

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR
GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Settlement Planning, Disaster Management and related Social Impacts Report

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Draft v3 Report for Stakeholder Review

Settlement Planning, Disaster Management and related Social Impacts

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ABBREVIATIONS AND ACRONYMS

COGTA	Department of Co-operative Governance and Traditional Affairs
DAFF	Department of Agriculture, Forestry and Fisheries
DisM	Disaster Management
DM	District Municipality
EA	Enumerator Area
EIA	Environment Impact Assessment
FBB	Fire Brigade Board
FBSA	Fire Brigade Services Act (1987)
FPA	Fire Protection Association
ICDM	Inter-ministerial Committee on Disaster Management
IDP	Integrated Development Plan
IFRC	International Federation of Red Cross and Red Crescent Societies
LM	Local Municipality
MHI	Major Hazardous Installation
MSA	Municipal Systems Act
NAFSAC	National Fire Services Advisory Committee
NDMC	National Disaster Management Council
NGO	Non-Governmental Organisation
NSDF	National Spatial Development Framework
PGDS	Provincial Growth and Development Strategy
PIPA	Pipelines and Informed Planning Alliance
PSDF	Provincial Spatial Development Framework
RSDF	Regional Spatial Development Framework
SALGA	South African Local Government Association
SAPS	South African Police Service
SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SOE	State Owned Enterprises
SPLUMA	Spatial Planning and Land Use Management Act
StatsSA	Statistics South Africa
TRB	Transportation Research Board
UNDP	United Nations Development Programme
USAR	Urban Search and Rescue

SUMMARY

This chapter aims to identify key social, settlement planning and development considerations relevant to the development of the gas pipeline corridors for South Africa, and to outline the various parties that need to be involved in disaster management as part of the proposed gas transmission pipeline operations.

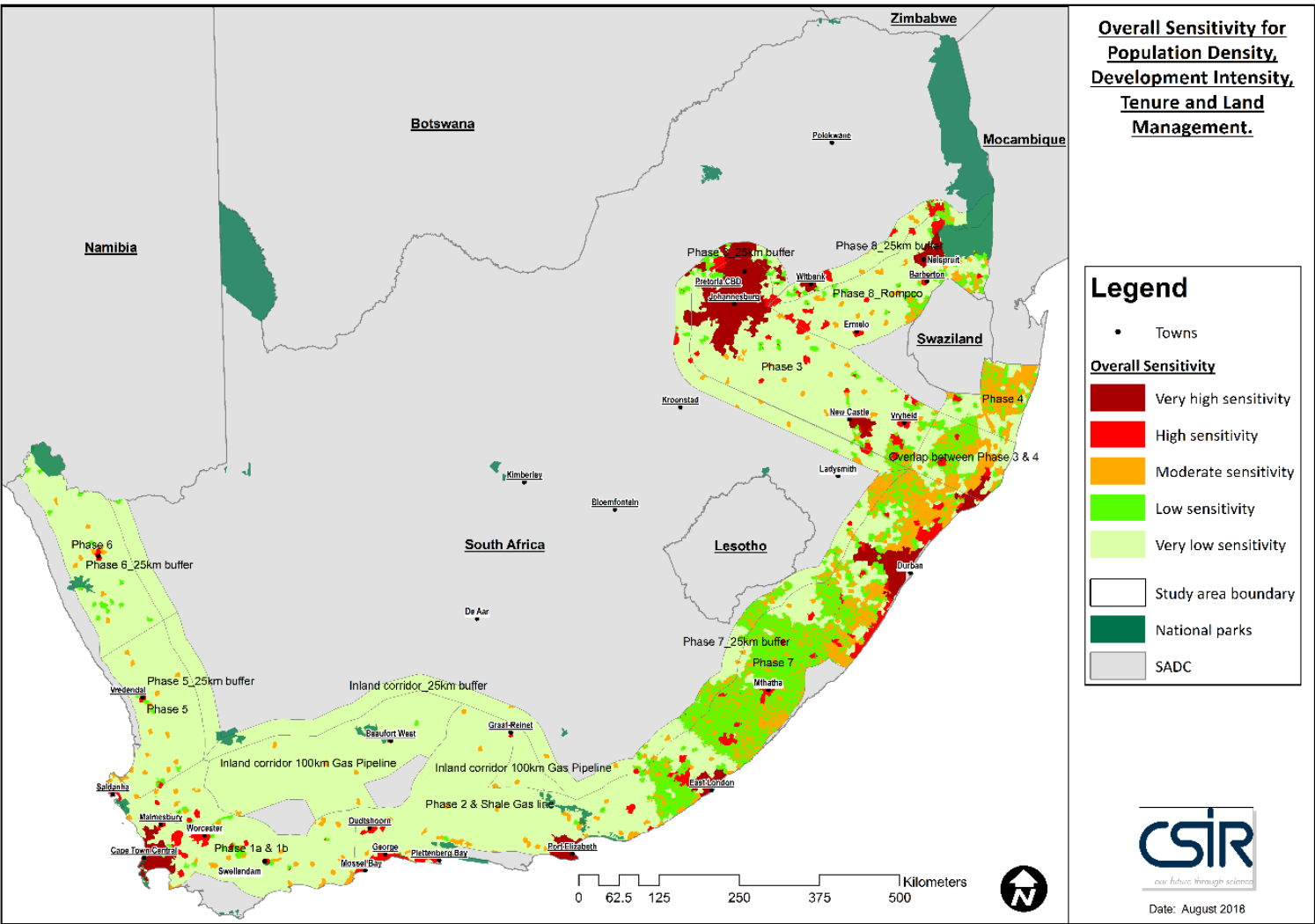
The study seeks to refine and optimise the location of the proposed gas pipeline corridors. It considers the planning of the gas pipeline network from a social, spatial planning and disaster management perspective identifying issues and opportunities in determining the final extent of the gas corridors.

The proposed development of gas pipelines in South Africa would be aimed at enabling the much needed economic growth, as well as realising national development objectives related to achieving a more sustainable energy mix for the Country (IRP 2018). While the proposed gas transmission pipeline corridor is intended to be kept outside cities and towns, these areas, due to population and economic agglomeration, also form the anchor points for future gas demand. **Construction of a gas transmission pipeline has the potential to cause substantial disruption to lives and livelihoods should it be constructed within (or very close proximity to) existing or future settlements.** Negative impacts of a gas transmission pipeline may manifest in land-use management implications (e.g. alienation of existing land uses making these uses untenable), tenure management considerations (i.e. number of landowners and municipal authorities affected), the potential need for resettlement, restriction in future development potential of a parcel of land and negative impacts on service delivery and local economies. Areas of **high population density are therefore foreseen as highly sensitive in relation to exposure to the planned gas transmission pipeline.** These specifically include cities, large coastal and inland towns and other densely settled areas. **Settlement and economic development nodes** play critical roles and are therefore also regarded as **highly sensitive (in terms of social and planning related impacts) when identifying the optimum gas transmission pipeline corridors.** Economic development nodes (such as IDZ, SEZ etc.) are however also regarded as areas of future development which could benefit from the availability of gas and will be taken into consideration when finalising the alignment of the proposed corridors.

High levels of sensitivity related to institutional and land-use management and development of regulatory systems are foreseen in cities and large towns due to the number of landowners and municipal authorities that would be affected. Lower levels of sensitivity are foreseen in sparsely populated areas and in small towns. The overall sensitivity for settlement and development planning is shown in Figure A.

While pipelines are generally the safest method of transporting hazardous chemicals, product releases (leaks or ruptures), **if such releases occur**, may constitute a safety risk for the surrounding community during the operational phase. It is thus imperative that careful, coordinated and integrated planning must take place when considering the development of a gas transmission pipeline.

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Figure A: Overall sensitivity with respect to impacts on lives and livelihoods associated with the development of a gas transmission pipeline

The overall suitability of the proposed corridors for the development of a gas transmission pipeline in relation to settlement planning is summarised below (Table A).

Table A: Overall sensitivity with respect to impacts associated with the development of a Phased Gas transmission Pipeline

Corridor	Overall suitability in terms of population, settlement planning and development and land use management
West Coast Corridor Phases 5 and 6	Suitable with limited settlement sensitivities. Higher sensitivity around service towns.
Southern Coastal Corridor (Phases 1 and 2)	Suitable - Highest levels of sensitivity within the vicinity of the greater Cape Town City Region area and around the coastal cities and medium sized service towns.
Inland Corridor (Central Karoo area)	Suitable with limited development sensitivities - Higher sensitivities around service towns. Mostly low sensitivity related to sparsely populated area with clusters of settlement and development related activities and land-uses.
Eastern Cape & KZN Coastal areas (Phase 7, Phase 3 and 4 overlap and Phase 4)	High levels of sensitivity around the bigger eThekweni - Pietermaritzburg City Region areas, Richards Bay urban complex, large and densely developed service towns and coastal settlement corridors. Moderate to high levels of sensitivity in dense rural settlement areas, where land use management and land administration systems and processes, respectively rests with and needs to involve, local municipalities and traditional authorities.
Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)	High levels of sensitivity around the bigger Gauteng City Region areas, major urban complexes, large towns and densely settled rural areas due to the large number of people and significant concentrations of livelihood-, service and economic related activities potentially impacted by planning and construction.

Disaster management

A disaster is considered to be a pipeline incident that causes a serious disruption, occurring over a relatively short time, of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Furthermore, it is assumed that various factors will influence the magnitude of the disaster such as vulnerability (of the affected people or the environment), the hazard (rupture, fire or explosion) and the capability to respond to it (access to suitable resources).

A pipeline incident can result from the operation of the gas pipeline system itself (e.g. aging, corrosion etc.), natural disasters or from a human error (e.g. breakages or pipeline strikes during maintenance work on other infrastructure). **The availability of Infrastructure masterplans is deemed an important dimension of disaster management** and it is critically important that relevant authorities have infrastructural maps to guide maintenance workers.

Safety and disaster management are key aspects of gas transmission pipeline planning and operations. These are critical matters for the pipeline operators themselves, but also for public agencies such as the local fire departments who are often the first responders in disasters, and have to manage subsequent impacts and recovery processes. **Disaster management, therefore, requires collaboration between public agencies and private-sector pipeline developers and operators.** It is critical that such collaboration is built up and sustained long before any incidents occur. **Institutional relationships also need to be clarified before disasters happen.** Very often, disasters are accompanied by conflict and confusion regarding the hierarchy of decision-making. This causes delays in disaster management interventions and recovery activities.

National, provincial and municipal governments need time, funding, staff and skills to develop disaster management capacity. In South Africa, municipalities vary from highly effective and resourced, to very under-capacitated. Very often, under-capacitated municipalities will require sustained guidance and assistance. The Disaster Management (DisM) component of this study focuses on the DisM preparedness (including institutional capacity and resilience) of South African government agencies. According to the Disaster Management Plan (2002) and the Amendment Act (2015), each metro, district and local municipality must establish capacity to respond to disasters they are exposed to. **The fire-fighting capabilities of the affected municipalities were considered as a proxy for the DisM preparedness of a**

municipality and, where available, were reviewed as part of this study. The review of the DisM preparedness of local municipalities within the gas corridors to respond to a disaster is shown in Figure B below. Overall, the West Coast and Southern Coastal Corridors have a good to fair fire-fighting preparedness currently in place. In contrast, municipalities within the Inland Corridor, Eastern Cape & KZN Coastal areas as well as the Northern and Gauteng Corridors will require disaster management preparedness in these areas should be addressed prior to the commissioning of pipelines.

A single incident could have major impacts through loss of life, possibility of injuries or environmental impacts, due to high operating pressures and large volumes of escaping gas, causing an explosive atmosphere. Pipeline incidents and disasters have specific management requirements. First responders and fire-fighters need to know the correct procedures, e.g. isolating the damaged section of the pipeline. Recovery management is a complex and often expensive phase, requiring several public agencies. It may also be important to reassure and empower communities about future safety precautions and the role that they can play to manage a pipeline disaster.

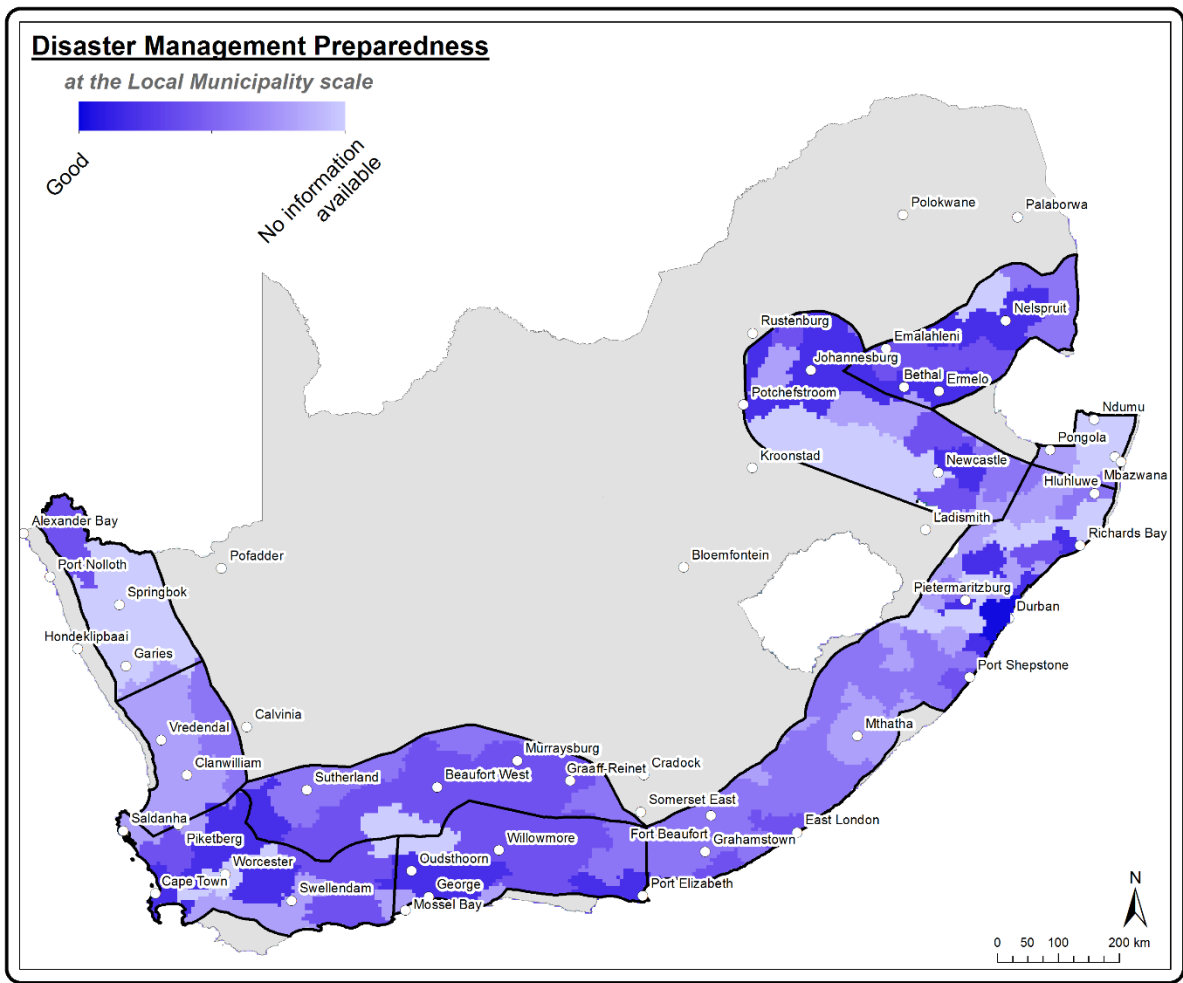


Figure B. Overall local municipal DisM preparedness

1 SCOPE OF WORK

With over 53% of the population living in Metros, Cities and Large regional centres, 18% in small and medium service centres and a further 5-6% living in small towns and villages in rural areas, settlements and larger urban conurbations are the key drivers of economic growth and are expanding rapidly to accommodate growth in urban populations in South Africa (van Huyssteen et al, 2018). The proposed large scale gas transmission pipeline corridor intervention is of strategic nature, with an extensive national footprint traversing almost all provinces (as illustrated in the Project Description Chapter). If correctly implemented, economically feasible and well located, the proposed gas pipeline network can contribute positively to the energy mix of the country and have a positive economic impact in the longer term.

Ongoing urbanisation and growth in service and enterprise related investment and needs in fast growing cities and large towns will not only result in an increased energy demand, but most likely be accompanied by an increased demand for natural gas as part of a more sustainable energy mix. To support government's directive (NDP, 2011) to improve the energy mix and provide more sustainable and financially viable options to support national and local development objectives (including the growth of the green economy, curbing emissions and stimulating innovation and enterprise development), timeous planning, design and possible construction of an enabling natural gas transmission pipeline in support of a network of cities and towns will be required.

The proposed gas transmission pipeline design needs to consider ways to maximise regional and local development impact of potential gas resources, as well as minimise and mitigate any potential risks and unintended consequences on the well-being of people and places – including risks to health (e.g. pipeline incidents), social cohesion in communities, socio-economic development within often already vulnerable local economies and markets, as well as enterprise viability, livelihoods, and increased costs to vulnerable households and enterprises.

While the proposed gas transmission pipeline corridor is intended to be kept outside cities and towns, these areas, due to population and economic agglomeration, also form the anchor points for future gas demand. The subsequent expansion of the gas network to urban areas (via distribution networks) may stimulate the growth of associated industry and business which may increase the demand for industrial land and servitudes associated with local gas reticulation networks. Spatial and economic planning must provide a balanced approach to support growth in the economy, planned settlement growth, and the provision and maintenance of strategic infrastructure, whilst at the same time protecting ecologically sensitive areas and critical ecological infrastructure.

If avoidance of highly populated areas is not feasible, negative impacts of a gas transmission pipeline may manifest in land-use management implications (e.g. alienation of existing land uses making these uses untenable), tenure management considerations, the potential need for resettlement, restriction in future development potential of a parcel of land and negative impacts on service delivery and local economies.

At a national and regional scale, it is pertinent that the proposed gas transmission pipeline corridors are designed in such a way that the investment in large scale infrastructure is done in support of current and planned future economic nodes and corridors for South Africa in the most effective and sustainable way. To achieve this, national and regional design considerations would need to include:

- The location of existing and future national and regional nodes and corridors (considering growth areas, as well as government, private sector and people-centred built-environment investment focus areas that will most likely require such energy resources over the long term), as well as strategic economic investment areas with relatively long term spatial footprint. The proposed gas transmission pipeline corridor traverses much of South Africa, enabling connection between and within significant economic and development nodes and development corridors of the country. It covers almost the entire coastal belt with links to Gauteng from Richard's Bay and onward to Maputo via Mpumalanga.

- The location of potential gas resource access (sources, as well as e.g. existing connections to significant gas resources) and inter-modal transfer points (from land to sea based), thus considering port connections per se;

At regional and local scale, it is pertinent that the proposed gas transmission pipelines are designed to ensure the most viable, cost effective and impact limiting construction and operation. The proposed national pipeline corridor will traverse a quite diverse regional and local settlement and socio-economic development context, often concentrated within the range of cities, towns and settlements. The proposed transmission pipeline will traverse diverse settlement and socio-economic contexts, often within the vicinity of cities, towns and settlements. The proposed corridors includes the sparsely populated and arid western areas of the country, through the developed, heavily populated Southern Corridor, and the densely populated rural traditional authority areas of the country which are also the country's most critical water resource areas.

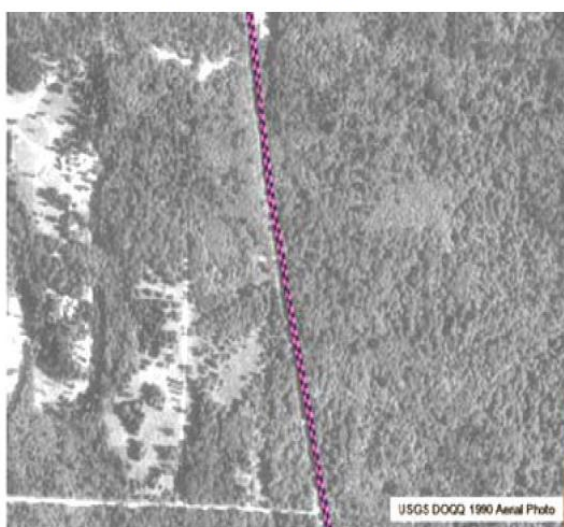
At national, provincial and sub-regional scale consideration of the different contexts of which the corridors consist will be critical to ensure the greatest development return, for the most sustainable long term infrastructure investment. It is imperative that, irrespective of whether the pipeline is developed or not, careful, coordinated and integrated planning must take place.

1.1 Integrated spatial and development planning

1.1.1 International Gas Pipeline Development: why is spatial and development planning important?

On an international scale, the United States (US) depends heavily on the transportation of fuels and gas via underground pipelines. As in many other countries, land use planning in the US is driven by development and population growth. Accordingly, land use planning is more detailed and structured in urban areas compared to rural areas. Rural areas therefore normally lack detailed zoning requirements in terms of allowable land-uses around pipelines. The problem with this is that even where areas were historically rural, due to urbanisation; these areas may now become developed and populated (Transportation Research Board (TRB), 2004). This is clearly shown in Figure 1 below, where a pipeline was developed in a rural area in 1990, with no development around it, and in 2002 the same piece of land is surrounded by a dense urban complex. With urbanisation, the likelihood of land development encroaching on transmission pipelines is increasing and with this, the risk of pipeline incidents causing casualties and/or extensive damage to properties also increases (TRB, 2004).

1990 - Undeveloped land around pipeline



2002 - Same land, developed



Figure 1: Development near a Transmission Pipeline in Washington State, US 1990-2002 (PIPA, 2015)

The TRB published a Special Report in 2004 with the primary objective to develop a risk-informed guidance document that could be used in land-use decisions (TRB, 2004). The report noted that pipeline safety and the regulation thereof are normally on a national level, while land-use regulations specifically relating to pipeline related matters occur on a local level, which vary considerably in how it is managed. As per the report, a key intervention noted in the report is:

“Local and state governments have little or no technical guidance available to assist them in managing the risk of the increasing number of people in proximity to pipelines through regulations and other tools governing land use, planning, zoning, and subdivision. Some local governments are proposing and developing new approaches to managing risk. However, state governments could take more of a leadership role, both in providing technical assistance and in requiring local governments to develop plans and regulations to prevent and mitigate damage from pipeline spills and explosions” (TRB, 2004).

Within Canada, guidelines have been developed to address the land-use issue around pipelines (MIACC, 1999). The MIACC noted that local governments were not aware of the location of pipelines and these were therefore not included in land-use planning and regulations. This meant that there was an increased cost to pipeline developers to maintain a pipeline that was not historically located in an urban area but due to urban sprawl, now occurs adjacent to, for instance, a hospital or school. In addition, human activity such as excavation with machinery around pipelines increased risk of incidents occurring (MIACC, 1999).

From a developing country perspective, the Bolivia-Brazil Pipeline Project (referred to as GASBOL) was established to primarily supply the Brazilian market with Bolivian gas, via a 3150 km long pipeline that traverses two countries (i.e. Bolivia and Brazil) and various states. Because of the length of the pipeline, GASBOL faced various significant environmental, institutional and social issues. The final routing of the pipeline was informed by environmental sensitive and densely populated areas that should be avoided (Quintero, 2006). Several lessons learned were highlighted, following the development of the pipeline, and include:

- Tools such as regional Environmental Assessments, SEAs and Analysis of Cumulative Effects can ensure that wider ranging project impacts are considered and addressed early in the project planning phase;
- Greater coordination between project engineering and environmental planning activities should have taken place; and
- Mapping of sensitive areas should be prepared before construction begins (Quintero, 2006).
- Environmental concerns should not overshadow social health and safety issues

As noted in Giovanni Ramírez-Camacho et al (2017), land-use regulations are essential to ensure a safe distance between the pipeline and inhabited zones. This is especially important for new pipelines but also in areas where urbanisation is occurring around existing pipelines.

1.1.2 Relevant South African Planning Related Policy

Given the international experience and applying it to South Africa, the alignment of long term infrastructure investment with current and future growth nodes on a national, regional and local scale will be critical. Within this regard, the following planning instruments provide direction and would need to be considered in future design and development phases:

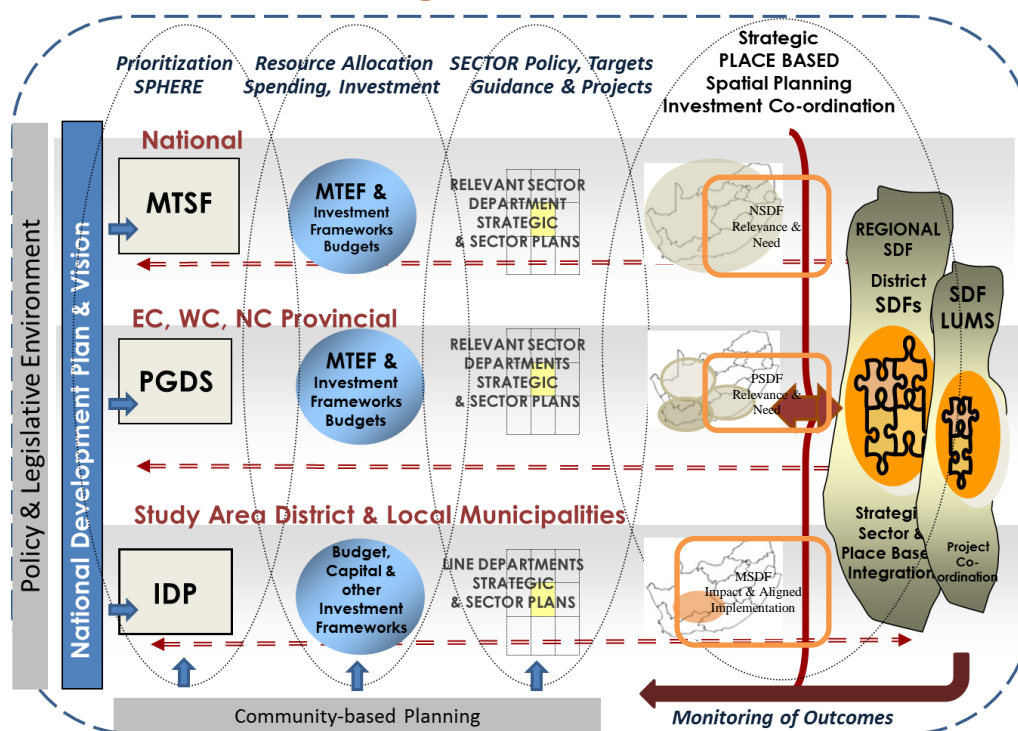
- National Spatial Development Framework (NSDF) – The first Draft of the NSDF is being prepared by the Department of Rural Development and Land Reform (DRDLR) in Collaboration with the Department of Planning Monitoring and Evaluation (DPME). The current draft version of the Draft NSDF, 2018 clearly highlights (1) the importance of cities, regional towns and service nodes in gearing up for increased urbanisation, population growth and associated people centred economic activities, to support the current transitions in the national economy, and (2) the importance of cities, towns and service nodes as anchors in regional development and spatial transformation for South Africa. The growth of settlements within the coastal corridors and in existing in-land nodes

up to 2050 is also clearly highlighted. At a national level various industrial and economic development interventions are also aimed at supporting employment and inclusive growth for the rising population in these spaces, including opportunities for enterprise development, a wide range of green and blue economic and industrial activities and the importance of recognising the limitations and potential associated with natural resources, recognising interrelationships in the energy, water and food nexus.

- Within the various provinces, the regional development priorities are typically captured within the provincial growth and development strategies (PGDSs) and provincial spatial development frameworks (PSDFs), under review every 5 years, and of value in considering socio-economic impact of the proposed gas transmission pipeline. The current frameworks highlight the importance and growth potential of significant cities and towns, and also place significant emphasis on context specific regional economic drivers and alignment of infrastructure investment in support thereof.
- Within a local context, investment planning and implementation of various agencies need to be incorporated into, and influenced by, municipal integrated development planning processes and subsequently reflected in municipal Integrated Development Plans (IDPs) and municipal Spatial Development Frameworks (SDFs). Large scale infrastructure investment design and implementation at municipal level will need to consider planned sector investment focus within Integrated Infrastructure Investment Frameworks (provincial and municipal), Capital Investment Frameworks (municipal) and spatially targeted budgeting instruments introduced and under development by National Treasury (i.e. within cities and intermediary cities), as well as sector specific integrated housing plans, integrated transportation plans and integrated disaster management plans;
- With regards to land development, the relevant land-use management schemes must be used to guide spatial development and change of land-uses. Land-use-management schemes are largely in place for towns, however in many cases not yet completed or managed with the necessary capacity in many local municipalities. In the Western Cape, local municipalities have all complied to the requirements of the Western Cape Land Use Planning Act (LUPA) (introduced in accordance with the national Spatial Planning and Land Use Act (SPLUMA)).

