

# Strategic Environmental Assessment for Shale Gas Development in South Africa

Draft Findings of the Scientific Assessment  
Stakeholder Meeting  
Cape Town 22 July 2016

# Programme

Time	Item
10:00-10:15	Introductions and objectives
10:15-12:00	Background & Chapters 1 - 18
12:00-13:00	Q&A
13:00-	Lunch

# Where are we in the Strategic Environmental Assessment?



# The Scientific Assessment has 18 chapters

## Report Structure

*Preface*

*Summary for Policy Makers*

<i>Ch 1</i>	Shale Gas Development Scenarios and associated Activities
<i>Ch 2</i>	Effects on National Energy Planning and Energy Security
<i>Ch 3</i>	Air Quality and Greenhouse Gas Emissions
<i>Ch 4</i>	Earthquakes
<i>Ch 5</i>	Water Resources, both on the Surface and Underground
<i>Ch 6</i>	Impacts on Waste Planning and Management
<i>Ch 7</i>	Biodiversity and Ecological Impacts: Landscape Processes, Ecosystems and Species
<i>Ch 8</i>	Impacts on Agriculture
<i>Ch 9</i>	Impact on Tourism in the Karoo
<i>Ch 10</i>	Impacts on the Economy
<i>Ch 11</i>	Impacts on Social Fabric
<i>Ch 12</i>	Impact on Human Health
<i>Ch 13</i>	Impact on Sense of Place Values
<i>Ch 14</i>	Impacts on Visual Aesthetics
<i>Ch 15</i>	Impacts on Heritage
<i>Ch 16</i>	Noise Generated by Shale Gas-Related Activities
<i>Ch 17</i>	Electromagnetic Interference
<i>Ch 18</i>	Impacts on Land, Infrastructure and Settlement Development

**SPM Just read this if you are busy!**

**Scenarios**

**Energy**

**Air pollution and climate**

**Earthquakes**

**Water**

**Waste**

**Biodiversity**

**Agriculture**

**Tourism**

**Economy**

**Social Fabric**

**Health**

**Sense of place**

**Scenery**

**Heritage**

**Noise**

**Square Kilometer Array**

**Infrastructure**

# Each chapter has a similar structure

## Chapter *title*

### 1.) Executive Summary

### 2.) Introduction and Scope

2.1) *What is meant by this topic?*

2.2) *Overview of International Experience*

2.3) *Special Features of the Karoo Environment*

2.4) *Relevant Legislation, Regulation and Practice*

### 3.) Key potential Impacts and their Mitigation

### 4.) Risk Assessment

4.1) *How the Risks (and Opportunities where appropriate) are measured*

4.2) *Limits of Acceptable Change*

4.3) *Risk Assessment*

### 5.) Best Practice Guidelines and Monitoring Requirements

5.1) *Planning*

5.2) *Construction*

5.3) *Operations*

5.4) *De-Commissioning*

5.5) *Monitoring and Evaluation*

### 6.) Topic on which information is inadequate for decision-making

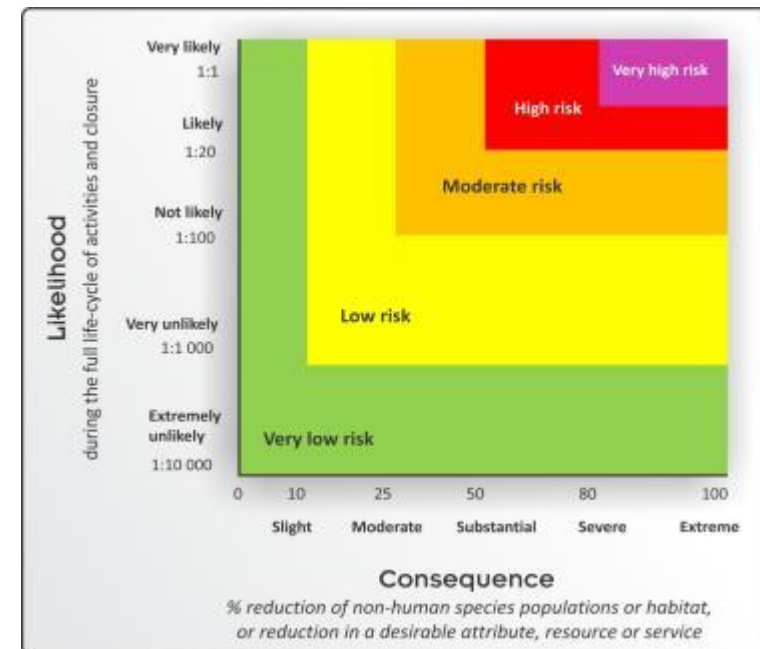
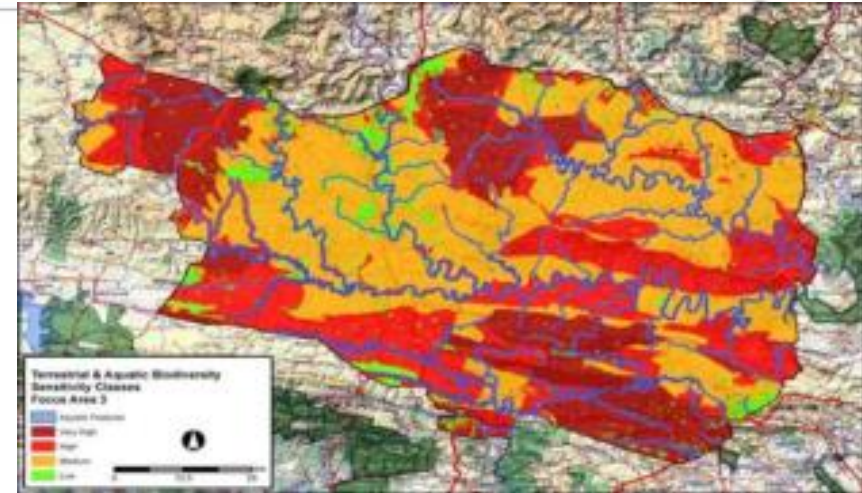
### 7.) References





# Risk Assessment: Step by step

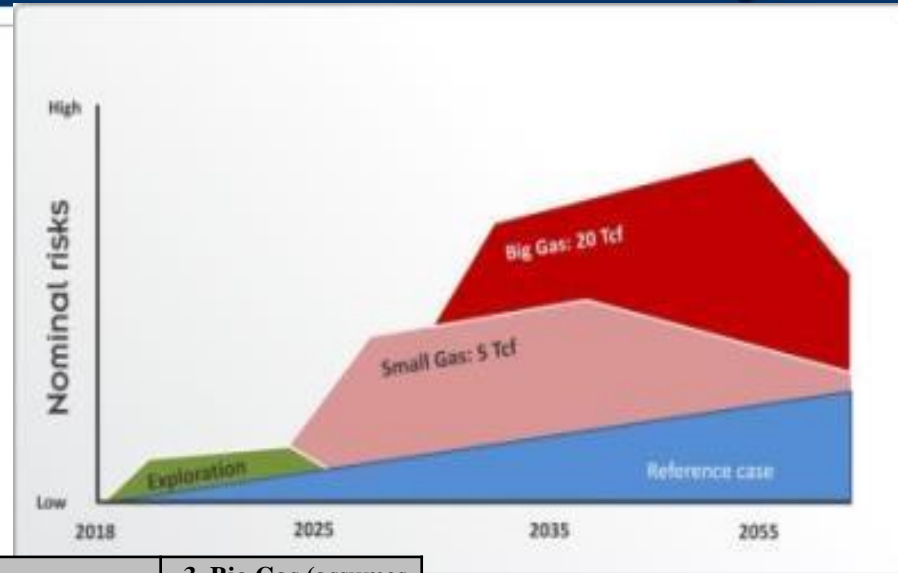
1. Define the impact
2. Map different sensitivities
3. Define mitigation
4. For each impact type
  - a) For each scenario
    - 1.) For each sensitivity
      1. Estimate likelihood
      2. Estimate consequence
      3.  $1 \times 2 = \text{Risk}$
    - 2.) Repeat 5.1.1 with mitigation as specified in 3
5. Project team will use the tabulated outputs of (4), with the map in (2) to create a risk surface for each impact type
6. Project team will create a composite risk map using the maximum rule applied to the with mitigation surfaces, and another risk map without mitigation.



