipelines (10 m servitude)
- ~28 booster stations (each 10 m x 14 m = 140 m<sup>2</sup>)
- 3 compressor stations (each 60 m x 60 m = 3600 m<sup>2</sup>)
- Access roads (2.5 m wide)
- LNG/LHe Plant (~9.6 ha) with temporary camp/laydown area (~15.8 ha)







## Locality Map

1473 Tetra4 Cluster 2 Project

### Legend

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Data Sources:  
 CSG; ESRI, SANBI, DHSWS  
 Coord System: GCS WGS 1984  
 Datum: WGS 1984  
 Units: Degree  
 Ref: Locality Map

Date: 2022/07/19  
 EIMS Ref: Locality  
 Compiled: CM  
 Reviewed: BW  
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Pigging Station



Compressor Station



LNG/LHe Plant



Pipeline Servitude

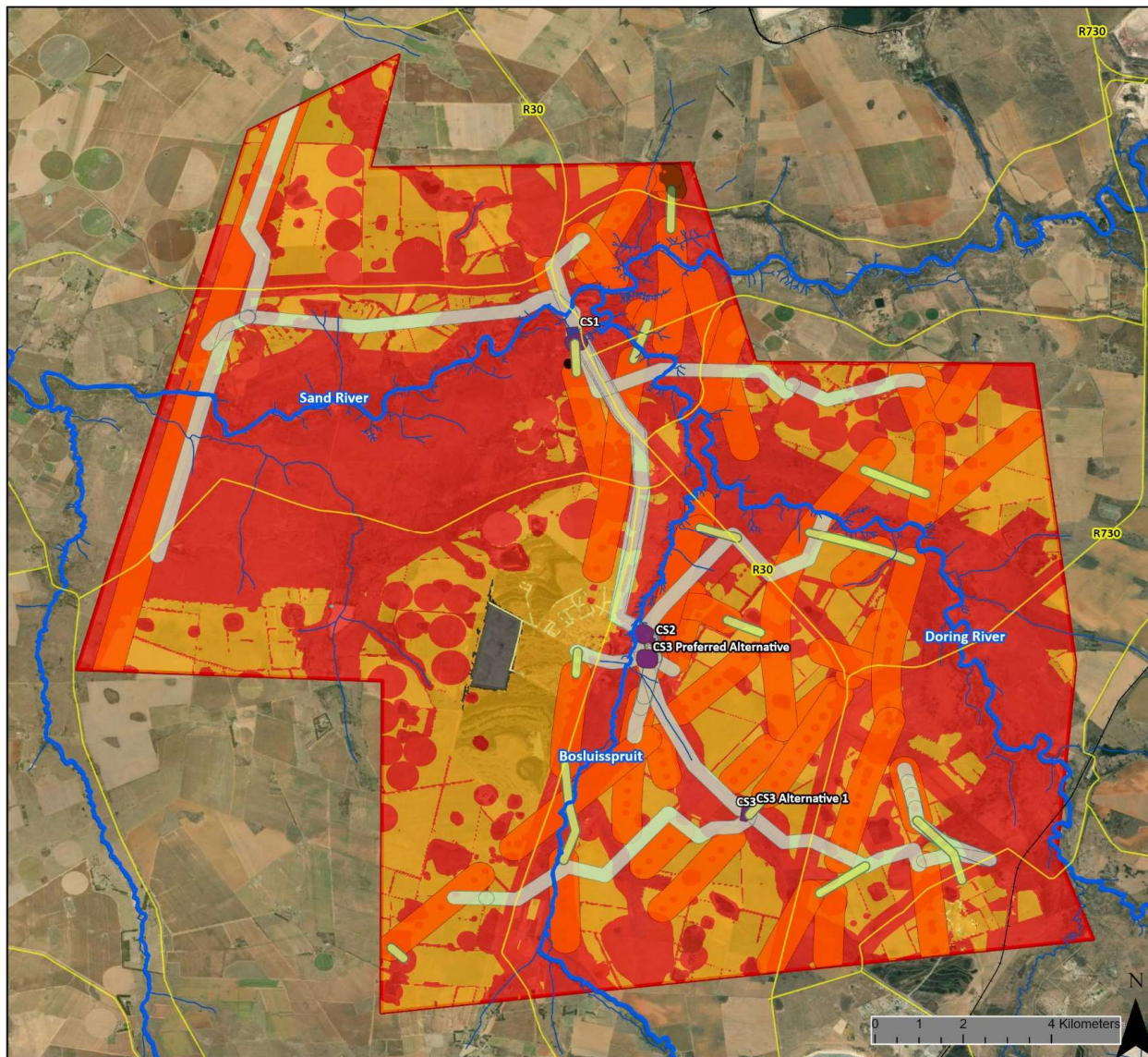


Low Point Drain

# Specialist Studies

Specialist Discipline	Company/Organisation
Agriculture, Soils and Hydropedology (soil water)	The Biodiversity Company
Air Quality & Health Risk + Climate Change / GHG	Airshed Planning Professionals
Economic	Strategy4Good
Geohydrology (groundwater)	Gradient Groundwater Consulting
Heritage and Palaeontology	PGS Heritage
Hydrology (surface water)	SMEC South Africa
Noise	Airshed Planning Professionals
Social	Equispectives Research and Consulting Services
Terrestrial Biodiversity	The Biodiversity Company
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## EIA Risk Based Combined Sensitivity Map

1473 Tetra4 Phase 2 BA WULA

### Legend

- Study Area
- Places
- Railway
- Rivers
- Infrastructure**
  - Compressor Stations
  - LNG/LHe Plant
  - Extensions
  - Pipeline (300m)
  - Wells Tansects (600m)
- Risk Adverse Sensitivity Ranking**
  - Low
  - Medium
  - High
  - No-Go



### Data Sources:

CSG; ESRI  
 Coord System: GCS WGS 1984  
 Datum: WGS 1984  
 Units: Degree  
 Ref: 1473 Combined Sensitivity Map

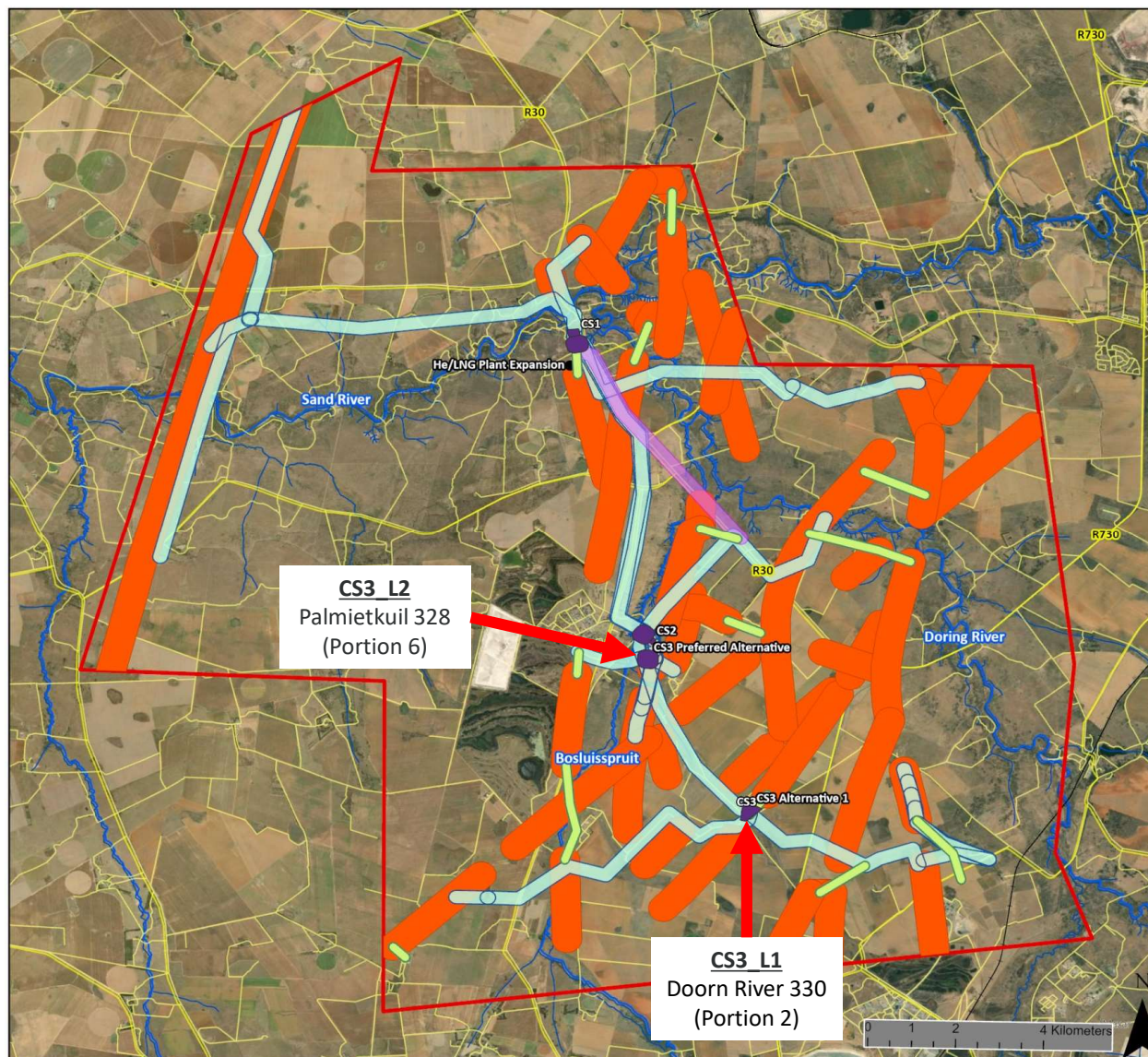
Date: 2022/10/18  
 EIMS Ref: 1473  
 Compiled: CM  
 Reviewed: BW  
 Approved: LW



# Alternatives

Alternative Category	Alternative	Alternative Description Summary	Advantages	Disadvantages/ Risks	Final Recommended Alternative
Location Alternatives	CS3_L1	Doorn River 330 (Portion 2).	Well positioned within the southern gas pipeline network to balance the system without expensive reinforced pipeline network.	Availability of electricity supply / connection unlikely.  Increased visual and social impacts as compared to CS3_L2	No
	CS3_L2	Adjacent to the existing Cluster 1 Compressor Station A on farm Palmietkuil 328 (Portion 6).	Electricity supply is confirmed as the existing Cluster 1 CSA is already connected to the Eskom grid.  Reduced visual and social impacts as compared to CS3_L1	Would require a more costly pipeline design in the southern gas pipeline network.	Yes
Layout Alternatives	Based on a sensitivity mapping of the well transects and pipeline transects, unacceptably high-risk areas have been delineated as no-go areas.				Yes
No-Go Alternative	No-Go	The proposed Cluster 2 project will not take place at all.	No additional environmental impacts as a result of the Cluster 2 project.	No benefits with respect to job creation and also no direct and indirect socio-economic benefits created for the local and regional economies.	No





## Locality Map

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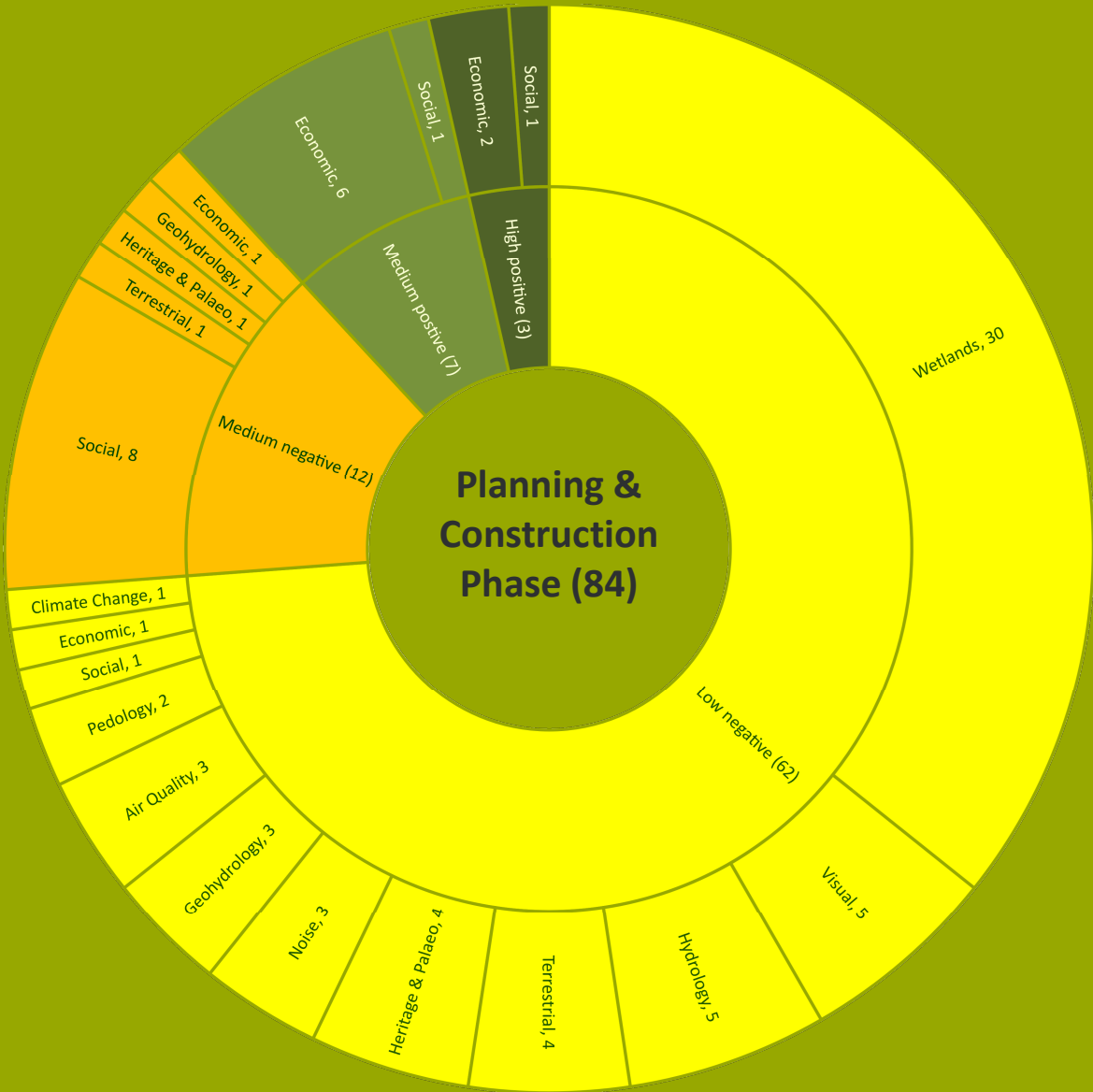