Integrated spatial and development planning and intergovernmental alignment with regards to infrastructure investment and management is therefore critical in enabling sustainable and coordinated development within the respective regional contexts. Coordinated inter-governmental planning with regards to national and regional infrastructure investment, to enhance developmental impact and efficiency, and diminish any negative impacts at local level is also quite a challenge in the context of a plethora of spatial and integrated development planning and governance instruments (see Figure 2), all requiring annual review, adaptation and alignment.

Place based intergovernmental co-ordination



Adapted from Oranje & Van Huyssteen 2010

Figure 2: Overview of Relevant Integrated Spatial and Development Planning Instruments
(Adapted from Oranje and van Huyssteen 2010)

It is both (1) legally mandated and (2) evident that government needs to create an enabling and guiding context for development and investment in the country through effective pro-active and coordinated planning, budgeting and targeted investment and governance, the risks and mitigations associated with the possible impact of the gas pipeline extension on land, infrastructure and settlements could, in many respects also be addressed through such pro-active planning.

The servitude planning and proclamation will need to comply with local land use planning regulation and be included in negotiations as part of Local SDF and Land Use Management Schemes all of which need to comply with the SPLUMA regulations or provincial regulations, where provincial planning legislation is in place (such as for parts of the corridor that fall within the Western Cape Province).

There is a wide range of development activities directly and indirectly related to pipeline development. However the key focus of this chapter is specifically in highlighting implications related to urban development and spatial planning. Consideration with regards to land development in the chapter is more focussed on the impact for the developer, within the area related to the number of stakeholder that the developer will have to engage with in obtaining the required rights for servitudes and pipeline construction than land use change applications per se. No consideration was given to differential land value, neither the different use value or intensity of use or attachment of individuals to any land parcel given that this data is not readily available. Should this be considered relevant, such studies will have to be undertaken and the data purchased or surveys undertaken. This can more realistically be done closer to development once all other factors environmental and geo-technical factors have been considered. Nonetheless considerable support will be required by municipalities with regards to capacity and resources to effectuate the institutional arrangements and processes to support municipal orientated land use decision-making required within SPLUMA as related to planning permission and servitude declaration.

The challenges related to ensure high quality wall-to-wall land use management schemes, to enhance collaboration between tribal authorities and municipalities with regards to management of land

development rights in many areas, to streamline possible procedural uncertainties and to increase capacity within the complex regulatory system, are well recognised.

The process associated with prioritisation of certain phases and time lines of the gas transmission pipeline will need to consider the need and relevance for national and regional development objectives and will require identified need, priorities for phasing and prioritisation for implementation.

The process associated with acquiring the required rights, with detailed planning and implementation of gas transmission pipeline development will need to be designed to contribute to integrated and coordinated planning and governance between different authorities and especially local role players in the region to ensure that development is done considering the public good and impact on local economies and the vulnerable.

1.2 Disaster Management

1.2.1 What is a disaster?

The International Federation of Red Cross and Red Crescent Societies (IFRC) defines a Disaster as a “serious disruption, occurring over a relatively short time, of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts, which exceeds the ability of the affected community or society to cope using its own resources” (IFRC, 2018). This is further supported by the definition outlined in the Disaster Management Act (Act 57 of 2002) that defines disaster as a progressive or sudden, widespread or localised natural or human-caused occurrence which:

1. Causes or threatens to cause (i) death, injury or disease; (ii) damage to property, infrastructure or the environment; or (iii) disruption of the life of a community; and
2. Is of a magnitude that exceeds the ability of those affected by the disaster to cope with its effects using only their own resources.

Factors that influence the magnitude of a disaster are vulnerability (this can be people or the environment), the hazard (fire, leak, or explosion) and the capability to respond to it (access to resources) (IFRC, 2018). A pipeline incident can result from the operation of the gas pipeline system itself (aging, corrosion etc.), or from a human error, or they may be an indirect result of another emergency such as a structure fire or motor vehicle crash (Parsley and Schwab, 2000). Incidents may also be caused, directly or indirectly, by natural events such as storms and flooding. An incident that cannot be managed by local resources would be considered a disaster.

Compared with other methods for transporting hazardous chemicals, such as rail or road, transmission pipelines are relatively safe and transmission pipeline accidents have caused few fatalities. However, a single incident can have devastating environmental, health, and economic consequences (Osland, 2015). In addition to acute accidents, chronic spills from transmission pipelines can have negative repercussions on human health and the environment through contamination of drinking water, reduction in air quality, or other long-term environmental damage. Gas pipeline accidents would therefore qualify as disasters.

1.2.2 The responsibility to Disaster Management in South Africa

South Africans have relatively little experience of gas pipelines and Disaster Management (DisM). DisM in the South African context, and the capability of public institutions to anticipate, prevent, manage, and mitigate potential gas-related disasters must therefore be adequately considered to ensure that risks are appropriately identified and managed. DisM as a function typically has to be shared between government (representing the public good and public resources) as well as key organisations (such as Pipeline Developer). Each party needs to play a critical role in managing DisM. Governments are best able to cope with large, uncertain risks and key organisations (such as the Pipeline Developer), in turn, have the technical expertise required to deal with complex high-tech incidents. Disasters are much better prevented than managed, and this requires pre-emptive capacity-building. When disasters happen, they are best

managed in collaborative ways, bringing together political, fiscal and technical resources. For this to happen, institutional capacity must be systematically developed. Furthermore, community empowerment is critical – in terms of understanding risks, appropriate responses, and community-level forms of assistance during actual disasters. Every single dimension of resilience which is built before a disaster pays handsome dividends if and when a disaster were to occur.

This raises the question of the capacity of the state, within its various agencies, to undertake the DisM function. The financial issue is a critical one: the issue for some governments is not only the absolute size of the risk; it is also the relative ability of a municipality or a country to dedicate resources to dealing with the risk (Freeman 2003:38). If Government is generally under financial pressure, then it is difficult to move resources from other sectors to the DisM function. This trade-off is faced almost anywhere in the world, where limited budgets have to be allocated to competing priorities and functions. Funding Disaster Management is always a challenge, because this has to be done before disasters happen; many stakeholders prefer to spend scarce funds on immediate and pressing functions. In South Africa, this phenomenon has been exacerbated because there is almost no specific funding allocated for disaster risk reduction efforts across the spheres of government (PMG, 2015).

In fact, the degree and types of disaster planning in place in developing countries vary considerably. The existence of government agencies says nothing about the quality of their operations in either planning or managing disasters (Quarantelli 2003:218). There may well be DisM policy papers and legislation in place, without it being translated into practice, either because of a lack of political will, or inadequate planning, or financial constraints. South African municipalities' lack of planning and management capacity have been extensively highlighted (e.g. Atkinson 2009; Koma 2010). In March 2018, the Minister of Co-operative Governance and Traditional Affairs (COGTA), Mr Zweli Mkhize, found that 31% of municipalities are almost dysfunctional, and a further 31% are fully dysfunctional. He announced a rapid programme of support for "municipalities in distress" (<http://www.cogta.gov.za/?p=3447>).

Another challenge is that disasters may need to be managed in cross-jurisdictional ways. Pipeline hazards, in particular, may be a regional issue. Pipeline ruptures could affect several communities or jurisdictions. Pragmatic forms of intergovernmental collaboration may well be required for hazard mitigation (Osland 2015).

Interestingly, pipeline-related hazards have often been accorded low priority, with a lack of stakeholder interest in pipelines, inconsistent regional policies for pipelines, and insufficient knowledge about pipelines (Osland 2015, writing about the United States). People are less likely to prepare for low-probability high-impact events (such as pipeline accidents) than for high-probability low-impact events (such as winter weather). The underground location of transmission pipelines may create a perception that they are less risk-prone.

A central theme in contemporary approaches to DisM is to promote risk mitigation, and to build resilience. Disasters are much better prevented than managed, and this requires pre-emptive capacity-building. When disasters happen, they are best managed in collaborative ways, bringing together political, fiscal and technical resources. For this to happen, institutional capacity must be systematically developed – and this may take years. Furthermore, community empowerment is critical – in terms of understanding risks, appropriate responses, and community-level forms of assistance during actual disasters. Every single dimension of resilience which is built before a disaster pays handsome dividends if and when a disaster were to occur.

2 SCOPE OF WORK

This chapter provides guidance on the alignment of the proposed gas corridors and assesses potential impacts that the construction of a gas transmission pipeline within the proposed corridors may have on communities' livelihoods, including well-being in local communities and safety hazards, temporary construction related job creation, disruption of population and service delivery. For the operational phase, the assessment considered the preparedness of public institutions to effectively respond to a disaster.

This chapter does not consider the economic opportunities, location of key industries and developments or key bulk users that may benefit from having access to the gas pipeline network. A separate high level economic opportunities assessment was undertaken to inform this SEA.

2.1.1 Construction phase considerations

The alignment planning, servitude demarcation and construction of the pipeline will have wide-ranging impacts on settlement and development fabric in all parts of the identified final corridor and can potentially impact land development, town growth and sustainable regional and settlement development. This study therefore also examines implications related to urban development and spatial planning, effects of the construction of a gas transmission pipeline on land use management (land use application, servitude proclamation and the required changes to land use schemes, if and where applicable, risks of resettlement, development pressure) and anticipated complexities where the gas transmission pipeline would cross land on communal tenure (tribal authority areas).

The implications of gas transmission pipeline construction on agricultural land use are briefly addressed within a separate chapter on Additional Impacts linked to the Gas Pipeline.

Once the construction is complete and affected land restored to the same or better level of development, the impact on the built environment will be negligible with the exception of any severance impact of servitudes. Land access for maintenance and/or accidents is considered to be low / unlikely. Thus a sensitivity assessment of this phase is not considered separately as it is encompassed in the planning stages with respect to servitudes.

Given the closed linear nature of pipelines, any post construction benefits (if any) to the community, can only be considered at specific identified interface / distribution nodes once specific interface points are identified. The identification of the locations of any interface point is unlikely until such time as a final alignment is selected. Thus any impact of specific distribution / interface locations cannot be considered at this time. Suffice to say, if gas becomes available, any town which has significant industry activity would have an alternative energy supply option available, but the likely derived benefit will be subject to costs of gas versus other energy forms available as well as technological and manufacturing feasibility. Another key question is the funding and construction of the local gas reticulation network to transport the gas transmission pipeline to the end users. There is insufficient information available to assess any benefit to a community at this stage.

2.1.2 Operational phase considerations

Although ruptures of gas transmission pipelines are relatively rare, impacts on surrounding communities in such an unlikely event may be catastrophic. Safety and disaster management are therefore key aspects of gas transmission pipeline planning and operations. The question of DisM, in the South African context, and the capability of public institutions to anticipate, prevent, manage, and mitigate potential gas-related disasters are therefore also considered in this Chapter. Several key factors need to be noted:

- The South African governmental “architecture” is very complex, due to the significant degree of decentralization which is built into the Constitution. National, provincial and municipal governments have complex allocations of powers and functions.
- The fire-fighting task is fundamentally bifurcated – between urban-focused legislation on Fire Brigades, and rural-oriented legislation on veld and forest fires. Each of these approaches involves a different institutional sector – respectively, the Department of Co-operative Governance and Traditional Affairs (COGTA), and the Department of Agriculture, respectively.
- In practice, intergovernmental relations are as much determined by organisational capacity as it is by Constitutional or legislative procedures. Such institutional capacity includes factors such as the tax or resource base, the number and type of staff, the level of skills, and political coherence.

- Various pieces of legislation, passed at different times in history, may still be relevant, and interact with one another in complex ways. In particular, the fire-fighting function is still largely “governed” by an Act passed in 1987, with several subsequent adjustments.

3 APPROACH AND METHODOLOGY

This assessment includes basic socio-economic conditions, land uses and key towns within the proposed gas corridors. The following socio-economic indicators have been used:

- Population numbers;
- Population growth (1996 to 2016);
- Population density;
- Economic sector and economy size; and
- Unemployment levels;
- Settlement footprints.

3.1 Sensitivity analysis in support of key social, settlement planning and development considerations

The sensitivity of the study area towards to the construction and operation of a gas transmission pipeline network will be assessed with respect to three key components of the built environment (refer to Appendix A.1 and A.2 for a description of data processing used to define the sensitivity criteria):

- Sensitivity in terms of population density: the number of people, households and dwellings affected. Due to the potential impact of construction and/or potential safety hazards related to the gas transmission pipeline construction and operation on lives and livelihoods of people within the proposed identified corridors, the areas of high population density are foreseen as highly sensitive in relation to the planned gas transmission pipeline. These specifically include cities, large coastal and inland towns and other densely settled areas.
- Sensitivity in terms of development intensity and extent: settlement development and economy extent, size and complexity. Settlement and development nodes play critical roles as:
 - Dense clusters of complex socio-economic and ecological systems providing access to housing, services and livelihood opportunities;
 - As anchors in local and regional economies through agglomeration benefits for social and economic functions;
 - Provision of centralised social services within the broader areas;
 - As infrastructure nodes within transport, trade, service delivery and engineering service networks.
- Sensitivity in terms of land-use management and tenure: the complexity of the land ownership issues in different parts of the proposed gas corridors. The key characteristic of this component is the number of impacted land holders and municipal authorities.

Consideration with regards to land-use management and tenure in the chapter is more focussed on the impact for the developer, within the area related to the number of stakeholders that the developer will have to engage with in obtaining the required rights for servitudes and pipeline construction than land use change applications per se. No consideration was given to differential land value, neither the different use value or intensity of use or attachment of individuals to any land parcel given that this data is not readily available. It must be noted that agricultural value has been included as part of the agriculture sensitivity analysis and impact assessment. Should this be considered relevant, such studies will have to be undertaken and the data purchased or surveys undertaken. This can more realistically be done closer to development once all other environmental and geo-technical factors have been considered and once a final route has been identified.

In terms of assessment of land ownership and the likely complexity of negotiations, the assessment considered the likelihood of the pipeline passing through Tribal Authority land that is communally owned and managed versus land that likely to have freehold title. It should be duly noted that in addition to Tribal Authority Land (Former Bantustans and TBVC states) other forms of communal tenure exist elsewhere in the country. Most of this communal land is held (owned) by the State and registered under the Department of Rural Development and Land Affairs. Examples include parts of the Northern Cape Richtersveld region as well as parts of the Eastern and Western Cape claimed by KhoiSan indigenous people. Land tenure, usufruct and land use rights (especially of communal land) are highly complex and subject to several recent legal processes and findings in South Africa. It is thus proposed that once the pipeline alignment is closer to finalisation that this issue is considered in local context and considering the current status quo.

Further due to the sensitivity with regard to the extent and ownership of the land, unresolved land claims and any potential “expropriation” and the use of State land for land restitution purposes; this data is not readily available, and GIS layers cannot be made publicly available in GIS format.

3.2 Status of municipalities preparedness

The following procedure was used to get a basic profile of strengths and weaknesses of the various municipalities (a total of 163 municipalities were surveyed) in terms of Disaster management preparedness:

1. Using the website www.municipalities.co.za (hosted by National Treasury) as the key source of information.
2. Selecting municipalities’ annual reports required to be submitted to National Treasury. This is a very useful repository, as information is provided according to specific formats. The latest report available (usually 2015/2016 or earlier version) was consulted. Difficulties arose when municipalities either did not supply such annual reports, or they were only partially filled in, or they used other formats which failed to provide comparable data.
3. Where annual reports were unavailable or incomplete, municipal Integrated Development Plans (IDPs) were consulted. However, IDPs generally focus on future goals and targets and do not often provide *actual* status quo information, in addition, in some cases IDPs were also not available.

Where comparable information was available, the following data was extracted, as indicators of municipal preparedness which was ranked from “marginal” to “good”:

1. Their status as **“main” or “satellite”** fire-fighting offices.
2. Number of fires and incident call-outs.
3. Number of fire fighters, disaster management volunteers and volunteers.
4. Number of vacancies (unfilled posts).
5. Number of “appliances” (vehicles and specialised equipment).
6. The repairs expenditure, to show municipal commitment to Operations and Maintenance.

Results of this assessment are shown in Figures 7 and 8.

3.3 Data Sources

Table 1: Data Sources

Data title	Source and date of publication	Data Description
CSIR Functional Town Areas, 2018	CSIR, 2018	Set of settlements or settlement areas classified largely on the basis of economic and demographic information. Drawn on the base of the CSIR mesozones from 2017. (See Appendix E for description of CSIR Functional Town Typology, 2018)
Settlement footprint layer, 2017	CSIR, 2017	This item aims to provide a more accurate extent of the built up footprints of South Africans settlements. It uses the Enumerator Area (EA) layer as the base, but manual adjustments were made where an EA extends beyond the built up areas.
Demographic information, disaggregated	Base Sources: StatsSA, 2011, Quantec, 2016 Spatial specific indicator: CSIR, Meso-frame Socio-Economic Indicators, 2017	This consists of a series of datasets from various sources as indicated. The CSIR Built Environment department has developed an algorithm, based on a hybrid method between dasymetric mapping and areal interpolation, to re-assign the socio-economic data from these different sources to the relevant analysis units, e.g. mesozones or settlement footprints.
Economic information disaggregated	Base source: Quantec, 2016 Spatial indicator: CSIR, Meso-frame Socio-Economic Indicators, 2017	Information drawn from Statistics SA but processed by Quantec to provide a year to year data series. Similar to the demographic information, the information is then processed/assigned to the relevant analysis units.
Major initiatives with potential impact on growth	Plans and development frameworks.	Range of official sector and/or provincial and/or State Owned Enterprise SOE plans and development frameworks.
Various municipalities' annual reports submitted to National Treasury	www.municipalities.co.za	Hosts annual reports submitted by local municipalities to the National Treasury.

3.4 Assumptions and Limitations

This assessment is based on high level information available based on census data and desktop literature available.

No information on the potential employment opportunities during the construction phase, the exact transshipment/distribution points or employment likely at these points and relative quantity and cost of gas or the use were available or explicitly used for this assessment, as such information would be available on a project-by-project basis. Therefore, the following assumptions were made in this regard:

- Limited short term local employment opportunities will be created, mainly during construction;
- Limited long term maintenance employment will be created, mainly with a level of skill required; and
- Some long term employment at main distribution points will be created. Note that the scope of this SEA is limited to the development of high pressure transmission lines, i.e. distribution lines are not included.

Detailed interviews with residents, site visits to the key towns within the corridors, finer scale assessments based on the receiving socio-economic environment of a specific area, direct and indirect employment opportunities and associated benefits would be considered on a project level and have therefore not been considered as part of this assessment.

It is also assumed that industry can make the technology switch to gas if cost effective and that there will be some benefits relating to wider range of energy generation and use options. It is anticipated that there will be no wide scale switch to gas for household use.

In addition, this study focuses on the DisM preparedness (including institutional capacity and resilience) of South African government agencies and not on the capacity of Pipeline Developer since it is assumed that the latter will have adequate technical skills to anticipate and manage possible accidents.

The fire-fighting data used within this analysis is highly specific for the fire-fighting function and must be regarded as, at best, a very limited proxy for actual disaster management capability. Furthermore, comparing DisM preparedness is not a straightforward matter, for at least four main reasons:

1. The sheer number of District and Local Municipalities potentially affected by a gas corridor.
2. The incompleteness of comparable data, in terms of municipal reporting.
3. The difficulties in comparing the balance between District and Local Municipalities, as regards the Disaster Management function (due to the existence of a vast array of possible kinds of relationships).
4. Choosing useful indicators, and appropriate definitions of such indicators, to capture the issue of municipal preparedness appropriately.

The ratings provided to municipalities DisM preparedness (i.e. no available information to good) are not reflective of the municipalities' general ability to effectively govern and/or supply services but is merely used to visually represent a municipality's current preparedness to respond to a disaster. However, given the extent of the corridors and the data available, the information is deemed sufficient in highlighting potential areas of concern.

4 RELEVANT REGULATIONS AND LEGISLATION

Regulations and legislation applicable from an economic, settlement planning and disaster management perspective is outlined in Table 2 Further details on legislation and regulations related to disaster management can be found in Appendix F.

Table 2: Relevant regulations and legislation relevant to gas pipeline development

Instrument	Key objective
International Instrument	
World Bank Operational Policy (4.12) on Involuntary Resettlement (Revised in 2011)	<p>Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. For these reasons, the overall objectives of the Bank's policy on involuntary resettlement are the following:</p> <ol style="list-style-type: none"> (a) Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs. (b) Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs. (c) Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.
International Finance Corporation (IFC) Performance Standards (PS) on Labour and Working Conditions (2012)	<p>For any business, its workforce is its most valuable asset. A sound worker-management relationship is key to the success of any enterprise. PS2 asks that companies treat their workers fairly, provide safe and healthy working conditions, avoid the use of child or forced labour, and identify risks in their primary supply chain. The key objectives are:</p> <ul style="list-style-type: none"> • To promote the fair treatment, non-discrimination, and equal opportunity of workers. • To establish, maintain, and improve the worker-management relationship. • To promote compliance with national employment and labour laws.

Instrument	Key objective
	<ul style="list-style-type: none"> • To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. • To promote safe and healthy working conditions, and the health of workers. • To avoid the use of forced labour. <p>Performance Standard 2 apply to both direct workers on the Project and also to indirect workers, including requirements in relation to primary supply chain employees and contracted workers and fair treatment of migrant workers. Employers are required to make "commercially reasonable efforts" to ascertain that the third parties who engage such workers are reputable and legitimate enterprises and have an appropriate Environmental and Social Management System (ESMS) that will allow them to meet the requirements of Performance Standard 2.</p> <p>Requirements are also set out for fostering workers organizations in jurisdictions where there is substantial interference in workers' freedom of association. Where these types of restrictions manifest, Performance Standard 2 requires employers to take steps to engage with workers to address issues relating to their working conditions and terms of employment, to the extent permissible by law. Employers must not impede workers from developing "alternative mechanisms" to express their grievances and protect their rights regarding working conditions and terms of employment. Alternative mechanisms include recognizing worker committees and allowing workers to choose their own representatives for dialogue and negotiation over terms and conditions of employment in a manner that does not contravene national law. Such mechanisms must be free from interference, influence or control by employers.</p>
<p>IFC PS on Environmental and Social Sustainability (Revised in 2012), specifically PS 5: Land Acquisition and Involuntary Resettlement, specifically PS 5: Land Acquisition and Involuntary Resettlement</p>	<p>PS 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land.</p> <p>The key objectives are:</p> <ul style="list-style-type: none"> • To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs. • To avoid forced eviction. • To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected. • To improve, or restore, the livelihoods and standards of living of displaced persons. • To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
<p>IFC PS 7: Indigenous People (2012)</p>	<p>PS7 seeks to ensure that business activities minimize negative impacts, foster respect for human rights, dignity and culture of indigenous populations, and promote development benefits in culturally appropriate ways. Informed consultation and participation with Indigenous People throughout the project process is a core requirement and may include Free, Prior and Informed Consent under certain circumstances.</p> <p>The key objectives are:</p> <ul style="list-style-type: none"> • To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples. • To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts. • To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. • To establish and maintain an ongoing relationship based on Informed

Instrument	Key objective
	<p>Consultation and Participation with the Indigenous Peoples affected by a project throughout the project's life-cycle.</p> <ul style="list-style-type: none"> • To ensure the Free, Prior, and Informed Consent of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present. • To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.
IFC's Handbook for Preparing a Resettlement Action Plan (2002)	<p>The purpose of this handbook is to provide guidance in the planning and execution of involuntary resettlement associated with IFC investment projects. IFC's policy on involuntary resettlement applies to any project that may result in the loss of assets, the impairment of livelihood, or the physical relocation of an individual, household, or community. The audience for this handbook includes: IFC clients; host government agencies that support private investment in development projects; nongovernmental organizations; and the people whose lives and livelihoods will be affected by projects financed by IFC.</p>
African Development Bank's (AfDB) Policy on Involuntary Resettlement (2003)	<p>The policy has the following key objectives:</p> <ul style="list-style-type: none"> • To avoid involuntary resettlement where feasible, or minimize resettlement impacts where population displacement is unavoidable, exploring all viable project designs. Particular attention must be given to socio-cultural considerations, such as cultural or religious significance of land, the vulnerability of the affected population, or the availability of in-kind replacement for assets, especially when they have important intangible implications. When a large number of people or a significant portion of the affected population would be subject to relocation or would suffer from impacts that are difficult to quantify and to compensate, the alternative of not going ahead with the project should be given a serious consideration; • To ensure that displaced people receive resettlement assistance, preferably under the project, so that their standards of living, income earning capacity, and production levels are improved; • To provide explicit guidance to Bank staff and to the borrowers on the conditions that need to be met regarding involuntary resettlement issues in Bank operations in order to mitigate the negative impacts of displacement and resettlement and establish sustainable economy and society; and • To set up a mechanism for monitoring the performance of involuntary resettlement programs in Bank operations and remedying problems as they arise so as to safeguard against ill-prepared and poorly implemented resettlement plans.
National Instrument	
The Constitution of the Republic of South Africa (Act 108 of 1996)	<p>Places a legal obligation on the government of South Africa to ensure the health (Personal and Environmental) and safety of its citizens. In terms of section 41 (1) (b) of the Constitution, all spheres of government are required to "secure the wellbeing of the people of the Republic". Section 152 (1) (d) also requires local government "to promote a safe and healthy environment". In light of the above, and the established understanding of disaster management, a primary responsibility for disaster management in South Africa rests with government.</p> <p>According to Part A, Schedule 4 of the Constitution, disaster management is a functional area of <i>concurrent national and provincial legislative competence</i>. This means that national and provincial governments have a legal imperative to ensure that disaster management is implemented according to legislative requirements (i.e. the <i>Constitution of the Republic of South Africa, 1996</i> (Act No. 108 of 1996) and <i>Disaster Management Act, 2002</i> (Act No. 57 of 2002).</p>
Prevention of Illegal Eviction from and Unlawful Occupation of Land Act	<p>This Act came into effect in 1998 and set out to prevent the arbitrary eviction of occupiers of a site. The Act supports the Constitution which states that "No one may be evicted from their home, or have their home demolished, without an order of court made after considering all the relevant circumstances. No legislation may permit arbitrary evictions.</p> <p>This Act sets out the procedure to be followed in the case of such evictions.</p>

Instrument	Key objective
Spatial Planning and Land Use Management Act (Act 16 of 2013): National Spatial Development Framework.	<p>Guiding large scale development priorities and national sector investment. The current draft version of the Draft NSDF, 2018 clearly highlights (1) the importance of cities, regional towns and service nodes in gearing up for increased urbanisation, population growth and associated people centred economic activities, to support the current transitions in the national economy, and (2) the importance of cities, towns and service nodes as anchors in regional development and spatial transformation for South Africa. The growth of settlements within the coastal corridors and in existing in-land nodes up to 2050 is also clearly highlighted. The importance of alignment of large scale infrastructure planning in terms of relevance, need, prioritisation at national and regional scale identified.</p> <p>Section 19-20 of the SPLUMA makes provision for a Regional Spatial Development Framework (RSDF). The drafting of a RSDF may be the correct spatial planning vehicle to use in relation to the proposed bulk gas pipeline where 1) there is uncertainty as to the phasing and the timing of the project which may be implemented over decades 2) there is the need for provinces and municipalities to apply consistent criteria for the assessment of development applications to assist in a situation where most municipalities would not have had to deal with bulk gas transmission pipeline applications before 3) there is a need to bridge the planning gap between an environmental assessment that focuses on the <i>status quo</i> and an Environmental Impact Assessment (EIA) that is reactive to a particular development application 4) the geographical area under consideration includes a number of provinces and municipalities 5) the nature of servitudes, development criteria for bulk, distribution, point gas facilities and gas reticulation consideration for related facilities (e.g. industrial, residential retail uses) can be included in the framework (Note that this SEA only focuses on Transmission gas pipelines) 6) bulk gas servitudes need to be preserved for an extended period of time from urbanisation 7) there are differing capacities within municipalities to undertake SDFs. This would be a means of ensuring that the correct safety measures are included in developments from the planning phase.</p>
Fire Brigade Services Act (Act 99 of 1987)	<p>The Act established a Fire Brigade Board, which would consist of a chairperson appointed by the national Minister responsible for provincial and local government. Other members would be appointed by the four provincial Administrators, two persons designated by the South African Local Government Association, one person designated by the Minister of Finance, one person designated by the SA Emergency Services Institute, and three other persons designated by the Minister (one has to represent organised business, and one to represent organised labour). (Note that several of these government agencies, active in 1987, have subsequently changed their names and functions).</p> <p>Significantly, this Board has virtually never functioned effectively since 1994, and Government has recently made fresh attempts to promote its effectiveness.</p> <p>In terms of the <i>Fire Brigade Act</i>, Local Authorities¹ were allowed to (“may”) establish and maintain a service in accordance with the prescribed requirements. It appears that this was not a definite requirement for all local authorities. Municipalities could make relevant by-laws or regulations for their areas of jurisdiction.</p> <p>This apartheid-era legislation has been adapted, in 1994, by the democratic Government. <i>Government Gazette</i> No. R 153, 1994 assigned the administration of the whole <i>Fire Brigade Services Act</i>, 1987 to the Provinces – with the exception of Section 2 (Fire Brigade Board) and Section 15 (Regulations), which remained with the national government. The key role of the municipalities remained intact.</p> <p>In terms of the new Constitution, adopted in 1996, fire-fighting is a “Schedule 4 Part B” function. This means that it involves concurrent national and provincial legislative competences, as well as being a municipal function.</p>

¹ Note that these were still racially-defined local authorities (in 1987). The terminology has also changed since 1987: “Local authorities” are now referred to as “Local Municipalities” or “Metropolitan municipalities”.