# Chapter 1: Scenarios and Activities

## Scenarios:

- 0 → Reference case
- 1 → Exploration only
- 2 → Small Gas (5 Tcf)
- 3 → Big Gas (20 Tcf)



Activity	1. Exploration Only	2. Small Gas	3. Big Gas (assumes several wellfields)
Number of wellpads [2 ha each]	30	55	410
New roads (km) [unpaved, 5 m wide]	30	58	235
Total area of wellpads and roads (ha)	75	199	998
Number of truck visits	45 000	365 000	2 177 000
Industry water needs (m³) [ no re-use]	488 250	9 212 625	65 524 500
Industry water needs (m³) [50% drill fluid & 30% frack fluid re-use]	319 110	6 056 160	43 087 235
Flowback (m³) [sludge+brine+water]	101 400	5 573 900	40 356 400
Hazardous waste (t/yr)	85	635	4 185
Domestic waste (t/yr)	144	35	230
Sanitary waste (m³/yr)	44 531	10 688	71 250

# Chapter 2: Energy Planning

- Natural gas would make the SA energy system more efficient, cheaper and more reliable. It complements solar and wind energy, rather than replacing them
- Three gas supply options are: (1) Imported by pipe (2) Imported as LNG (3) Sourced in South Africa: offshore or Karoo shale.
- The availability of *high volumes* of cheap gas would alter national energy plans by displacing coal and enabling the integration of more renewables. It would reduce the portfolio costs of power generation.
- The main risk is developing infrastructure for shale gas that does not materialise.

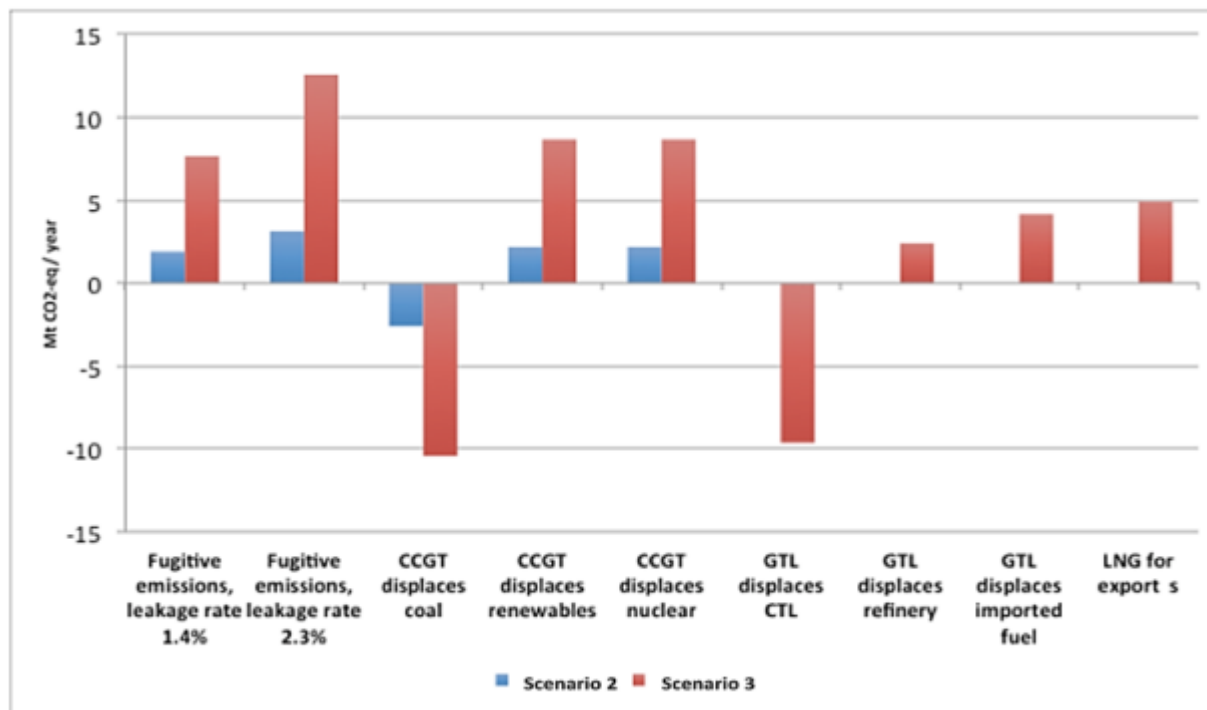


# Chapter 3: Air Quality

- SGD *without mitigation* would be associated with:
  - a high risk to workers on the drill rigs of exposure to air pollutants, silica especially.
  - a moderate risk of local community exposure to air pollutants.
- *With mitigation* these risks reduce to low
- The extensive use of heavy diesel trucks exposes the entire study area to increased levels of air pollution.
- Use of gas or electricity instead of wood or coal for domestic heat would improve indoor air quality.
- There is insufficient information on air quality in the Karoo to form a reliable baseline against which to measure the impacts of SGD.

# Chapter 3: Greenhouse gas emissions

- Use of shale gas could either *increase* or *decrease* the nation GHG emissions, depending on
  - If coal or renewables are displaced from the mix
  - If ‘fugitive’ methane leaks amount to more than 2%