# Impacts and Assessment

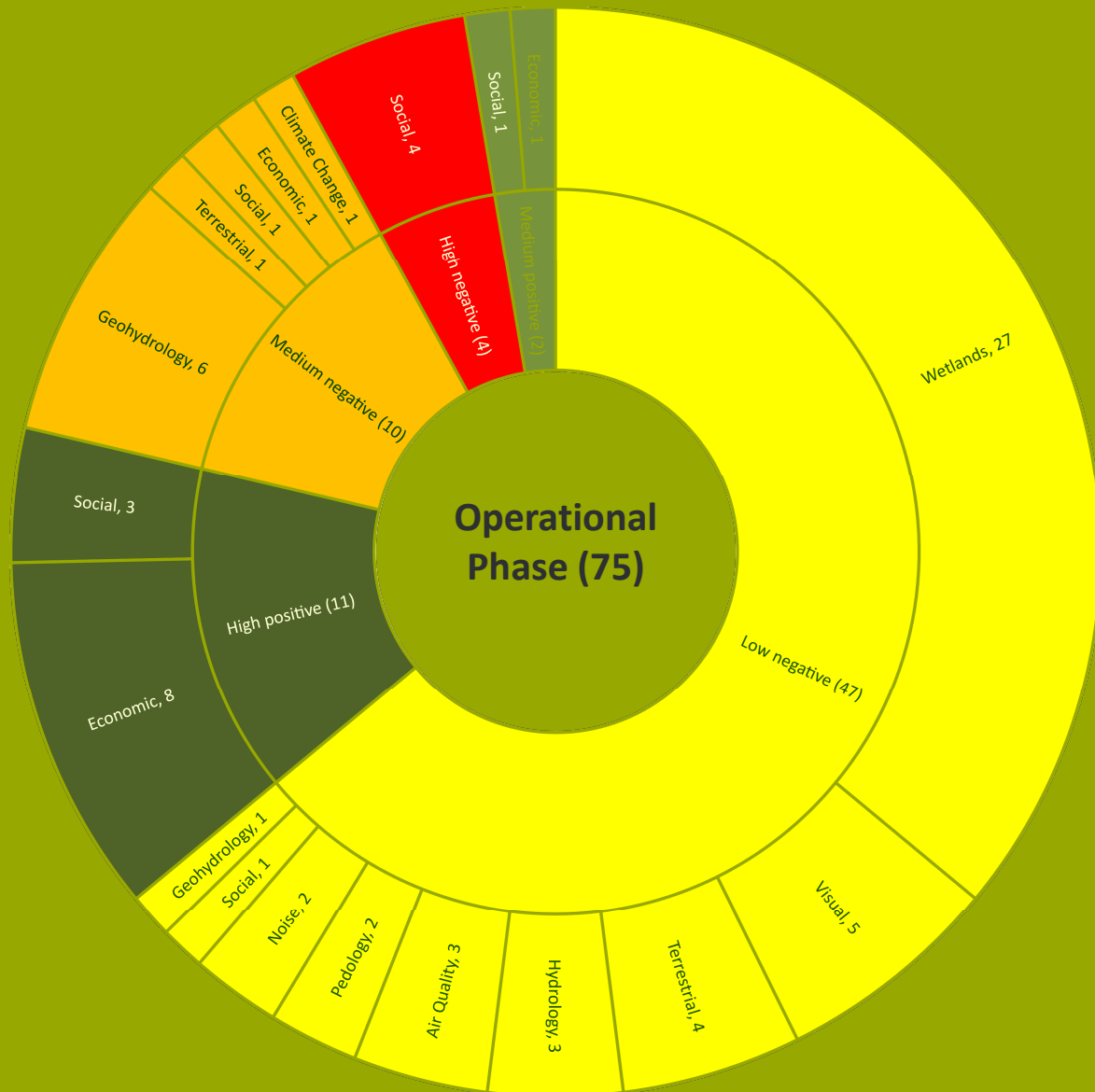
- 225 impacts identified and assessed for the various project phases (planning, construction, operation, decommissioning, rehabilitation and closure).
  - Pre- and Post-mitigation Impacts assessed according to:
    - Nature
    - Extent
    - Duration
    - Magnitude
    - Reversibility
    - Probability
  - Priority factors applied based on:
    - Cumulative Impact
    - Irreplaceable Loss of Resources



Environmental Significance Rating	
Value	Description
$\leq -17$	<b>High negative</b> (i.e. where the impact must have an influence on the decision process to develop in the area).
$> -17 \leq -9$	<b>Medium negative</b> (i.e. where the impact could influence the decision to develop in the area).
$> -9 < 0$	<b>Low negative</b> (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	<b>No impact</b>
$> 0 < 9$	<b>Low positive</b> (i.e. where this impact would not have a direct influence on the decision to develop in the area).
$\geq 9 < 17$	<b>Medium positive</b> (i.e. where the impact could influence the decision to develop in the area).
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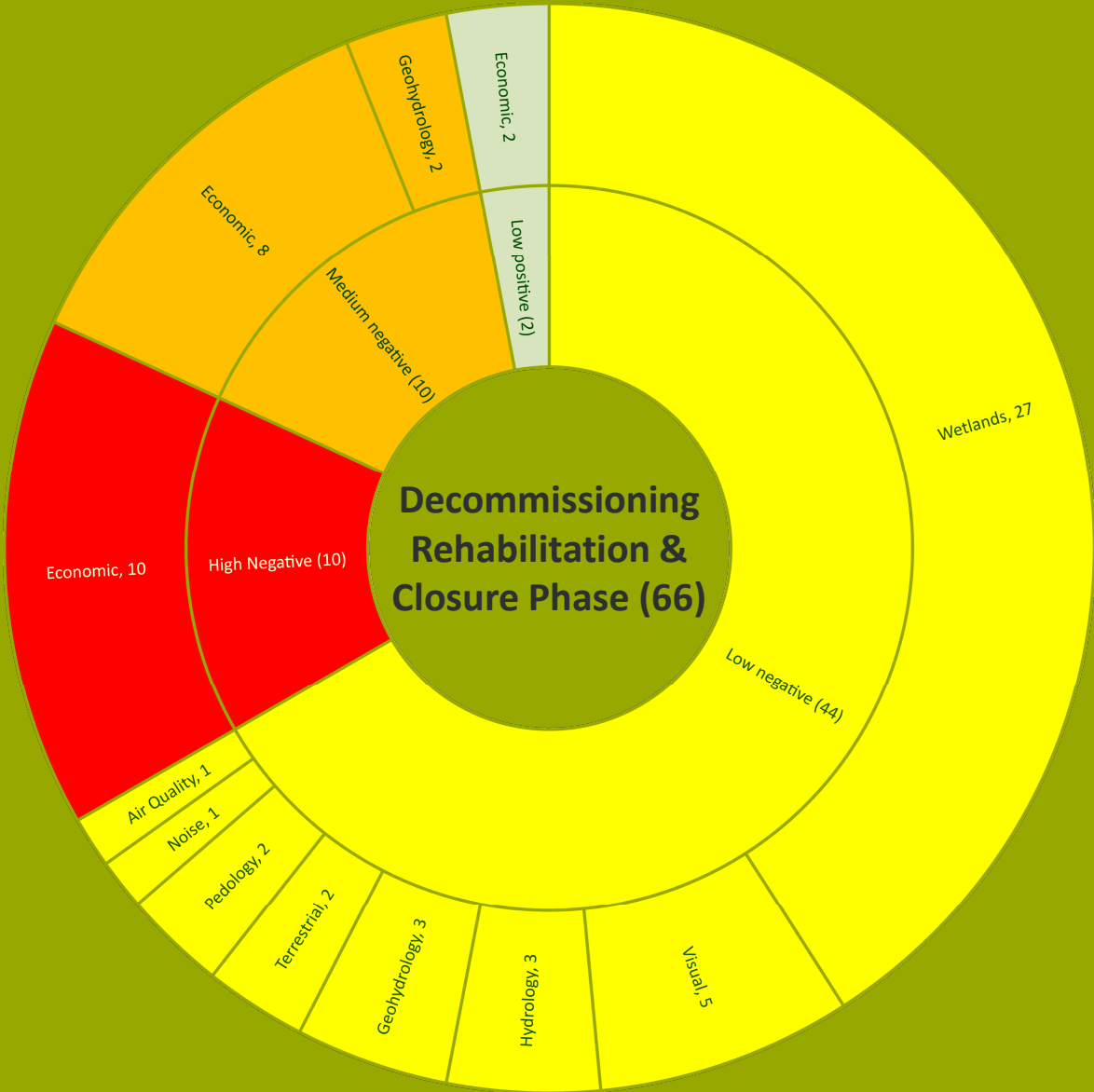


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## Impact Assessment (Notable Highlights)

Social	Impact on livelihoods	Operation	-21
	Impact of servitudes on land values	Operation	-21
	Impacts on safety and security of local residents	Construction	-17
	Impacts on safety and security of local residents	Operation	-18
	Impacts on sense and spirit of place	Operation	-28
	Contribution to economy of South Africa	Operation	27
	Secondary economic opportunities	Construction	20
	Secondary economic opportunities	Operation	21
	Potential opportunity for education, skills development, and training	Operation	21



# Amended EMPr

- On 21 April 2021, the Minister of Forestry, Fisheries and Environment published the Generic Environmental Management Programme (EMPr) for Gas Pipeline Infrastructure (refer to GN373 of 23 April 2021).
- Revised Tetra4 EMPr contains the following sections:
  - Pre-approved Generic EMPr for the Gas Pipeline Infrastructure which includes
    - **Part A:** Background and context.
    - **Part B:** Environmental Controls – Pre-approved generic template mitigation measures.
    - **Part C:** Detailed property information as well as sensitivity mapping and landowner details.
    - **Part D:** Documentation of site-specific sensitivities and attributes (additional mitigation measures over and above the Generic EMPr measures in Part B).





## Additional Mitigation Highlights Summary

- A revised landowner contract must be finalized prior to commencement of construction.
- Tetra4 will engage with each individual affected landowner regarding the detailed planned works on their properties and suitable annual compensation.
- As far as possible, exploration wells should be constructed (drilled) outside of existing cultivated lands. Where this is not possible, the final production well surface infrastructure must be located outside of cultivated lands and the borehole and connecting pipeline must be at least 1.5 m below surface to prevent interference with crop production activities.
- Tetra4's activities will cause a certain level of economic displacement for some of the affected farmers. In the event that the farmer disagrees with the compensation offered, the actual impact on their livelihoods must be assessed by an agricultural economist or suitably experienced third party.
- Affected landowners must be provided with the construction schedule and when revisions to the schedule are made, these must be communicated to the affected landowners.



# Mitigation Highlights Summary

- The impacts of servitudes on the land value of the affected properties must be considered and mitigated by means of negotiation. If the negotiation process is unsuccessful, it must be arbitrated by a suitably qualified third party.
- Farm safety must be a priority and the landowners and Tetra4 must agree on security measures prior to construction on their farms.
- Once the preferred routing has been identified, Tetra4 must engage with the affected landowners for consensus of the preferred final pipeline routing. The preferred or final routing will be developed (where possible) in conjunction with landowners for their respective property. The agreed upon routing must be attached to Landowner agreements as a sketch plan and indicate the provisional servitude area.
- Tetra4 must investigate alternative methods to remove condensation water within the pipe network with the intention to limit or reduce the number of low points drains in the system. This may include nitrogen purging lines to flush out the system.



# Environmental Impact Statement

- The findings of the specialist studies conclude that there are no fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented.
- EAP and specialist team conclude that the project should be authorized based on:
  - The nature and extent of the proposed project;
  - The limited level of disturbance predicted as a result of the production activities;
  - The overall findings of the specialist studies;
  - The significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures;
  - The project should be authorized with conditions included in the decision; and
  - It is assumed that compliance with the EMPr will be adhered to.

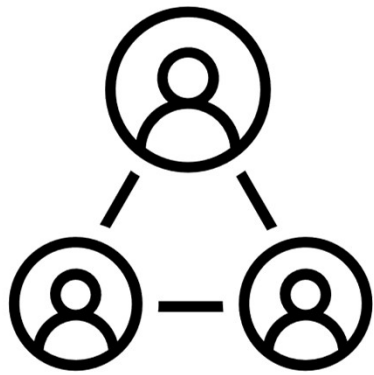




# Who to Contact

- Contact Person: Qaphela Magaqa
- EIMS Reference Number: 1473
- Postal Address: P.O. Box 2083; Pinegowrie; 2123
- Telephone: (011) 789 7170/ Fax: (086) 571 9047
- E-mail: [tetracluster2@eims.co.za](mailto:tetracluster2@eims.co.za)
- Please include the project reference number 1473 in all correspondence.