Instrument	Key objective
Major Hazard Installation (MHI) Regulations issued under Section 43 of the Occupational Health and Safety Act (Act 85 of 1993)	The MHI Regulations apply to employers and self-employed persons, who have on their premises, either permanently or temporarily, a MHI or a quantity of a substance which may pose a risk that could affect the health and safety of employees and the public. It also deals with on-site emergency planning, and requires that such planning must be discussed with the relevant local government and fire-fighting department. No local government shall permit the erection of a new MHI at a separation distance less than that which poses a risk to airports, neighbouring MHI, housing and other centres of population. The municipality is responsible for all off-site emergency plans.
National Environmental Management Act (Act 107 of 1998)	Section 30 of the Act, deals with the control of emergency incidents – defined as an unexpected sudden occurrence including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution. After such an incident, a responsible person must report it to the SAPS and relevant fire prevention service.
National Veld and Forest Fire Act (Act 101 of 1998)	<p>The primary focus of this Act was to create Fire Protection Associations in rural areas, to predict, prevent, manage and extinguish veld fires. These Associations would be established and managed by local land owners. The Associations' rules have to include controlled burning to conserve ecosystems and reduce the fire danger. (Significantly, these Associations would cover regions which have regular veldfires, or relatively uniform climatic conditions and vegetation. It therefore created the possibility of associations which crossed municipal boundaries).</p> <p>A 2007 study found that Fire Protection Associations (FPAs) were generally well established & functional in most areas. In 2013, there were an estimated 219 Fire Protection Associations in South Africa, covering about 49% of South Africa's land surface (COGTA n.d.).</p> <p>The main implication, for the gas pipeline project, is that the more rural parts of the pipeline may be located in areas where there are Fire Protection Associations, with their own rules in force. They would function within the jurisdictions of municipalities, but they may also straddle municipal boundaries. The pipeline developer must therefore include municipalities and Fire Protection Associations in their disaster management planning procedures.</p>
Disaster Management Act (Act 57 of 2002)	<p>This Act requires the local government to also deal with disaster management responsibilities. It was an attempt to address the litany of problems faced by the fire-fighting sector. It provides for:</p> <ul style="list-style-type: none"> • an integrated and co-ordinated disaster management policy that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery; and • the establishment of national, provincial and municipal disaster management centres. <p>For the purpose of the gas transmission pipeline SEA project, two requirements are significant: (a) The integration of prevention and mitigation methodologies with municipal IDPs; and (b) promote formal and informal initiatives to encourage risk-avoidance behaviour by private and public sector organisations.² This suggests that, as the planning process continues for the gas transmission pipeline SEA project, COGTA and the Disaster Management Centre must take <i>proactive</i> steps to plan for possible pipeline-related disasters.</p>
Draft White Paper on Fire Services (2016)	This White Paper seeks to reposition the country's municipal fire services from a response-oriented approach towards a greater emphasis on fire prevention and risk reduction.
National Housing Code (2009) Policy developed in terms of the Housing Act (1997)	Chapter 4 of the Housing Code (2009) includes the provision of the National Housing Programme for Housing Assistance in Emergency Housing Circumstances. The programme's objective is to provide for temporary relief to people in urban and rural areas who find themselves in emergencies.

² Section 22 of the Disaster Management Act, No. 57 of 2002.

Instrument	Key objective
	National Housing Programme: Upgrading of Informal Settlements deals with the process and procedure for the in situ upgrading of informal settlements as it relates to the provision of grants to a municipality to carry out the upgrading of informal settlements within its jurisdiction in a structured manner. The grant funding provided will assist the municipality in fast tracking the provision of security of tenure, basic municipal services, social and economic amenities and the empowerment of residents in informal settlements to take control of housing development directly applicable to them. The Programme includes, as a last resort, in exceptional circumstances, the possible relocation and resettlement of people on a voluntary and co-operative basis as a result of the implementation of upgrading projects.
Provincial Instrument	
Spatial Planning and Land Use Management Act (Act 16 of 2013): Provincial SDFs	SDFs guide regional and spatial development and long term implications.
Integrated Infrastructure Development Frameworks	Integrated Infrastructure Development Frameworks guide and prioritise implementation for large scale infrastructure development. There are 16 key policy proposals set out in the 2016 White Paper on Fire Services.
Municipal Instrument	
Municipal Structures Act (Act 117 of 1998)	According to Section 84, fire-fighting functions are divided between district and local municipalities. A District Municipality (DM) has the following functions: <ul style="list-style-type: none"> • Planning, co-ordination and regulation of fire services; • Specialised fire-fighting services such as mountain, veld and chemical fire services; • Co-ordination of the standardisation of infrastructure, vehicles, equipment and procedures; and • Training of fire officers.
Disaster Management Plan of 2002	Each Metropolitan and District Municipality must establish and implement a framework for DisM in the municipality, which must include the local municipalities within the area. It should also be integrated with non-state actors. Such a framework must be consistent with the National and Provincial frameworks. Each Metro and District Municipality must establish a Disaster Management Centre. A District municipality must establish it after consultation with the local municipalities in its area; and it may operate such a Centre in partnership with local municipalities. The Amendment Act (2015) created an important role for Local Municipalities: “(3) A local municipality must establish capacity for the development and co-ordination of a disaster management plan and the implementation of a disaster management function for the municipality ... 4) A local municipality may establish a disaster management centre in consultation with the relevant district municipality in accordance with the terms set out in a service level agreement between the two parties, in alignment with national norms and standards.” A Municipal DisM Centre must advise other agencies on levels of risk, assessing the vulnerability of communities, increasing the capacity of communities to minimise risks and disaster impacts, and monitor the likelihood of disasters. It should promote risk-avoidance behaviour by state and non-state actors. This would presumably be an important point of contact for a pipeline operating organisation.
Spatial Planning and Land Use Management Act (Act 16 of 2013): Spatial Development Framework and Land Use Management Scheme	Municipal SDFs: SDFs guide municipal spatial development and investment, and coordinate intergovernmental investment in municipal areas. The importance of alignment of detailed planning and implementation at municipal scale required by SPLUMA, 2013 and Municipal Systems Act (MSA), 2000. Land Use Management Systems and Schemes provide for the development and land-use rights to guide development, ensure safety, sustainability and effective urban form.
Municipal Systems Act, (2000): Integrated Development Plan	IDPs guide investment and governance priorities within municipalities and their areas of jurisdiction. The importance of alignment of detailed planning and implementation in reflection of such implementation alignment within municipal

Instrument	Key objective
	IDPs and SDFs at municipal scale required by SPLUMA, 2013 and MSA, 2000.
Communal Property Associations Act (1996), Extension of Security of Tenure Act (1997) Ingonyama Trust Act (1994)	The issue of land rights in Traditional Authorities is a contentious issue where adopted legislation has not been implemented as intended, with different pieces of legislation applicable in different provinces.

5 DESCRIPTION OF FEATURES IN CORRIDORS

Figure 3 outlines the various corridor phases and the grouping of these corridors used within this assessment.

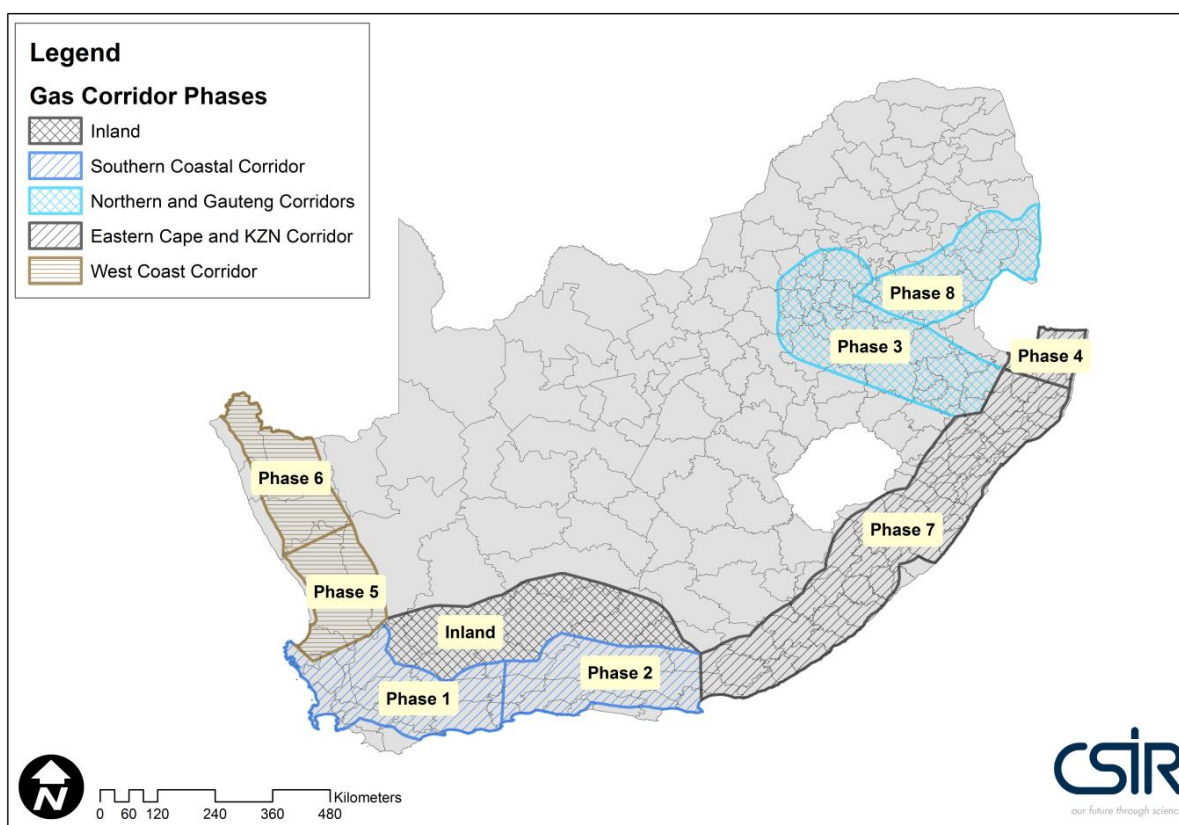


Figure 3: Corridor phases and associated grouping used in this assessment

Although it is highly unlikely that everyone will be affected by the gas transmission pipeline, it is estimated that the proposed total corridor area is home to about 35.7 million people, largely concentrated in dense rural settlements and a network of cities and towns. The most populous areas (shown in the figure below as population size) are within the main metropolitan areas of Cape Town (Phase 1), eThekweni (Phase 7), Gauteng (Phase 3) and Nelson Mandela Bay (Phase 2) (Figure 4). These are also the areas that show the most significant population growth between 1996 and 2016 (shown in the figure below as population growth) (Figure 4).

Of the 35.7 million, about 23.62 million live in large metropolitan areas, cities and large regional service centres (big towns), about 4.5 mill people in medium and large towns and about 1.45 mill people in small towns. Whilst these mostly constitute high density formal and informal settlement areas, the bigger city and town areas also constitute a significant number of traditional settlement areas which have the additional complexity of traditional or communal land tenure issues that need to be considered (StepSA Town Area Typology, 2018) (Figure 4). Within the major metropolitan areas and cities and large regional towns, more

than 1 million people are actually living on traditional settlement land areas. More than 6 million people live in dense rural settlements in the study area, of which the majority (an estimated 5.9 million of this group) are settlements under traditional authority jurisdiction, largely in the east coast corridor area (shown in green in Figure 5), and only 31 000 in the sparsely populated areas (CSIR Settlement Footprint, 2017) (Figure 5). Refer to Appendix E of this report for further details on the description of the settlement typology and population numbers of all settlements impacted arranged by corridor groupings.

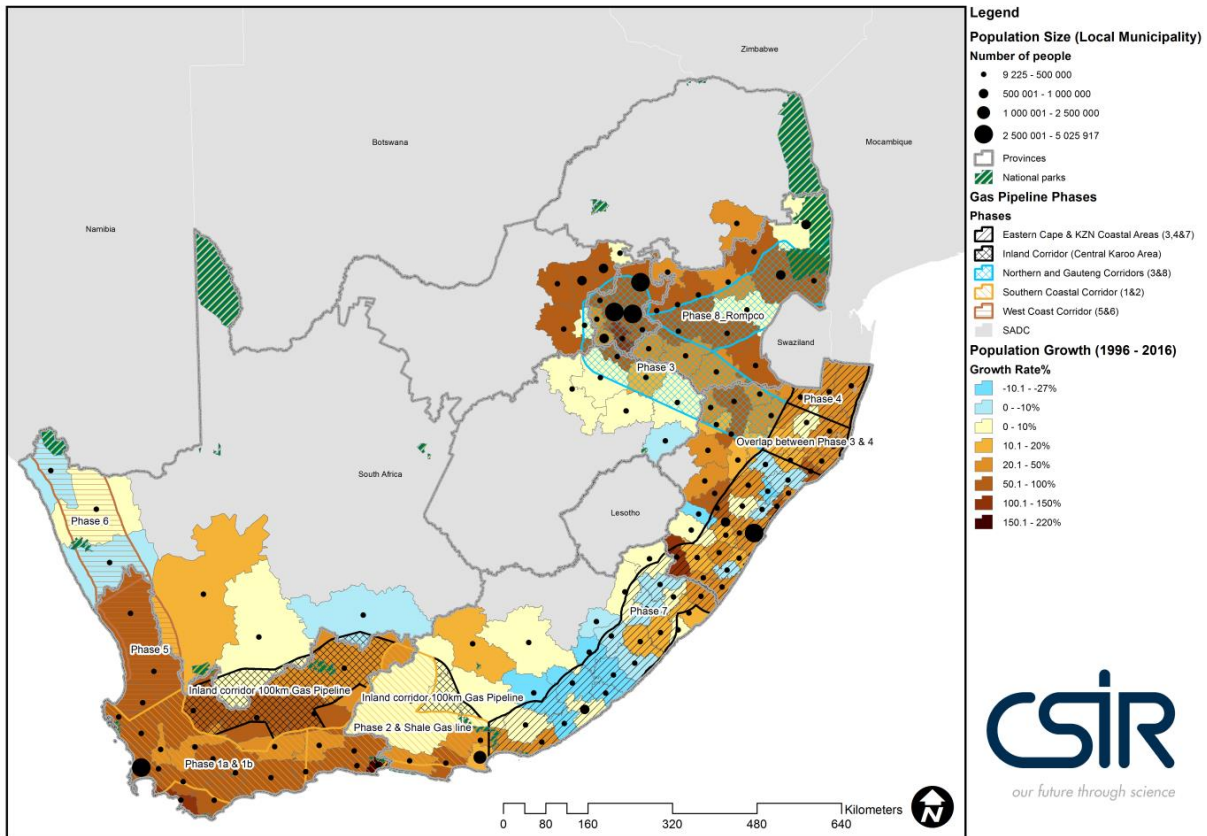


Figure 4: Population number and growth characteristics of local municipalities within the gas corridor
(Source: StepSA Town Area Typology, 2018)

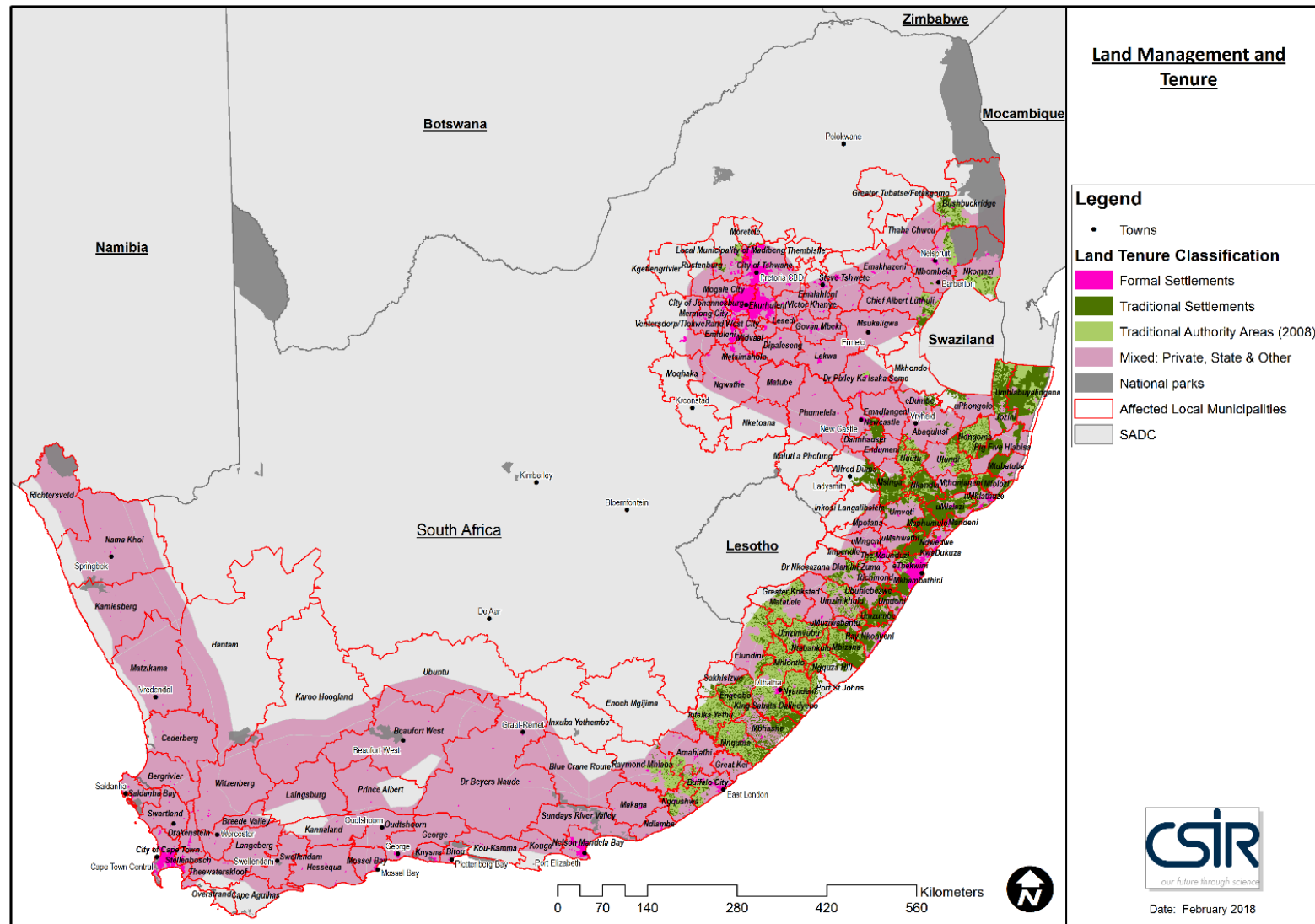


Figure 5: Land management and tenure in gas transmission pipeline corridor
(Source: StepSA Town Area Typology, 2018)

Unemployment levels (Figure 6) indicate the dire need for local employment opportunities, should this be provided during the construction phase. It also points to the vulnerability of the economic environment and that any interruption or disruption on the economy should be avoided.

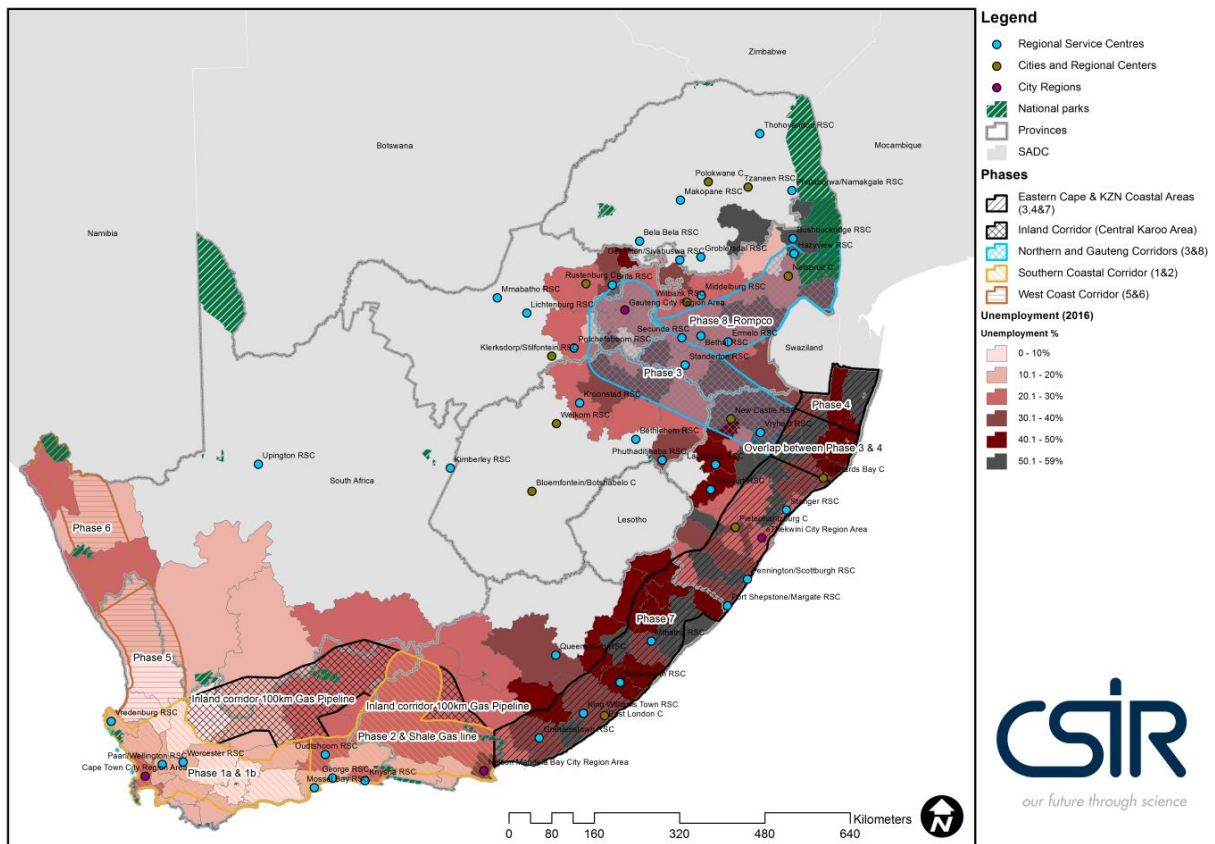


Figure 6: Unemployment percentages within municipalities
(Source: Van Huyssteen et al., 2018)

Figure 7 provides an overview of key new infrastructure (rail and road) in the affected areas. A review of development projects contained in available PGDSs (January 2018) in the corridor area can be found in Appendix E of this report. Given that time lines, phasing, scale, funding and spatial specific implications are not clearly evident from these studies and is subject to change, relevant local and provincial plans will have to be reviewed for each sector closer to the time of final construction. Available planning for the N2 road corridor and possible rail linkages in the same corridor in future is illustrated in Figure 7 to inform future alignment of the gas corridor servitude. Any other new servitudes of a linear nature for road and rail will need to be considered at the time of more detailed planning and implementation. At this stage no detailed alignment of new road or rail projects is available for public use and as such is not considered in detail. Final gas pipeline alignment must consider alternative projects in the area when the time comes.



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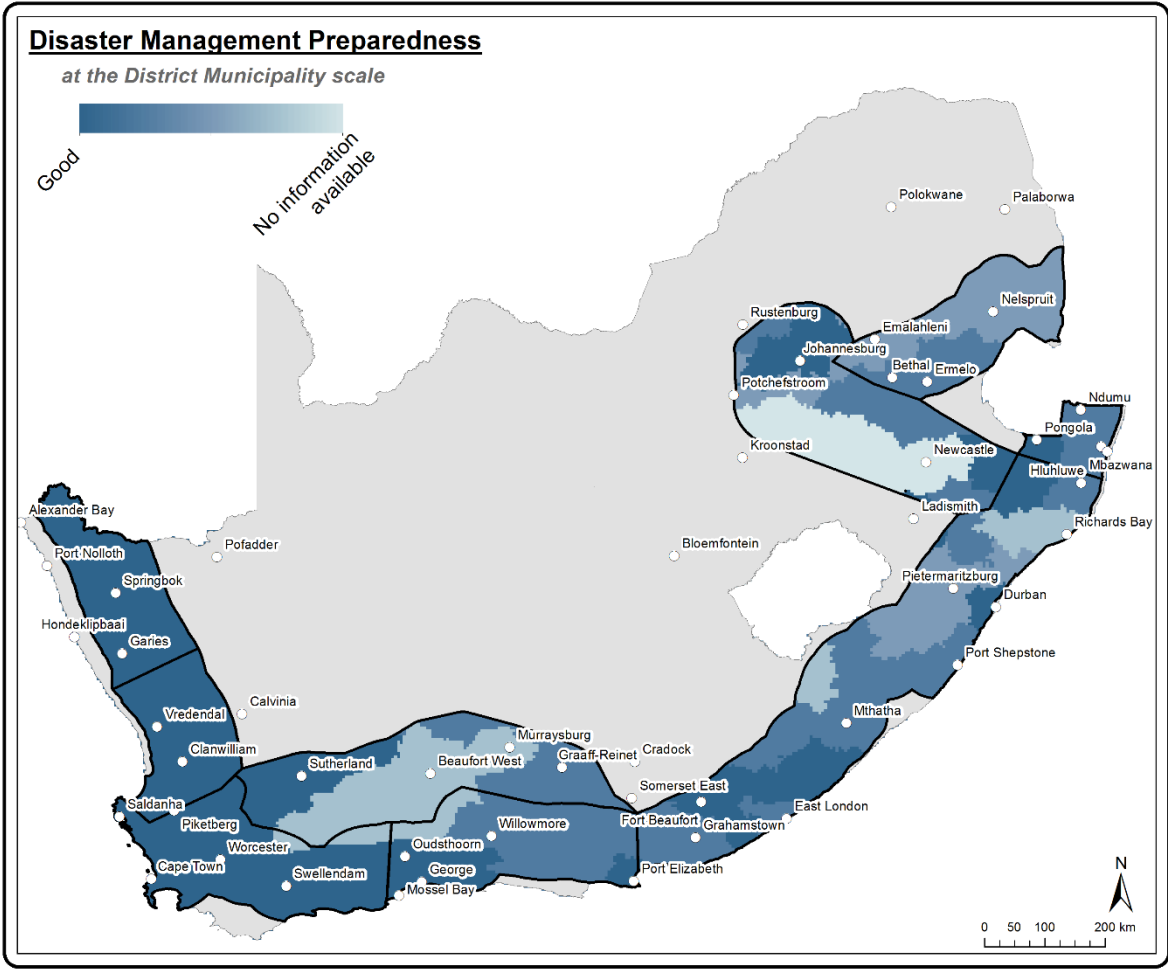


Figure 8: DisM preparedness of district municipalities that fall within the proposed corridors

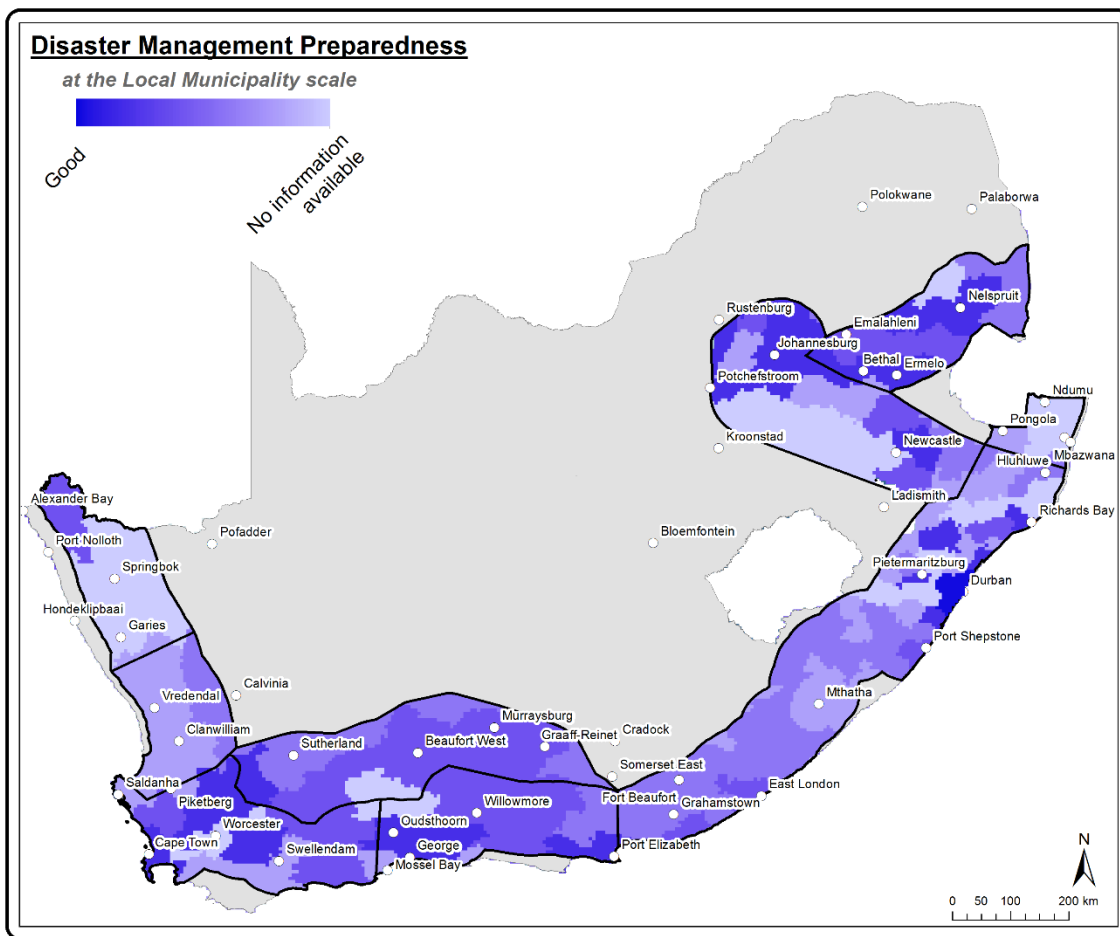


Figure 9: DisM preparedness of local municipalities that fall within the proposed corridors

5.1 Sensitivity mapping

As described in Section 3, the sensitivity of the study area with respect to the construction and operation of a gas transmission pipeline network was assessed with respect to three key components of the built environment, i.e. population density, development intensity and, tenure and land management (i.e. complexity of number of stakeholders involved in land negotiation) (individual maps are included in Appendix C). Appendices A.1 and A.2 include a description of data processing used to define the sensitivity criteria. An overall sensitivity map for spatial and development planning, taking into consideration the three above criteria, is shown in Figure 10 below (refer to Appendix D for the individual overall sensitivity maps per corridor).