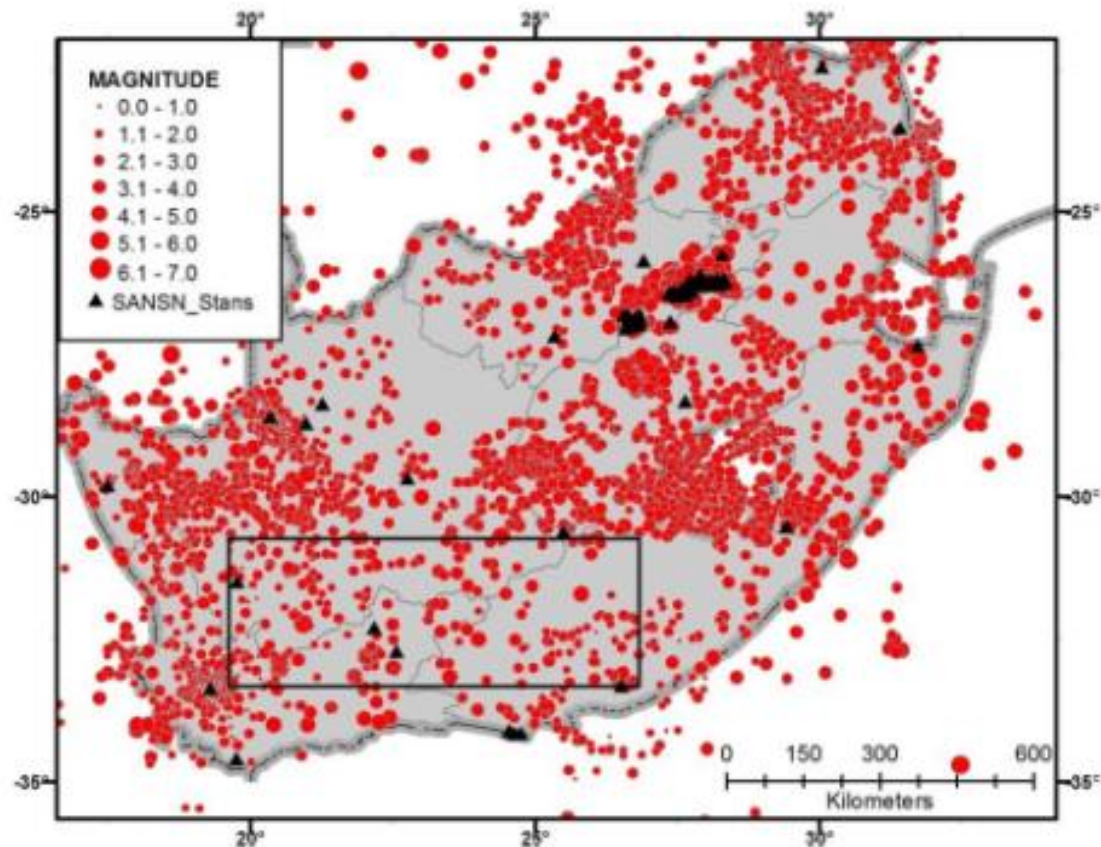


The net change in national greenhouse gas emissions which would result from SGD under various assumptions

# Chapter 4: Earthquakes

- SGD increases the likelihood of small earth tremors near the well bores.
- Heritage buildings made of unbaked clay bricks, and poorly-constructed low-cost housing are the most vulnerable.
- Locating fracking sites a safe distance from population centres reduces the risk of earthquakes to very low.

*The locations of recorded seismic events in South Africa. The study area is relatively seismically quiet. The black triangles are locations of seismic monitoring stations*

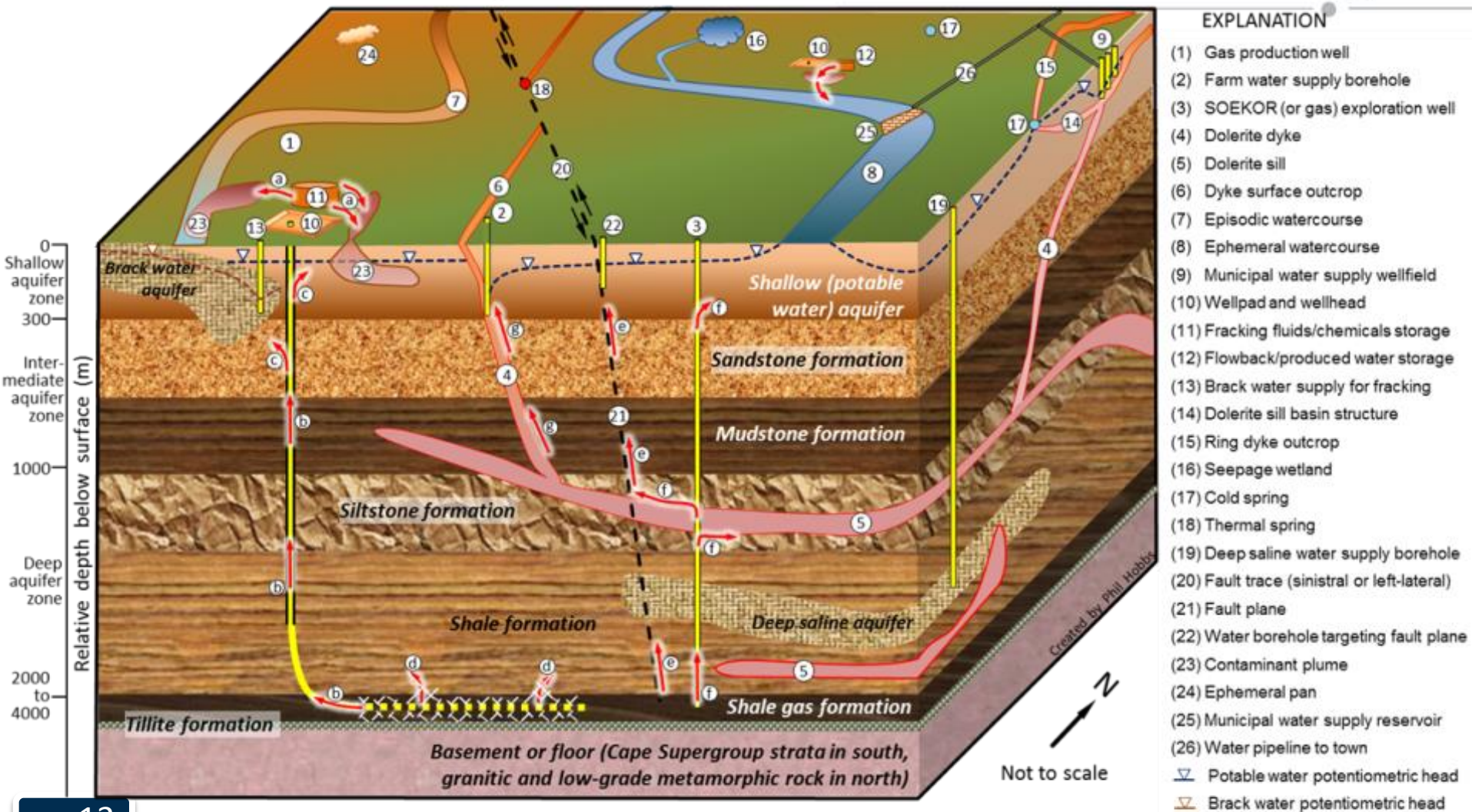


# Chapter 5: Surface- and Groundwater

- There is not enough water from current sources in the Karoo to supply the needs of hydraulic fracturing and other growing demands, such as for mining, towns and farms
  - non-drinkable ( brack) groundwater could be used for fracking at a limited scale. Otherwise water would need to be trucked in.
- Surface spills on-site and along transport networks are the most likely source of water contamination. Risks of contamination last beyond the end of SGD
- Improved water resources monitoring before, during and after SGD is an imperative.
- The Karoo currently lacks adequate infrastructure and institutional capacity for water management.
- Exploration for shale gas will improve our knowledge of Karoo groundwater resources



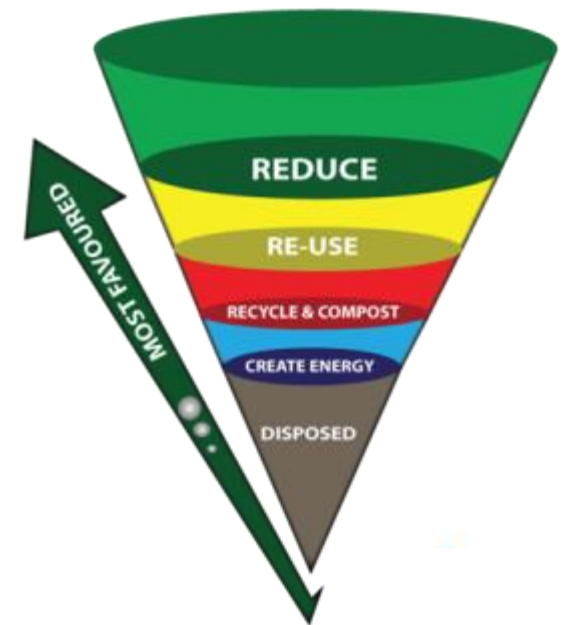
# Chapter 5: Surfacewater and Groundwater





# Chapter 6: Waste Planning and Management

- SGD would generate waste in significant volumes, some of types new to the Karoo
- Municipal landfills are completely inadequate for disposing of this waste
- Some fracking wastes are hazardous. There is no site licenced for their disposal in the Karoo. They would need to be transported to and disposed of near Cape Town or PE.
- Existing laws on waste management, if rigorously enforced, would reduce the risks associated with SGD waste to low.