Discussion

# Specialist Studies

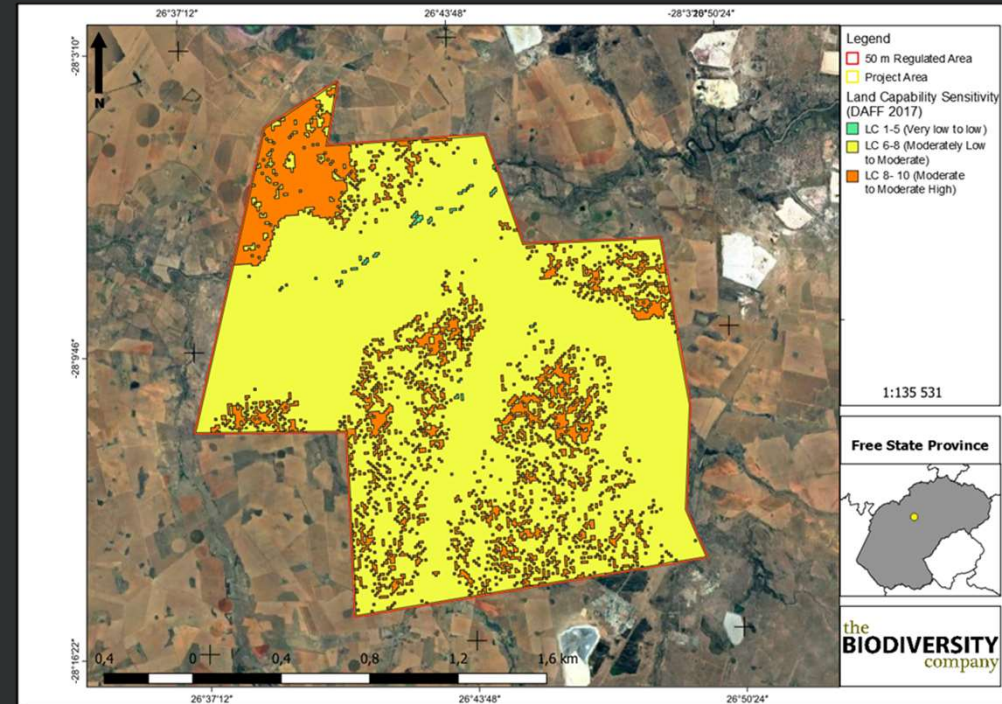
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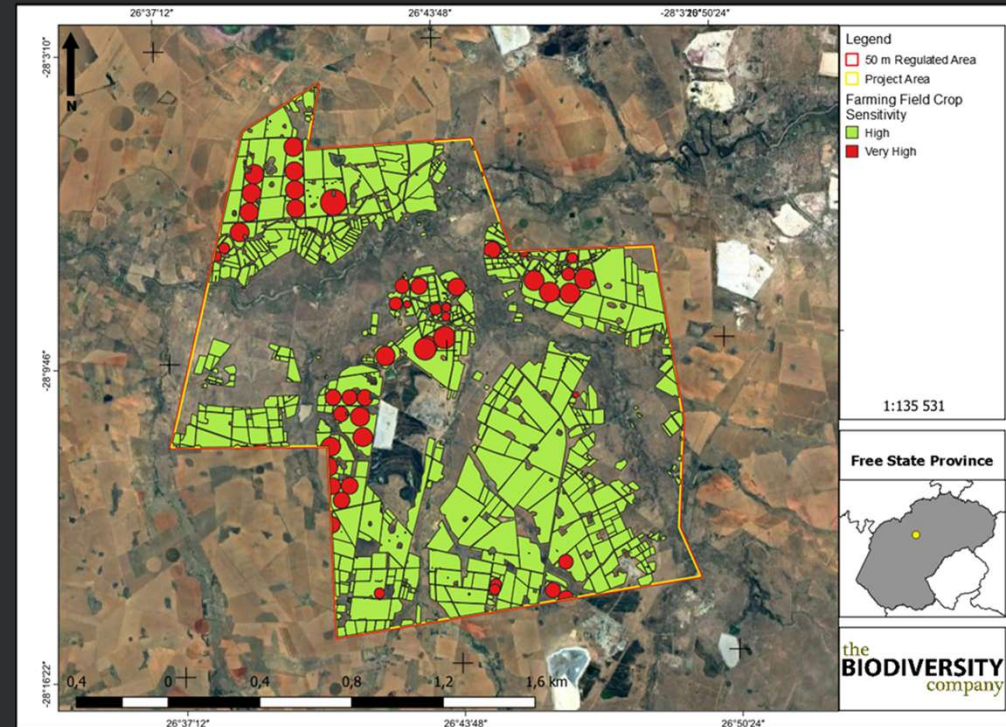
# Agriculture/Soils

- Three main sensitive soil forms, namely the Avalon, Ermelo and Griffin soil forms.
- The land capability sensitivities (DAFF, 2017) indicate land capabilities with “Low” and “Moderate high” sensitivities.
- Identified high to very high sensitivity for field crops farming.
- Climatic conditions limits crop production resulting in land capabilities with “Low” and “Moderate high” sensitivities.
- Land capabilities suitable for cropping and grazing.



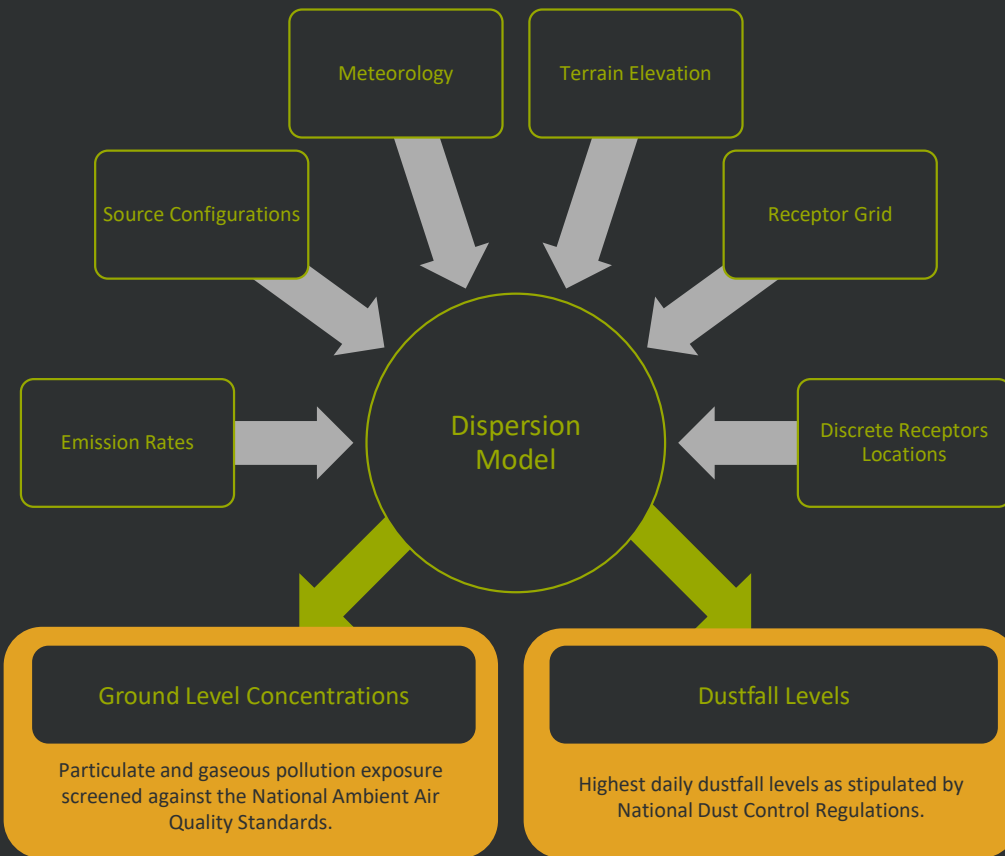
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- Land capabilities suitable for cropping and grazing.



# AQIA Methodology

- AQIA conducted for construction, operation, decommissioning, rehabilitation and closure phases of the Tetra4 Cluster 2 Project.
- The assessment included:
  - Calculating atmospheric emissions,
  - Model pollutant levels; and
  - Assess the significance of impacts.





## AQIA Main Findings: existing environment

- North-northeasterly and northeasterly winds dominate.
- Average wind speed of 3.7 m/s.
- Current sources of pollution include agricultural activities, gold mining and ore processing, vehicles, household fuel combustion, biomass burning and windblown dust from exposed areas.
- Air quality receptors are where people reside and include residences and farm holdings outside the project boundary, with nearby towns of Welkom, Virginia, Bronville, Harmony and Theunissen.



## AQIA Main Findings: planning, design and construction phase

- Sources of air pollution: construction of the roads, pipelines, wells, booster and compressor stations and plant will include land clearing, topsoil removal, material loading, hauling, excavation, back-filling, traffic, rig-move/drilling, pipeline installation, and wind erosion from exposed areas.
- Resulting potential air quality health and nuisance impacts at the nearest residential receptors resulted in a **medium** significance without mitigation and **low** significance with mitigation.
- Construction activities will only last a few weeks and peak activities will not be consistent over the specified period.



## AQIA Main Findings: operational phase

- Sources of air pollution: well pad, roads, pipelines, compression stations, booster stations and combined LNG/LHe plant, trucks and other vehicles, heavy machinery, flaring (if applicable), and gas processing.
- Vehicles on unpaved roads, and the plant access road, are likely to result in **medium** significance at the nearest receptors but will reduce to **low** significance should the road be paved.
- Air quality impacts due to booster station (generator) operations of **medium** significance but **low** significance at the nearest receptors with mitigation measures in place.
- Plant (flaring) operations are unlikely to result in exceedances of the respective air quality standards and are considered **low** significance at the nearest receptors.



# Climate Change Assessment (CCA)

- Calculated greenhouse gas (GHG) emissions for the project using the DFFE 2017 Technical guidelines which are based on the Intergovernmental Panel on Climate Change (IPCC) emission factors.
- Assessed Scope 1,2 and 3 emissions:
  - Scope 1 are the emissions directly attributable to the project.
  - Scope 2 are the emissions associated with bought-in electricity.
  - Scope 3 consider the “embedded” carbon in bought-in materials and transport as well as the use of exported materials.
- DFFE guidelines only require Scope 1 emissions.
- Scope 2 would place the assessment in line with the guidelines provided by the International Finance Corporation (IFC).





## CCA Main Findings

- The region around Welkom and Virginia where Tetra4 Cluster 2 project is proposed is likely to experience increased temperatures and extreme weather-related events in the future. Climate change impacts will disproportionately affect under-developed communities that lack the physical and financial resources to cope with the physical effects of climate change, such as droughts, floods and increases in diseases.
- Construction- and operational-related GHG emissions cannot be attributed directly to any particular climate change effects, but GHG emissions from the proposed Tetra4 Cluster 2 project, when considered in isolation, will have a **Low to Medium** impact on the National GHG inventory total.
- Since climate change is a global challenge, there is a collective responsibility to address climate change and Tetra4 has an individual responsibility to minimise its own negative contribution to the issue. It is recommended that renewable energy (such as photovoltaic solar panels) be considered to replace/ reduce the reliance on ESKOM electricity which is likely to reduce the significance from the Tetra4 Cluster 2 project from Medium to Low, since ESKOM's contribution to the operational phase is the main source of GHG emissions. Also, the use of LNG instead of diesel will reduce the GHG footprint further.



# Economic Assessment

## Current Reality

Historically, South Africa is neither a gas driven economy, nor did it produce any helium.

Of its total energy usage, gas contributes less than 3% (compare to USA of 40%).

South Africa's expected GDP of 345 USD Billion by the end of 2022 is dependent on the stable supply of energy.

- For H1 2022 South Africa had 20% loadshedding to total hours in half-year.

Alternative forms of energy provision thus very important for the South African economy.

SA Integrated Resource Plan call for gas to contribute 15% of energy mix by 2030.

Gas development strongly supported by the SA Government



# Economic Impacts

- At the potential steady state production (Cluster 2), Renergen has the opportunity of a USD 360 million turnover, which translates to an economic value add (GDP) of approximately USD 198 million.
- The added economic value is just under 14% of the GDP in its labor areas.
- Adding downstream jobs, Renergen could create slightly under 6% new jobs in its labor area.
- South Africa's unemployment rate one of the highest in the world (between 30 and 40% depending on the source – some sources even liken this to 50%).



## Economic Impacts – continued

- Given that Tetra4's total production would either be saving on SA imports or increasing exports, its total turnover must be regarded as adding to South Africa's foreign reserves. It could be argued that earning foreign reserves may well be one of Renergen's more important benefits.
- This is because the US dollar is a strong reserve currency in the world, and given that South Africa has had a negative current account over the last 10 years of USD 7 billion per annum on average, any forex currency savings or earnings will add to South Africa's balance of payments.





## Economic Impacts – continued

- The following benefits are highlighted:
  - South Africa would grow an industry in which it has had a major comparative disadvantage.
  - The Renergen investment would grow South Africa's capabilities in the chemical industry on an unprecedented scale.
  - It is possible that Renergen may even change the face of the energy profile in its labor areas and north to Gauteng.
  - The provision of helium is positive not only for South Africa, but also for the rest of the world where a helium shortage is foreseen.
- Although there is controversy as to whether gas is positive in the world in the long term, it can be argued that as an alternative energy source for South Africa it is positive given its reduced carbon emissions relative to coal.

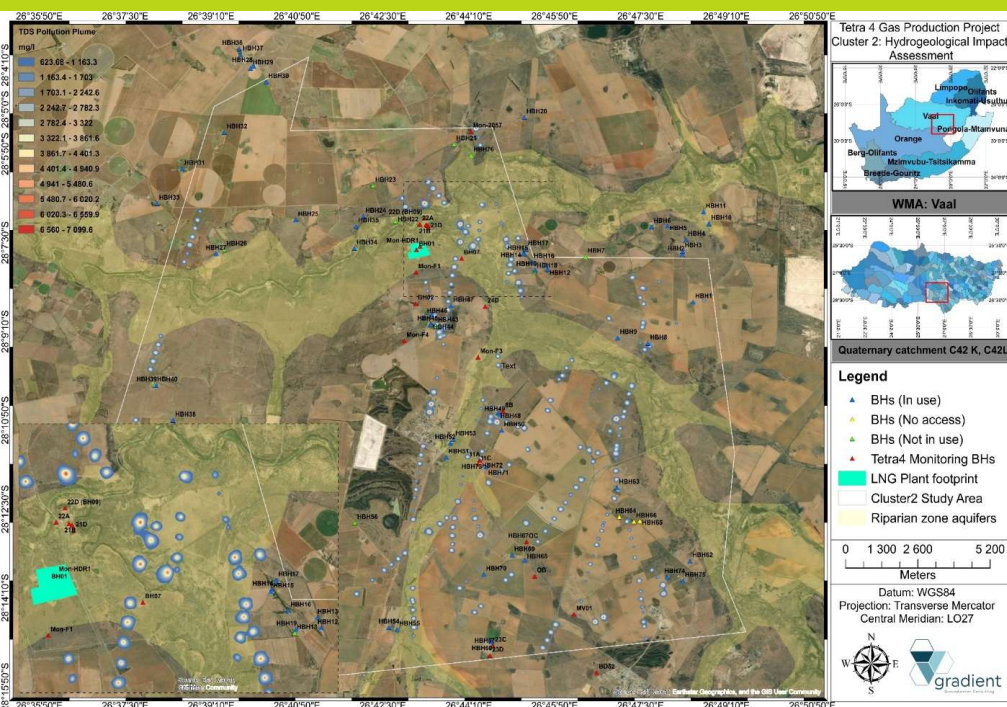


## Conclusion

- Should Renergen achieve its vision, mission and objectives, then its investment must be seen as a significantly positive “game changer” for the South African economy.



# Geohydrology - Pollution plume migration:



# Groundwater impact assessment:

- It should be noted that vast areas within the study area have been subjected to historical mining activities and, as such, reflect modified to highly modified present ecological status.
- A total number of >15 000 historical exploration wells have been drilled throughout the study area, some of which remain uncased and unsealed. The latter may act as preferential pathways and conduits for groundwater flow and contaminant transport mechanisms.
- The most significant impact of the project on the regional groundwater regime is deterioration of the potable Karoo aquifer water quality as well as modification of the riparian zone primary porosity aquifer associated with alluvium material deposited in flood plains. Groundwater is the sole water resource to the landowners and rural communities within the study area and can thus be classified as a sole source aquifer.