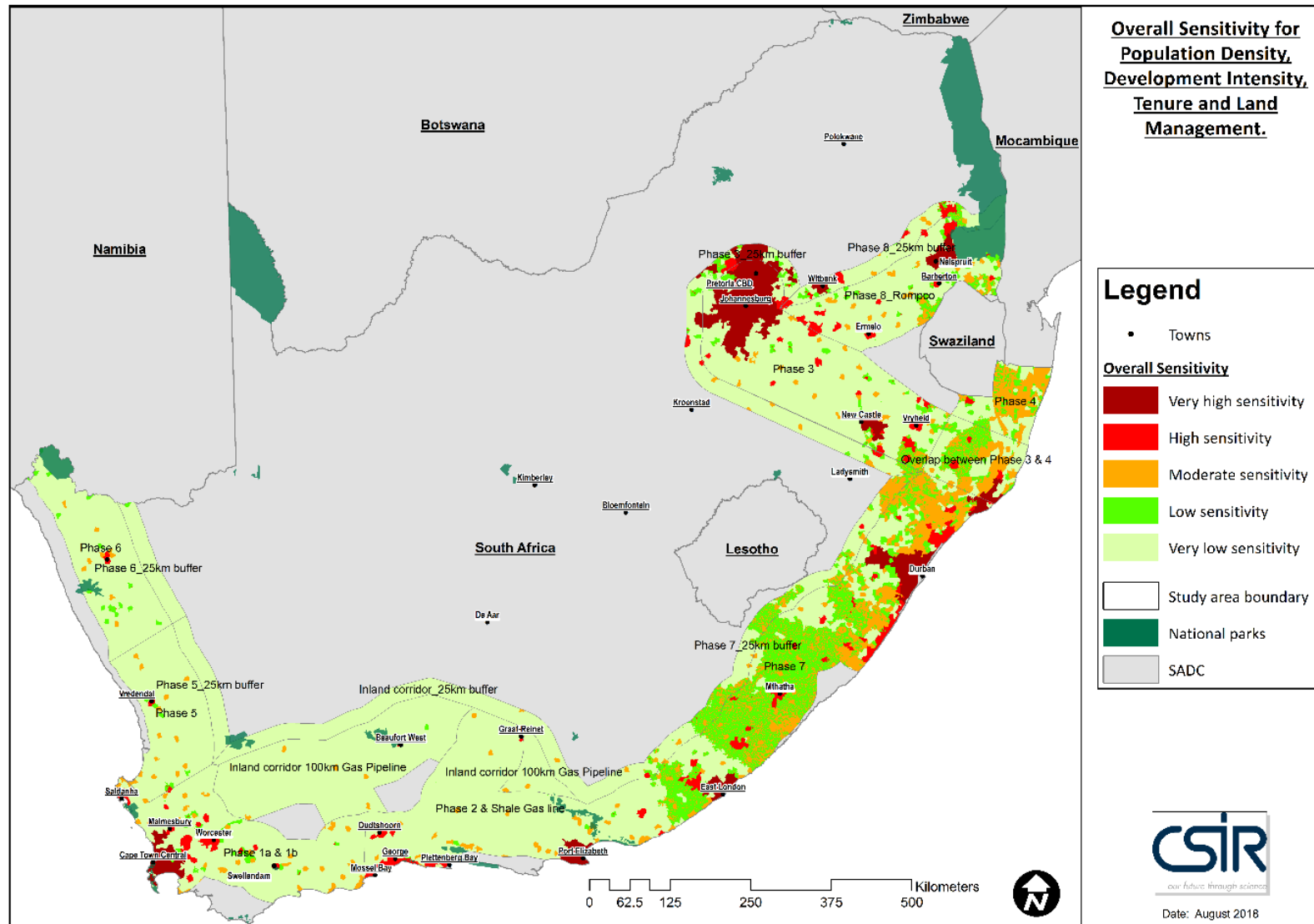


Figure 10: Overall sensitivity map for spatial and development planning

6 DESCRIPTION OF FEATURES IN EACH CORRIDOR

Table 3 below gives a brief description of the various corridors in terms of population, development intensity, land tenure and management, disaster management preparedness and overall sensitivity towards the development of a gas transmission pipeline

Table 3: Description of the Gas transmission Pipeline Proposed Corridors

Site	Brief description
<p><i>West Coast Corridor Phase 5 and 6</i></p> <p>Refer to Figures 7, 8 & 9, Appendix B (Figures B.1 to B.3), Appendix C (Figures C.10 to C.12) and Appendix D</p>	<p>These two phases cover the western coastal part of the country. These areas are characterised by small towns surrounded by arid and semi-arid areas and are the most sparsely populated and also declining in population. Areas within Phase 5 are mostly mixed economy while Phase 6 is mostly dependent on Government sector and services.</p> <p>The majority of the district and local municipalities that fall within this corridor have good to fair fire-fighting capabilities currently in place.</p> <p><i>The majority of this corridor has a low overall sensitivity as there are no areas of communal tenure and no large urban areas or areas of extensive economic activity. Commercial farmland covers the largest extent of the low sensitive areas. The corridor also contains some National Parks. There are a few areas of medium level sensitivity in a small number of towns with medium or dense population. These towns cover less than 5% of the area.</i></p>
<p><i>Southern Coastal Corridor Phase 1 & 2</i></p> <p>Refer to Figures 7, 8 and 9, Appendix B (Figures B.4 to B.6), Appendix C (Figures C.13 to C.15) and Appendix D</p>	<p>Includes large parts of the Western Cape Province extending along the coast as far as the Eastern Cape boundary. It includes the major metropolitan areas of Cape Town, the Winelands district and the southern coastal towns and Garden Route tourism corridor featuring a large number of towns and major economic infrastructure. Includes the large parts of the Eastern Cape Province Coastal areas including Nelson Mandela Bay Metropolitan. Areas within Phases 1 and 2 are mostly mixed economy. The area is also a very productive farming area, along the coastal plain between CPT and PE, also important tourist areas, plus national parks etc. See Table B.1 (Appendix A) for detail of towns and settlements affected.</p> <p>Various fire-fighting capabilities exists within this corridor depending on the district and local municipality being considered. Most of the district municipalities within the southern coastal corridors have good fire-fighting capabilities currently in place. Thirteen of the affected local municipalities (approximately 50%) have a 'fair to good' rating. The remainder of the local municipalities either do not have suitable fire-fighting capabilities currently in place or no information in terms of fire-fighting was readily available during this assessment.</p> <p><i>In this corridor the highest levels of sensitivity are within the greater Cape Town City Region area and around the coastal cities and medium sized service towns which have high populations and intensive development and economic activity. The low sensitivity areas in the corridor are dominated by sparsely populated commercial farmland.</i></p>
<p><i>Inland Corridor (Central Karoo)</i></p> <p>Refer to Figures 7, 8 & 9, Appendix B (Figures B.7 to B.9), Appendix C (Figures C.4 to C.6) and Appendix D</p>	<p>This area is characterised by low density semi- arid farmland interspersed with small towns and rural villages. The area is the subject of Shale Gas exploration which may have a major impact on settlement growth and development in future. The northern section of the inland corridor is sparsely populated and also declining in population. Economy is highly dependent on Government sector and services.</p> <p>Within the Inland corridor various levels of fire-fighting capabilities exist, depending on whether district or local municipalities are being considered.</p>

Site	Brief description
	<i>In this corridor the highest sensitive areas are dominated by the medium sized service towns which include Beaufort West, Laingsburg and Prince Albert as well as smaller settlements like Nelspoort. These towns cover less than 1% of the area. The remainder of the area is of low sensitivity. Commercial farmland covers the largest extent of the low sensitive areas.</i>
<p><i>Eastern Cape & KZN Coastal areas (Phase 7, Phase 3 and 4 overlap, Phase 4, and part of Phase 3</i></p> <p>Refer to Figures 7, 8 & 9, Appendix B (Figures B.10 to B.12), Appendix C (Figures C.1 to C.3) and Appendix D</p>	<p>This corridor extends from the Eastern Cape along the N2 highway through the former homeland areas of Ciskei and Transkei which are areas of tribal land authority and communal ownership into KwaZulu-Natal. Phase 4 extends from the St Lucia all the way up to the South Africa – Mozambique border. This area includes the eThekweni Metro, East London, Richards Bay and Mthatha as well as extensive areas of dense rural settlement. The traditional areas are home to some of the most disadvantaged people in the country. Parts of the eastern section (Phase 7) are however sparsely populated (declining in population). The economy is highly dependent on Government sector and services.</p> <p>The majority of the local municipalities within these corridors have a “marginal” rating in terms of fire-fighting capabilities currently in place. In terms of district municipal capabilities, 50% of the affected municipalities within these corridors have a good or fair fire-fighting capability currently in place.</p> <p><i>These corridor sections have concentrations of very high sensitivity due to the large cities with high population and intensive economic development which include the greater eThekweni - Pietermaritzburg City Region area, Richards Bay urban complex, large, densely populated service towns and the coastal settlement corridors. It also has extensive areas of moderate sensitivity due to the extent of the densely settled rural areas which are mainly within traditional authority areas. The low sensitivity areas are a mixture of sparsely populated state and privately owned land and commercial farmland.</i></p>
<p><i>Northern and Gauteng Corridor Phase 3 and 8</i></p> <p>Refer to Figures 7, 8 & 9, Appendix B (Figures B.13 to B.15), Appendix C (Figures C.7 to C.9) and Appendix D</p>	<p>This phase includes the Gauteng City region and extends southward to eThekweni and west from the border of Gauteng, across Mpumalanga and ends at the Mozambique border. The area is densely developed with respect to both population, economy and infrastructure and land management issues are likely to be highly complex. The corridors also include areas under tribal authority jurisdiction. Areas within Phases 3 and 8 are mostly mixed economy.</p> <p>Approximately 50% of district municipalities potentially affected within these corridors have a good to fair rating in terms of fire-fighting capabilities. The fire-fighting capability currently in place in the local municipalities varies largely across the corridors and do not correlate with the capability of the district municipality which contains them.</p> <p><i>In this corridor the very high sensitive areas are dominated by densely populated and intensively developed economic zone comprising the Gauteng City Region and larger cities. There are also areas of moderate sensitivity characterised by dense population settlements in areas under tribal authority jurisdiction. In all these areas, land rights and land management issues are likely to be highly complex. The low sensitivity areas are a mixture of sparsely populated state and privately owned land and commercial farmland.</i></p>

7 KEY POTENTIAL IMPACTS

The detail planning of the pipeline alignment and the demarcation and associated proclamation of development servitude will need to be undertaken with strict diligence and consider minimum land disruption given the number of people that may potentially be impacted along the proposed gas transmission pipeline route.

The alignment should where possible minimise impact and disruption on settlements, economy, population and land use given the spatial extent and the number of towns, villages and people likely to be impacted. In addition, the safe operation of the pipeline will be critical, in particular if the gas transmission pipeline is located in areas of high population density (i.e. an unlikely situation).

7.1 Spatial and development planning, land use management

7.1.1 Land-use management and tenure implications

The extent of land parcels and stakeholders potentially affected by the proposed construction of a gas transmission pipeline as well as land ownership issues are expected to be highly complex. The complexity of land-use management and tenure implications are summarised in the table (Table 4) and expanded on below.

Table 4: Land-use management and tenure implications

Type of settlement	Implication
<i>Large formal towns (Cities, Towns, Regional Service Centres)</i>	<i>Many people & land parcels are likely to be impacted by land use or servitude proclamation if the pipeline goes through Cities and Large Regional Service Centres.</i>
<i>Land in traditional authority areas</i>	<i>Due to the complexity of land ownership and use rights and limited legal and economic capability the residents in this area will be sensitive to changes in land use application or over servitudes being created and special measures will be required to ensure fair and ethical negotiations where these are required.</i>
<i>Small Towns and Small Service Centres</i>	<i>Mainly formal land tenure & freehold property rights. Thus negotiations regarding land use & servitudes will be less complex with less people impacted than in larger towns.</i>
<i>Sparsely populated non-traditional authority areas</i>	<i>Fewer people impacted on a fewer large tracts of land which is in private or other means of formal ownership</i>

The larger the settlement and the higher the number of stakeholders, the greater the sensitivity with respect to impacts for the developers and the community due to lengthy negotiations, alternative approaches to land access, road diversions and closures, and disruption of urban services. It is therefore anticipated that land-use applications and required stakeholder interaction (significant input from citizens with respect to negotiations regarding loss of usage rights, compensation and hardship suffered) associated with the development of a gas transmission pipeline network may put additional pressure on relevant authorities, in particular in large cities/towns, that may be beyond their capability. This would also lead to delays in development implementation and increase the duration of the associated impacts.

In small towns and sparsely populated non-traditional authority areas, the planning processes are likely to be less complex (no additional pressure on land-use applications), and fewer people are likely to be impacted in a negative manner. There are also likely to be major land use management implications especially for small towns and municipalities with limited capacity to address changes in land use application, servitude proclamation and the required changes to land use schemes.

The planning processes are also likely to be complex where the land is in on communal tenure (tribal authority areas). It is critical to note that much of the land within the eastern pipeline corridor phase falls with areas identified as being within traditional authority jurisdiction were communal property rights with all the associated complexities is the dominant tenure form with the exception of areas within formal

settlements in the area. Planning and land use negotiation issues are likely to require a great deal of negotiation and community participation with respect to the current legal use or usufruct of land in traditional authority areas. Collaboration with regards to land use management decisions and practices between municipalities and traditional authorities might remain a challenge and will need to be considered.

Access to the land for maintenance purposed during the operational phase is also anticipated to be highly sensitive where land is under tribal authority.

Management actions

- Major sensitivity in dense rural settlements and communally owned land should be avoided.
- Timeous negotiations and detailed studies must be undertaken to minimise negative impact in vulnerable communities especially in traditional authority areas.
- The servitude planning and proclamation will need to comply with local land use planning regulation and be included in negotiations as part of Local SDFs and Land Use Management Schemes all of which need to comply with the SPLUMA regulations.

7.1.2 Resettlement and relocation/displacement impacts

The establishment of gas transmission pipelines has the potential to result in involuntary resettlement or relocation. In addition, during operation a pipeline disaster may necessitate relocation/resettlement. If the resettlement is not properly planned or managed it can have an impact on the livelihoods of the said community (DEA, 2016). Resettlement in rural areas and small villages has an impact on livelihoods in the form of the loss of houses and farmland and the loss of access to farmland and other resources. One of the key challenges therefore facing resettlement in rural areas is linked to the restoration or maintenance of livelihoods based on land and access to resources (DEA, 2016).

Resettlement issues are normally associated with large infrastructure projects such as mines or large industrial areas. Although a gas transmission pipeline network would qualify as a large infrastructure project, the physical footprint of the gas pipeline network is usually much smaller compared to these other types of large developments. In addition, due to it being a linear activity, this would further limit the impact on the loss of land or access to resources. The need to therefore relocate entire communities would be unlikely.

Should involuntary resettlement occur, two types of displacement would need to be considered; i.e. 1) physical displacement, where people have to move to a new area as a result of the direct impact of the project and thus would need to be compensated for their loss of assets; and 2) economic displacement, where access to productive assets are interrupted or cut off. The type of displacement will inform the type of Resettlement Action Plan (RAP) that would need to be developed to manage the impact of resettlement. The type of RAP will depend on the location, scale and type of project (DEA, 2016).

In addition to the above, in certain emergencies, the support provided by NGOs, communities and disaster management centres will not be sufficient to aid the affected community and additional housing support and interventions are necessary. Should a pipeline disaster require relocation or resettlement of communities, the Department of Human Settlements at the affected local and provincial municipal level should provide emergency housing response. A summary of when relocation/resettlement would be the suitable option is detailed in the figure below (Figure 11) (HDA, 2012).

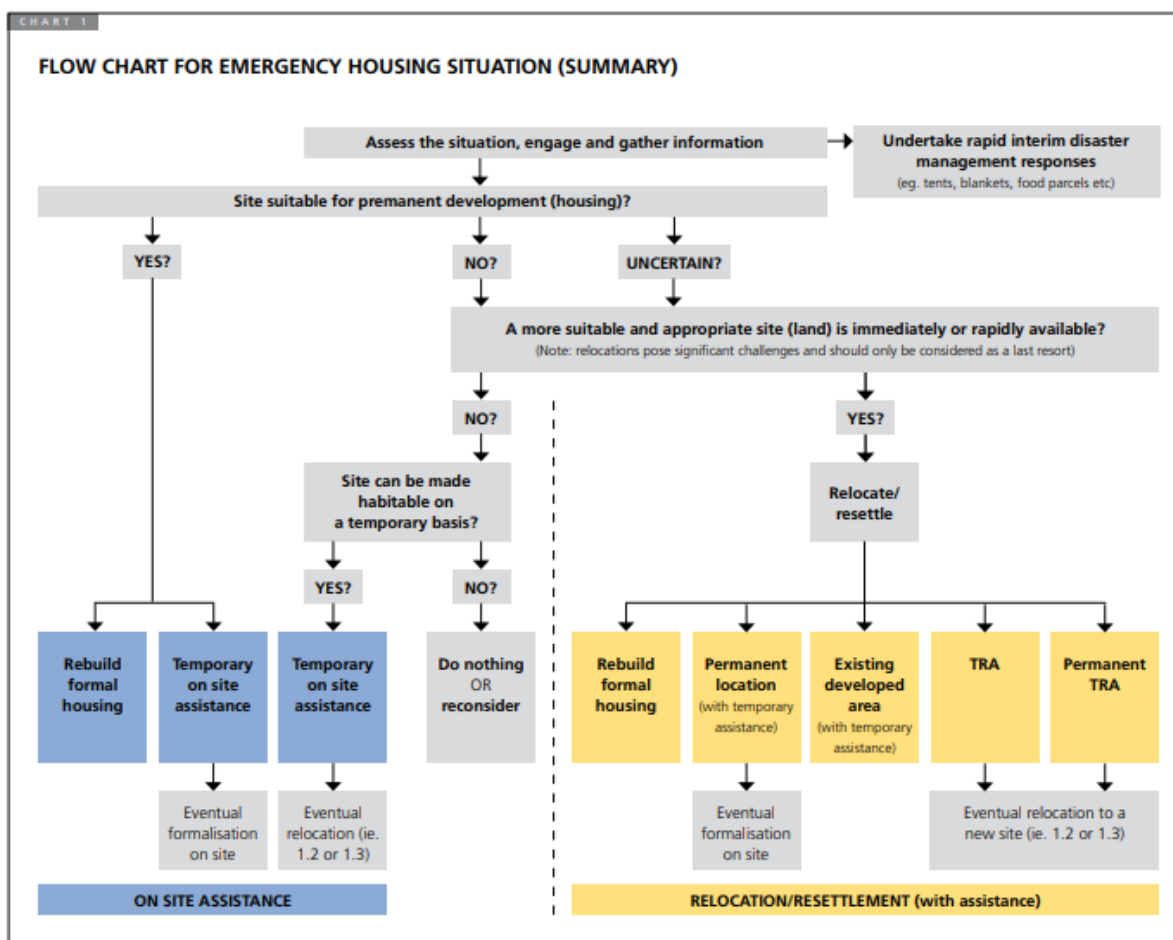


Figure 11: Flow chart for emergency housing situation (HDA, 2012)

In terms of the Prevention of Illegal Eviction from and Unlawful Occupation of Land Act, certain procedures must be followed to evict occupiers of land. Different procedures are set out within the Act, depending on whether the occupier is a private owner, is an urgent applicant or an organ of state.

Management actions

Accepted international best practice requires that involuntary resettlement be avoided where possible. If this is not possible the number of people affected should be minimised. The key mitigation measure therefore involves siting of transmission pipelines so as avoid the need for resettlement.

Where involuntary resettlement cannot be avoided, the relocation of affected households and or compensation for economic displacement should be guided by international best practice and a RAP should be developed to manage the impact of resettlement.

Key best practice documents to guide the involuntary resettlement include:

- World Bank Operational Policy (4.12) on Involuntary Resettlement (Revised in 2011);
- IFC PS on Environmental and Social Sustainability (Revised in 2012), specifically PS 5: Land Acquisition and Involuntary Resettlement;
- IFC's Handbook for Preparing a RAP (2002);
- AfDB Policy on Involuntary Resettlement (2003).

If a disaster occurs during the operation of the pipeline that require resettlement/relocation, the the Department of Human Settlements at the affected local and provincial municipal level should be consulted to ensure that any relocation/resettlement is appropriately managed.

Any eviction process must be considered under the Prevention of Illegal Eviction from Unlawful Occupation of Land Act.

7.1.3 Impact on the location options of new developments

The placement of a servitude may impact the location options of new developments (extent and direction) in towns / economic nodes and limit potential economic growth. Highly sensitive areas (such as surrounding areas of Cape Town, eThekweni and Gauteng city region areas and coastal settlement corridors) are under continuous development pressure due to continued growth and will be unable to respond to increased development pressures whereby economic nodes are constrained in terms of future development initiative. In rural settlements and sparse populated areas, restriction on new developments is not anticipated and economy can grow without being impeded by potential development constraints due to the presence of a gas pipeline and or any declared servitude.

Management actions

- At time of planning a section of the proposed gas transmission pipeline, the developer must check growth direction of nearby settlements as well as existing and approved township development applications and land use rights. New development areas indicated in SDFs and applicable municipal infrastructure masterplans must also be taken into consideration.
- The pipeline design would need to be carefully considered together with relevant design and building standards should it be constructed in the vicinity of higher density population areas and economic nodes such as eThekweni, Cape Town, Nelson Mandela Bay and Gauteng. The current development contexts, industrial and port activities within other smaller nodes might also warrant access to gas as alternative energy resources and thus also need to be considered i.e.: Witbank/Middelburg, Richards Bay, Mossel Bay, Saldanha and Buffalo City/East London. Whilst a link to supply gas to industry for power generation in these cities and towns may be beneficial this will be dependent on cost and detailed route design.
- The same requirements as above will need to be considered in future when increased or specific needs might be identified for increased access to or demand for gas as an energy resource in fast growing and high density cities. These cities include Mbombela/Nelspruit, Newcastle, Vryheid, Mthatha, the South Coast Corridor (east of Durban) and the North Coast corridor (north of Durban), the Durban-Pietermaritzburg corridor area and nodes, the coastal corridors of Plettenberg Bay and George, and smaller development concentrations and footprints in the various inland service towns.

7.1.4 Impacts on property values

The presence of a gas transmission pipeline servitude on a property may negatively influence the value of the property. The presence of a high pressure pipeline can influence property values due to health concerns, disturbance of the current land-use of the property and reduction in the amenity of use within the servitude and it creates usage uncertainty. The servitude negotiation process and, in particular, the amount paid to property owners plays a key role in mitigation. If these are fair and truly reflective of all value losses and risks associated with accommodating a gas transmission pipeline, then one would expect less opposition from land owners (DEA, 2016)

Furthermore, the impact on property values is highly case specific and depends on factors such as the use of the land, the size of the property and the uniqueness of the property (DEA, 2016). It may also be dependent on the current development pressure in the surrounding of the targeted land. Therefore, the impact of the proposed gas transmission pipeline on property values requires further investigation.

Currently, compensation is not offered as a remedy for those owning land adjacent to or nearby a site earmarked for linear infrastructure development. Under South African law, those acquiring servitudes such as Eskom, Transnet and others are not required to compensate neighbouring property owners for potential values losses. This essentially places a limit on achieving full compensation for property value decreases for a number of different infrastructure project types including EGI, roads, railways, wind farms, etc. (DEA, 2016).

Management actions

- Ensure a fair compensation process is implemented by the developer.
- Avoid high value land uses (luxury estates, high end game farms etc.) where possible.
- Use existing infrastructure servitudes where viable and agreed to.
- Refer to Section 7.4 (Disaster management) for additional management actions.

7.2 Disruption of population livelihoods due to construction activities as well as impacts on service delivery and local economies during construction

Settlements and development nodes and specifically industrial and manufacturing clusters within them, may potentially benefit from energy supply through the extension of the gas transmission pipeline or temporary construction related job creation. However, within large towns, cities and metropolitan areas, the high density of activities and livelihoods might be at risk or disrupted through construction. This is considered to be the main impact associated with the construction phase and would need to be evaluated in terms of how it impacts the built environment. The latter includes all human settlements (cities, towns and villages), the population in the area and the economic function.

The construction phase of any segment of the pipeline is indicated as 6 months. Impacts associated with construction activities that may affect livelihoods include construction noise, traffic, dust, waste management, current land use etc. Planned disruption may occur for an extended period of time and may be accompanied by uncertainty about when land use activities can revert to current/future use. During this phase any unexpected delays in either the start or completion time will increase the disruption and, in the case of agricultural land, would mean that the land in question would most likely be left unproductive or at best disrupted. Productive use of land is restricted when certainty of use period cannot be provided. This is due to lead times with respect to changing production use, acquiring alternative property or due to uncertainty with regard to completion of a production cycle before the land will become unusable. Also refer to the separate chapter on Additional Impacts for further details.

Compensation for loss of land use amenity value will also need to be considered. This is a major issue and the associated risks will need to be limited and considered in detail during the EIA phase. This cannot be considered now due to lack of detail. Due to the impact of uncertainty on the likely usage of land and property with respect to any production cycle, it will be critical at the planning stage to clearly outline the time period of construction and provide certainty with respect to start and end dates.

Infrastructure too may be impacted while construction over or under the infrastructure occurs. This may consequently impact on the delivery of any services in the area that may be disrupted through the construction, including engineering services that provide services to large numbers of people as well as the local economies in the city regions such as Cape Town Nelson Mandela Bay, Gauteng and of eThekweni, large cities such as Richard Bay and dense coastal settlement corridors along the garden route and the KZN north and South coast. Large cities such as Mbombela and dense boarder settlement corridors and tribal authority areas will also be impacted. The number and density of people, businesses, livelihoods and current quality of life experienced will thus increase sensitivity levels.

This may also by implication impact the local economies in the area that may be disrupted through the construction. Within medium and smaller towns, local economies are more likely to be vulnerable and thus also highly sensitive.