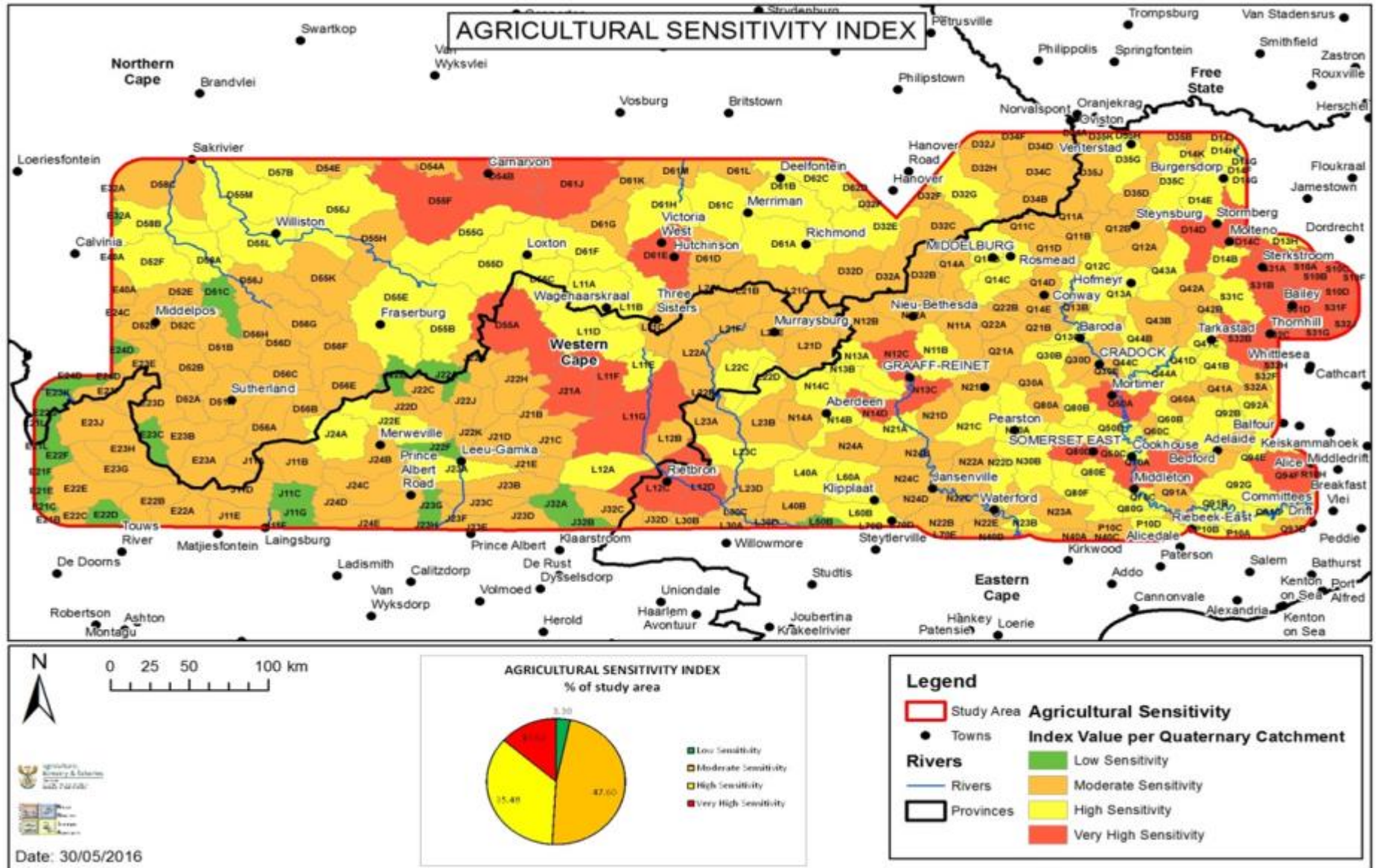
# Chapter 7: Biodiversity and Ecosystems

- The study area includes relatively high levels of biodiversity, including highly sensitive and unique ecosystems and species
- The main threats are habitat fragmentation and noise disturbance
- Areas identified in this assessment as being of very high ecological importance and sensitivity are irreplaceable if substantively damaged
- The main mitigation is to not conduct damaging activities in these areas

# Chapter 8: Impacts on Agriculture

- The biggest potential threat of SGD to agriculture relates to the use and contamination of water resources. If this threat is mitigated, the risk to agricultural productivity in the long term is low.
- Any activity that undermines land-based livelihoods is likely to have a long-term impact on the resilience of both the area and its land users.
- Shale gas exploration and exploitation puts the security and privacy of land users at risk.
- Local economic development associated with the exploration and extraction of shale gas will likely stimulate local markets for agricultural products
- Sufficient policy, legislation and regulation exist to protect the natural agricultural resources., but long-term monitoring and evaluation is essential.