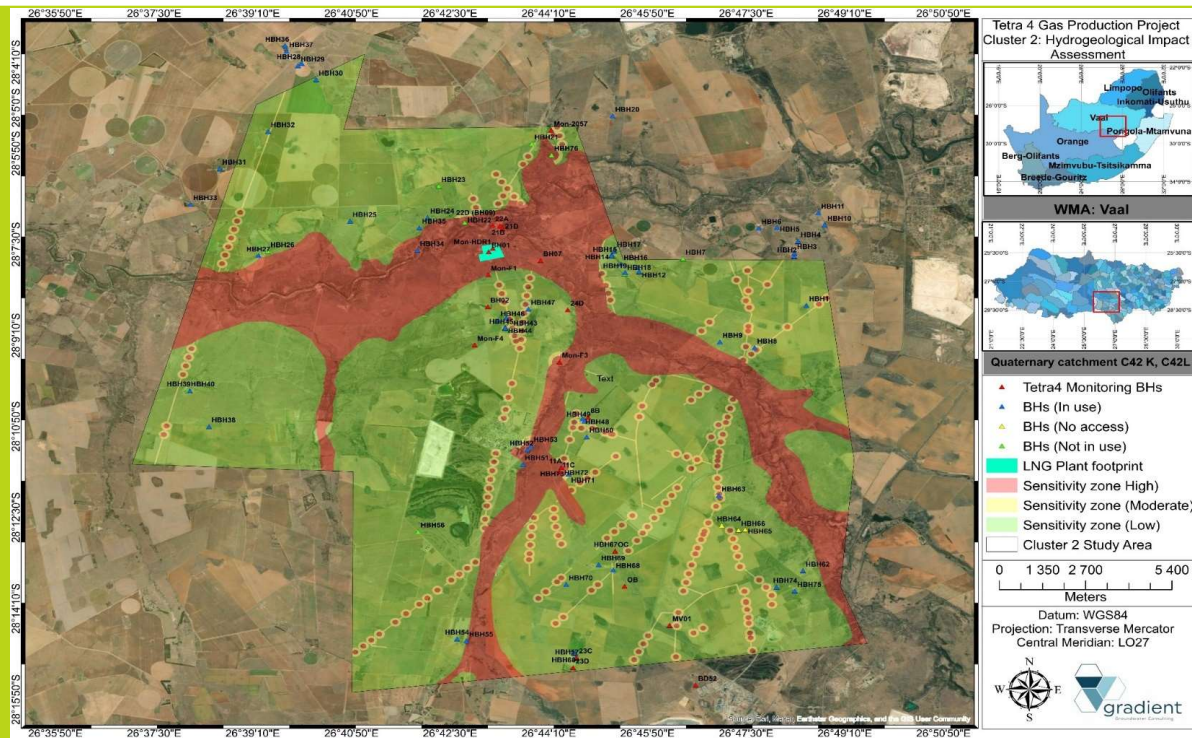


# Groundwater impact assessment (continues):

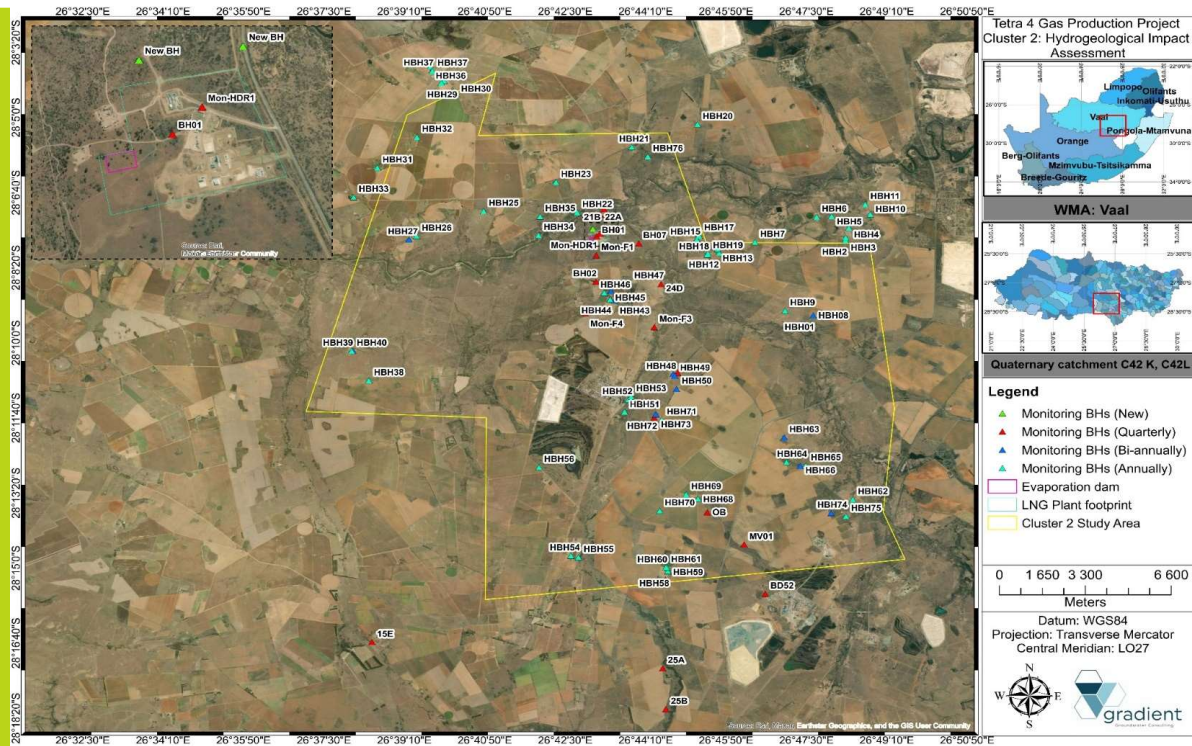
- During the construction phase the environmental significance rating of groundwater quality impacts on down-gradient receptors are rated as **medium negative** without implementation of remedial measures and **low negative** with implementation of proposed mitigation measures.
- During the operational phase the environmental significance rating of groundwater quality impacts on down-gradient receptors are rated as **medium** to **high negative** without implementation of remedial measures and **low** to **medium negative** with implementation of proposed mitigation measures.
- During the decommissioning and post-closure phase the environmental significance rating of groundwater quality impacts on down-gradient receptors are rated as **medium negative** without implementation of remedial measures and **low** to **medium negative** with implementation of proposed mitigation measures.
- It can be concluded that, should the prescribed mitigation and management measures, as stipulated in the groundwater management plan, be implemented and honoured, the impacts associated with the project phases can be minimised. It is important that an integrated groundwater monitoring program be implemented serving as an early warning and detection mechanism to implement mitigation measures.



# Hydrogeological sensitivity map:



# Updated groundwater monitoring network:





# Heritage Study Findings

- The field work component for the Heritage Impact Assessment (HIA) identified a total of 37 newly discovered heritage sites of varying heritage significance.
- Previous fieldwork identified 35 other heritage finds that also fall within the current study area.
- **The heritage sites consist of:**
  - 16 burial sites (High Significance)
  - 22 historic to recent heritage sites with possible graves (High Significance)
  - 34 Historical Structures (Medium - Low Significance)

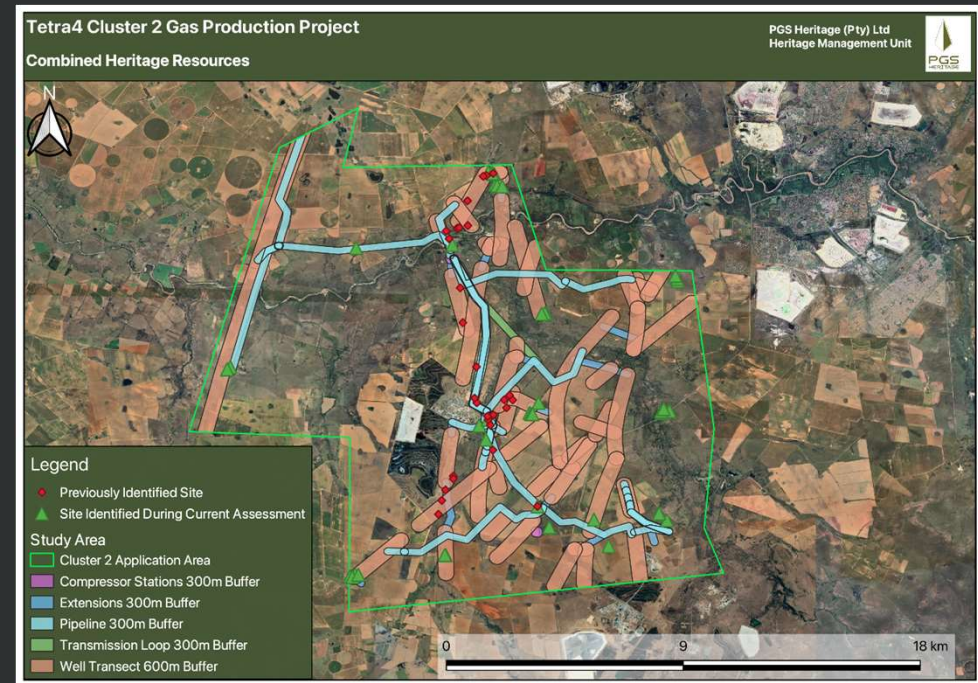


Figure 1 - Heritage Sites identified within the study area.



# Heritage - Potential Impact and Management

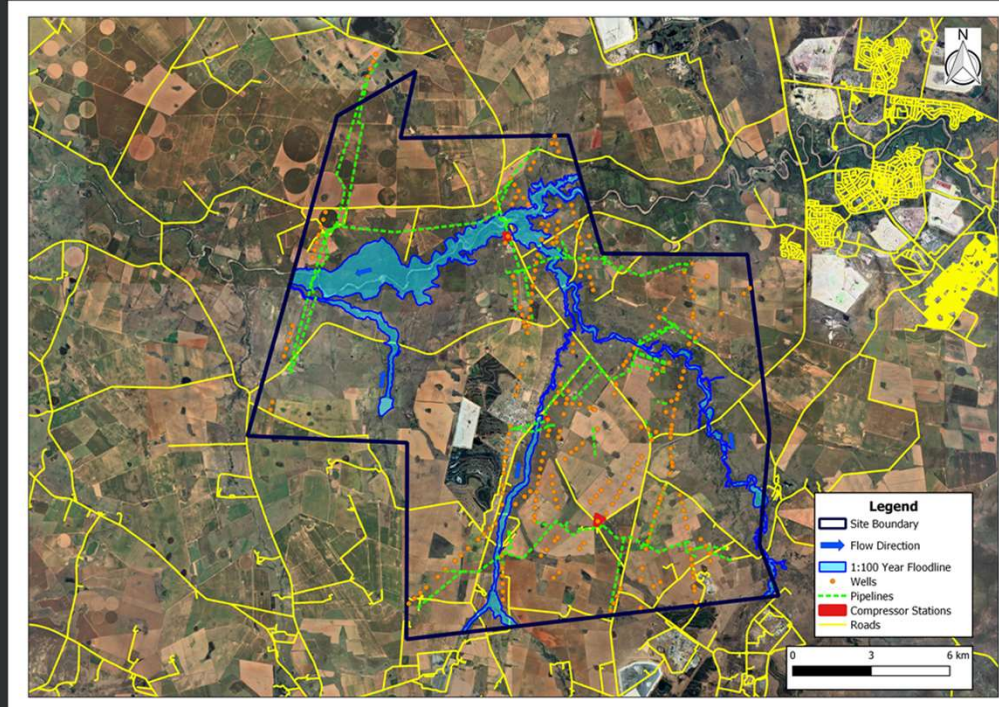
- 38 sites (High - Medium Significance) could potentially be impacted upon by the proposed development and will require mitigation (i.e.: implementation of exclusion zones; further analysis with documentation and/or possible grave relocations).
- Once mitigated, the overall impact on heritage finds will be reduced to an acceptable level.



# Hydrological Impact Assessment

## Objectives:

- To determine impacts and mitigation measures on the hydrological environment.
- To ensure environmental legal compliance.
- To ensure efficient, cost-effective surface water management.
- To delineate floodlines and protect future infrastructure from flooding.



# Noise Impacts due to Project Construction Activities

- Activities were specified to take place during day-time hours only
- Exceedances of the day-time IFC noise guidelines for residential areas (55 dBA) were as follows:
  - Wells: Up to 400 m from activities.
  - Pipeline: Up to 90 m from activities.
  - Blower Stations: Up to 600 m from activities.
  - Plant: Up to 420 m from Plant area.
  - Compressor Stations: Up to 380 m from Compressor Station areas.



## Noise Impacts due to Project Operation Activities

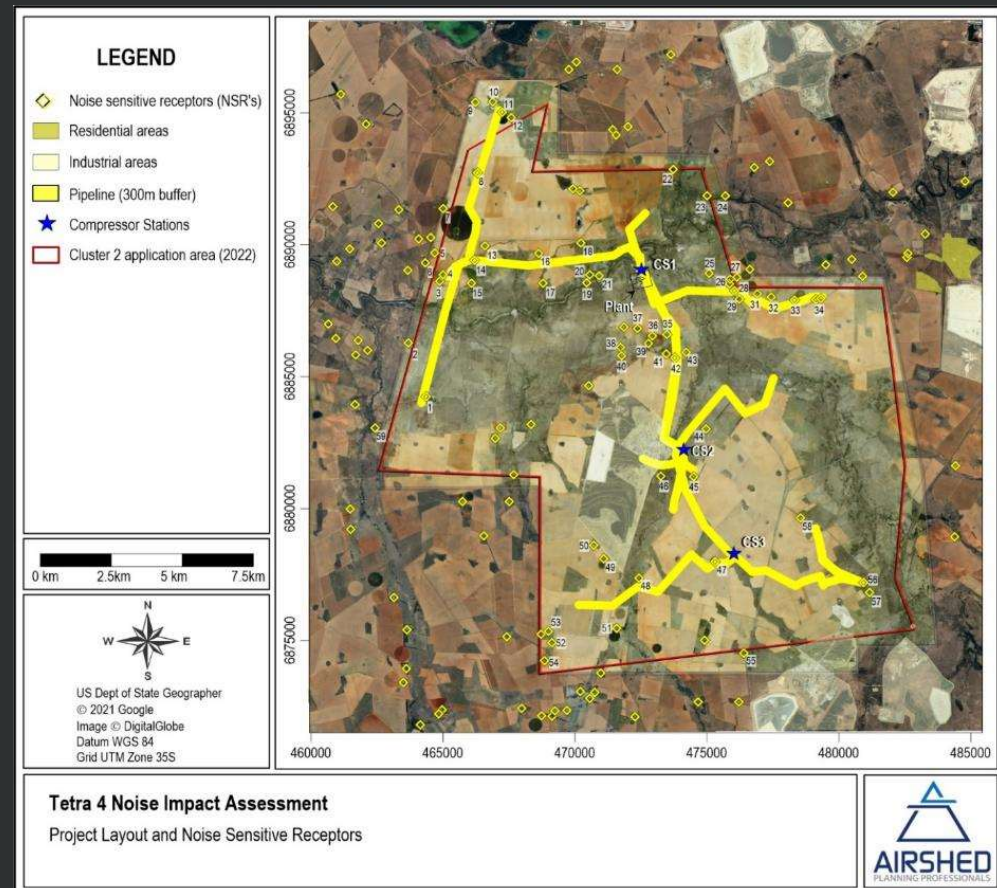
- Activities were assumed to take place continuously (24 hours per day)
- Exceedances of the night-time IFC noise guidelines for residential areas (45 dBA) were as follows:
  - Blower Stations: Up to 150 m from activities.
  - Plant: Up to 600 m from plant area.
  - Compressor Stations: Up to 120 m from compressor station areas.