Mitigation measures

- Avoidance of sensitive areas:
 - Avoidance of built-up areas in identified cities and functional city region areas. To limit the impact of the gas corridor it is best to avoid built-up areas in towns where large numbers of people and / or business are located in order to limit the disruption to the least number of people and the least number of economic entities. Where connections (i.e. through the development of distribution lines) need to be provided to support industrial and other future service and development needs, detailed route design will be required within the identified functional town areas.
 - Avoidance of functional areas around identified service towns and rural service settlements recommended. For the same reason as provided above services towns should be avoided. In addition to the normal towns functions service towns provide services to large numbers of people living in the hinterland of the town. If a specific service is not provided or is cut-off through a construction process, the towns' people as well as all people in the surrounding service region will be impacted.
 - Avoidance of high density population and economic nodes within the bigger Cape Town city region area for bulk pipeline. Avoidance of the area will limit impact and level of land use management planning required.
- Where avoidance of a populated area is not possible, the following management measures need to be put in place:
 - Detailed route design considering existing and planned land use and developments to minimise impact on people and livelihoods as far as possible.
 - Consult and inform the stakeholders.
 - Ensure agreed time frames are respected.
 - Ensure alternative access to properties is identified.
 - At the time of construction, ensure that clear access to public facilities and public transport is maintained (e.g. detour less than 500 m (walking distance)), as well as clear 24 hour access to emergency services.).
- Timeous negotiations and compensation measures with land owners to minimise impacts on current land-use (e.g. crops harvest etc.);
- Timeous construction to avoid extended disruptions, ensure access to local businesses is not disrupted;
- Where local businesses are anticipated to be highly impacted during the construction phase, consider compensation for lost businesses, in particular for location dependent businesses;
- The EMPr should outline procedures for managing construction in an environmentally friendly manner (waste management, good housekeeping, erosion management etc.)
- Location of servitudes should not exclude existing or potential businesses or industries that use or would benefit from access to a high volume, regular source of natural gas.

7.3 Impacts associated with project workers/workforce

The potential impacts associated with the presence of project workers mainly apply to the construction phase of the gas transmission lines. Although, given that gas transmission pipelines are planned to be constructed outside towns, cities and other areas of high population densities and given the linear nature of the proposed development, the anticipated social impact associated with the development of gas transmission lines within the Gas corridors are considered to be low.

While some temporary local employment of unskilled labour is likely to be provided during the construction phase, long term employment opportunities are limited and will be considered at a project specific level.

Construction workers

The *presence of workers* during the construction phase may lead to the disruption of existing family structures and social networks, specifically in rural areas (Ruddell et al., 2014, Negi, 2014). The key risks that could lead to a social impact due to the influx of job seekers and presence of workers include:

- Increased alcohol and drug use;
- Increased crime levels,
- Increased teenage and unwanted pregnancies;
- Increased prostitution; and
- Increased prevalence of sexually transmitted diseases (STDs), including HIV.

The *movement of construction workers* on and off site in rural areas may also lead to anti-social activities within local communities and amongst farmers and farm workers in the vicinity of the construction site. Farm infrastructure such as gates and fences may also be damaged which can lead to financial losses. In addition, stock losses may occur due to the damage to the farm infrastructure or stock theft. The activities associated with the construction workers may also lead to an increase in veld fires which pose a risk to the livelihoods of the farmers (ESMAP, 2006 and DEA, 2016).

The potential risk posed by the presence of construction workers will be linked to the location of the construction activities, size of the work force, duration that they are on site and where they are accommodated. Given nature of the work associated with the establishment of linear infrastructure projects, such as pipelines, the construction activities will not be confined to a single area, as would be the case with the establishment of a say a new mine. In addition, the size of the work force is likely to be relatively small compared to large civil construction projects. The potential social impacts associated with the presence of construction workers is therefore likely to be limited and can be managed through the implementation of effective management and mitigation measures as listed below (DEA, 2016).

During the operational phase, the potential impacts associated with the presence and movement of maintenance workers is anticipated to be very limited.

Influx of job seekers

Construction projects also have the potential to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These issues are similar to the concerns associated with the presence of construction workers as listed above. The impact of the influx of job seekers may pose a higher risk to the local community, compared to the presence of construction workers, since unlike the employed construction workers; job seekers may not have accommodation in the area nor a stable source of income, and may decide to stay on in the area. Linked to this, the risk of crime is therefore higher. Based on experiences of other large projects, job seekers that are unsuccessful become economically stranded and sometimes, the families of the job seekers can also follow the job seeker to the new area. This places additional pressure on existing municipal services.

Given the linear nature of pipelines, the construction activities will not be confined to a single area and unlike other major development projects, such as a mine, the employment opportunities associated with the operational phase of a gas transmission pipeline are limited to repairs and maintenance. The attraction potential for job seekers during both the construction and operational phase is therefore low. The potential social impacts associated with the influx of job seekers are therefore not regarded as a key social issue (DEA, 2016).

Management actions

The mitigation measures apply to construction and maintenance related activities.

- Ensure all engagement, management and communication with workers are in line with the requirements stipulated by the Department of Labour. Labour management measures that fall within the ambit of the Department of Labour include employment contracts, working hours, minimum wage, working clothing and compensation for occupational injuries and diseases.

- Ensure contractors implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories;
- Develop a recruitment process and/or use a recruitment agency to advertise job and secure positions beforehand, thereby minimising the amount of job opportunities offered on-site during the construction phase;
- Ensure that the number and availability of jobs is clearly mentioned and discussed during the awareness sessions that would be undertaken when the final alignment of a proposed section of the pipeline has been confirmed;
- Develop a Code of Conduct for the construction/maintenance phase. The code should identify which types of behaviour and activities are not acceptable, such as trespassing, hunting, stock theft etc. Construction/maintenance workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation;
- The developer should be liable for compensating farmers and/or communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction/maintenance workers. This should be contained in the Code of Conduct to be signed between the Developer and the affected landowners. The agreement should also cover losses and costs associated with veld fires caused by construction/maintenance or construction/maintenance related activities;
- The EMPr should outline procedures for managing and storing waste on site, specifically plastic waste as it poses a threat to livestock if ingested, and to the general environment;
- The EMPr should also address risks posed by veld fires. In this regard no open fires for cooking or heating should be permitted, except in designated areas, the contractor(s) should ensure that construction/maintenance related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk periods, such as dry, windy months, the contractor(s) must provide adequate fire-fighting equipment on-site and fire-fighting training to selected construction/maintenance staff;
- The Developer and the appointed contractor(s) should implement an HIV/AIDS awareness programme for all construction/maintenance workers at the outset of the construction/maintenance phase. Reference should be made to the requirements contained in Guidelines for Integrating HIV and Gender-related Issues into Environmental Assessment in Eastern and Southern Africa. Prepared for United Nations Development Programme (UNDP) Regional Centre for Eastern and Southern Africa by the Southern African Institute for Environmental Assessment (UNDP, 2012);
- The Developer and/or the appointed contractor should provide transport to and from the site on a daily basis for construction/maintenance workers. This will enable the contractor to effectively manage and monitor the movement of construction/maintenance workers on and off the site;
- Depending on the duration of the contract, the project developer and or the contractor(s) should make the necessary arrangements for construction/maintenance workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks;
- Where feasible, no construction/maintenance workers, with the exception of security personnel, should be permitted to stay over-night on the site. This would reduce the risk to local farmers;
- Accommodation must be found in existing settlement or the construction camp must be located in or adjacent to an existing settlements;
- Ensure that construction camps do not remain permanent and should not be permanently occupied more than 3 months.

7.4 Disaster management

7.4.1 Health Risks associated with a gas transmission pipeline leak, rupture or fire

Compared with other methods for transporting hazardous chemicals, such as rail or road, transmission pipelines can be very safe, and transmission pipeline accidents are relatively rare and have caused few fatalities. Pipelines are primarily underground, which keeps them away from public contact and accidental

damage. However, a single major incident can have devastating environmental, health, and economic consequences (Osland, 2015:1064) because of the high operating pressures and large volumes of escaping gas. The damage to the immediate area, including structures, can be severe even when no ignition of escaping gas occurs. Failures on transmission pipelines will almost always cause escaping gas to excavate a large crater at the point of damage. If the escaping gas ignites during the resulting pressure-release explosion, the heat release will be tremendous, creating life-safety and fire-exposure problems extending to hundreds of metres or more from the pipeline (Parsley and Schwab, 2000).

In addition to acute accidents, chronic spills from gas transmission pipelines can have negative repercussions on human health and the environment through contamination of drinking water, reduction in air quality, or other long-term environmental damage. The presence of a gas transmission pipeline in crowded urban and suburban areas would therefore lead to increased health and safety risks.

Due to the intensity of underground infrastructure lines, including water, sewerage, electricity, telecommunications and gas pipes, in urban areas unintended pipeline strikes may happen. Workers focusing on other kinds of infrastructure may well damage gas pipelines. On the other hand, gas pipeline planning processes also need to be sufficiently careful not to compromise existing infrastructure, particularly if it is located underground (refer to Section 7.2). It is therefore important for regulatory frameworks to regulate and restrict land uses near gas transmission pipelines. This would help to reduce risk, but there must be political support for the design and implementation of such measures.

Another complication lies in the inaccessibility of municipality plans indicating the location of the various underground infrastructure. In South Africa, many municipalities have lost their original “as-built” plans, increasing the risk of incidents. Given that much of the pipeline would be underground, locating and assessing the condition of components is difficult. An additional factor increasing risks is the encroachment of suburban growth upon pipelines designed for rural areas. As such, these pipelines expose large numbers of the community to risks that they are blithely ignorant of, and have no say or choice over. Land use change due to residential and other development around pipelines that were built to a rural specification.

Parsley and Schwab (2000) give valuable advice in the case of a pipeline fire: do not expect to extinguish fires on gas pipelines. The only safe way of extinguishing such a fire is to remotely eliminate the fuel source by isolating the damaged section of the pipeline - a task that only the Pipeline Developer can perform. However, it remains important to secure a water supply and stretch hand-lines where appropriate to effect viable rescues and protect properties. Do not enter the immediate fire area until the pipeline operator has indicated that it is safe to do so. Most pipelines today operate with automatic valves that open when timers and pressure sensors on the line indicate the need. The large loss in pressure that results from a pipeline failure may be read by automatic systems as an increased demand, causing valves to operate, sending a rush of gas toward the breach in the line, resulting in a violent increase in the size of the fire (Parsley and Schwab, 2000).

Management actions

- Undertake a metre by metre risk assessment over the entire length, ensuring that all threats are eliminated or at least minimised such that risk of leak/rupture of the pipeline is avoided or at least reduced to *As Low as Reasonably Practicable* (ALARP);
- Ensure that pipelines located in high population density areas or areas requiring high levels of protection for the public, are designed to leak rather than break (full bore rupture) in the event of an incident, e.g. if impacted, for example, by an excavator, or if some material failure occurs;
- Ensure that pipelines are designed and built according to international standards and based on the surrounding land-use;
- Ensure maintenance is undertaken as per required schedule and appropriate corrective actions implemented timeously. Normally, leaks are detected by abnormal pressure drops and a loss of transported volumes. Risk Based Inspection via scheduled intelligent pigging of the pipeline sets an initial baseline and thereafter monitors the condition of the pipeline. This methodology has been successfully employed on the Rompco Pipeline, detecting corrosion and signalling maintenance and repair long before failure actually occurs.

- Ensure that the latest technology is used during integrity testing (in particular to detect general corrosion, pitting corrosion, stress corrosion cracking, etc.) – for example automated ultrasonics, electromagnetic acoustic transducer (EMAT);
- Ensure that risks to the pipeline due to any changes in the environmental conditions surrounding the pipeline (e.g. increase in moisture in the drainage line where the pipe is laid down) are considered;
- Ensure that the location class of a section of existing pipeline is changed in the event of land use change. Where there are changes in land use planning (or existing land use) along the alignment of an existing pipeline, a safety assessment must be carried out and additional control measures determined to ensure that the risk associated with a rupture or leak is ALARP;
- Ensure the use of competent people for welding;
- Pigging stations must be located in an area accessible to 24 hour emergency services.

7.4.2 Preparedness in responding to a disaster

Without adequate disaster management planning, a pipeline incident can escalate into a disaster. Therefore, irrespective of what disaster occurs or whether there is loss to property or lives, the consequence would be considered to be extreme if authorities are not able to effectively respond to it.

Another concern is that most civil emergency planning looks at critical infrastructures only from the perspective of dealing with the *primary* emergency. Hardly any planning for pro-active and incident response activities is made to protect the *secondary impacts* on critical infrastructure³ in, and directly around, the emergency area. This concerns the most obvious visible infrastructures: road, rail, hospitals. (Luijff and Kluver 2005:3). Other secondary problems could include impacts on sewerage, electricity lines, water reticulation, burial capacity, rapid access to city planning information, food and medicine distribution, and the functioning of schools (Luijff and Kluver 2005:6).

A *disaster response* can be defined as a wide array of reactions, measures, and policies that mitigate, counteract, and prevent disaster impacts and effects. Once a disaster has occurred, the impacts stimulate the unfolding of systemic response mechanisms and the creation of specially designed response measures. These responses provide emergency relief and rehabilitation activities and can compensate stock losses and promote reconstruction. This also stimulates an anticipatory response aimed at the prevention and mitigation of future potential disasters. There are therefore three types of responses: (a) immediate response, (b) compensatory response; and (c) anticipatory response. After the immediate disaster response, compensatory and anticipatory responses usually follow. Reversing the negative impacts is possible once the emergency response has contained the spread and worsening of indirect effects. These responses normally require a significant amount of public involvement, and puts pressure on public resources (Albala-Bertrand, 2003).

An assessment of fire and rescue services was done by the SA Insurance Association (SAIA) in **1999**. The study was precipitated by growing statistics in the preceding eight years which indicated a dramatic increase in value of fire claims. The claims of R400 m in 1990 increased to R1.4 billion during these eight years. Most insurers suffered significant losses on fire accounts. In its analysis, SAIA noted that a major contributory factor for this increase in value per loss was a *decline in ability of fire services to fight fires and contain losses* (COGTA, 2013).

The Inter-Ministerial Committee on Disaster Management conducted its own research in **1999**. It highlighted several reasons for the decline in municipal capacity:

- Lack of compulsory national standards hinders objective evaluation.
- Employment practices often overlook objective criteria due to political expediency and trade union action.
- A lack of municipal Council responsibility and accountability, so that vast areas throughout the country still have no fire service at all.
- Lack of maintenance plans result in critical shortages of equipment.
- Widespread employment of fire safety personnel as consultants in building design compromise their objectivity.

³ Gas pipelines are now regarded as a key component of critical infrastructure (CI); this is defined as those physical and information technology facilities, networks, services and assets which, if disrupted or destroyed, have a serious impact on the health, safety, security or economic well-being of citizens or the effective functioning of governments (Luijff and Kluver 2005:1)

The Disaster Management Act (Act 52 of 2002) was an attempt to address the litany of problems faced by the fire-fighting sector and provides for:

- an integrated and co-ordinated *disaster management policy* that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post-disaster recovery; and
- the establishment of national, provincial and municipal disaster management centres.

- Basic Conditions of Employment Act (BCEA): The imposition of new labour legislation has impacted negatively on shift-based fire services. Changes to accommodate the BCEA meant doubling up on manpower and a concomitant huge increase in costs.
- Municipal funding is mostly diverted to create infrastructure rather than for essential services.
- The Fire Brigade Board has been virtually dormant, to the detriment of the function (COGTA, n.d.)

This Act is much more holistic than either the Fire Brigades Act or the National Veld and Forest Fire Management Act. "Disaster Management" is defined as "a *continuous and integrated multi-sectoral, multi-disciplinary process* of planning and implementation of measures, aimed at:

- Preventing or reducing the risk of disasters;
- Mitigating the severity or consequences of disasters;
- Emergency preparedness;
- A rapid and effective response to disasters;
- Post-disaster recovery and rehabilitation.

The Disaster Management Act is far-reaching in several ways. It has a strong focus on disaster prevention, preparedness⁴, and post-disaster recovery. It includes several functional sectors; and it goes beyond the state.

In **2007**, as part of the preparations for the 2010 FIFA World Cup, the former Department of Provincial and Local Government commissioned a group of experts to determine the state of fire services in the country. The team identified two key issues affecting fire services: the first relates to the different interpretations of Section 84(1)(j) of the *Municipal Structures Act*, which has resulted in a complex and dissimilar division of fire functions between district and local municipalities. These developments have in some areas led to a two-tiered fire service in the same jurisdiction, resulting in costly and wasteful duplication of efforts and resources. The second issue relates to the relationship and jurisdictional contests between municipal fire services and other emerging government-funded initiatives aimed at addressing fire challenges such as veld fire management. In some instances, these programmes are presented as an alternative model for the provision of fire services which raises fundamental questions, as fire-fighting services are a municipal function as outlined in the Constitution. This places the Chief Fire Officer at the heart of sustainable delivery of fire services. The proposed fire service legislation should provide clarity on the jurisdiction of chief fire officers in relation to role-players (government-funded or private) who are involved in fire-fighting across the country (COGTA, 2013).

The **2007** study (i.e. 8 years after the original SAIA assessment) found additional problems (COGTA 2013)¹:

- None of the services evaluated complies fully with SANS 10090 - Community protection against fire.
- Almost all services are under-staffed, some by over 50% resulting in some officials having to be permanently available on a 24 hour basis.
- The extension of municipal jurisdictional areas as a result of boundary re-alignment increased workloads.
- The audit suggested that a one-size-fits-all approach was not suitable, as smaller municipalities have unique needs and operating conditions.
- There were inconsistent standards for service delivery.
- There was an unclear division of functions and financial responsibilities between District and Local municipalities, and this results in duplication and inefficiency.
- There is a lack of a national three-digit emergency service telephone number outside existing cellular telephone networks.
- Most emergency communication and control centres do not have back-up facilities to ensure continuity of service during disasters.
- Most services (with a few exceptions) lack formal capital replacement policies which results in excessive downtime

⁴ "Emergency preparedness" is defined as "a state of readiness which enables organs of state and other institutions involved in disaster management, the private sector, communities and individuals to mobilise, organise and provide relief measures to deal with an impending or current disaster, or the effects of a disaster. This goes far beyond urban fire-fighting and rural fire associations.

and consequent unavailability of vehicles.

- Lack of Incident Command Systems to assist in inter-agency cooperation.
- A shortage of technical training such as Urban Search & Rescue, Advanced level Hazmat response capabilities, and Incident Management.
- Some services appoint personnel without due regard to technical and physical competencies.
- Poorly coordinated workplace skills programs, no comprehensive safety policies and procedures.
- Some municipal water departments not complying with codes for fire-fighting water supply.
- General poor maintenance of fire hydrants.
- Divergent fire safety by-laws. Inadequate focus on Major Hazard Installation Regulations
- Insufficient emphasis on community fire safety education.
- The Municipal Infrastructure Grant is utilized by most municipalities to fund the updating of infrastructure, including fire stations. But some municipalities are then unable to budget for operational costs (vehicles and fire houses) to run a functional service.

Although these challenges were identified many years ago, they have not been resolved, and “require urgent and concerted efforts by all stakeholders led by government to address them effectively” (COGTA 2013:27).

This Act created a new institutional architecture and outlines the requirements of the creation of a National Disaster Management Centre (NDMC). The Centre is tasked with promoting an integrating and co-ordinated system of Disaster Management, emphasising prevention and mitigation, across all spheres of government, and with non-state actors, including communities. It is staffed by a Head, as well as staff drawn from COGTA.

For the purpose of the pipeline project, two requirements are significant: (a) The integration of prevention and mitigation methodologies with municipal IDPs; and (b) promote formal and informal initiatives to encourage risk-avoidance behaviour by private and public sector organisations.⁵

7.4.2.1 Status of DisM preparedness

As part of its functions, the NDMC must guide the drafting and updating of Disaster Management plans by organs of state; provide technical assistance in the drafting of these plans; assist in aligning these plans and co-ordinating strategies, and develop strategies for prevention and mitigation. It must promote disaster management capacity building, training and education throughout South Africa. The National Centre is also responsible for the administration of the Fire Brigade Services Act, 1987.

The effectiveness of the NDMC has been questioned. In 2012, the head of the Centre reported to Parliament about the functioning of the Centre. The Parliamentary report found that “The National Disaster Management Centre was currently hugely understaffed, and it was not possible to deal with all the issues that the Centre was confronted with” (PMG 2012). By 2015, the NDMC was still a programme within the Department. The *Disaster Management Amendment Act* (Act 16 of 2015), which made the Centre a government component only came into operation on the 1st of May 2016. After that, some progress was made. A Parliamentary report listed factors such as the creation of an integrated urban development framework, and facilitating a coordinated response to disasters such as the drought and other smaller incidents. The NDMC undertook monitoring of various prevention and mitigation initiatives during the period, including the introduction of the International Day for Disaster Reduction (IDDR) commemoration in 2015, where they visited disaster management stakeholders across the country (PMG 2016).

On a provincial level, DisM Centres in most provinces have not been implemented effectively. A Parliamentary Committee discussion heard about the National DisM Centre’s challenges in implementing disaster management include the poor functionality of Disaster Management Advisory forums, the failure of government stakeholders to report on and implement disaster risk reduction measures, the non-responsiveness of the state to prescripts to respond to disaster occurrences, and the lack of funding for awareness programmes. In response, the Presidency approved the Inter-ministerial Committee on Disaster Management (ICDM) in 2016, making provincial disaster reporting a statutory requirement and creating a

⁵ Section 22 of the Disaster Management Act, No. 57 of 2002.

legislative platform for effective and responsive policy creation in coordination with the NDMC (PMG 2016). However, building provincial DisM capacity will still require a great deal of attention.

When considering municipal DisM capacity, the NDMC indicated that, especially in sector departments and local municipalities, little or no organisational capacity for disaster management existed (PMG 2015). The NDMC Annual Report (2014) noted the following problems related to municipal DisM capacity:

- Lack of disaster management units or focal points for sectors lead to lack of clarification of some of the policies developed by the sectors, for example: when do sectors contribute and for what type of infrastructure before funding applications are submitted to the Treasury Committee?;
- Lack of equipment by some centres in dealing with disasters as quickly as possible to minimise the effects of the disasters, for example fire engines, appropriate vehicles;
- Lack of trained and skilled personnel, resulting in delays in submitting the required documentation to the NDMC. In most cases, the NDMC has to physically go and assist with the compilation of the report. This also relates to availability of the provincial engineers to assist with the cost estimates so as to reduce the time it takes for the application to be submitted for national contribution;
- Lack of political will in some municipalities where decisions on either declaration or reprioritisation are delayed, thus delaying the whole process of responding to the affected communities;
- Lack of involvement of government departments, for example the provincial departments of Human Settlements to provide guidance on emergency housing;
- Lack of sector participation in the municipal advisory forums and other technical task teams impact negatively on disaster planning and resource mobilisation;
- Incorrect interpretation of the Disaster Management Act, particularly with regard to the perception that a declaration means that the NDMC and national government will provide funding for the disasters; and
- Placement of the function within the organisational structure of a municipality. If the placement is not within the decision-making structures of the municipality, challenges are often experienced in implementing the legislation effectively (NDMC 2014:60).

The NDMC also noted there were common challenges raised by some Disaster Management Centres that

- Disaster management is not prioritised by many municipalities. As a result, they lack funding and the human and material capacity to do the job. It is often a consequence of the inappropriate placement of the function within the organisational structure of the municipality;
- Sector departments do not participate in local disaster management forums, but parachute projects from the province or national government without involving the Disaster Management Centres or municipalities concerned;
- Where there is political instability or frequent political changes, disaster management is often affected by those changes, as in some cases benefit from disaster relief support is said to be politicised (NDMC 2014:61).

Three years later, the NDMC recorded some issues raised during Fire Safety and Prevention Capacity Assessments: The lack of implementation of bylaws, or no relevant bylaws at all; the lack of fire services in certain municipalities; inadequately staffed fire safety units, lack of standard operating procedures; weak community-based fire education and awareness; inadequate systems for hydrant maintenance; as well as weak cooperation with the town planning division and law enforcement agencies (NDMC 2017:97).

This suggests that, as the planning process continues for the pipeline project, COGTA and the Disaster Management Centre must take *proactive* steps to plan for possible pipeline-related disasters.

Management actions

Pipeline-related disaster management

During a pipeline-related disaster, the key strategies that apply to all natural gas emergencies are to establish command and a safe staging area, secure the scene, evacuate at-risk occupants and bystanders, effect viable rescues, eliminate ignition sources, and co-operate with the local utility company. The key overall strategy involves developing a working partnership between Government (at various levels) and the

Developer. This would include conducting pre-incident planning sessions at large gas customers in the response area (Parsley and Schwab, 2000).

All of this requires ongoing public awareness and involvement. In Canada, the Onshore Pipeline Regulations require that a Pipeline Developer develops a continuing-education program for all first responders and the public residing adjacent to the pipeline. Providing continuing education ensures that these parties remain informed about the products being transported through the pipeline, the location of the pipeline, and the safety procedures to follow during emergencies (Wong, 2014). There have been many cases where the lack of technical knowledge of first responders and community members has worsened gas-related crises. For example, there have been instances of fire departments provoking explosions and fires by spraying water on otherwise inert chemicals (Qurantelli 2003).

Responders and military operations should develop awareness of and plan for safeguarding critical infrastructures. Furthermore, training exercises of first responders and military need to take critical infrastructure services into account. Preferably, joint exercises with providers of critical infrastructure services should be regularly scheduled (Luijff and Kluver, 2005).

The Disaster Management Act requires the National Centre to create a **National Disaster Management Framework**, to guide the promotion of Disaster Management within all spheres of government, and include non-state actors. The Framework should promote disaster management capacity building, training and education, including in schools. It should also provide a funding framework, including grants to contribute to post-disaster recovery and rehabilitation, and payment to victims of disasters.

Each national organ of state indicated in the Framework must prepare a **disaster management plan**, describing its role and responsibilities, capacity, strategies, and emergency procedures. It must co-ordinate and align the implementation of its plan with those of other organs of state and institutional role-players. It must also regularly review and update its plan. The Disaster Management Amendment Act (2015) specified that each national organ of state must (a) conduct a disaster risk assessment for its functional area; (b) and identify and map risks, areas, ecosystems, and communities that are exposed or vulnerable to threats. This elaborate institutional architecture is then replicated at **provincial level**: each province must design a Provincial Framework, to ensure an integrated approach to Disaster Management by all provincial organs of state and non-state actors. Each province must establish a disaster management centre. The Premier must designate a department responsible for DisM co-ordination. In practice, this is within provincial COGTA. The Province must create a Provincial DisM Centre, with several key functions:

- Collecting and distributing information concerning actual or potential disasters in the province;
- Advising organs of state and non-state actors;
- Recommending funding principles for DisM in the province;
- Making recommendations on draft DisM legislation;
- Making recommendations on the declaration of provincial disasters;
- Promoting the recruitment and training of DisM volunteers in the province;
- Promoting DisM training in schools;
- Promoting research on DisM in the province; and
- Giving advice to vulnerable communities.

The Provincial DisM Centres must appoint their own Head. The Amendment Act (2015) added that the staff must also consist of suitably qualified persons, designated by the Head of the department within which the provincial disaster management centre is established.

The Disaster Management Act (2002: section 33) provides a useful list of *types of guidance* which a provincial DisM Centre must provide. **These are particularly useful in the case of an important infrastructure project, such as a gas transmission pipeline.** This guidance could include:

1. Determining *levels of risk*
2. Assessing the *vulnerability of communities*
3. Increasing the *capacity of communities* to reduce the risk and potential impacts of disasters
4. Monitoring the *likelihood*, and state of *alertness to* disasters

5. Develop and implement appropriate *prevention and mitigation methodologies*
6. Integrating such methodologies with *development plans and initiatives*
7. The management of *high-risk developments* (a pipeline might be considered to fall in this category).

The Amendment Act (2015) added that (1) Each provincial organ of state must —

1. conduct a disaster risk assessment for its functional area;
2. identify and map risks, areas, ecosystems, communities and households that are exposed or vulnerable to physical and human-induced threats;
3. draft a Disaster Management plan, and align it with those of other organs of state.

Such plans must:

- Be specific to gas pipeline incidents and disasters;
- Anticipate likely types of disaster in the province, and their possible effects;
- Develop measures that reduce the vulnerability of specific areas and communities;
- Develop a system of incentives to promote DisM in the province;
- Take into account indigenous knowledge related to DisM;
- Promote DisM research;
- Identify and address weaknesses in capacity to deal with possible disasters;
- Provide for appropriate prevention and mitigation strategies;
- Facilitate maximum emergency preparedness; and
- Contain contingency plans and emergency procedures, including the allocation of responsibilities to different actors, prompt response, the procurement of essential goods and services, the establishment of strategic communication links, and the dissemination of information.

Managing medical dimensions of disasters

A pipeline disaster may bring many victims to the emergency department of a hospital, as a mass casualty incident (Kirk *et al.*, 1994). Emergency doctors must be aware of the nature of the chemical composition of the gas.

Hospitals will need a Mass Casualty Incident Plan, which should establish a hospital command centre, and define who is in charge of communication with the public. The command centre would collect information from the scene, patient care areas, local hospitals, inter-hospital transfers, and medical supplies.

Furthermore, a Haz-Mat disaster may continue after the event, due to contamination of air, soil, food, animals, and drinking water (Kirk *et al.*, 1994).

Recovery management after a pipeline disaster

Recovery deals with activities undertaken after a crisis response period is over in an attempt to return an area to normal. In the short term, the focus is on restoring infrastructure and service delivery. In the long term, the attempt is to restore community life. Specific measures can include providing financial and technical assistance to farmers in cleaning up contaminated farmland, setting up of counselling services for victims, restoring urban services, and rebuilding damaged and destroyed facilities (Quarantelli, 2003).