# Chapter 8: Impacts on Agriculture

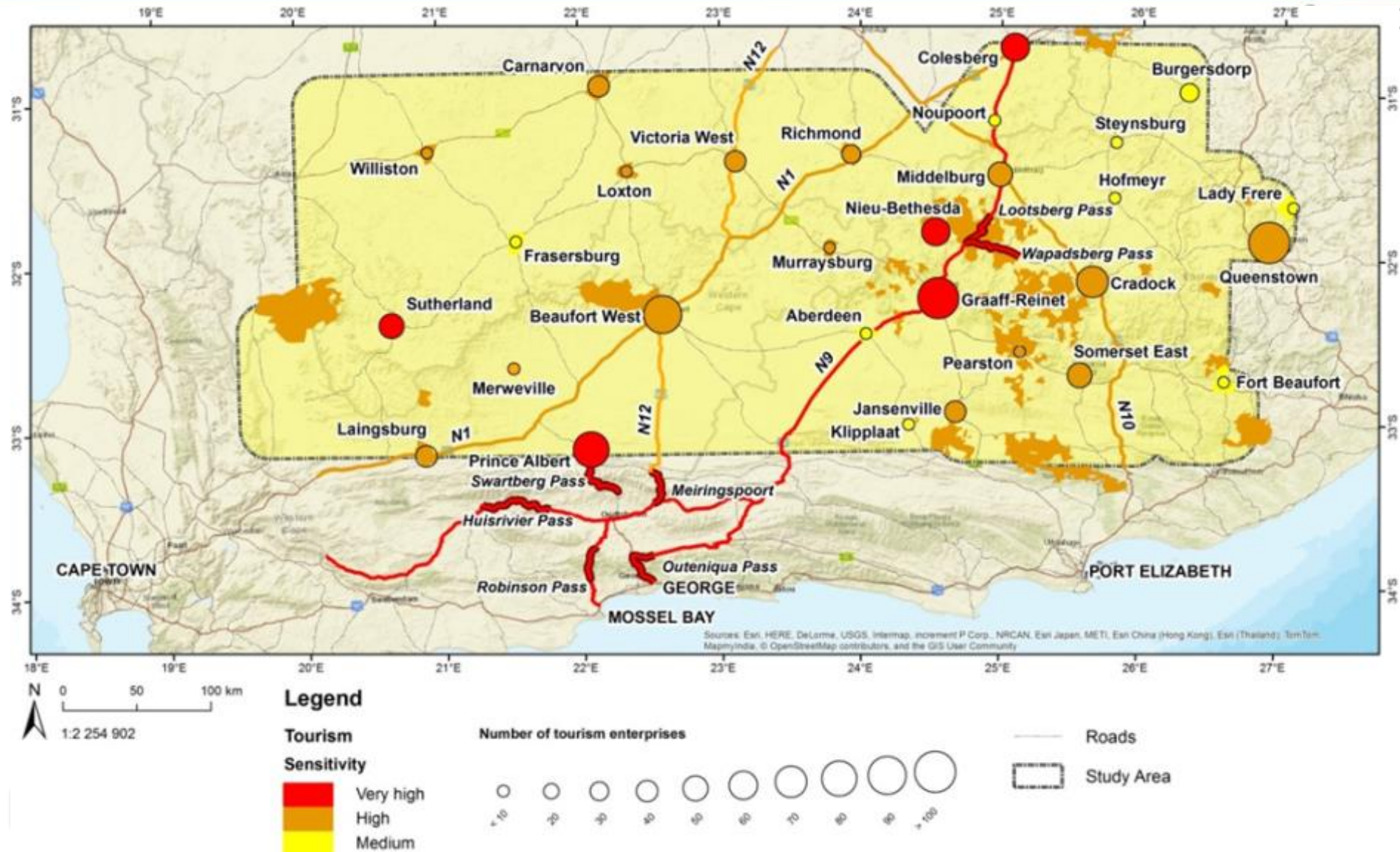


# Chapter 9: Impacts on Tourism

- Tourism is an important and growing economic sector in the Karoo, with further growth potential.
  - employment for some 13000 persons, R2.5 billion/y of value
- Broadly, there are three types of tourists:
  1. Business tourists and those visiting friends and relatives - not very sensitive to SGD
  2. People travelling through the region – not very sensitive to SGD
  3. Niche tourists who actively seek out the Karoo as a destination – sensitive to SGD
- More traffic and noise and visual impacts are the main problem.
- The negative impacts on tourism can be mitigated by keeping SGD activities away from the most sensitive towns and routes.



# Chapter 9: Impacts on Tourism



# Chapter 10: Impacts on the Economy

- Shale gas development could deliver economic opportunities
  - High volumes of shale gas would improve the trade balance and reduce exposure to the volatility of international markets
  - Shale gas development would deliver jobs, but not very many (<1000, in the best case) for unskilled local people
- Achievement of long term macro-economic benefits depends on how the proceeds of SGD are used.
- The boom-and bust nature of SGD also brings economic risks
  - 'ghost towns' after ~30 years

# Chapter 11: Impact on Social Fabric

- Large investments in small towns areas creates 'boomtown' conditions
- Actual or anticipated investments stimulates rapid in-migration of work-seekers, some with families
- Challenges the already-stressed capacity to deliver services.
- Rapid change brings disruption of the social fabric and feelings of insecurity.
- SGD could raise the average social welfare both nationally and locally
- At the same time it could make social inequalities and schisms worse.

## CAUSAL PATHWAYS



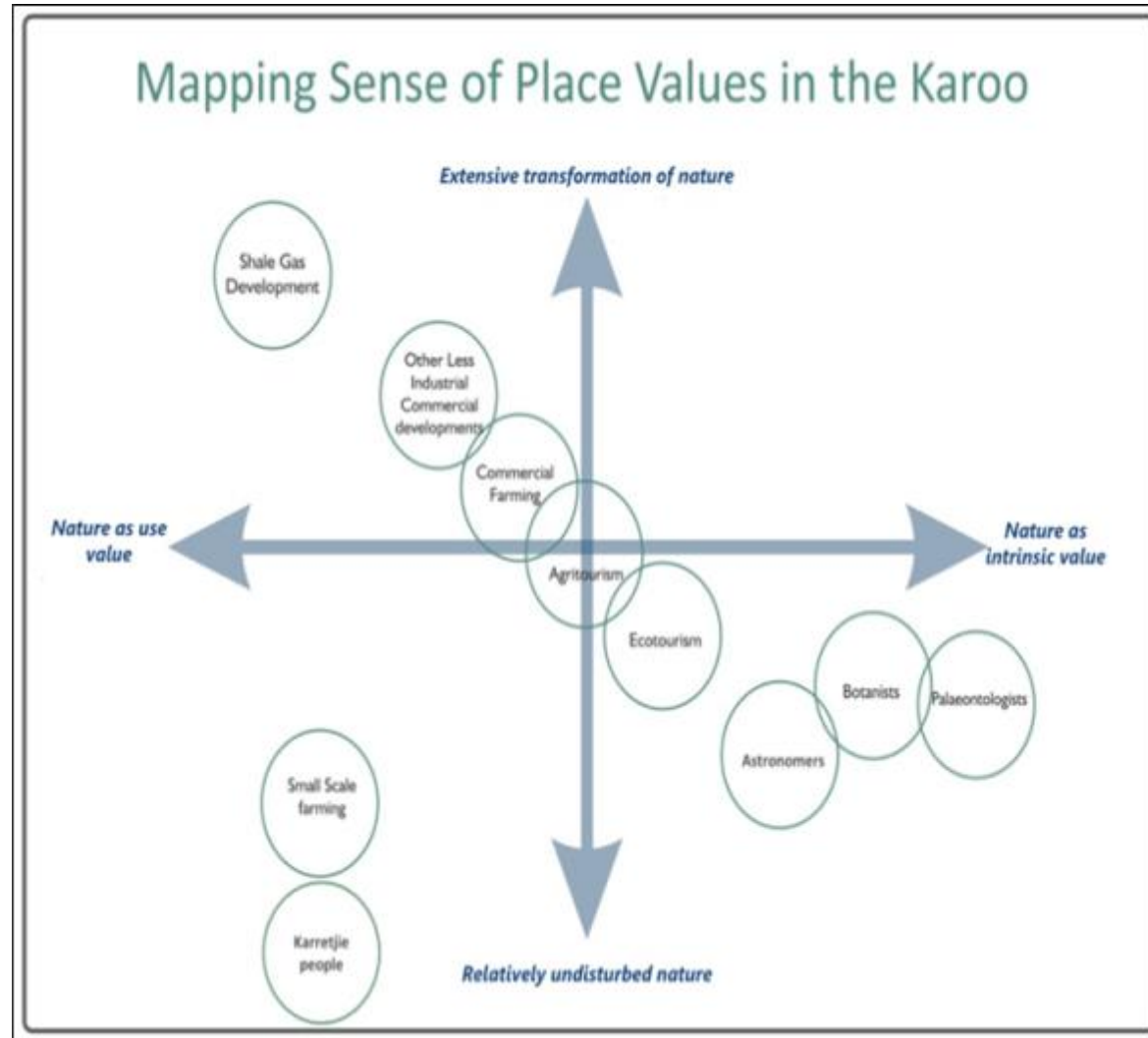
# Chapter 12: Human Health

- People in the Karoo are less healthy than the national average, mostly because they are poor. This makes them more vulnerable to impacts on their health.
- Those living close to shale gas well-pads and busy roads will experience more air, water and noise pollution
  - Shale gas workers are potentially directly exposed to toxic substances
- The potential health impacts remain quite uncertain, given that this is a new industry.
- Baseline monitoring is crucial to attribute a future negative or positive impact of SGD on human health in the study area.



# Chapter 13: Sense of Place Values

- There are not enough studies to adequately assess the issue of 'sense of place':. Sense of place is seldom adequately addressed in development processes, although it often turns out to be a major issue
- There is not one, but several, "senses of place" in the Karoo.
- SGD will affect values associated with sense of place, negatively in some cases and positively in others
- In some cases changes to the sense of place may be irreversible. .