# Impact Significance Rating

- Construction activities:
  - Wells, Blower Stations and pipeline: **medium** without mitigation and **low** with mitigation
  - Compressor Stations and plant: **Low** without and with mitigation.
- Operational activities:
  - Blower Stations, Compressor Stations and plant: **low** without and with mitigation
- Decommissioning activities:
  - **Medium** without mitigation and **low** with mitigation.



# Social Impact Assessment – Positive Impacts (highlights)

- Tetra4 will have many positive social impacts – locally, in the region and in South Africa
- Most of the positive impacts relate to the economy
  - Job creation (limited on-site, but many spin-offs)
  - Secondary economic opportunities
  - Socio-economic contributions through the Social and Labour Plan



## Social Impact Assessment – Negative Impacts (highlights)

- There are some negative impacts as well, especially on the directly affected land-owners (many related to livelihoods and the economic impact on their ability to maintain their current livelihoods and uncertainty).
- Construction sites are associated with negative social impacts such as crime, social pathologies and safety on farms and in communities.
- Some people also have safety concerns related to gas production, given that it is relatively new in South Africa.



## Social Impact Assessment – Mitigation (highlights)

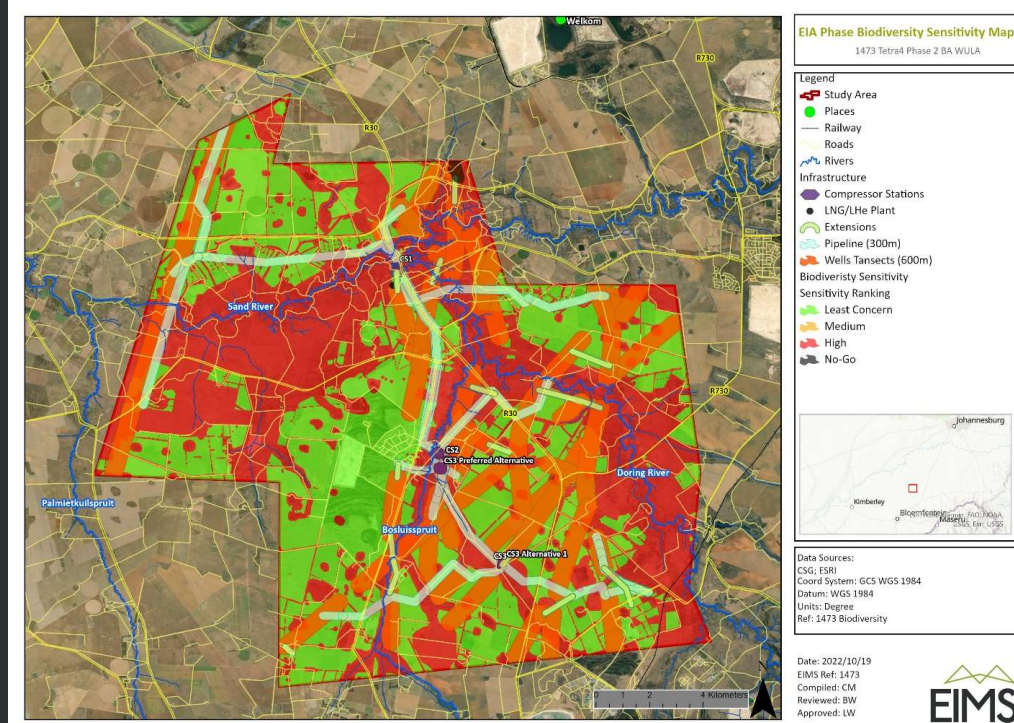
- Mitigation measures are put in place – some on an individual level, some on community level.
- There are a grievance mechanism and Community Liaison Officer that can deal with any queries and grievances.
- There is a Social and Labour Plan in place that must be reviewed and updated every 5 years.





# Terrestrial Ecology

- Certain areas contain CBA 1 and ESA 1& 2 as per the Free State Conservation Plan.
- Threatened species:
  - Four (4) avifaunal species;
  - Three (3) mammal species;
  - One (1) reptile species; and
  - One (1) amphibian species.
- Similar impacts / management as Cluster 1.
- A new impact consideration to the recorded Sungazer (*Smaug giganteus*). Protocols advise a minimum buffer of 250 meters, to up to 400 m buffer. A follow up survey of Sungazer Lizard is strongly recommended.
- Monitoring programme has been recommended.



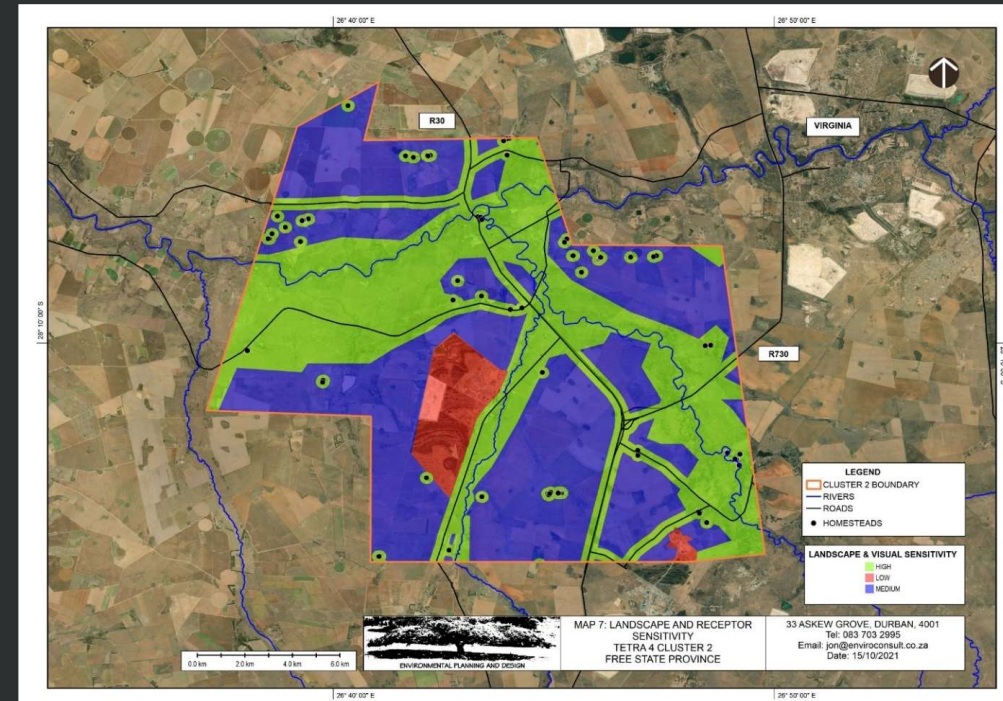
# Visual Impact Study

Receptors include Local Road Users and Residents of Homesteads.

Potential impact on views for both of these groups of receptors were assessed as likely to have a medium significance during construction. However, the significance is likely to reduce to a low level throughout the rest of the project cycle.

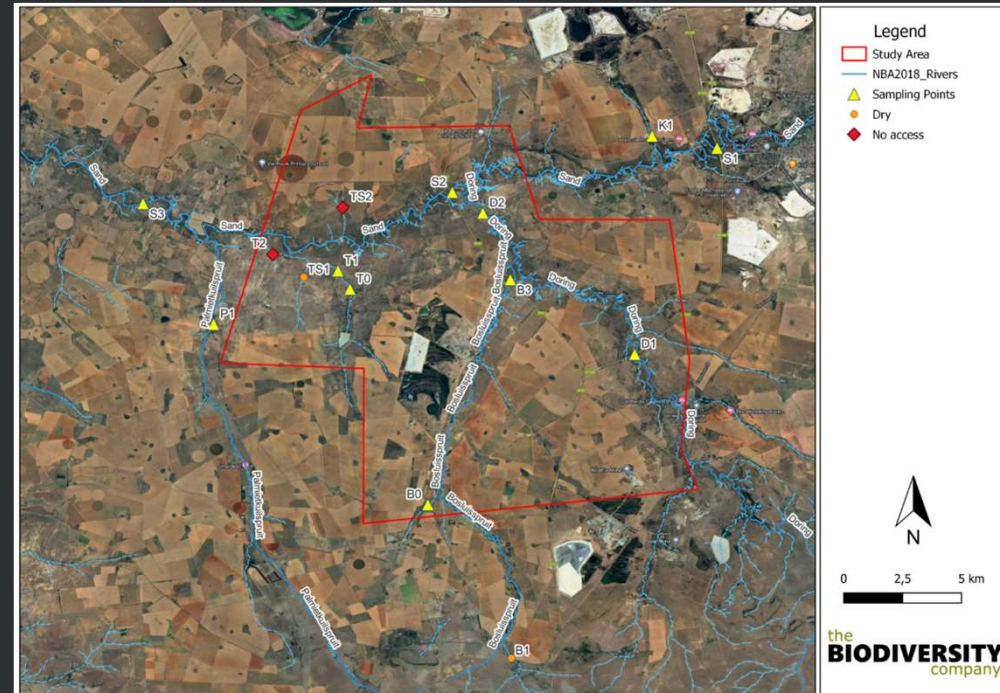
Mitigation should include:

- Where possible ensuring that a minimum distance of 250m is included between proposed development and receptors;
- Minimising disturbance of the landscape; and
- Undertaking landscape rehabilitation.



# Aquatic Ecology

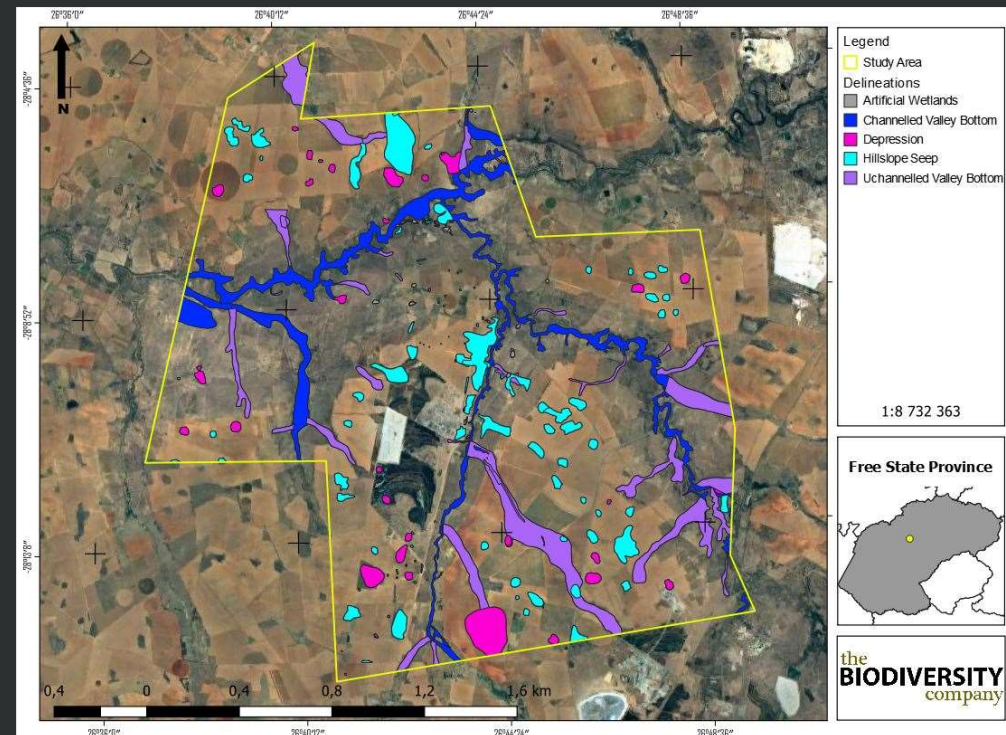
- No pristine or natural waterbodies observed.
- Doring River and Boschluispruit classed as largely modified (class D), the Sand River as moderately modified (class C).
- The buffers for lower foothill systems at 50 m, and for the ephemeral systems, drainage lines and wetlands a buffer of 35 m.
- Risks for infrastructure range from low to moderate, with most residual risks low with.





# Wetlands Ecology

- Four types of natural wetlands, many units. Artificial wetlands (i.e. dams) also identified.
- The ecosystem service benefits range from “Moderately High” to “Moderately Low”.
- Health ratings ranging from “Moderately Modified” (class C) to “Seriously Modified” (Class E).
- Ecological importance ranging from “Moderate” to “High”.
- A 35 m buffer recommended.
- Similar impacts / management as Cluster 1.







# TETRA4 CLUSTER 2 GAS PRODUCTION PROJECT

EAP: Environmental Impact Management Services (Pty) Ltd (EIMS)

Applicant: Tetra4 (Pty) Ltd

## Project Description

Tetra4 (Pty) Ltd, a wholly owned subsidiary of Renegen (hereafter Tetra4) holds a Gas Production Right (Ref: 12/4/1/07/2/2) that was granted in 2012 which spans approximately 187 000 hectares for the development of natural gas production operations near the town of Virginia in the Free State Province. Tetra4 wishes to expand the natural gas operations, to be located within the approved production right area and within and around the Cluster 1 project. The Cluster 2 application area covers a total of ~27 500 hectares.

Cluster 2 development aims to produce a total of ~45 Million Standard Cubic Feet per Day (MMSCFD) of gas. The construction of the gas gathering network (including pipelines, booster and compressor stations, etc) is planned to commence in ~May 2023 and be completed by ~October 2025. Construction of the LNG/LHe Plant is planned to commence in ~March 2023 and be completed by ~February 2026. The operational (gas production) timeframe for the project is approximately 20 years (~2026 to ~2046).

Cluster 2 Environmental Authorisation (EA) is being applied

for to increase the gas production within the Production Right. This application will include a MPRDA Section 102 revision of the Cluster 1 EMPr to include Cluster 2 specific infrastructure as well as amendments or additions of mitigation measures as and where required. The EA application and study area covers 284 farm portions within the Masilonyana and Matjhabeng Local Municipalities and includes ~27 500 hectares. The site boundary is ~5km southwest of Virginia, ~9km south of Welkom and ~16km north of Theunissen.