There may also be political consequences, due to public anger. The discovery of building codes unenforced, warning messages not passed along, and delays in disaster response can provoke the wrath of disaster victims. Once politicized, citizens may insist upon the passage of laws and regulations to prevent similar disasters in the future. Activist groups may also try to prepare the local population for future threats. Taking advantage of public interest and partnership opportunities, governments can channel resources of these groups to be better prepared in the event of other emergencies (Quarantelli, 2003).

Regular consultations and training with municipalities need to be conducted, about changing systems, operations and risks.

8 RISK ASSESSMENT

8.1 Consequence levels

Table 5 below provides a description of the consequence levels used in the rating process.

Table 5: Consequence levels determination

Impact	Consequence level	Reason
Impact to lives and livelihoods; Settlement Planning and Development	Slight	<ul style="list-style-type: none"> • Little or no additional disruptive impact on local economies and/or service delivery. • Little or no land-use management implications whereby there is no additional pressure on land-use applications. • Little or no impact with respect to disruption on human activity and livelihood activities through construction activities or reduction in land use amenity. • No restriction on new development in towns / economic nodes; economy can grow without being impeded by potential development constraints due to the presence of a gas pipeline and or any declared servitude.
	Moderate	<ul style="list-style-type: none"> • Limited and short-term (less than 12 months) disruptive impact on local economies and/or service delivery. • Limited land-use management implications whereby the additional pressure on land-use applications and stakeholder interaction required is within the capability of the local authority and does not place additional burden on the citizens with respect to negotiations on loss of usage rights, compensation and hardship suffered. • Limited impact with respect to disruption on human activity and livelihood activities through construction activities or reduction in land use amenity. Planned disruption on fixed schedule of 6 months and small areas impacted. • Little or no additional restriction on development and economic growth due to the construction or the presence of a gas pipeline.
	Substantial	<ul style="list-style-type: none"> • The construction has a disruptive impact on local economies and/or service delivery with respect to large areas and construction related activities and preparation phases extend between 12 to 24 months or more. • Numerous land management implications whereby the additional pressure on land-use applications and stakeholder interaction requirement is beyond the capacity of the local authority requiring significant input from citizens with respect to negotiations regarding loss of usage rights, compensation and hardship suffered. This leads to delays in development implementation and occurs for 2-3 years and affecting more than 20 % of the community members. • Disruption on human activity and livelihoods activities through construction activities or reduction in land use amenity. Planned disruption extends into 12-24 months and accompanied by uncertainty about when land use activities can revert to future use. • Development of towns and economic growth is impacted due to the construction or the placement of the servitude in areas that limit other economic potential for the future.
	Severe	<ul style="list-style-type: none"> • The local economies and/or social service delivery is interrupted for 2-3 years. • Numerous land management implications whereby the additional pressure on land-use applications and stakeholder interaction requirement is beyond the capacity of the local authority requiring significant input from citizens with respect to negotiations regarding loss of usage rights, compensation and hardship suffered. This leads to delays in development implementation and occurs for 4 or more years. • Disruption on human activity and livelihood activities through construction activities or reduction in land use amenity. Planned disruption extends between 2-3 years and accompanied by uncertainty about when land use activities can revert to future use and

Impact	Consequence level	Reason
		<p>impacting more than 30% of the community.</p> <ul style="list-style-type: none"> Development of towns and economic growth is impacted due to the construction or the placement of the servitude in areas that limit other economic potential for the future.
	Extreme	<ul style="list-style-type: none"> Exponential disruptive impact on local economies and service delivery from which it is unlikely to recover. Disruption on human activity and livelihood activities through construction activities or reduction in land use amenity. Planned disruption extends more than 3 years and accompanied by uncertainty about when land use activities can revert to future use. Affect dense rural settlements and communally owned land whereby land negotiations would be required that would increase complexity of planning and land use applications extending for 6 and more years and impacting more than 50 % of current users. Unable to respond to increased development pressures whereby economic nodes are constrained in terms of future development initiatives.
DisM preparedness	Slight	<ul style="list-style-type: none"> Minor leak. Small fire Localised Developer should be able to contain this disaster, with municipality providing support (e.g. water access, traffic control, evacuation of people)
	Severe	<ul style="list-style-type: none"> Large leak / fire requiring specialist fire-fighting; May threaten properties and livestock May threaten human health and safety May require some time (several days) to return the area to normal Will require considerable local and district municipal support to ensure leak or fire is adequately contained
	Extreme	<ul style="list-style-type: none"> Major leak/large fire/impact on other critical infrastructure May create extensive damage to properties May result in loss of life May have impacts on other critical infrastructure (e.g. telecoms) May have a significant interruption to gas supply (e.g. up to a month), with consequences for “downstream” users of gas products. Will require local and district municipal and provincial support to ensure that leak or fire is adequately contained.

8.2 Risk Assessment results

Tables 6 and 7 provide the results of the Risk Assessment.

Table 6: Risk assessment of the gas transmission pipeline construction and operation on settlements planning and development and on lives and livelihood

Criteria	Impact	Study area	Location (sensitivity)	Without mitigation			With mitigation		
				Consequence	Likelihood	Risk	Consequence	Likelihood	Risk
Land-use management and tenure	Land-use management implications (land negotiations, servitude proclamation)	All phases (Construction)	High	Severe	Very Likely	High	Substantial	Likely	Moderate
			Medium	Moderate	Very Likely	Low	Slight	Likely	Very Low
			Low	Slight	Likely	Very Low	Slight	Likely	Very Low
Development intensity and extent (Settlement and economic nodes)	Risks to the local population due to the influx of job seekers	All phases (Construction)	Very high	Slight	Very Likely	Very Low	Slight	Very Likely	Very Low
			High	Slight	Very Likely	Very Low	Slight	Very Likely	Very Low
			Medium	Severe	Likely	High	Severe	Unlikely	Moderate
			Low	Severe	Very Unlikely	Low	Severe	Very Unlikely	Low
			Very low	Severe	Very Unlikely	Low	Severe	Very Unlikely	Low
	Impact on the location options of new developments (extent and direction) due to the presence of the gas transmission pipeline	All phases (Operation)	Very high	Extreme	Very Likely	Very High	Moderate	Likely	Low
			High	Severe	Very Likely	High	Moderate	Likely	Low
			Medium	Moderate	Very Likely	Low	Slight	Likely	Very Low
			Low	Slight	Very Likely	Very Low	Slight	Unlikely	Very Low
			Very low	Slight	Very Likely	Very Low	Slight	Unlikely	Very Low
	Disruptive impact on businesses contributing to the local economy during construction	All phases (Construction)	Very high	Extreme	Very Likely	Very High	Severe	Likely	High
			High	Severe	Likely	High	Moderate	Likely	Low
			Medium	Moderate	Likely	Low	Moderate	Likely	Low
			Low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low
			Very low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low
Population density	Disruptive impact on population and service delivery during construction	All phases (Construction)	Very high	Extreme	Very Likely	Very High	Moderate	Likely	Low
			High	Severe	Likely	High	Moderate	Likely	Low
			Medium	Moderate	Likely	Low	Slight	Likely	Very Low
			Low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low
			Very low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low
	Impacts on local population due to the	All phases (Construction)	Very high	Slight	Likely	Very Low	Slight	Unlikely	Very Low
			High	Slight	Likely	Very Low	Slight	Unlikely	Very Low

Criteria	Impact	Study area	Location (sensitivity)	Without mitigation			With mitigation		
				Consequence	Likelihood	Risk	Consequence	Likelihood	Risk
	Presence of project workers/workforce		Medium	Severe	Likely	High	Severe	Unlikely	Moderate
			Low	Extreme	Likely	High	Extreme	Unlikely	Moderate
			Very low	Extreme	Likely	High	Extreme	Unlikely	Moderate
	Resettlement and relocation/ displacement impacts	All phases (Construction)	Very high	Extreme	Very Likely	Very High	Extreme	Very Likely	Very High
			High	Severe	Likely	High	Severe	Likely	High
			Medium	Moderate	Likely	Low	Moderate	Likely	Low
			Low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low
			Very low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low
	Health Risks associated with a gas transmission pipeline leak or fire	All phases (Operation)	Very high	Extreme	Very Likely	Very High	Moderate	Likely	Low
			High	Severe	Likely	High	Moderate	Likely	Low
			Medium	Moderate	Likely	Low	Slight	Likely	Very Low
			Low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low
			Very low	Slight	Very Unlikely	Very Low	Slight	Very Unlikely	Very Low

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Table 7: Assessment of Health and Safety impacts associated with the operation of a gas transmission pipeline

Impact	Study area	Location	Without mitigation: Inadequate level of preparedness in the event of a disaster			With mitigation: Adequate level of preparedness in the event of a disaster		
			Consequence	Likelihood	Risk	Consequence	Likelihood	Risk
Health and safety risks associated with a Minor leak/small fire	Rural	Extensive farms	Slight	Likely	Very low	Slight	Not likely	Very low
		Small-holding farms	Slight	Likely	Very low	Slight	Not likely	Very low
		Rural villages	Moderate	Likely	Low	Slight	Not likely	Very low
	Urban	Small towns	Moderate	Likely	Low	Slight	Not likely	Very low
		Medium towns	Moderate	Likely	Low	Slight	Not likely	Very low
		Large towns	Moderate	Likely	Low	Slight	Not likely	Very low
	Metro	Residential	Moderate	Likely	Low	Slight	Not likely	Very low
		industrial	Moderate	Likely	Low	Slight	Not likely	Very low
		CBD	Moderate	Likely	Low	Slight	Not likely	Very low
Health and safety risks associated with a Large leak / fire requiring specialist fire-fighting	Rural	Extensive farms	Moderate	Likely	Low	Moderate	Not likely	Low
		Small-holding farms	Moderate	Likely	Low	Moderate	Not likely	Low
		Rural villages	Moderate	Likely	Low	Moderate	Not likely	Low
	Urban	Small towns	Severe	Likely	High	Moderate	Not likely	Low
		Medium towns	Severe	Likely	High	Moderate	Not likely	Low
		Large towns	Severe	Likely	High	Moderate	Not likely	Low
	Metro	Residential	Extreme	Likely	High	Severe	Not likely	Moderate
		industrial	Extreme	Likely	High	Severe	Not likely	Moderate
		CBD	Extreme	Likely	High	Severe	Not likely	Moderate
Health and safety risks associated with a Major leak / large fire / impact on other critical infrastructure	Rural	Extensive farms	Severe	Likely	High	Moderate	Not likely	Low
		Small-holding farms	Severe	Likely	High	Moderate	Not likely	Low
		Rural villages	Severe	Likely	High	Moderate	Not likely	Low
	Urban	Small towns	Severe	Likely	High	Moderate	Not likely	Low
		Medium towns	Extreme	Likely	High	Severe	Not likely	Moderate
		Large towns	Extreme	Likely	High	Severe	Not likely	Moderate
	Metro	Residential	Extreme	Likely	High	Severe	Not likely	Moderate
		industrial	Extreme	Likely	High	Severe	Not likely	Moderate
		CBD	Extreme	Likely	High	Severe	Not likely	Moderate

9 GAPS IN KNOWLEDGE

Settlement Planning and Development

Regarding potential negative impacts of future gas transmission pipeline within approved corridors, the potential impact on existing mining rights (especially in Gauteng) has been identified as a potential issue to be mitigated through the routing of any future gas pipelines.

In order to make a better assessment of the impact on settlement development the following information would have been required:

- Location points of gas pipeline break bulk distribution points;
- Narrower extent of corridor with clearer idea of likely preferred alignment;
- More detail on time lines;
- Likely employment potential and or labour requirements; and
- Clarity on the process to be followed and use status of the servitude for the gas transmission pipeline.

No town growth that may occur as a result of the realisation of the gas pipeline and distribution was analysed. Thus the impact of the gas having any impact on population and or economic growth was not considered. If any growth above already anticipated growth should happen as a result of the development, additional planning to accommodate the growth will be required with respect to additional service delivery for social services, housing, facilities and bulk infrastructure.

When considering project level impacts at a later stage, there would be a need for a baseline study or studies with regard to current land use, population numbers, land ownerships and economic use of land. Baseline data on these aspects will be essential if negotiation with regards to use limitations, servitude proclamation and impact of construction and evaluation of any economic impact of the disruption or loss of earning is to be fair and transparent. Such studies are essential to attribute specific costs and negative impacts of the construction process.

There are substantial information gaps as to the state of land use management instruments, such as land use management schemes, in the country. The quality of many municipal SDFs is very weak, especially in the smaller municipalities. There is thus in general (1) a shortage of information on which decision-makers can rely when making land use and spatial planning decisions, and (2) a lack of clarity regarding the regulatory implications of the location, timing and use right of future gas transmission pipeline servitude.

Disaster Management

The DisM information presented within this assessment provided a high level indication of the disaster preparedness of the potentially affected municipalities but a much more detailed survey of municipal firefighting and DisM capacity should be undertaken, once the final routing of the gas transmission pipeline is determined.

10 BEST PRACTICE GUIDELINES AND MONITORING

In addition to the above recommended management actions (Section 7), the following best practice guidelines are also recommended.

10.1 Planning phase

Capacity building and municipal support

When a proposed bulk pipeline goes through a municipal jurisdiction, it will trigger various municipal activities, including spatial planning requirements and disaster management. Such negotiations will inevitably drag on for months, as it will involve two major aspects, namely, spatial co-ordination according to municipal SDFs, which may well have to be adjusted to cater for the pipeline (e.g. urban residential expansion) and administrative capacity, particularly regarding disaster management capacity-building, i.e. assessing current capacity, determining what additional capacity (staff, finances, skills) will be required to deal with potential pipeline problems, and determining the source of such financial support. One of the major mitigation factors critical to planning, implementation, monitoring and adaptation will therefore be the capacity, especially in smaller rural municipalities, of the relevant settlement planning, service delivery, integrated planning and other authorities in the area. Private-sector planners would also need to receive rapid technical orientation and guidance. Building capacity and expanding numbers of planners in municipalities could address this, but this requires resources. In order to deliver on this mandate, local planning officials will have to be capacitated and informed to provide the necessary enabling and regulatory services. The role and support of the South African Local Government Association (SALGA), COGTA, research councils, academia and local civil society led initiatives can be solicited in support of the respective Provincial Governments. The following mechanisms support the above requirement:

- Municipalities which may be affected by the final routing of the gas transmission pipelines must be identified. The Developer must consult with these municipalities on the roll-out of the gas transmission pipeline and what support would be required, should a disaster occur.
- The Developer must have top-level discussions with the national COGTA, as well as affected provinces, about municipal DisM capacity-building measures.
- Affected municipalities' DisM capacity needs to be investigated in detail, and a comparative matrix established as a baseline ("status quo") situation⁶.
- In partnership with the provincial governments, the Developer must draft a set of interventions to build municipal DisM capacity.
- The challenges and potential opportunities posed by pipeline construction and downstream development associated with it, clearly illustrate the need for a sound IDP and SDF at municipal level and requirement of the Developer to participate in the process. All spheres of government and the Developer should participate in municipal IDP processes with SDFs providing guidance.
- For SDFs to play this role, it is critical that municipal SDFs be updated to cater for large scale infrastructure development (such as pipeline development and other major road and rail projects which may occur within the same area or any expanded renewable electricity developments) and to inform the reprioritisation of budget allocations where and if required. The process associated with acquiring the required rights, with detailed planning and implementation of gas transmission pipeline development will need to be designed to contribute to integrated and coordinated planning and governance between different authorities and especially local role players in the region to ensure that development is done considering the public good and impact on local economies and the vulnerable. The servitude planning and proclamation will need to comply with local land use planning regulation and be included in negotiations as part of Local SDF and Land Use Management Schemes all of which need to comply with the SPLUMA regulations or provincial regulations where provincial planning legislation is in place (such as for parts of the corridor that fall within the Western Cape Province).
- For coordinated spatial and delivery planning all projects have to be planned in the context of national, regional and local SDFs and IDPs, as well as relevant sector plans. Given the extent of the

⁶ See Van Riet (2009) for a useful description of a Participatory Disaster Risk Assessment process in the Fezile Dabi District Municipality, Free State Province

gas transmission pipeline and construction and operational timeframes, the adaptation of sector plans is a crucial mitigation factor required for the planning, environmental clearance, servitude proclamation, land negotiation, compensation for loss of use where necessary, before construction starts. Effective and efficient land-use management and regulatory environment is critical. The process associated with prioritisation of certain phases and time lines of the gas transmission pipeline will need to consider the need and relevance for national and regional development objectives and will require identified need, priorities for phasing and prioritisation for implementation within the NSDF and associated national infrastructure alignment processes.

- The development of a RSDF (provision for this framework is included in Section 19-20 of SPLUMA) should be investigated as a suitable spatial planning tool for the gas pipeline. If determined to be the appropriate tool, a RSDF should be developed for the gas pipeline. The development of a RSDF would mean that municipalities do not need to alter their SDFs and IDPs specifically to accommodate the gas pipeline and the outcomes of the SEA will support the content of the RSDF.
- The cost of improving the state of readiness of all spheres of government, especially municipalities, to deal with the implementation of the gas transmission pipeline servitude planning must be considered when the planning and implementation of the corridor is undertaken. It is anticipated that all spheres of government (especially municipalities) will struggle to handle the increased strategic planning and regulatory challenges without creating additional capacity. When referring to regulatory capacity, special mention should be made to the need for compliance monitoring and enforcement for successful implementation of the gas transmission pipeline project.

Avoidance of key areas

- Transmission pipelines should avoid crossing through town areas, service towns, dense rural settlements and high density population areas...
- Major sensitivity in communally owned land should be avoided.
- Timeous negotiations and detailed studies must be undertaken to minimise negative impact in vulnerable communities especially in traditional authority areas.

Planning interventions and decision-making support

- Develop and implement an emergency plan – which has to be compiled beforehand, based on widespread consultation and awareness-raising.
- The main implication, for the gas transmission pipeline project, is that the more rural parts of the pipeline may be located in areas where there are Fire Protection Associations, with their own rules in force. They would function within the jurisdictions of municipalities, but they may also straddle municipal boundaries. The Pipeline Developer must therefore include municipalities and Fire Protection Associations in their disaster management planning procedures.
- All planning will have to take the current and future growth potential of towns into consideration in selecting the final gas transmission pipeline alignment.
- Ensure transparency in decision-making to provide clarity and ensure clean processes.
- All negotiations and planning process should ensure that the phasing is clear, that schedules for the construction is limited and clearly communicated to limit the impacts on the population and their livelihoods.
- The Developer should consider the need to establishing a Monitoring Forum (MF) in order to monitor the implementation of the recommended mitigation measures. The MF should be established before the construction/maintenance phase commences, and should include key stakeholders, including representatives from the relevant local municipalities, farmers, local farming unions, local community representatives etc. The MF should also be briefed on the potential risks to the local community and farm workers associated with construction/maintenance workers.

10.2 Construction phase

Disaster management

Effective DisM training/capacity-building/awareness processes must be established for municipalities. This may be part-funded by the Pipeline Developer.

10.3 Operations phase

Disaster management

- During a pipeline-related disaster, the key strategies that apply to all natural gas emergencies are to establish a command and safe staging area, secure the scene, evacuate at-risk occupants and bystanders, effect viable rescues, eliminate ignition sources, and co-operate with the local utility company.
- Government officials need to be aware of the activities of the operators of the gas infrastructure. These include:
 - Process hazard analysis, i.e. regular checking of the integrity of the infrastructure (e.g. pipes);
 - Infrastructural maps and diagrams;
 - Operating procedures;
 - Emergency training of pipeline staff; and
 - Accurate emergency planning and response procedures.
- The preparedness of local emergency responders is critical to protecting those who live and work near pipelines. They need to be aware of warning signs of a possible gas leak, such as:
 - Dirt being blown or appearing to be thrown into the air;
 - A white vapour stream or mist-like cloud over the pipeline;
 - Dead or dying vegetation in an otherwise green area;
 - A dry area in a wet field;
 - Flames coming from the ground or appearing to burn above the ground;
 - Continuous bubbling in wet or flooded areas;
 - Unexpected frost or ice on the ground;
 - A roaring, blowing or hissing sound;
 - An unusual “rotten egg” odour (Natural gas actually has no smell, but gas producers add chemicals to create a smell, and this helps with identification of leaks).
- There are some important steps emergency responders can take during the initial stages of an incident:
 - If it is safe to do so, turn off any mechanized equipment and ignition sources in the vicinity of the suspected leak
 - Secure the site and determine a plan to evacuate or sheltering place
 - Monitor for hazardous atmospheres
 - Control and redirect traffic
 - Provide immediate access to representatives from the pipeline company
- The role of the local responders would include:
 - Handling traffic control and evacuation
 - Securing the site
 - Firefighting
 - Making appropriate contacts if it appears other agencies, facilities or local authorities are impacted by the pipeline incident
 - Handling search and rescue
 - Providing medical assistance
 - Coordinating a community emergency response plan.
- Develop a continuing-education program for all first responders and the public residing adjacent to the pipeline. Providing continuing education ensures that these parties remain informed about the

products being transported through the pipeline, the location of the pipeline, and the safety procedures to follow during emergencies.

- Plans should be developed for safeguarding critical infrastructure.
- Training exercises of first responders must take into account critical infrastructure. Preferably, joint exercises with providers of critical infrastructure services should be regularly scheduled.

11 REFERENCES

Albala-Bertrand, J.M. (2003). Urban Disasters and Globalization, in Kreimer A, Arnold, M and Carlin, A (ed)s. *Building Safer Cities: The Future of Disaster Risk*, World Bank, Washington, DC.

Atkinson, D. (2007). Taking to the streets: Has developmental local government failed in South Africa?, S Buhlungu, J. Daniel, R. Southall and J. Lutchman (eds), *State of the Nation: South Africa*, Human Sciences Research Council, Pretoria. Available at, published by the HSRC

COGTA (2013). *Towards a Fire Services White Paper*. Discussion document. Government Gazette, 18 March. Pretoria. Accessed at: pmg-assets.s3-website-eu-west-1.amazonaws.com/

COGTA (n.d.). *National State of Fire Services*, Powerpoint presentation. Pretoria.

Deloitte (2015). Report for the Western Cape Government's Department of Economic Development and Tourism The socio-economic impact of importing LNG into the West Coast of the Western Cape.

Department of Energy (2013). Draft 2012 integrated energy planning report executive summary (For Public Consultation). Pretoria. Available online: http://www.energy.gov.za/files/IEP/IEP_Publications/Draft-2012-Integrated-Energy-Plan.pdf

Department of Energy (2016). Integrated Resource Plan Update Assumptions, Base Case Results and Observations Revision 1. Pretoria.

Department of Energy (2018). Draft Integrated Resource Plan 2018. Pretoria.

Department of Environmental Affairs (DEA) (2015). Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa. CSIR Report Number: CSIR/CAS/EMS/ER/2015/0001/B. Stellenbosch.

Energy Sector Management Assistance Program (ESMAP) (2006). Best Practices in Mainstreaming Environmental & Social Safeguards into Gas Pipeline Projects. Report 322/06.

eThekwin Municipality (2017), Spatial Development Framework 2017-2018 to 2021-2022: Final Report, Durban.

Freeman, P.K. (2003). Natural Hazard Risk and Privatization, in Kreimer A, Arnold, M and Carlin, A (ed)s *Building Safer Cities: The Future of Disaster Risk*, World Bank, Washington, DC.

[Gas, Health & Safety, Integrity & Maintenance, Magazine, October 2015](#) (2015). [Opinion, Pipelines, Policy](#), 16 March 2016. Safety of high pressure natural gas pipelines in Australia: is all as well as it should be?

Giovanni Ramírez-Camacho, J., Carbone, F., Pastor, E., Roberto Bubbico, R., and Casal, J. 2017. Assessing the consequences of pipeline accidents to support land-use. *Safety Science* 97: 34-42

Gray, A. (2017). Countries are announcing plans to phase out petrol and diesel cars. Is yours on the list? Available online at: <https://www.weforum.org/agenda/2017/09/countries-are-announcing-plans-to-phase-out-petrol-and-diesel-cars-is-yours-on-the-list>

- The Housing Development Agency (HDA). 2012. Implementation of Emergency Housing Guidelines. Available online at: http://thehda.co.za/pdf/uploads/multimedia/HDA_Implementing_Emergency_Housing_Guidelines.pdf
- International Energy Agency (2018). World Energy Outlook 2017. Available online at: http://www.iea.org/media/weowebiste/2017/Chap1_WEO2017.pdf
- The International Federation of Red Cross and Red Crescent Societies (IFRC) (2018). What is a disaster? Available online at: <http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/> [accessed: 23 August 2018]
- Koma, S.B. (2010). The state of local government in South Africa: issues, trends and options, *Journal of Public Administration*, Special issue 1, June, p. 111.-120. Available at <https://journals.co.za/content/jpad/45/si-1/EJC51773>
- Kirk, M.A., Cisek, J. and Rutherford, S. (1994), Emergency Department response to hazardous materials incidents, *Emergency medicine clinics of North America*, vol. 12, no. 2.
- Luijff E.A.M. and Kluver, M.H.A. (2005) "Critical Infrastructure Awareness required by Civil Emergency Planning", In *Proceedings 1st IEEE Workshop on Critical Infrastructure Protection*, Darmstadt, Germany, pp 110-117. IEEE P2426, Library of Congress 2005928245, ISBN 0-7695-2426-5
- Ma, L., Cheng, L. and Li, M. (2013). Quantitative risk analysis of urban natural gas pipeline networks using geographical information systems, *Journal of Loss Prevention in the Process Industries* 26
- Major Industrial Accidents Council of Canada (MIACC). 1999. Land Use Planning With Respect to Pipelines: A Guide for Local Authorities, Developers and Pipeline Operators. Major Industrial Accidents Council of Canada.
- Maritz, J., van Huyssteen, E. Green, C., McKelly, D. and Sogoni, Z. South African Functional Town Typology (CSIR 2018 v2). CSIR, Built Environment South African Functional Town Typology. CSIR document. Available on http://stepsa.org/map_space.html
- Negi, R. 2014. 'Solwezi Mabanga': Ambivalent Developments on Zambia's New Mining Frontier, *Journal of Southern African Studies*, 40(5), 999-1013, DOI:10.1080/03057070.2014.946215
- Office of Pipeline Safety, 2010 Building Safe Communities: Pipeline Risk and its Application to Development Decisions US Department of Transportation, Pipeline and Hazardous Material Safety Administration, Washington, DC.
- Oranje, M and van Huyssteen, E. (2011). Nestling national 'transformation' imperatives in local 'servicing' space: Critical reflections on an intergovernmental planning and implementation project. *Town and Regional Planning*. 2011 (58).
- Osland, A.C. (2015). Building hazard resilience through collaboration: the role of technical partnerships in areas with hazardous liquid and natural gas transmission pipelines, *Environment and Planning A* 2015, volume 47, pages 1063 – 1080.
- Parsley, B.L. and Schwab, G.F. (2000). Managing natural gas emergencies, *Fire Engineering*, 7 January. Accessed at <http://www.fireengineering.com/articles/print/volume-153/issue-7/features/managing-natural-gas-emergencies.html>
- Parliamentary Monitoring Group (PMG) (2012). "Disaster Management Centre operations and how its funds are distributed", accessed at <https://pmg.org.za/committee-meeting/14748/>.

- 1 Parliamentary Monitoring Group (PMG) (2015). Disaster Management Amendment Bill: briefing by
2 Department of Cooperative Governance, accessed at <https://pmg.org.za/committee-meeting/20021/>
3
- 4 Parliamentary Monitoring Group (PMG) (2016). "Municipal Demarcation Board, SALGA, Municipal
5 Infrastructure Support Agent, National Disaster Management Centre on their 2015/16 Annual Reports",
6 accessed at <https://pmg.org.za/committee-meeting/23440/>
7
- 8 Pipelines and Informed Planning Alliance (PIPA). 2015. Hazard Mitigation Planning: Practices for Land Use
9 Planning and Development near Pipelines. US Department of Transportation
10
- 11 Quarantelli, E.L. (2003). Urban Vulnerability to Disasters in Developing Countries: Managing Risks in
12 Kreimer A, Arnold, M and Carlin, A (ed)s *Building Safer Cities: The Future of Disaster Risk*, World Bank,
13 Washington, DC.
14
- 15 Quintero, J. (2006) Best Practices in Mainstreaming Environmental & Social Safeguards into Gas Pipeline
16 Projects: Learning from the Bolivia-Brazil Gas Pipeline Project (GASBOL). World Bank, Washington, DC.
17
- 18 Republic of South Africa. (2014). Operation Phakisa: Unlocking the Economic Potential of
19 South Africa's Oceans Offshore Oil and Gas Exploration Final Lab Report.
20
- 21 Ruddell, R., Jayasundara, D.S., Mayzer, R. and Heitkamp, T. 2014. Drilling down: An examination of the
22 boomtown-crime relationship in resource-based boom counties, *Western Criminology Review*, 15(1)3-17
23
- 24 Scholes, R., Lochner, P., Schreiner, G., Snyman-Van der Walt, L. and de Jager, M. (eds.). 2016. Shale Gas
25 Development in the Central Karoo: A Scientific Assessment of the Opportunities and Risks.
26 CSIR/IU/021MH/EXP/2016/003/A, ISBN 978-0-7988-5631-7, Pretoria: CSIR. Available at
27 <http://seasgd.csis.co.za/scientific-assessment-chapters/>
28
- 29 Transportation Research Board (TRB). 2004. Transmission Pipelines and Land Use: A Risk-Informed
30 Approach. Washington DC: Transportation Research Board of the National Academies.
31
- 32 Van Huyssteen, E., Green, C., Maritz, J., McKelly, D. and Songoni, Z. 2018. South Africa's towns and
33 functional town areas.
34
- 35 Visagie. H.J. (2013). Report for the Western Cape Government's Department of Economic Development and
36 Tourism: Pre-Feasibility report for the importation of natural gas into the Western Cape with specific focus
37 on the Saldanha Bay – Cape Town corridor.
38
- 39 Wong, A. (2014). Pipeline Emergency Management–A Canadian Context. *Energy Litigation Journal*,
40 Summer2014, Vol. 13, Issue 4.