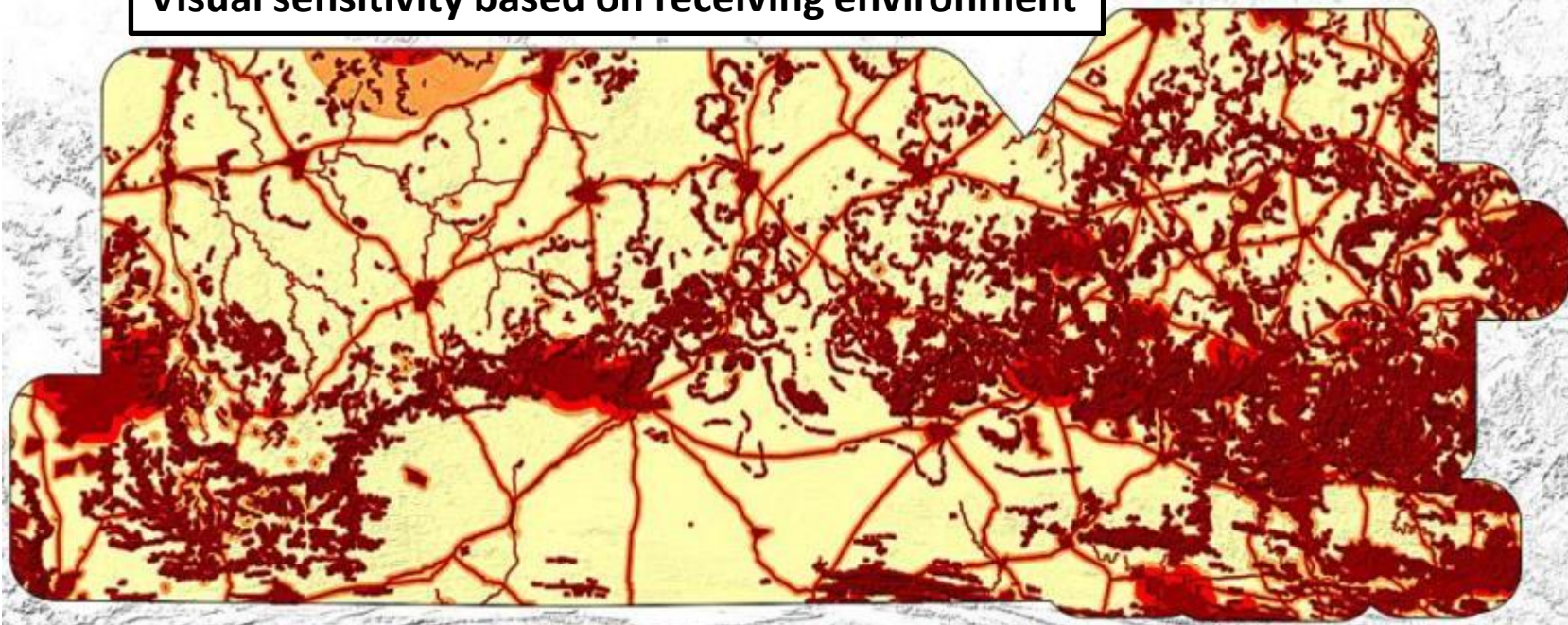




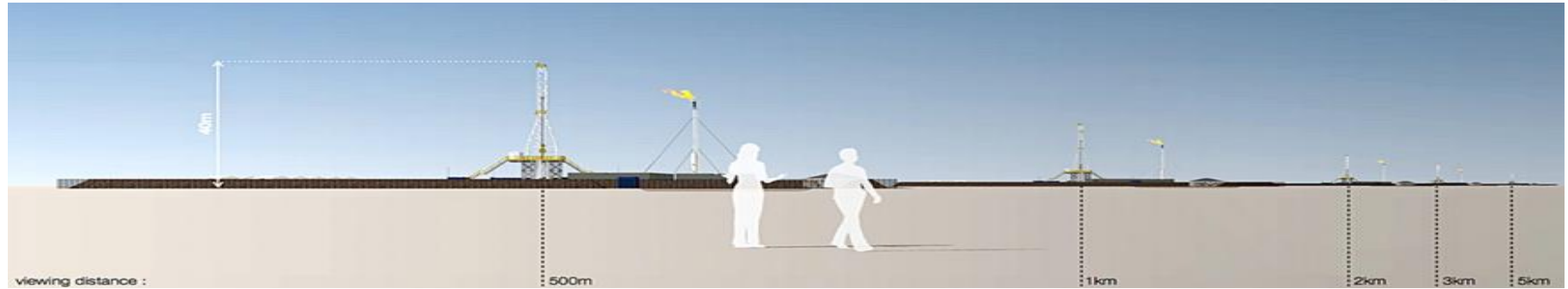
# Chapter 14: Impacts on Visual and Scenic Resources

- Without mitigation, SGD is likely to lead to the visual fragmentation of Karoo landscapes. In the affected areas the pastoral or wilderness character will be transformed to an industrial connotation
- There is no standard approach to mapping or rating the value of scenic resources in South Africa, but the study identified scenic 'hotspots' that are sensitive to SGD. Avoidance of these areas, or actions to reduce the visual impact, reduces to risk to low.

**Visual sensitivity based on receiving environment**



# Chapter 14: Impacts on Visual and Scenic Resources



Visual simulation of a wellpad during the day (top) and at night (lower) indicating visibility at a range of distances from 500m to 5km, before mitigation. The flatness and low vegetation in the karoo enhances visibility. Nighttime visibility of lights and flares would tend to be pronounced in the dark rural landscape of the Karoo.

# Chapter 15: Impacts on Heritage

- There is no part of the study area where there is *no* risk to heritage resources, but the risk varies markedly from place to place.
  - type of heritage resource (eg fossils, archaeological sites, buildings)
  - specific locations of SGD infrastructure eg well pads, access roads
  - amount of induced seismic activity that occurs..
- The impacts on heritage from SGD scenarios could be high, but are typically confined to particular areas.
- Exploration for shale gas has potential for widespread but low intensity impacts
- A marked improvement in the institutional capacity to apply National Heritage Resources Act (NHRA) is required.