A full Scoping and Environmental Impact Assessment (S&EIA) application process is being followed for the EIA Listing Notices listed activities applicable to the project namely:

- NEMA GNR 983: Activity 12, 16, 19, 21D, 27, 28, 34, 48, 51, 56, 59, 60, 67
- NEMA GNR 984: Activity 4, 5, 7, 15
- NEMA GNR 985: Activity 10, 12, 14, 18, 22, 23



Additional licence applications:

- NEMWA Category A1, A6, A7, A12, A13, A14, B1, B10, B11, C1, C2, C6 – Integrated EA and WML application
- NEMAQA: Section 21 Subcategory 2.4 – Air Emissions Licence Application
- NWA: Section 21 (c), (g) and (i) – Water Use Licence Application

**This planned expansion to the existing approved production activities will involve:**

- ❖ ~400 exploration wells (each 50 m X 50 m = 250 m<sup>2</sup>)
- ❖ ~300 production wells (each 1,4 m x 1,1 m = 1.54 m<sup>2</sup>)
- ❖ ~480 km of gas transmission pipelines (10 m servitude)
- ❖ ~28 booster stations (each 10 m x 14 m = 140 m<sup>2</sup>)
- ❖ 3 compressor stations (each 60 m x 60 m = 3600 m<sup>2</sup>)
- ❖ Access roads (2.5 m wide)
- ❖ LNG/LHe Plant (~9.6 ha) with temporary camp/laydown area (~15.8 ha)

# EIMS and Specialist Team

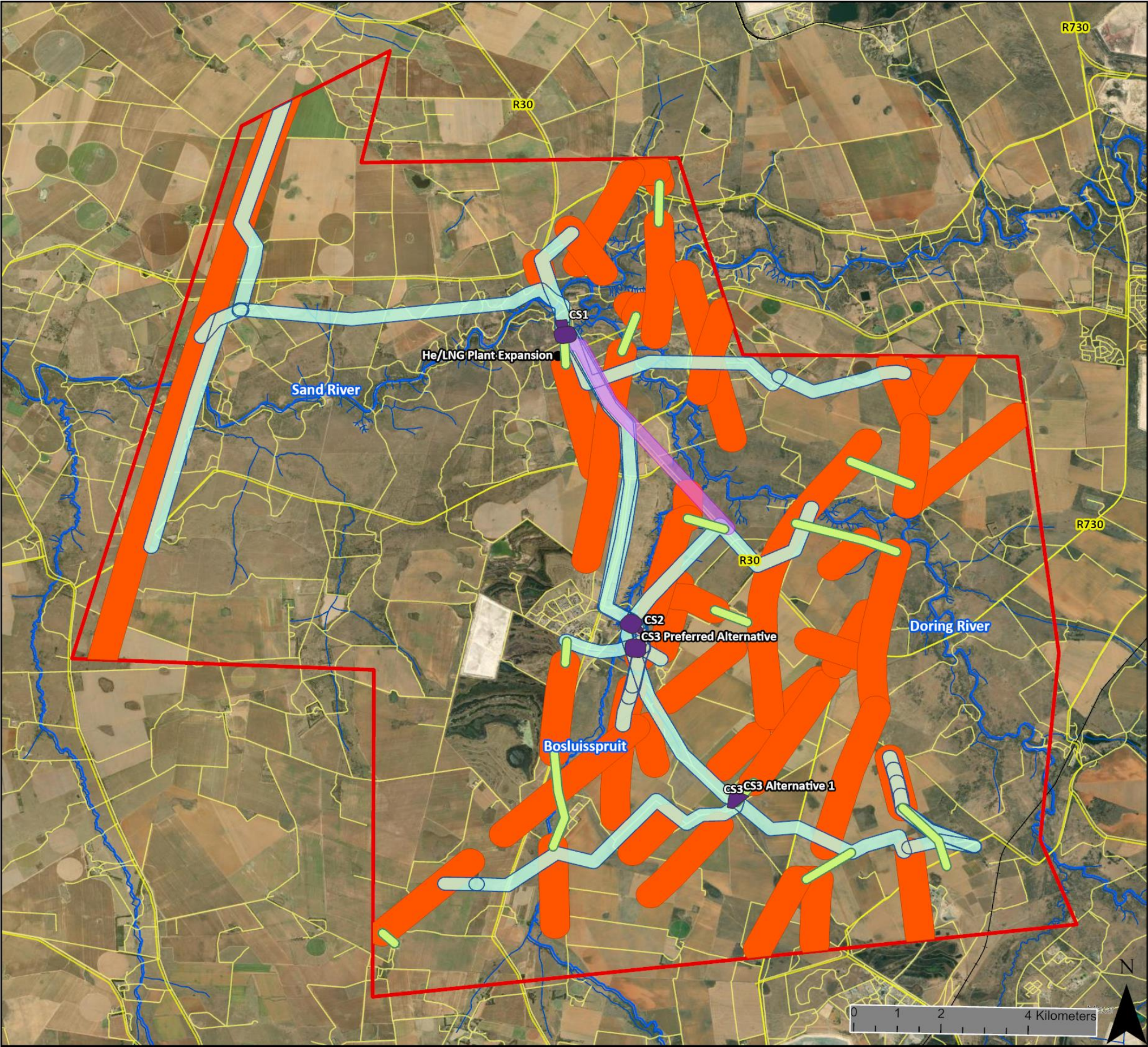
Company	Name	Project Responsibility
	Mr Brian Whitfield	Environmental Assessment Practitioner EAPASA Ref: 2022/4496
	Mr Andrew Husted	Agriculture and Soils / Terrestrial Biodiversity / Wetlands and Aquatics
	Dr Hanlie Liebenberg-Enslin	Noise / Air Quality & Health Risk / GHG & Climate Change
	Mr Ferdinand Mostert	Geohydrology
	Mr Gerrie Muller	Economic
	Mr Wouter Fourie	Heritage and Palaeontology
	Mr Rendani Thovhakale	Hydrology
	Ms Ilse Aucamp	Social
	Mr Jon Marshall	Visual

# Scoping and EIA Process





# Infrastructure Transects Map



## Locality Map

1473 Tetra4 Cluster 2 Project

### Legend

- Study Area
- Places
- Railway
- Roads
- Rivers
- Infrastructure
  - Compressor Stations
  - LNG/LHe Plant
- Project Footprint Buffer Zones
  - Pipeline (300m)
  - Wells Tansects (600m)
  - Transmission Loop Buffer (300m)
  - Extensions



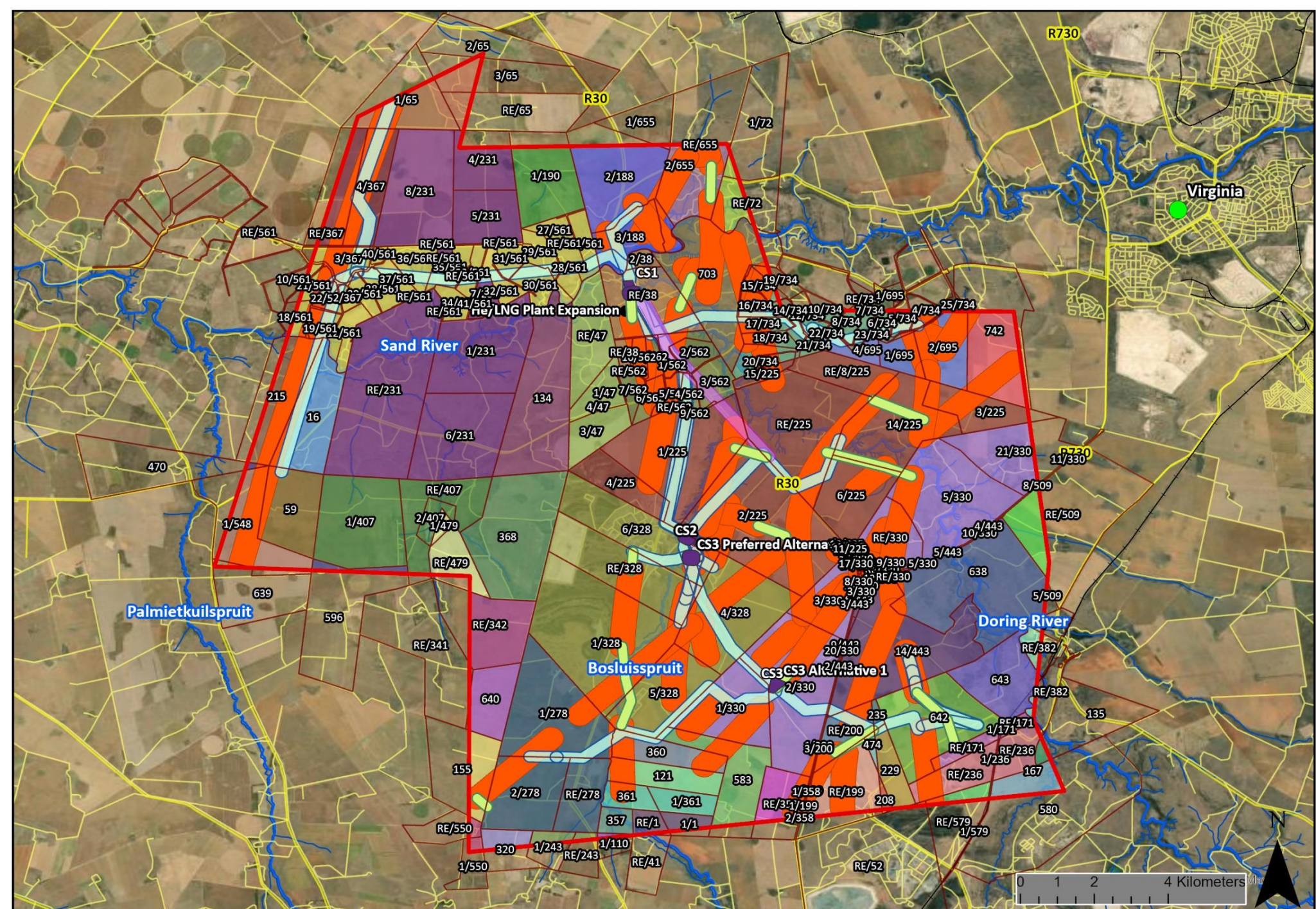
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EIMS Ref: Locality  
Compiled: CM  
Reviewed: BW  
Approved: LW





# Cadastral Map



Legend

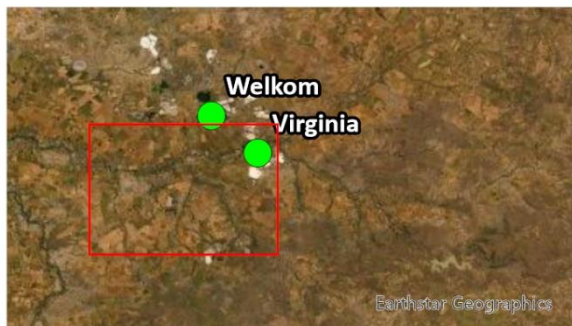
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|--------------------------|-------------------------|----------------------------|-----------------------------|-------------------------------|---------------------|
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| Annex Glen Ross No. 562  | Carlo No. 596           | Hakkies No. 695            | Kleinbegin No. 134          | Nortier No. 361               | Vlakpan No. 358     |
| Annex Grusde No. 474     | Damplaats No. 341       | Hakkies No. 695            | Kovno No. 235               | Palmietkuil No. 548           | Welgelegen No. 382  |
| Annex Mooivlakte No. 208 | Dankbaarheid No. 16     | Hakkies No. 742            | Langlaagte No. 110          | Palmietkuil No. 328           | Weltevrede No. 638  |
| Blaauwdrift No. 188      | De Klerks Kraal No. 231 | Harmonie No. 579           | Leeuwaarden No. 171         | Paulina No. 470               | Weltevreden No. 443 |
| Bloemhoek No. 509        | Die Mond No. 479        | Helpmekaar No. 47          | Leeuwbult No. 52            | Richelieu No. 135             | Zoetendal No. 243   |
| Boschuis Spruit No. 278  | Digito No. 642          | Jonkers Rust No. 72        | Leeuwbult No. 580           | Rondehoek No. 200             | Zonderzorg No. 342  |
| Braklaagte No. 41        | Doorn River No. 330     | Jordaan No. 1              | Lekkerlewe No. 643          | Siberia No. 464               | Zonderzorg No. 640  |
| Brakspruit No. 121       | Doorndeel No. 236       | Jordaans Rust No. 59       | Middelplaas No. 583         | Spoorleggerswoning 54 No. 167 |                     |
| Bruintjes Hoogte No. 367 | Enkeldoorn No. 360      | Kaalpan No. 65             | Mond Van Doornrivier No. 38 | Stille Woning No. 703         |                     |
| Bruintjes Hoogte No. 367 | Frisgewaag No. 550      | Kalkoenkrans No. 225       | Mooifontein No. 639         | Terra Blanda No. 155          |                     |
| Bryan No. 561            | Glen Ross No. 734       | Klein Palmiet Kuil No. 407 | Mooivlakte No. 199          | Toulon No. 368                |                     |

## Cadastral / Infrastructure

1473 Tetra4 Cluster 2 Project

Legend

- Study Area
- Places
- Railway
- Roads
- Rivers
- Infrastructure
  - Compressor Stations
  - LNG/LHe Plant
- Project Footprint Buffer Zones
  - Pipeline (300m)
  - Wells Tansects (600m)
  - Transmission Loop Buffer (300m)
  - Extensions