APPENDIX A.1: SETTLEMENT AND DEVELOPMENT PLANNING

The following table provides a brief overview of the settlements affected in the corridors classified by settlement type and grouped by spatial regions for the corridor phases. Details per settlement are provided with respect to population numbers and growth characteristics of all land within the affected corridors. (Source: South African Functional Town Typology (Maritz *et al*, 2018) and Settlement Footprint Layer (Mans *et al*, 2017))

Table A.1: Summary statistics for affected towns

PHASE	Overview settlement feature	Functional city region areas (not metro boundaries)	Cities Large Regional Centres	Regional Service Centres	Service Towns	Small Service Towns & Service Settlements	Small Towns	Rural Settlement Areas	Sparsely Populated Area
West Coast Corridor Phases 5 and 6	# of towns	Cape Town is in the Southern Section of the Corridor			3	3	20	24	5
	Pop 2011				48 654	22 371	62 212	15 377	1 932
	% growth/decline (2001-2011)				19.36	8.52	26.41	7.87	53.50
Southern Coastal Corridor (Phases 1 and 2)	# of towns	Cape Town city region		7	11	16	38	7	15
	Pop 2011	4 940 057		752 342	288 523	126 838	142 493	15 634	6 088
	% growth/decline (2001-2011)	24.87		27.02	30.69	20.83	17.06	37.15	65.85
Inland Corridor (Central Karoo area)	# of towns	No city regions in Karoo			1	2	7	1	1
	Pop 2011				34 013	12 433	23 360	1 531	417
	% growth/decline (2001-2011)				10.16	16.55	18.79	105.53	10.44
Eastern Cape & KZN Coastal areas (Phase 7, Phase 3 and 4 overlap and Phase 4)	# of towns	eThekwin and Nelson Mandela Bay city regions	4	7	22	39	47	2 648	44
	Pop 2011	3 479 924	1 549 101	905 940	600 687	223 385	268 144	5 146 187	14 855
	% growth/decline (2001-2011)	11.47	13.27	17.44	21.86	14.25	17.81	(3.53)	(2.93)
Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)	# of towns	Gauteng city region	4	14	23	20	36	207	20
	Pop 2011	12 400 572	1 252 390	1 280 061	632 730	268 746	302 397	864 793	7 992
	% growth/decline (2001-2011)	30.97	24.01	26.55	26.92	20.86	20.27	6.07	9.95

Table A.2: Description of data processing used to define the sensitivity criteria

<i>Sensitivity Criteria</i>	<i>Data Source + Date of Publications</i>	<i>Data Description, Preparation and Processing</i>	<i>Feature Class</i>	<i>Feature Class Sensitivity⁷</i>	<i>Buffer Distance Sensitivity⁸</i>
Population density Due to the potential impact of construction and/or potential safety hazards related to the gas transmission pipeline operation on lives and livelihoods of people within the proposed Gas Pipeline Corridor, areas of high population density are foreseen as highly sensitive in relation to the planned gas transmission pipeline. These specifically include cities, large coastal and inland towns and other densely settled areas.	<ul style="list-style-type: none"> Census 2011 StatsSA CSIR Settlement Footprint Layer, 2017. 	<ul style="list-style-type: none"> Mapping of all formal and traditional settlements within the gas pipeline study area. The primary data source used was the CSIR Settlement Footprint Layer, 2017. This settlement footprint was recently developed for South Africa. It is based on a spatial footprint created by using a combination of StatsSA small areas and main places, the ESKOM spot building count (adapted and corrected) and land cover related information. Demographic information for the respective settlements has been compiled using the outlined data through a spatial disaggregation process. The population baseline data made use of StatsSA, 2011 demographic data. For more information see (Maritz et al, 2018 – Under process) Population density has been determined for the corridor area both within the settlement footprint areas, as well as within the sparsely populated regions. Density categories and indicators to determine different scales of settlement density and likely sensitivity were calculated, using density categories relevant within urban service delivery and spatial planning contexts (see Green et al https://www.socialfacilityprovisiontoolkit.co.za/attachments/Social_Facility_Provision_Toolkit_Manual.pdf?etag=true & StepSA http://stepsa.org/SocialFacilityToolkit.). 	More than 5000 people/km ²	Very High	500m
			Between 1000-5000 people/km ²	High	500m
			Between 600-1000 people/km ²	Moderate	400m
			Between 200-600 people/km ²	Low	300m
			Less than 200 people /km ²	Very Low	200m

⁷ Refer to Appendix A for an explanation on the various sensitivity classes

⁸ The buffer area takes into account the current population and extent of the urban area, as well as a reasonable expectation of likely future population growth. Based on this, a pragmatic approach was taken to calculate an area large enough to accommodate the growth expected in 10-15 years and to distribute this as a buffer around settlements. Where specific growth was indicated on development plans, this was noted. Given that the direction of growth of each individual settlement is mostly unknown or unpredictable at this early stage, the buffer was calculated to conservatively enable most growth.

<i>Sensitivity Criteria</i>	<i>Data Source + Date of Publications</i>	<i>Data Description, Preparation and Processing</i>	<i>Feature Class</i>	<i>Feature Class Sensitivity⁷</i>	<i>Buffer Distance Sensitivity⁸</i>
Development intensity and extent Settlement and economic development nodes are regarded as highly sensitive for future construction of the proposed Gas transmission Pipeline. Within large towns, cities and metropolitan areas the number of people, businesses, livelihoods and quality of life increase sensitivity levels. Within medium and smaller towns local economies are more vulnerable and thus also highly sensitive.	<ul style="list-style-type: none"> CSIR Town Area Typology, 2018 	Settlement and economic development nodes, as clusters of (1) physical dense built-environment structures and infrastructure networks, as well as (2) high levels of complex socio-economic and institutional and ecological activities and systems within settlement footprint areas and surrounding hinterlands that have high levels of interaction have been identified as significant and spatially distinct areas that are considered within the sensitivity analyses. Given that the benefit to the nodes from the gas transmission pipeline will depend on the final alignment of the pipeline, the sensitivity of construction related activities will be the main focus of the assessment and thus the high density of activities and livelihoods in larger settlements might be at risk or disrupted through construction. Nodes of development intensity have been identified throughout the gas pipeline study area. The following methodology was used: <ul style="list-style-type: none"> The official socio-economic information is only currently available at administrative reporting or information gathering units such as Local and District municipal levels. Data could not be analysed for population or economy for separate settlements or demarcated urban areas. The development of the StepSA Town Area Typology (2018) has changed this through the effective functional demarcation of settlements, towns and cities that can now be used for assessments such as these. The Town Areas Typology 2018 that was developed and is used here, is an adapted and updated version of the former SACN/CSIR Functional Settlement Typology, 2015 which until now has been used widely for the purpose of town growth analysis (inter alia within the National Development Plan 2011 and the Integrated Urban Development Framework, 2015). This data layer is based on the spatially disaggregated settlement footprint data sets and has attribute data for verified spatial indicators (based on population as well as disaggregated economic output data that can be used as spatial indicators for socio-economic development. The CSIR Geospatial Analyses Platform, 2017 (Maritz et al, 2018) as well as a range of additional spatial indicators and accessibility analyses (http://stepsa.org/) were used to develop this data set. A typology of different classes of cities, towns and settlement areas was used as integrative proxy for the extent of population, economic activity, infrastructure, engineering services and related complex set of systems and functions within each of the settlement and economic development nodes within the study area. 	Metro's (more than 1 million people), cities & large regional towns (typically larger than 300 000 people) with larger economies.	Very High	500m
			Big regional towns (about 100 000 people) & service towns (more than 20 000 people but significant (even if small) economic functions)	High	500m
			Smaller highly sensitive towns with less intense economies are regarded as settlements	Moderate	200m
			Dense rural settlements have lower sensitivities in terms of economic and	Low	150m

<i>Sensitivity Criteria</i>	<i>Data Source + Date of Publications</i>	<i>Data Description, Preparation and Processing</i>	<i>Feature Class</i>	<i>Feature Class Sensitivity⁷</i>	<i>Buffer Distance Sensitivity⁸</i>
			development extent.		
			Sparse rural areas – few people and limited economic activity	Very Low	-
Land-use management and tenure	<ul style="list-style-type: none"> StepSA Town Area Typology, 2018 Traditional Authority layer (Demarcation Board, 2011) 	The sensitivity of institutional, land-use management and land development regulatory systems are foreseen to impact planning, land servitude proclamation, any land expropriation and construction for the gas transmission pipeline. The prevailing dominant land use management system and land tenure system may potentially point to capacity challenges for the local authority and the occupiers of the land. This will require different approaches to land access for construction and operations for the pipeline development for different land tenure or use regimes. The ideal would be to use information on land ownership and size from a national land audit register. Unfortunately this register is not complete for every land parcel in the country.	Large formal towns (Cities, Towns, Regional Service Centres)	High	-
High levels of sensitivity related to institutional and land-use management and development regulatory systems are foreseen in cities, large towns and dense rural settlements in areas under traditional authority jurisdiction.			Dense Rural Settlements in traditional authority areas	Moderate	-
			Small Towns and Small Service Centres	Moderate	-
			Sparsely populated areas	Low	-

1
2

APPENDIX A.2: DETAILS ON FEATURE RATINGS

Corridor	Feature Class	Feature Class Sensitivity	Reason for rating
Population density	More than 5000 people/km ²	Very high sensitivity	<i>The less people whose homes, roads or livelihoods are impacted the better. The rating takes into consideration the likely number of people impacted per unit area. The more densely populated an area, the more people are likely to be impacted.</i>
	Between 1000-5000 people/km ²	High sensitivity	
	Between 600-1000 people/km ²	Moderate sensitivity	
	Between 200-600 people/km ²	Low sensitivity	
	Less than 200 people /km ²	Very low sensitivity	
Development intensity and extent (See Appendix E for description of CSIR Functional Town Typology, 2018)	Metro's (more than 1 million people), cities and large regional towns (typically larger than 300 000 people) with larger economies.	Very high sensitivity	<i>The larger extent of the urban/ settlement development and the larger the economic activity the greater the likely impact of construction will be. In addition, any delay or uncertainty that arises before or during the construction period will increase the disruption.</i>
	Big regional towns (about 100 000 people) & service towns (more than 20 000 people but significant (even if small) economic functions	High sensitivity	
	Smaller highly sensitive towns with less intense economies	Moderate sensitivity	<i>The lower the economic activity or development extent, the lower the sensitivity overall, although in limited cases the impact on a few individuals may be high.</i>
	Dense and sparse rural settlements with limited economic and development or extent	Low sensitivity	
	Sparse rural areas – few people and limited economic activity	Very low sensitivity	
Land-use management and tenure	Large formal towns (Cities, Towns, Regional Service Centres	High sensitivity	<i>Many people & land parcels are likely to be impacted by land use or servitude proclamation if the pipeline goes through Cities and Large Regional Service Centres.</i>
	Dense Rural Settlements in traditional authority areas	Moderate sensitivity	<i>Due to the complexity of land ownership and use rights and limited legal and economic capability the residents in this area will be sensitive to changes in land use application or over servitudes being created and special measures will be required to ensure fair and ethical negotiations where these are required.</i>
	Small Towns and Small Service Centres	Moderate sensitivity	<i>Mainly formal land tenure & freehold property rights. Thus negotiations regarding land use & servitudes will be less complex with less people impacted than in larger towns. Planning Capacity may be lacking, and may negatively impact on timeframes in finalising servitudes.</i>
	Sparsely populated	Low sensitivity	<i>Fewer people impacted on a fewer large tracts of land which is in private or other means of formal ownership</i>

APPENDIX B – FEATURE MAPS

B.1 West Coast Corridor (Phases 5 and 6)

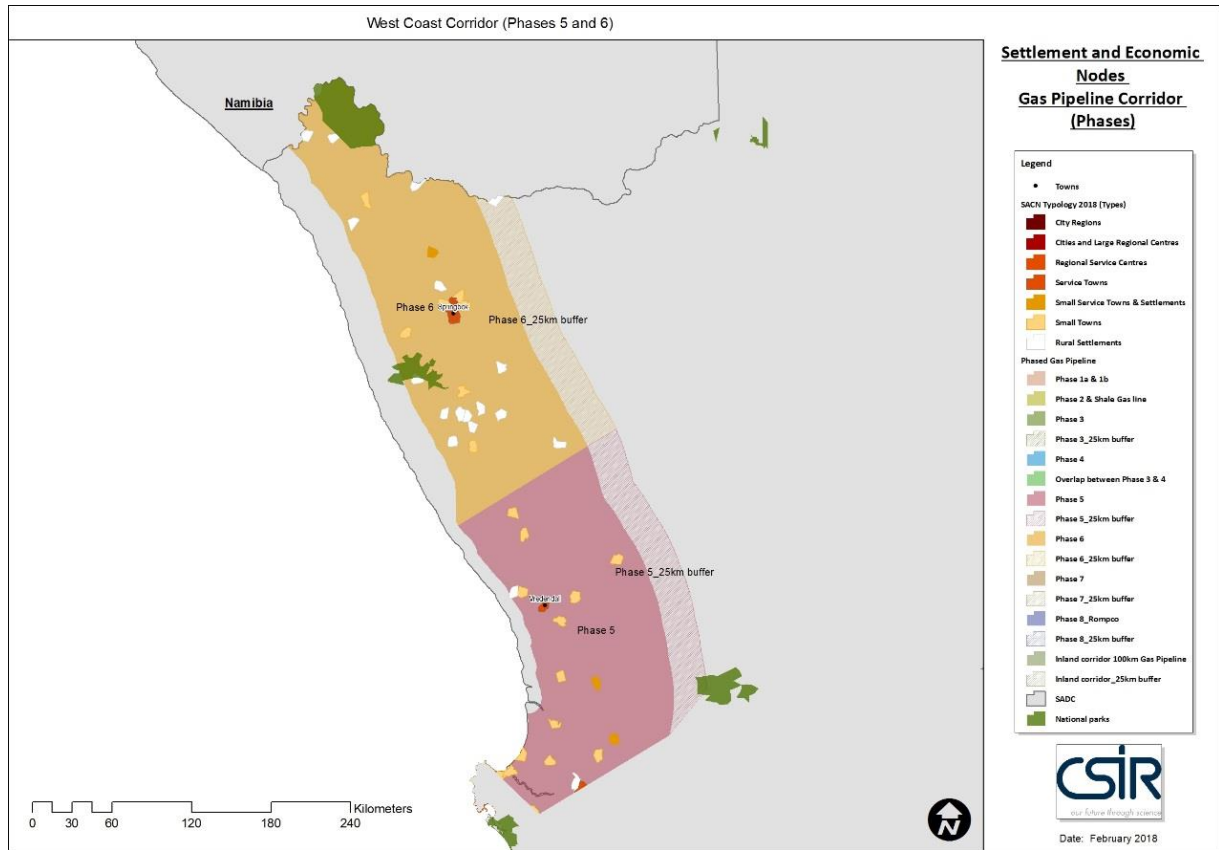


Figure B.1: Settlement and Economic Nodes Gas Pipeline Corridor (West Coast Corridor (Phases 5 and 6))

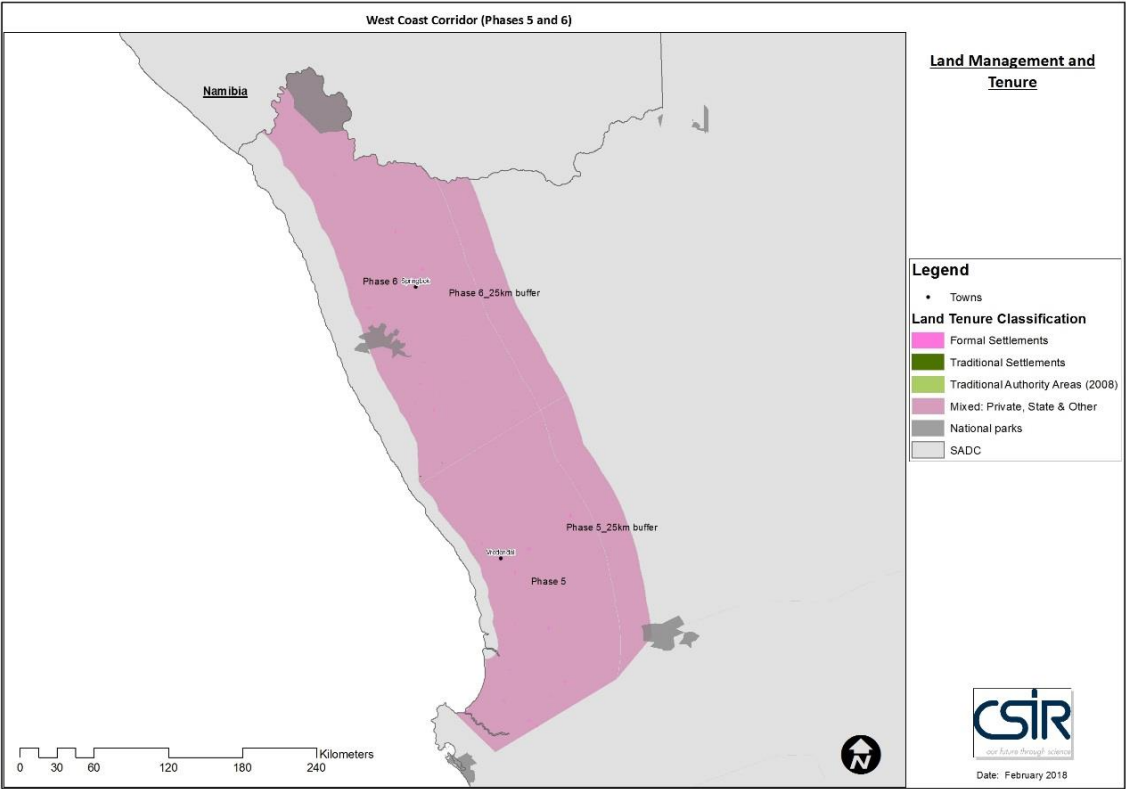


Figure B.2: Land Management and tenure in Gas Pipeline Corridor (West Coast Corridor (Phases 5 and 6))

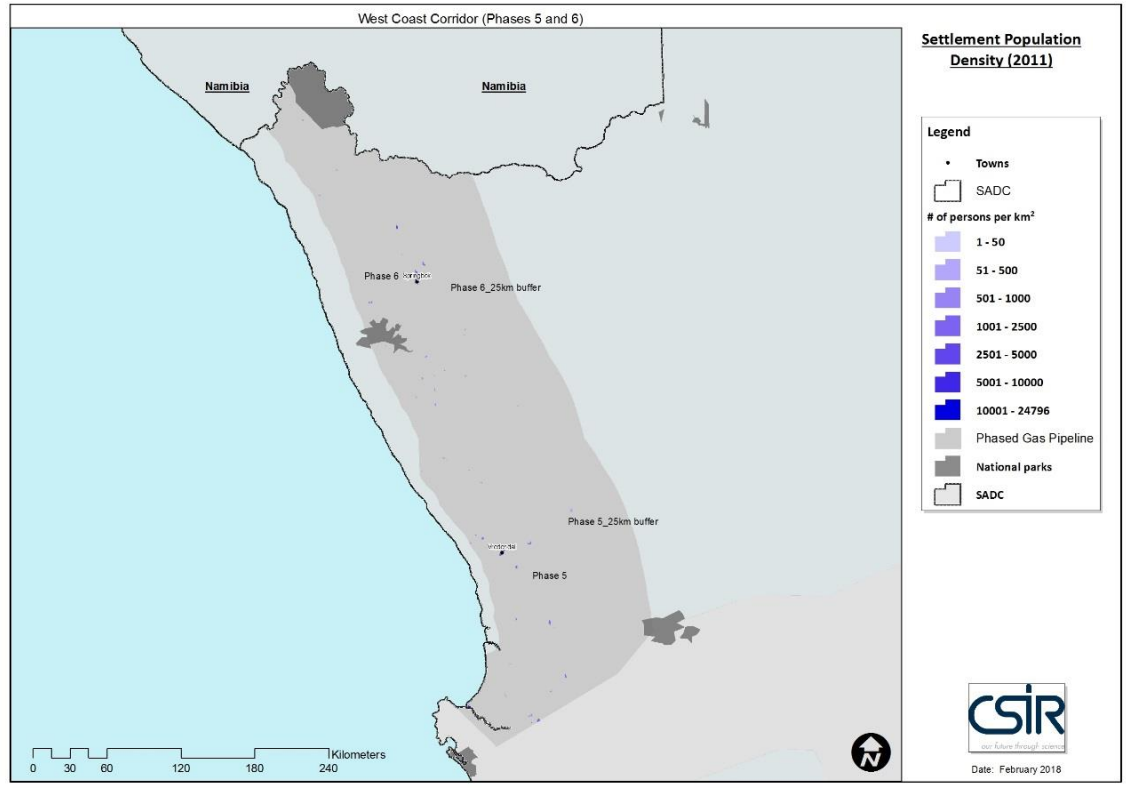


Figure B.3: Population density of Settlements in Gas Pipeline Corridor (West Coast Corridor (Phases 5 and 6))

B.2 Southern Coastal Corridor (Phases 1 and 2)

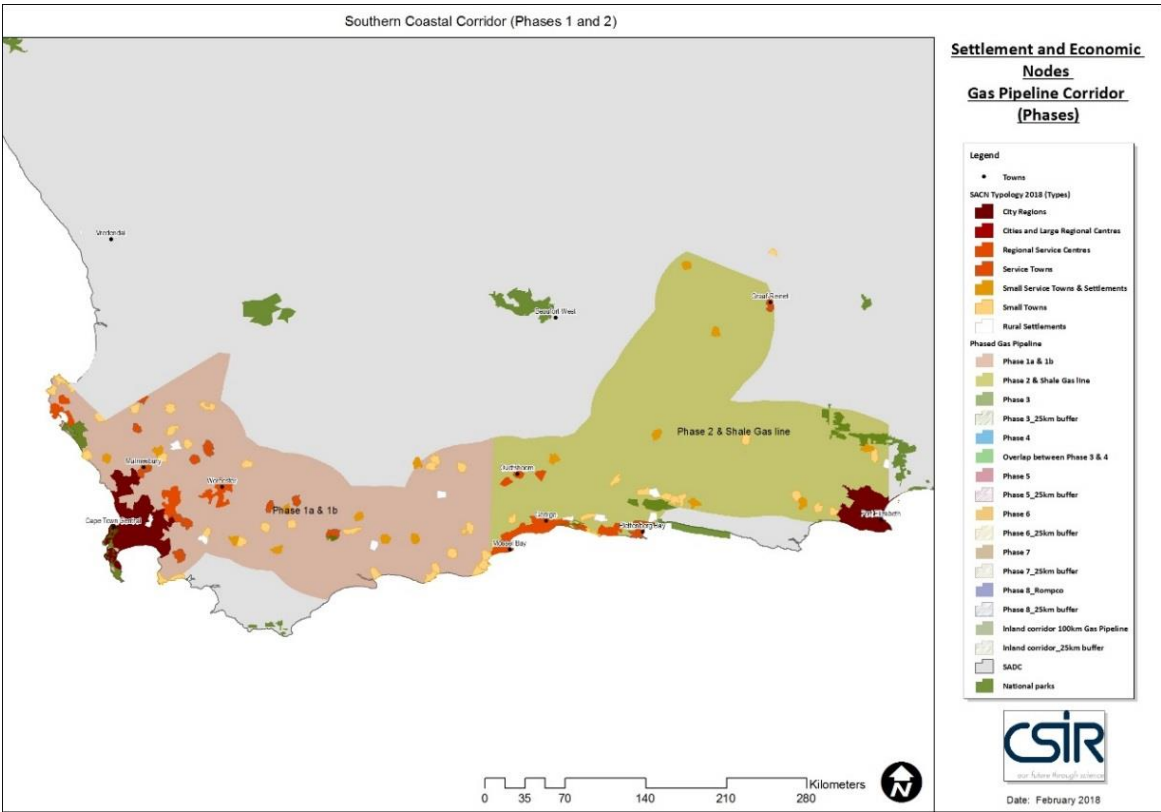


Figure B.4: Settlement and Economic Nodes Gas Pipeline Corridor (Southern Coastal Corridor (Phases 1 and 2))

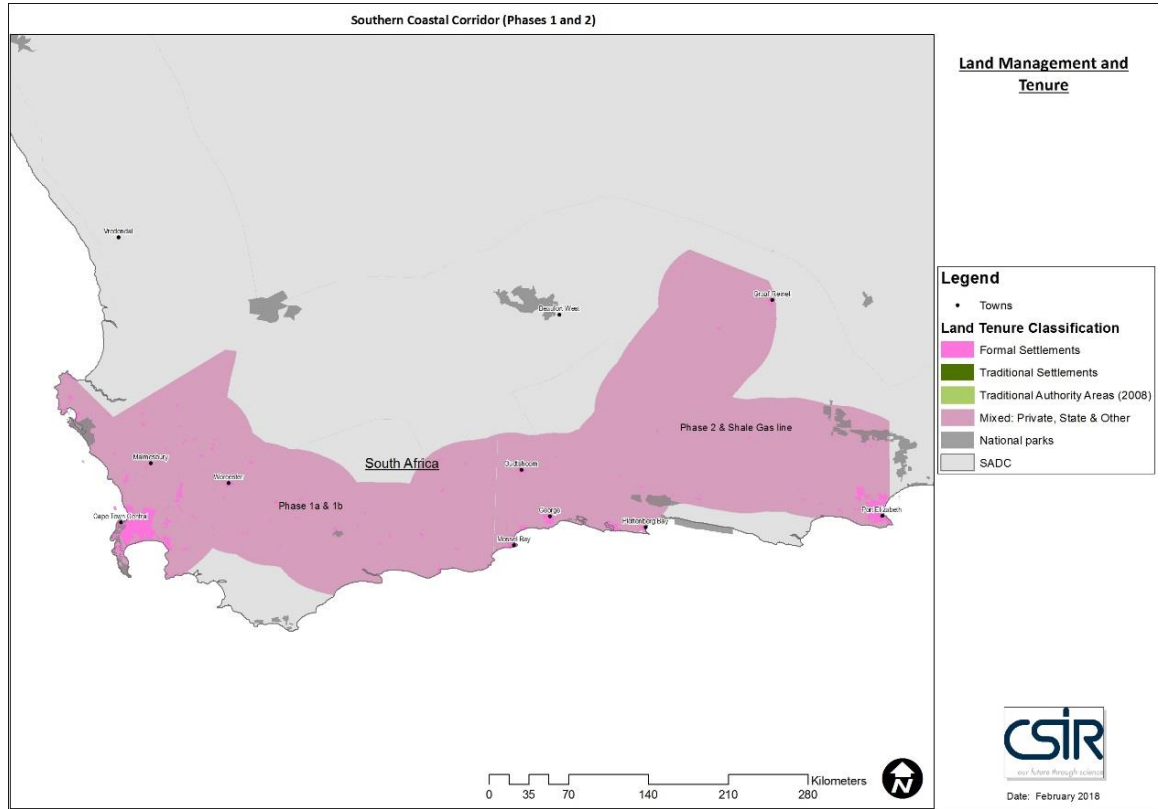


Figure B.5: Land Management and tenure in Gas Pipeline Corridor (Southern Coastal Corridor (Phases 1 and 2))