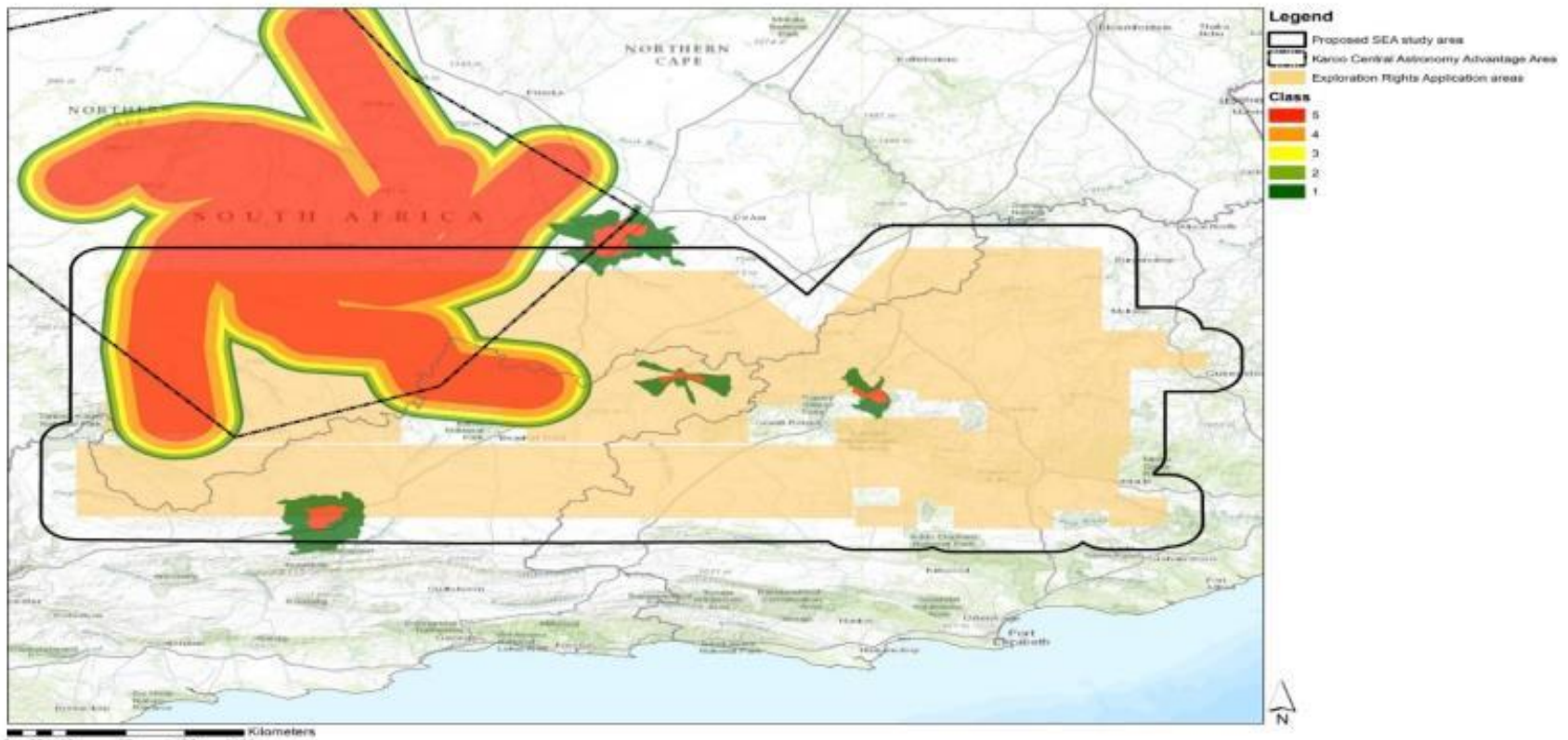
# Chapter 16: Noise generating activities

- Noise affects people's health and wellbeing. The Karoo is a quiet area (background ~33 dBA in the day and ~25 dBA at night)
- Noise during exploration is localised and brief, primarily from trucks
- During the construction, operation and decommissioning phases noise will create impacts for humans and animals within 5 km of the drilling sites. They will need individual Noise Impact Assessments in accordance with SANS 10328 to determine the severity of these impacts
- Road noise due to increased heavy vehicle traffic will increase



# Chapter 17: Interference with SKA: EMI 'noise'

- The electrical motors, switchgear, spark-ignited engines and communication devices used in SGD which can potentially cause electromagnetic interference with the Square Kilometer Array
- The key mitigation is to exclude EMI-generating sources for up to 40 km from the most sensitive parts of the radio-telescope array
- 5 classes of sensitivity are prescribed, each with varying degrees of required mitigation in order to reduce the detrimental impact to acceptable levels of change





# Chapter 17: EMI noise

	Mitigation guidelines in each class				
Buffer Class	1 (least sensitive)	2	3	4	5 (most)
Guideline	Broad EMI assessment, undertaken by specialists to identify key sources of risk.	Detailed site specific EMI assessment to be undertaken by specialists to identify key sources of risk.			No hydraulic fracturing
	Hydraulic fracturing only permitted if it complies with mitigation requirements.				
Potential Level of Mitigation	Modest shielding of highest sources of EMI	Proper shielding. . Cables below ground if possible	More extensive mitigation through proper shielding of a greater fraction of equipment likely. Cables belowground, Improved earthing	Extensive shielding of every aperture from which interference can be generated. Greater attention to cabling and earthing	Not applicable

# Chapter 18: Spatial Planning and Infrastructure

- **Towns in close to SGD activities would experience accelerated growth**
- **Construction of a network of private local access roads and well pads.**
- **Substantial increase in heavy vehicle traffic on regional roads.**
- **Regulatory uncertainties and limited municipal capacity to cope with land use and land development applications associated with shale gas exploration.**
- **Integrated spatial planning will be essential but governance capacity is limited**



**environmental affairs**

Department:  
Environmental Affairs  
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Water and Sanitation  
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# Public opportunity to comment on the 'Second draft'

**<http://seasgd.csir.co.za/>**

## until 22 July 2016



# Key dates going forward

- Release of SOD for registered stakeholder comment, 14 June
- 30 days public comment (14 June to 15 July)
- Collate all public/stakeholder comments and send to specialists, 22 July
- Public outreach planned for week of 18-22 July → additional comments
- Specialist workshop (AM#3) on 25-27 July at Goudini
- PEC meeting # 5, Phase 3 on 15 August
- Final draft Scientific Assessment by 22 August
- PCG #4 on 26 Sept 2016
- Phase 2: Scientific Assessment (final output), mid-October 2016
- Phase 3: Decision-Making Framework (draft outputs), end-2016
- Phase 3: Decision-Making Framework (final outputs), Feb 2017





# Feedback Public Outreach

- Round 1 Nov 2015:
  - GRT 09 Nov 2015: 73 ppl.
  - VW 10 Nov: 45 ppl.
  - BW 11 Nov 2015: 56 ppl.
  - CPT: ?? ppl.
- Round 1a May 2016:
  - GRT 16 May 2016: 86 ppl.
  - BW 17 May 2016: 93 ppl.
- Round 2 July 2016:
  - GRT 18 July 2016: ?? ppl.
  - VW 19 July 2016: ?? ppl.
  - BW 20 July 2016: ?? ppl.

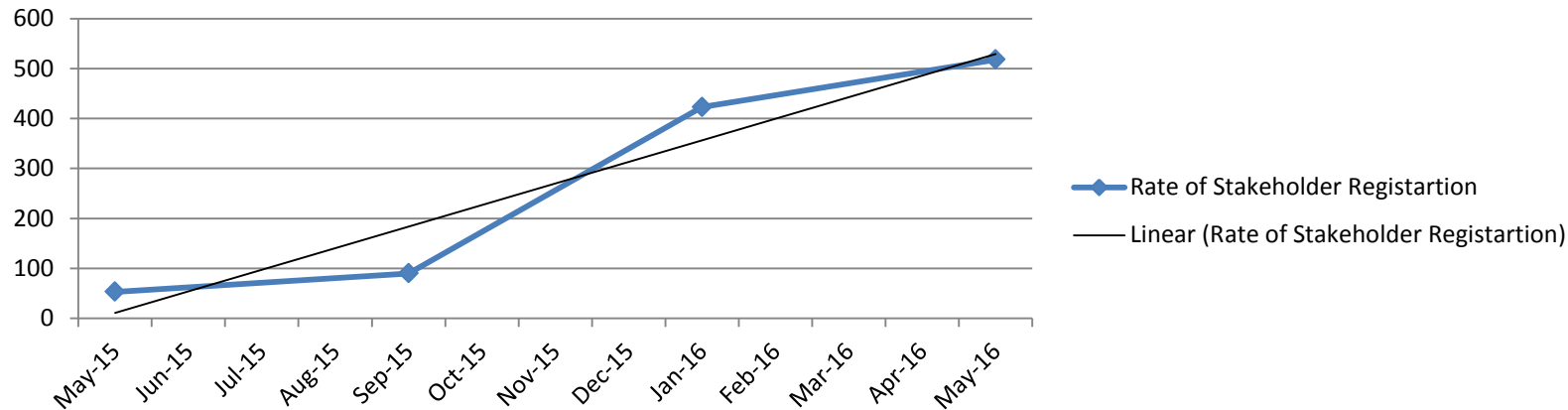
## Round #2 Outreach

Date	Town	Proposed Venue and Time
18 July 2016	Graaff-Reinet	Masizakhe Community Centre, 5-8pm
19 July 2016	Victoria West	Victoria West Town Hall, 5-8pm
20 July 2016	Beaufort West	Rustdene Community Centre, 5-8pm
22 July 2016	Cape Town	iZiko Museum, 10am-3pm