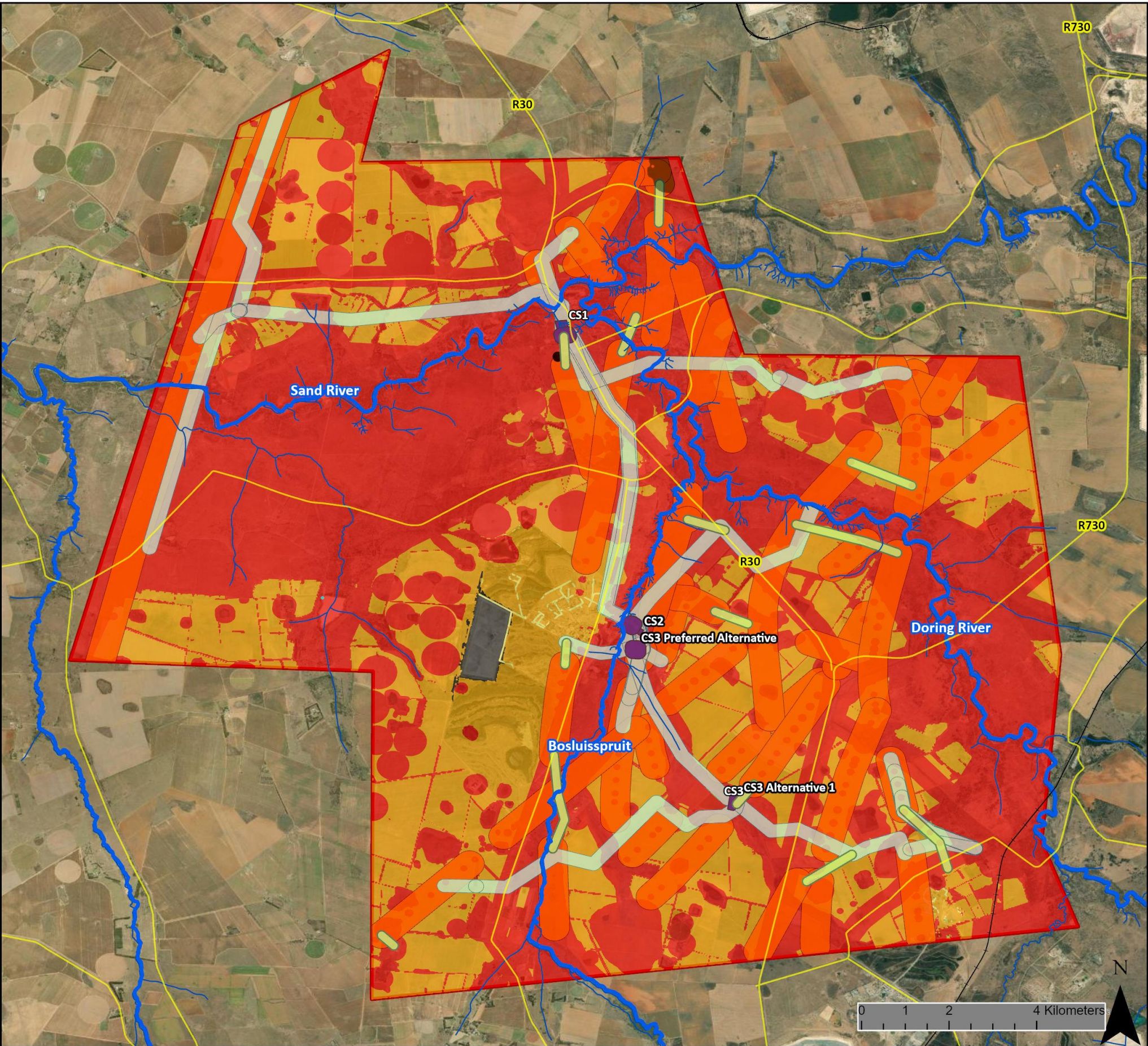
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Reviewed: BW  
Approved: LW





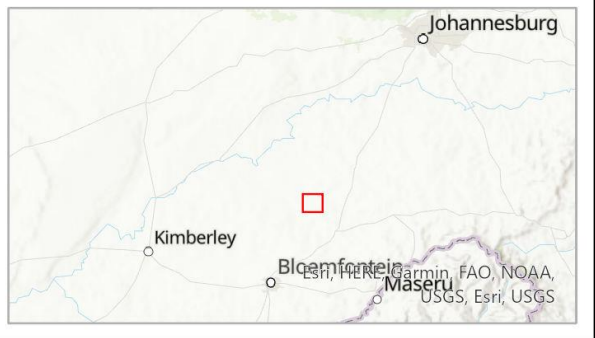
# Sensitivity Map



## EIA Risk Based Combined Sensitivity Map

1473 Tetra4 Phase 2 BA WULA

- Legend
- Study Area
  - Places
  - Railway
  - Rivers
  - Infrastructure
    - Compressor Stations
    - LNG/LHe Plant
    - Extensions
    - Pipeline (300m)
    - Wells Tansects (600m)
  - Risk Adverse Sensitivity Ranking
    - Low
    - Medium
    - High
    - No-Go



Data Sources:  
CSG; ESRI  
Coord System: GCS WGS 1984  
Datum: WGS 1984  
Units: Degree  
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EIMS Ref: 1473  
Compiled: CM  
Reviewed: BW  
Approved: LW





# Infrastructure Examples



Pipeline Servitude



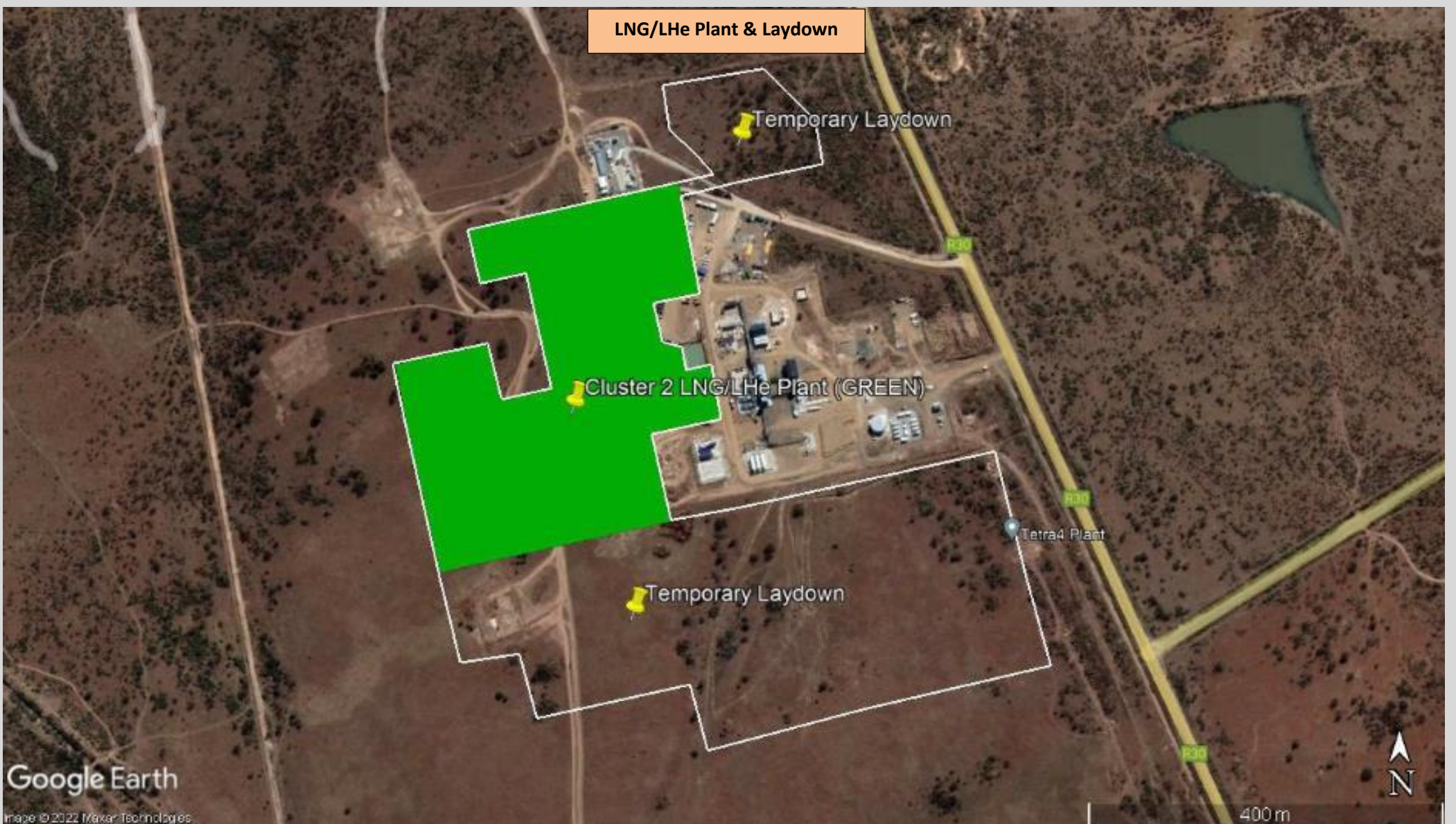
Pigging Station



Low Point Drain



Compressor Station



LNG/LHe Plant & Laydown

Temporary Laydown

Cluster 2 LNG/LHe Plant (GREEN)

Tetra4 Plant

Temporary Laydown



# Planning/Construction Impact Assessment

Discipline	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final score
Air Quality	Increase in air quality impacts due to construction of the road/pipeline	Construction	-9	-6.8	-8
	Increase in air quality impacts due to construction of the wells and booster stations	Construction	-10	-6.8	-8
	Increase in air quality impacts due to construction of the plant and CSs	Construction	-11	-7.5	-8
Climate Change	Climate Change risk due to Scope 1 & 2 construction	Construction	-8	-7	-9
Noise	Increase in noise levels due to construction of the pipeline	Construction	-11	-7.5	-8
	Increase in noise levels due to construction of the wells and Blower Stations	Construction	-12	-8.3	-8
	Increase in noise levels due to construction of the Plant and Compressor Stations	Construction	-8.3	-7.5	-8
Geohydrology (Groundwater)	Groundwater deterioration and siltation due to contaminated stormwater run-off from the construction area.	Construction	-4	-1.8	-2
	Poor quality leachate from the construction camp impact on groundwater quality.	Construction	-8.3	-4.5	-6
	Contamination of groundwater resources due to poor maintenance of machinery.	Construction	-12	-7.5	-9
	Groundwater pollution from poor management of hazardous substances.	Construction	-8.3	-4.5	-6
Hydrology (Surface Water)	Hydrology - Loss of watercourse vegetation	Construction	-3	-1.5	-2
	Erosion	Construction	-6	-3	-3
	Stormwater contamination	Construction	-7	-3	-3
	Alien and/or Invasive Vegetation	Construction	-6.5	-1.8	-2
	Alterations of the river banks and river bed	Construction	-6.8	-3.5	-4
Heritage & Palaeontology	Impact on unidentified heritage resources	Construction	-3	-5.5	-8
	Impact on burial grounds and graves	Construction	-16	-6	-8
	Impact on historic to recent sites with possible graves	Construction	-11	-6	-8
	Impact on structures of medium heritage significance	Construction	10.5	-5	-6
	Impact on palaeontology	Construction	-18	-8	-11
Social	Impact on livelihoods	Construction	-15	-11	-14
	Uncertainty	Planning	-16	-8.3	-10
	Nuisance factor due to increase in ambient dust and noise levels	Construction	-13	-10	-11
	Changes in travel patterns	Construction	-13	-9	-10
	Damage to farm roads, existing services, and infrastructure	Construction	-15	-10	-11
	Impacts on livelihoods due to behaviour of contractors	Construction	-11	-6.8	-8
	Impacts on safety and security of local residents	Construction	-13	-11	-17
	impacts on sense and spirit of place	Construction	-15	-10	-14
	Impacts on the social licence to operate	Construction	-12	11	14
	Increase in social pathologies	Construction	-11	-10	-11
	Secondary economic opportunities	Construction	11	17.5	20
Visual	Impact on Existing Agricultural Landscape Character	Construction	-8	-8	-9
	Impact on Existing Natural Landscape Character	Construction	-8	-3	-3
	The visual impact on views from local roads	Construction	-8	-5.3	-6
	Change of Natural of Views from Homesteads	Construction	-12	-4.5	-5
	The visual impact on views from local homesteads due to Lighting	Construction	-8	-1	-1
Terrestrial	Temporary disturbance of wildlife due to increased human presence and use of machinery and/or vehicles.	Planning	-3.5	-2	-2
	Destruction, further loss and fragmentation of the vegetation community	Construction	-11	-9	-11
	Introduction of alien species, especially plants	Construction	-7.5	-6	-7
	Erosion due to storm water runoff and wind	Construction	-7.5	-6.8	-8
	Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, vibration and poaching).	Construction	-9	-7.5	-8
Soils	Construction of compressors and wells	Construction	-7.5	-7.5	-8
	Construction of pipelines and transmission loop	Construction	-6	-6	-7
Wetlands	Exploration Wells - Habitat	Planning	-4	-2.3	-3
	Exploration Wells - Water Quality	Planning	-4	-2.3	-2
	Exploration Wells - Flow	Planning	-3	-1.5	-2
	Pipelines and Transmission loop - Habitat	Construction	-7.5	-4	-5
	Pipelines and Transmission loop - Water Quality	Construction	-3.5	-3.5	-4
	Pipelines and Transmission loop - Flow	Construction	-3	-3	-3
	Compressors Station CS1 - Habitat	Construction	-8.3	-5	-6
	Compressors Station CS1 - Water Quality	Construction	-3.5	-3.5	-4
	Compressors Station CS1 - Flow	Construction	-3	-3	-3
	Compressors Station CS1 - Habitat	Construction	-3	-3	-3
	Compressors Station CS1 - Water Quality	Construction	-3	-3	-3
	Compressors Station CS1 - Flow	Construction	-3	-2.5	-3
	Compressors CS2 - Habitat	Construction	-4	-4	-5
	Compressors CS2 - Water Quality	Construction	-3.5	-3.5	-4
	Compressors CS2 - Flow	Construction	-3	-3	-3
	Compressors CS3 - Habitat	Construction	-3.8	-3	-3
	Compressors CS3 - Water Quality	Construction	-3.5	-3.5	-4
	Compressors CS3 - Flow	Construction	-3	-3	-3
	Compressors CS3 - Habitat	Construction	-4	-4	-5
	Compressors CS3 - Water Quality	Construction	-3.5	-3.5	-4
	Compressors CS3 - Flow	Construction	-3	-3	-3
	Powerlines - Habitat	Construction	-5.5	-3	-3
	Powerlines - Water Quality	Construction	-2	-1.3	-1
	Powerlines - Flow	Construction	-2.5	-1.3	-1
	Access Roads - Habitat	Construction	-4.5	-3	-3
	Access Roads - Water Quality	Construction	-6.8	-4	-4
	Access Roads - Flow	Construction	-3.5	-2	-2
	LNG/LHe Plant - Habitat	Construction	-4	-3	-3
	LNG/LHe Plant - Water Quality	Construction	-3.5	-2.5	-3
	LNG/LHe Plant - Flow	Construction	-3	-2.5	-3
Economic	GGP Impact	Construction	16	16	18
	Employment Impacts	Construction	13	13	15
	Forex savings	Construction	-9.8	-9.8	-11
	Fiscal Income	Construction	12	12	14
	Economic development per capita	Construction	15	15	17
	Country and Industry Competitiveness	Construction	16	16	18
	Black Economic Transformation	Construction	14	14	16
	Alternative Land-use	Construction	8.75	8.75	10
	Need and Desirability	Construction	15	15	17
	Impact on individual farmland values	Construction	-7.5	-7.5	-8



# Operational Impact Assessment

Discipline	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final score
Air Quality	Increase in air quality impacts due to the operation of vehicles on unpaved roads	Operation	-12	-7.5	-8
	Increase in air quality impacts due to operation of the booster stations	Operation	-12	-8.3	-8
	Increase in air quality impacts due to operation of the plant	Operation	-7.5	-7.5	-8
Climate Change	Climate Change risk due to Scope 1 & 2 construction	Operation	-12	-11	-15
Noise	Increase in noise levels due to Blower Station operation	Operation	-9	-6	-6
	Increase in noise levels due to Plant and Compressor Station operation	Operation	-9	-6	-6
Geohydrology (Groundwater)	Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas production phase.	Operation	-18	-12	-15
	Migration of stray gas from the deep, fractured aquifer to the overlying, potable aquifer(s) during the gas production phase.	Operation	-18	-12	-15
	Groundwater pollution as a result of wastewater spills and seepage from the evaporation dams.	Operation	-12	-7.5	-9
	Poor quality leachate may emanate from the plant footprint area which may have a negative impact on groundwater quality.	Operation	-12	-7.5	-9
	Mobilisation and maintenance of heavy vehicle and machinery on-site may cause hydrocarbon contamination of groundwater resources.	Operation	-8.3	-4.5	-6
	Poor storage and management of hazardous chemical substances on-site may cause groundwater pollution.	Operation	-12	-7.5	-9
	Leakage of harmful substances from tanks, pipelines or other equipment may cause groundwater pollution.	Operation	-12	-7.5	-9
Hydrology (Surface Water)	Erosion	Operation	-5.5	-2.8	-3
	Stormwater contamination	Operation	-9	-3.5	-4
	Alien and/or Invasive Vegetation	Operation	-9.8	-4	-5
Social	Impact on livelihoods	Operation	-20	-15	-21
	Impact of servitudes on land values	Operation	-21	-15	-21
	Damage to farm roads, existing services, and infrastructure	Operation	-14	-13	-16
	Impacts on safety and security of local residents	Operation	-19	-14	-18
	impacts on sense and spirit of place	Operation	-20	-20	-28
	Impacts on the social licence to operate	Operation	-15	13	16
	Public perceptions about safety associated with gas production	Operation	-12	-6.8	-7
	Contribution to economy of South Africa	Operation	22.5	23.8	27
	Secondary economic opportunities	Operation	13	18.8	21
Visual	Potential opportunity for education, skills development, and training	Operation	13	18.8	21
	Impact on Existing Agricultural Landscape Character	Operation	-4	-4	-5
	Impact on Existing Natural Landscape Character	Operation	-7.5	-3.5	-4
	The visual impact on views from local roads	Operation	-11	-7.5	-8
	Change of Natural of Views from Homesteads	Operation	-6.8	-4	-5
Terrestrial	The visual impact on views from local homesteads due to Lighting	Operation	-11	-1.8	-2
	Environmental pollution due to potential leaks, discharges, pollutant leaching into the surrounding environment	Operation	-9	-5.5	-6
	Continued fragmentation, further loss and fragmentation of the vegetation community	Operation	-11	-8.3	-10
	Vegetation loss due to erosion and encroachment by alien invasive plant species	Operation	-8.3	-4.5	-5
	Potential leaks, discharges, pollutant from activities leaching into the surrounding environment	Operation	-9	-7.5	-8
Soils	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Operation	-12	-5.5	-6
	Operation of Compressor and Wells	Operation	-8.3	-5.5	-6
Wetlands	Operation of pipelines and transmission loop	Operation	-7.5	-5	-6
	Pipelines and Transmission loop - Habitat	Operation	-4	-2.5	-3
	Pipelines and Transmission loop - Water Quality	Operation	-3.5	-2	-2
	Pipelines and Transmission loop - Flow	Operation	-3	-1	-1
	Compressors Station CS1 - Habitat	Operation	-9.8	-6	-7
	Compressors Station CS1 - Water Quality	Operation	-3.5	-3.5	-4
	Compressors Station CS1 - Flow	Operation	-4	-4	-4
	Compressors Station CS1 - Habitat	Operation	-6.8	-3.5	-4
	Compressors Station CS1 - Water Quality	Operation	-3.5	-3.5	-4
	Compressors Station CS1 - Flow	Operation	-3	-1	-1
	Compressors CS2 - Habitat	Operation	-8.3	-3	-3
	Compressors CS2 - Water Quality	Operation	-3	-2	-2
	Compressors CS2 - Flow	Operation	-4.5	-2	-2
	Compressors CS3 - Habitat	Operation	-7.5	-4	-5
	Compressors CS3 - Water Quality	Operation	-3.5	-3.5	-4
	Compressors CS3 - Flow	Operation	-4	-4	-4
	Compressors CS3 - Habitat	Operation	-7.5	-4	-5
	Compressors CS3 - Water Quality	Operation	-3.5	-3.5	-4
	Compressors CS3 - Flow	Operation	-4	-4	-4
	Powerlines - Habitat	Operation	-5	-3.5	-4
	Powerlines - Water Quality	Operation	-1	-1	-1
	Powerlines - Flow	Operation	-1	-1.3	-1
	Access Roads - Habitat	Operation	-9	-4.5	-5
	Access Roads - Water Quality	Operation	-5	-4	-4
	Access Roads - Flow	Operation	-5	-3.5	-4
	LNG/LHe Plant - Habitat	Operation	-4.5	-4	-4
	LNG/LHe Plant - Water Quality	Operation	-3.5	-3.5	-4
	LNG/LHe Plant - Flow	Operation	-3	-3.5	-4
Economic	GGP Impact	Operation	23.8	23.8	33
	Employment Impacts	Operation	17	17	23
	Forex savings	Operation	18	18	25
	Fiscal Income	Operation	17	17	23
	Economic development per capita	Operation	17	17	23
	Country and Industry Competitiveness	Operation	20	20	28
	Black Economic Transformation	Operation	16	16	22
	Alternative Land-use	Operation	11.3	11.3	15
	Need and Desirability	Operation	20	20	28
	Impact on individual farmland values	Operation	-9	-9	-12

# Decommissioning and Rehabilitation Impact Assessment

Discipline	Impact	Phase	Pre-mitigation ER	Post-mitigation ER	Final score
Air Quality	Increase in air quality impacts due to decommissioning and closure	Decommissioning	-11	-7.5	-8
Noise	Increase in noise levels	Decommissioning	-11	-7.5	-8
Geohydrology (Groundwater)	Migration of saline groundwater from the deep, fractured aquifer to the overlying, potable aquifer(s) during the borehole closure and decommissioning phase.	Decommissioning	-16	-9	-11
	Migration of stray gas from the deep, fractured aquifer to the overlying, potable aquifer(s) borehole closure and decommissioning phase.	Decommissioning	-16	-9	-11
	Groundwater pollution as a result of wastewater spills and seepage from the evaporation dams.	Decommissioning	-6.5	-2.3	-3
	Poor quality leachate may emanate from the plant footprint area which may have a negative impact on groundwater quality.	Decommissioning	-6.5	-2.3	-3
	De-mobilisation of heavy vehicle and machinery as part of the decommissioning phase on-site may cause hydrocarbon contamination of groundwater resources.	Decommissioning	-6.5	-2.3	-3
Hydrology (Surface Water)	Erosion	Decommissioning	-5	-2.5	-3
	Stormwater contamination	Decommissioning	-9	-3.5	-4
	Alien and/or Invasive Vegetation	Decommissioning	-6.5	-1.8	-2
Visual	Impact on Existing Agricultural Landscape Character	Decommissioning	-10	-1	-1
	Impact on Existing Natural Landscape Character	Decommissioning	-5.3	-2	-2
	The visual impact on views from local roads	Decommissioning	-10	-1	-1
	Change of Natural of Views from Homesteads	Decommissioning	-10	-1	-1
	The visual impact on views from local homesteads due to Lighting	Decommissioning	-8	-1	-1
Terrestrial	Continued encroachment of vegetation community by alien invasive plant species as well as erosion due to disturbed soils	Decommissioning	-7.5	-4.5	-5
	Continued displacement and fragmentation of the faunal community (including potential threatened or protected species) due to ongoing habitat degradation/loss (infringement, litter, road mortalities and/or poaching).	Decommissioning	-7.5	-4.5	-5
Soils	Decommissioning of Compressors and Wells	Decommissioning	-6	-6	-7
	Decommissioning of pipelines and transmission loop	Decommissioning	-4	-4	-5
Wetlands	Pipelines and Transmission loop - Habitat	Decommissioning	-7.5	-4	-5
	Pipelines and Transmission loop - Water Quality	Decommissioning	-3.5	-3.5	-4
	Pipelines and Transmission loop - Flow	Decommissioning	-3	-3	-3
	Compressors Station CS1 - Habitat	Decommissioning	-8.3	-5	-6
	Compressors Station CS1 - Water Quality	Decommissioning	-3.5	-3.5	-4
	Compressors Station CS1 - Flow	Decommissioning	-3	-3	-3
	Compressors Station CS1 - Habitat	Decommissioning	-3	-3	-3
	Compressors Station CS1 - Water Quality	Decommissioning	-3	-3	-3
	Compressors Station CS1 - Flow	Decommissioning	-3	-2.5	-3
	Compressors CS2 - Habitat	Decommissioning	-4	-4	-5
	Compressors CS2 - Water Quality	Decommissioning	-3.5	-3.5	-4
	Compressors CS2 - Flow	Decommissioning	-3	-3	-3
	Compressors CS3 - Habitat	Decommissioning	-3.8	-3	-3
	Compressors CS3 - Water Quality	Decommissioning	-3.5	-3.5	-4
	Compressors CS3 - Flow	Decommissioning	-3	-3	-3
	Compressors CS3 - Habitat	Decommissioning	-4	-4	-5
	Compressors CS3 - Water Quality	Decommissioning	-3.5	-3.5	-4
	Compressors CS3 - Flow	Decommissioning	-3	-3	-3
	Powerlines - Habitat	Decommissioning	-5	-3	-3
	Powerlines - Water Quality	Decommissioning	-2	-1.3	-1
	Powerlines - Flow	Decommissioning	-2.5	-1.3	-1
	Access Roads - Habitat	Decommissioning	-4.5	-3	-3
	Access Roads - Water Quality	Decommissioning	-6	-4	-4
	Access Roads - Flow	Decommissioning	-3.5	-2	-2
	LNG/LHe Plant - Habitat	Decommissioning	-4	-3	-3
	LNG/LHe Plant - Water Quality	Decommissioning	-3.5	-2.5	-3
	LNG/LHe Plant - Flow	Decommissioning	-3	-2.5	-3
Economic	GGP Impact	Decommissioning	-13	-13	-13
	Employment Impacts	Decommissioning	-13	-13	-13
	Forex savings	Decommissioning	-23	-23	-23
	Fiscal Income	Decommissioning	-23	-23	-23
	Economic development per capita	Decommissioning	-13	-13	-13
	Country and Industry Competitiveness	Decommissioning	-18	-18	-18
	Black Economic Transformation	Decommissioning	-16	-16	-16
	Alternative Land-use	Decommissioning	-15	-15	-15
	Need and Desirability	Decommissioning	-15	-15	-15
	Impact on individual farmland values	Decommissioning	8.25	8.25	8
	GGP Impact	Rehab and closure	-23	-23	-23
	Employment Impacts	Rehab and closure	-23	-23	-23
	Forex savings	Rehab and closure	-23	-23	-23
	Fiscal Income	Rehab and closure	-23	-23	-23
	Economic development per capita	Rehab and closure	-23	-23	-23
	Country and Industry Competitiveness	Rehab and closure	-15	-15	-15
	Black Economic Transformation	Rehab and closure	-16	-16	-16
	Alternative Land-use	Rehab and closure	-19	-19	-19
	Need and Desirability	Rehab and closure	-18	-18	-18
	Impact on individual farmland values	Rehab and closure	8.25	8.25	8

# Conclusions & Recommendations

## Specialist study conclusions:

SPECIALIST	SPECIALIST CONCLUSION
<b>Air Quality</b>	It is the specialist opinion that the project may be authorised provided that the recommended air quality management measures are implemented
<b>Climate Change</b>	Based on Tetra4 Cluster 2 Scope 1, 2 and 3 GHG emissions, it is the specialist opinion that the project may be authorised due to its low to medium impact significance
<b>Noise</b>	Based on the findings of the assessment and provided the recommended general “good practice” management and mitigation measures are in place, it is the specialist opinion that the project may be authorised.
<b>Economic</b>	Both the economic quantitative and qualitative factors ought to be considered as positive for the SA economy in general and therefore the project is supported from an economic perspective.
<b>Geohydrology</b>	It can be concluded that, should the prescribed mitigation and management measures, as stipulated in the groundwater management plan, be implemented and honoured, the impacts associated with the project phases can be minimised and therefore the project is supported.
<b>Hydrology</b>	Most impacts are easily detectable and the considered mitigation measures are easily practicable therefore the risks associated with the development are considered to be low and therefore the project is supported.
<b>Terrestrial Biodiversity</b>	The project is supported on condition that the mitigation measures and no-go recommendations are adhered to.
<b>Aquatic</b>	It is the specialist’s opinion that no fatal flaws have been identified for the proposed activities and the project is supported.
<b>Wetlands</b>	It is the specialist’s opinion that no fatal flaws have been identified, and that the proposed activities may proceed as have been planned. Given the fact that “Low” post-mitigation significance ratings were determined for various aspects of the proposed project, it’s the specialist’s opinion that a General Authorisation could be applied for.
<b>Soil and Agriculture</b>	The results of this assessment indicate “Insignificant” to “Very Low” post-mitigation significance ratings for the proposed project components, and it is therefore recommended that the proposed activities may proceed as have been planned.
<b>Visual</b>	Because the affected landscape areas are neither unique or protected and since mitigation measures should generally be effective in minimising landscape impacts and visual impact experienced by potential receptors, there is no reason from a landscape and visual impact perspective that the project should not proceed as long as the mitigation measures are implemented.

## Final Alternative Assessment:

- Location Alternatives for Compressor Station 3 (CS3): As neither of the two CS3 location alternatives were highlighted as no-go or significantly flawed by any of the specialist assessments, the CS3\_L2 (Preferred Alternative) on the farm Palmietkuil 328 Portion 6 is considered the preferred alternative due to its reduced visual and social impacts.
- Layout Alternatives: Based on the sensitivity planning approach, two areas have been delineated as no-go areas as follows:
  - Sibanye Beatrix tailings facility however there is no planned project infrastructure in this location and therefore this no-go area is for information purposes.
  - The Terrestrial Ecology study identified a viable population of a protected species on the farm Adamsons Vley 655 (Portion 0) which cannot be relocated. Consultation and communication with the lead or implementing agent for the sensitive species, Endangered Wildlife Trust (EWT), must be implemented before any construction proximal to the specific area.
- No-go Alternative: This alternative is not considered reasonable as no fatal flaws in the overall project plan have been identified. Where necessary, certain restrictions on sensitive areas have been put forward as well as identification of no-go areas however the overall project plan remains feasible.

## Environmental Impact Statement:

The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the limited level of disturbance predicted as a result of the production activities, the findings of the specialist studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team and the EAP that the significance levels of the majority of identified negative impacts can generally be reduced to an acceptable level by implementing the recommended mitigation measures and the project should be authorized on condition that the recommended conditions are included in the decision and that compliance with the amended EMPr must be strictly adhered to.