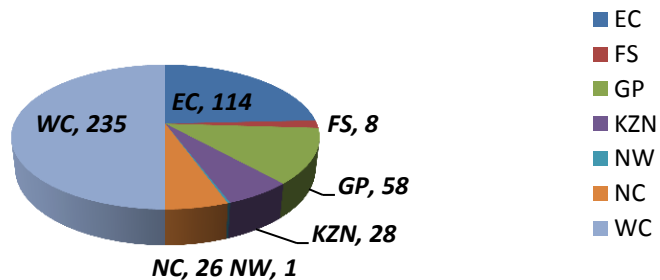


# Stakeholder participation in the SEA

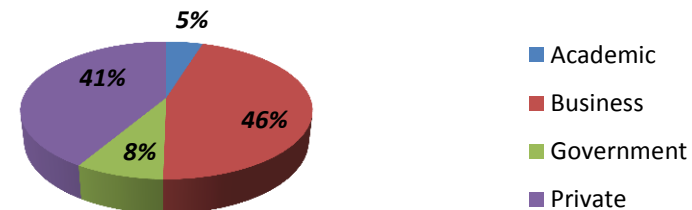
Rate of stakeholder registration from May 2015 – May 2016



Provincial distribution



Sectoral representativity



# Other issues

**Air quality** – mostly affects workers on wellpads, low risk

**Earth tremors** – low risk of damaging earthquakes

**Waste** – hazardous waste would need to be taken out

**Health** – uncertain, thus hard to assess, but generally low risk

**Sense of place** – not enough known to adequately assess,

**Noise** – risk can be mitigated through design and siting

**Square Kilometre Array** – risk can be mitigated through siting

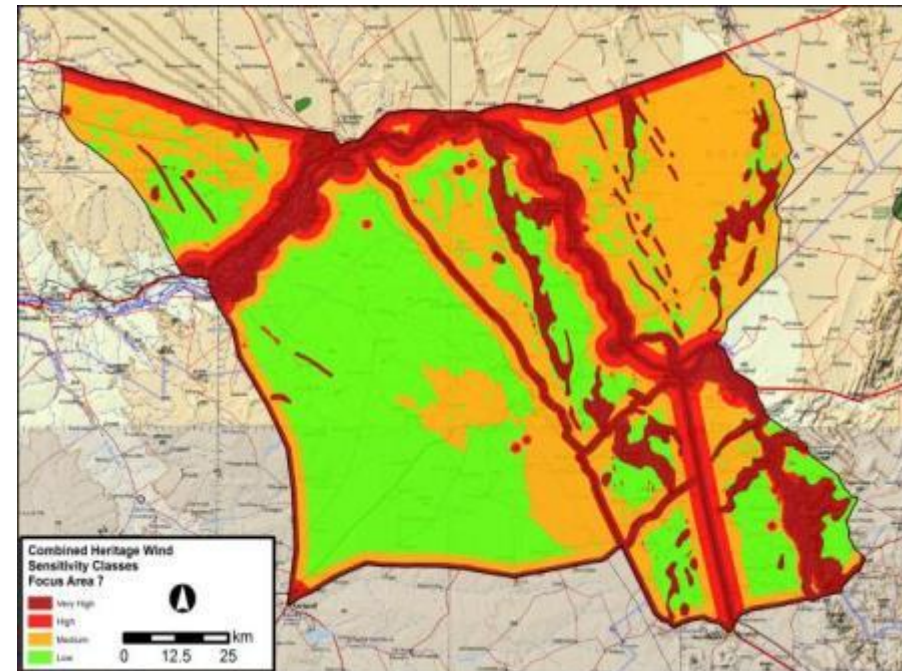
**Spatial planning** – would require revision and capacity upgrade

# Risk assessment table and mapping

## Key Strategic Issue

Sub-issue	Scenario	Location	Without mitigation			With specified mitigation		
			Likelihood	Consequence	Risk	Likelihood	Consequence	Risk
xxx	Baseline	within 50 km of towns	v unlikely	substantial	v low	v unlikely	moderate	v low
	Exploration only		unlikely	substantial	low	unlikely	moderate	low
	Small gas development		v likely	substantial	moderate	v likely	moderate	low
	Large gas development		almost cert	substantial	high	almost certain	moderate	moderate
	Baseline	beyond 50 km of towns	v unlikely	substantial	v low	v unlikely	substantial	v low
	Exploration only		y unlikely	substantial	v low	v unlikely	moderate	v low
	Small gas development		unlikely	substantial	moderate	unlikely	moderate	moderate
	Large gas development		not likely	substantial	moderate	not likely	moderate	moderate

- Based on explicit locations of risk in relation to existing surface features, we can create risk surfaces





# Chapter 7: Biodiversity and Ecosystems

- The Karoo is an arid ecosystem characterised by ecological processes that operate over extensive areas.
- Mitigation of ecological and biodiversity impacts must take place primarily at the landscape scale rather than solely on the physically-disturbed footprint
- Where activities in areas of high ecological importance and sensitivity are unavoidable, their impact should be minimised by strenuous mitigation efforts.
- Environmental compliance is still required in areas of medium-low and low ecological importance and sensitivity
- The cumulative and unforeseen impacts of SGD on biodiversity, as well as effectiveness of mitigation, must be monitored

# Chapter 10: Impacts on the Economy

- Measures focused on ownership, procurement, hiring and training are the key ways in which the benefits of SGD can be maximized, both in the study area and nationally.
- The risk that SGD could ‘crowd out’ other economic sectors in the study area, such as agriculture and tourism, by causing rises in the prices of labour and other inputs, is generally low for the scenarios considered.
- Local government finances are likely to be put under significant strain particularly for the large scale development scenario.
- There is a risk that the remaining costs associated with SGD after well closure become the responsibility of society.
- Adequate and unambiguous compensation mechanisms will be needed for land owners to cover the use of their land, and for other affected parties where environmental and other damages cannot be mitigated.

# Chapter 10: Impacts on the Economy

	<b>Seismic exploration</b>	<b>Exploration and appraisal drilling</b>	<b>Small-scale production ('Small Gas')</b>	<b>Large-scale production ('Big Gas')</b>
Size or recoverable reserve (tcf)	N/A	1	5	20
Use of gas resource	N/A	Potential movable modular power plants (1-2 MW each)	One 1 000 MW CCGT power station in the study area	Two 2 000 MW CCGT power stations in the study area and a 65 000 bpd GTL plant at the coast
Duration of activity (years)	1	5 to 10	35 minimum	35 minimum
Number of rigs/areas	5	5	3	20
Jobs per rig/area	100 to 150	100	100	100
Exploration and drilling jobs*	500 to 750	500	300	2 000
Transport/trucking jobs**	N/A	20	40	275
Power station jobs (by 2050)***	0	0	80	300
Total eventual jobs (regardless of where employees are from)	500 to 750	520	420	2 575
Initial % employees from within the study area	20%	15% to 35%	15% to 35%	15% to 35%
Initial number of employees from within the study area	100 to 150	80 to 180	60 to 145	390 to 900



**Thank you**

**<http://seasgd.csir.co.za/>**