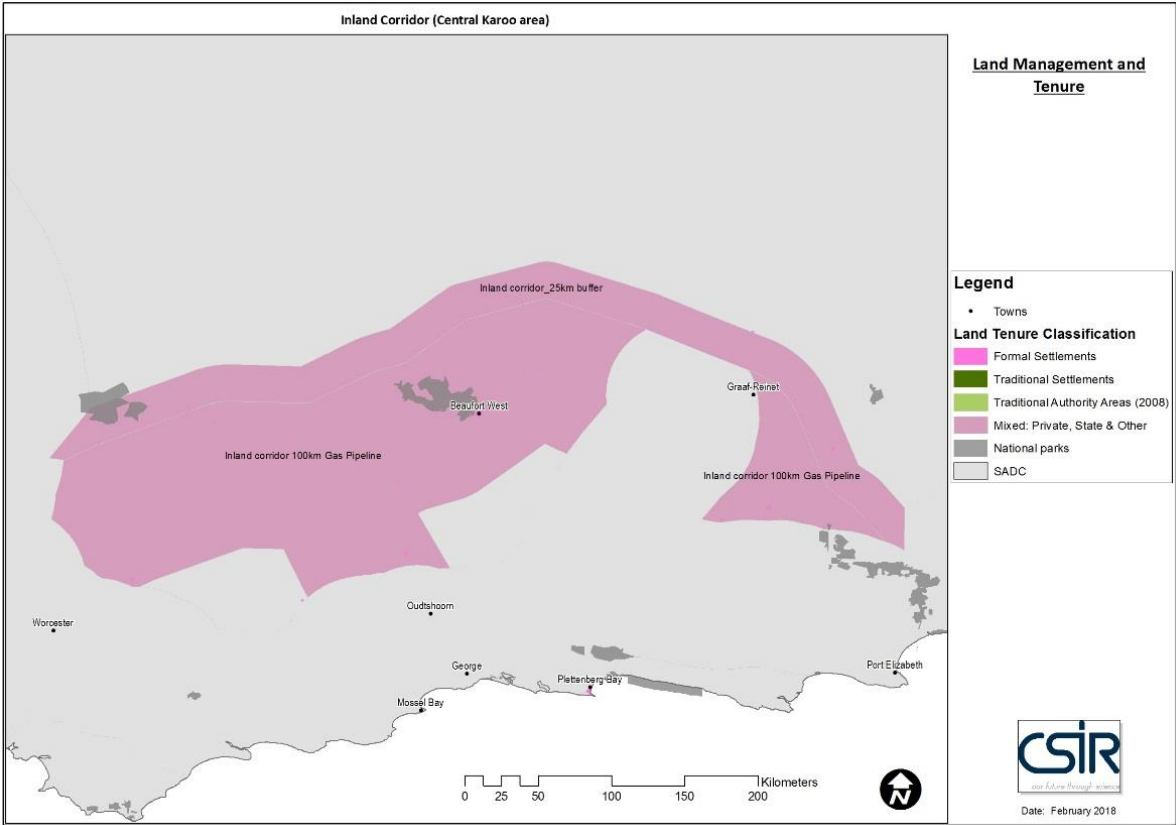


Figure B.8: Land Management and tenure in Gas Pipeline Corridor (Inland Corridor (Central Karoo area))

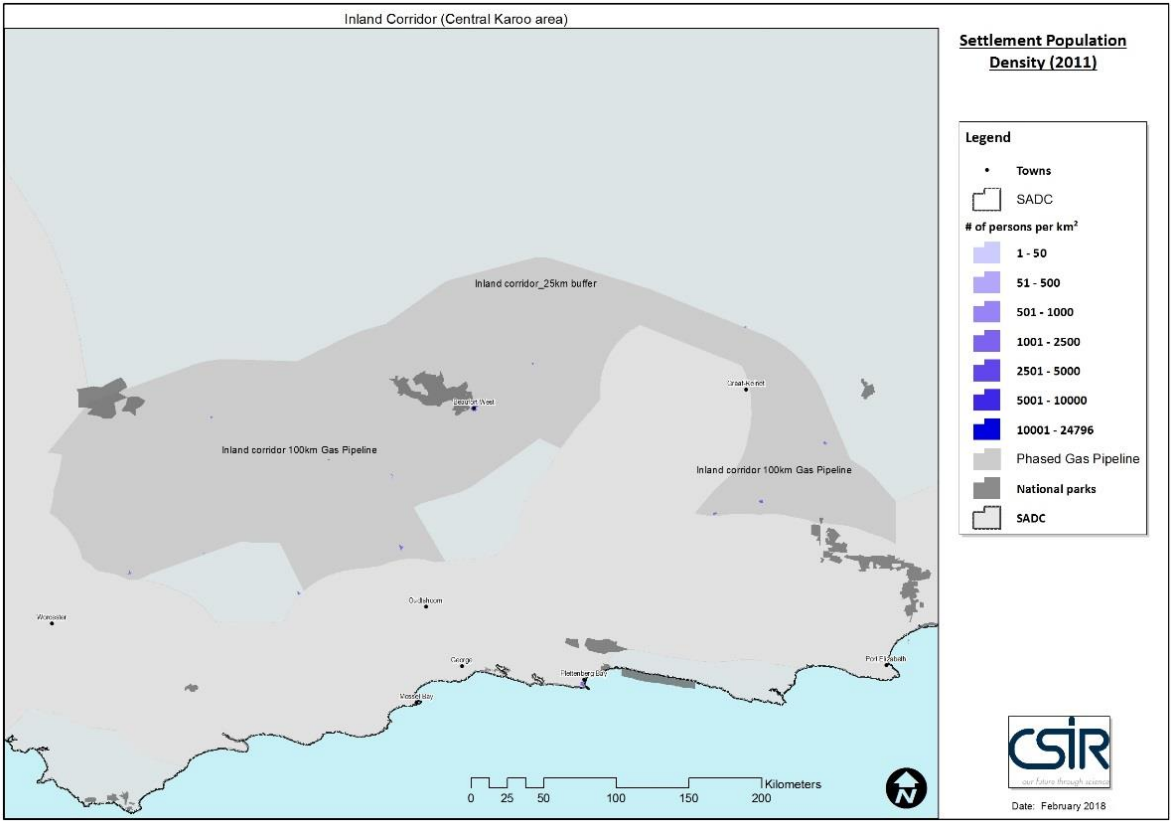


Figure B.9: Population density of Settlements in Gas Pipeline Corridor (Inland Corridor (Central Karoo area))

B.4 Eastern Cape & KZN Coastal areas (Phase 7, Portion of Phase 3 and Phase 4)

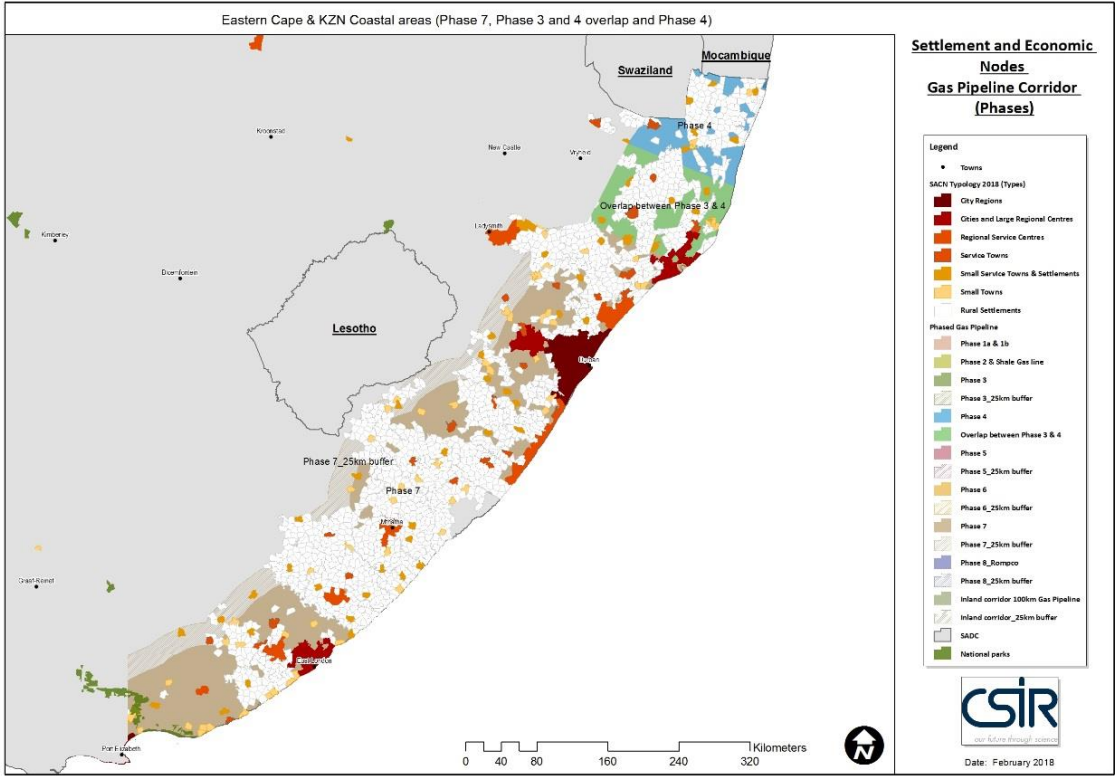


Figure B.10: Settlement and Economic Nodes Gas Pipeline Corridor (Eastern Cape & KZN Coastal areas (Phase 7, Portion of Phase 3 and Phase 4))

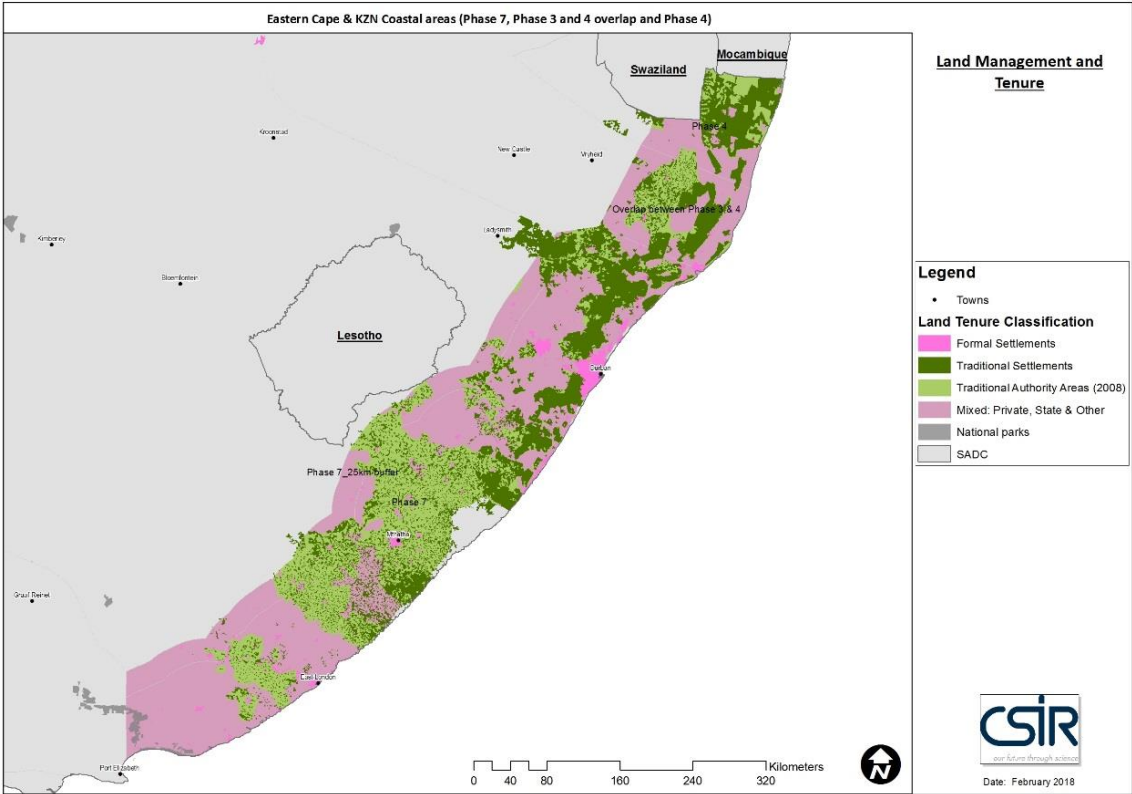


Figure B.11: Land Management and tenure in Gas Pipeline Corridor (Eastern Cape & KZN Coastal areas (Phase 7, Portion of Phase 3 and Phase 4))

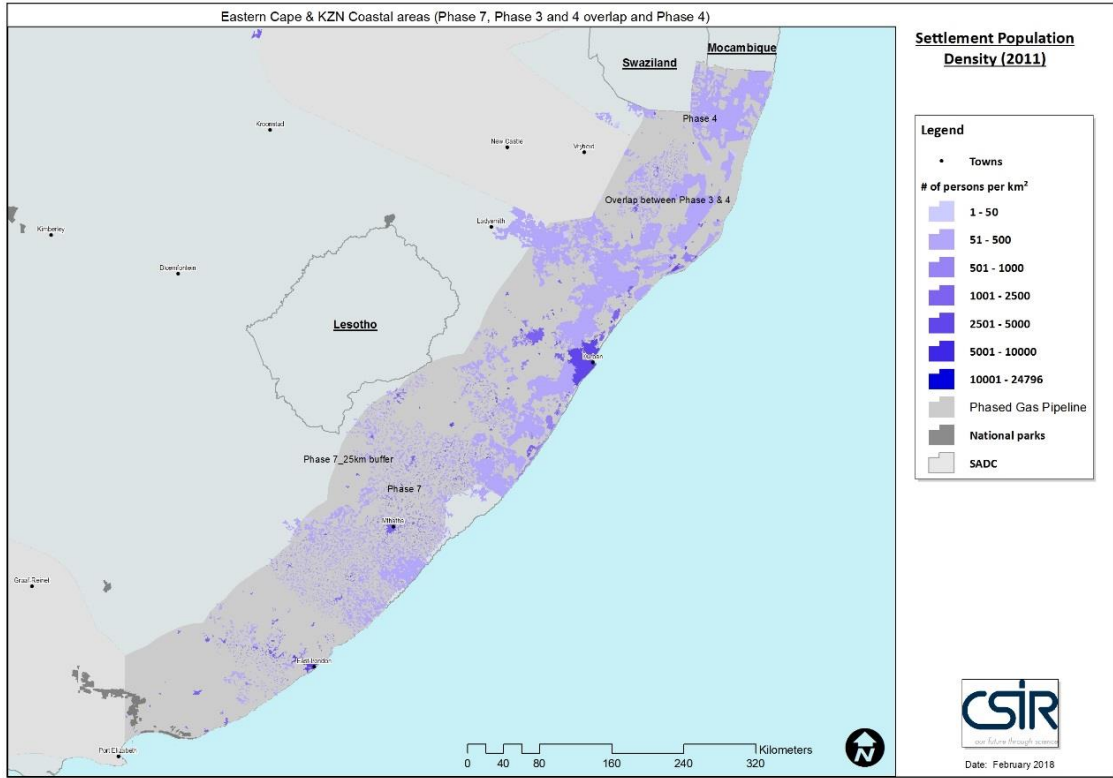


Figure B.12: Population density of Settlements in Gas Pipeline Corridor (Eastern Cape & KZN Coastal areas (Phase 7, Portion of Phase 3 and Phase 4))

B.5 Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)

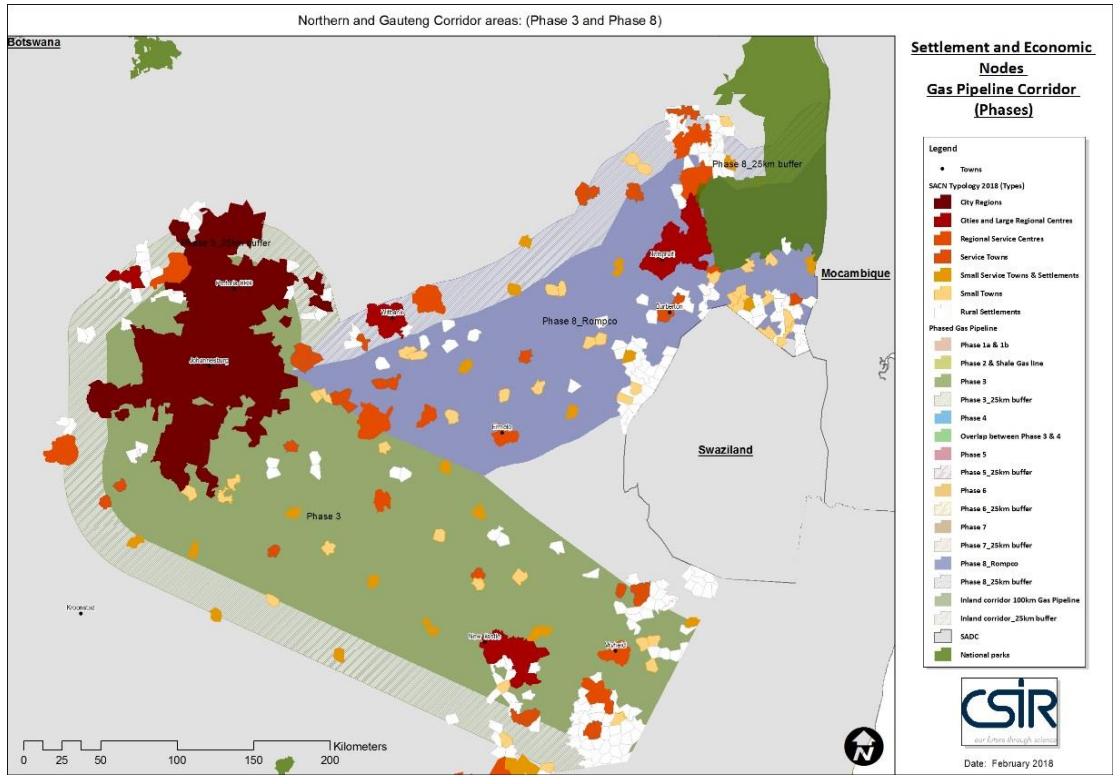


Figure B.13: Settlement and Economic Nodes Gas Pipeline Corridor (Northern and Gauteng Corridor areas: (Phase 3 and Phase 8))

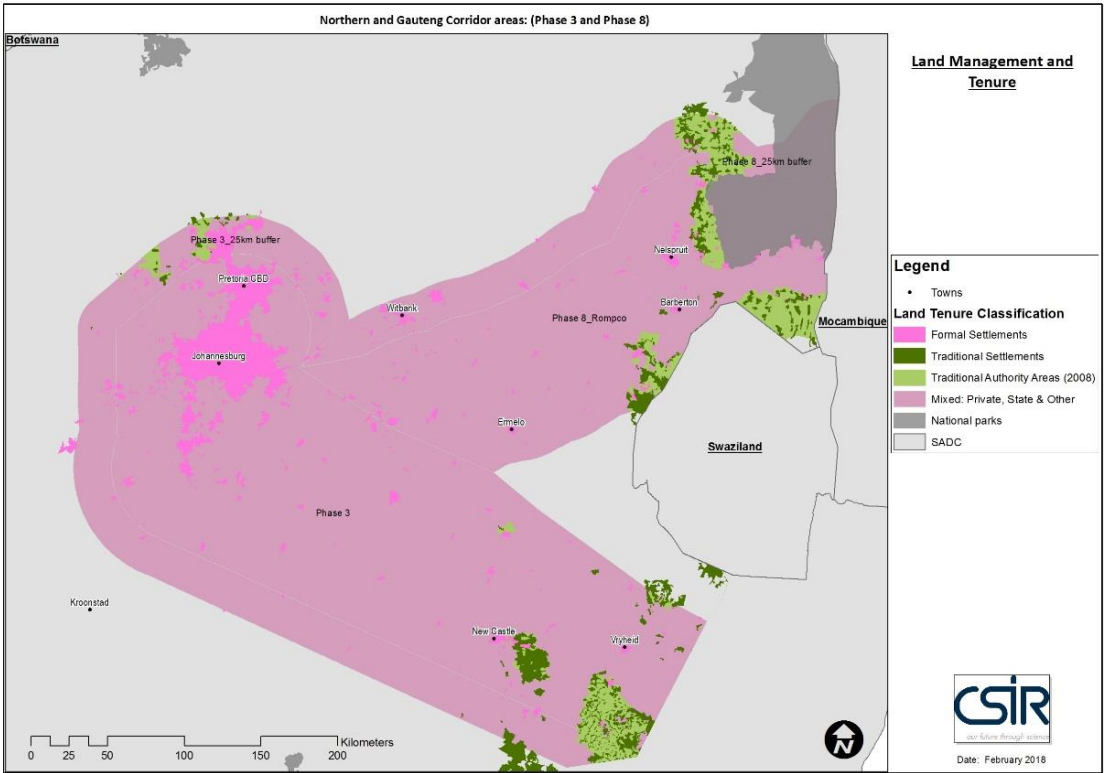


Figure B.14: Land Management and tenure in Gas Pipeline Corridor (Northern and Gauteng Corridor areas: (Phase 3 and Phase 8))

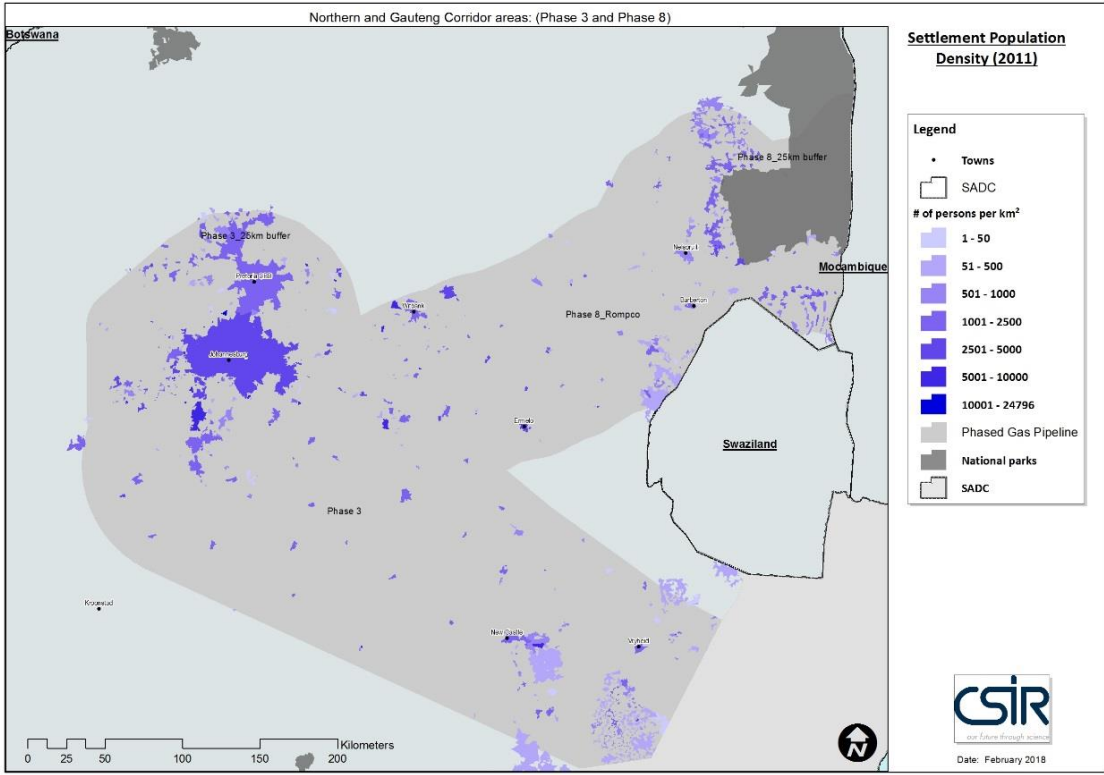


Figure B.15: Population density of Settlements in Gas Pipeline Corridor (Northern and Gauteng Corridor areas: (Phase 3 and Phase 8))

APPENDIX C - FOUR-TIER SENSITIVITY MAPPING

C.1 Eastern Cape and KZN coastal areas (Phases 7, 4 & overlap between Phases 3 and 4)

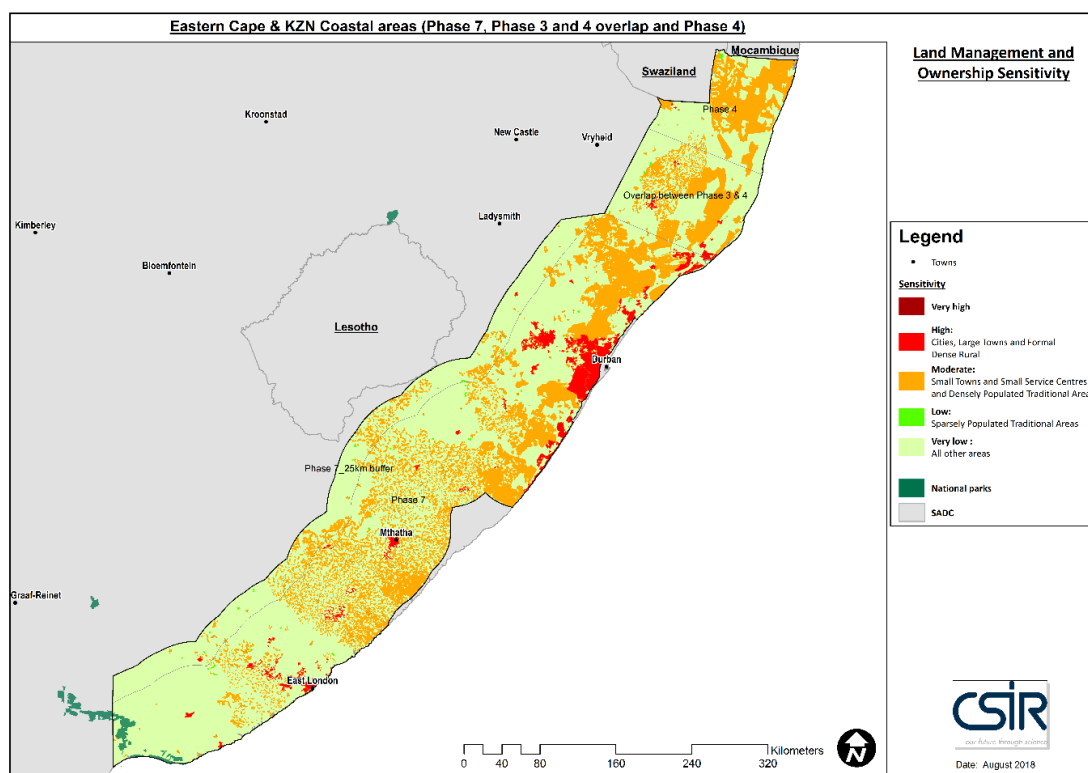


Figure C.1: Land-use Management and Ownership Sensitivity - Eastern Cape and KwaZulu-Natal Coastal Areas

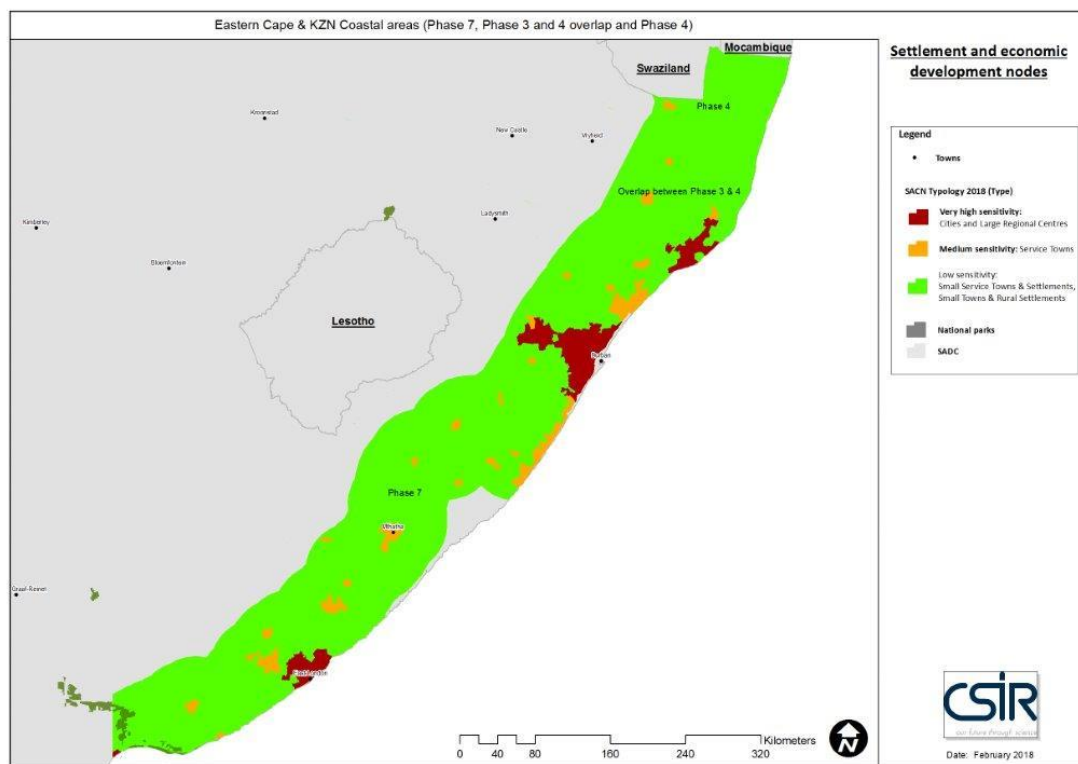


Figure C.2: Settlement and Economic Nodes Sensitivity - Eastern Cape and KwaZulu-Natal Coastal Areas

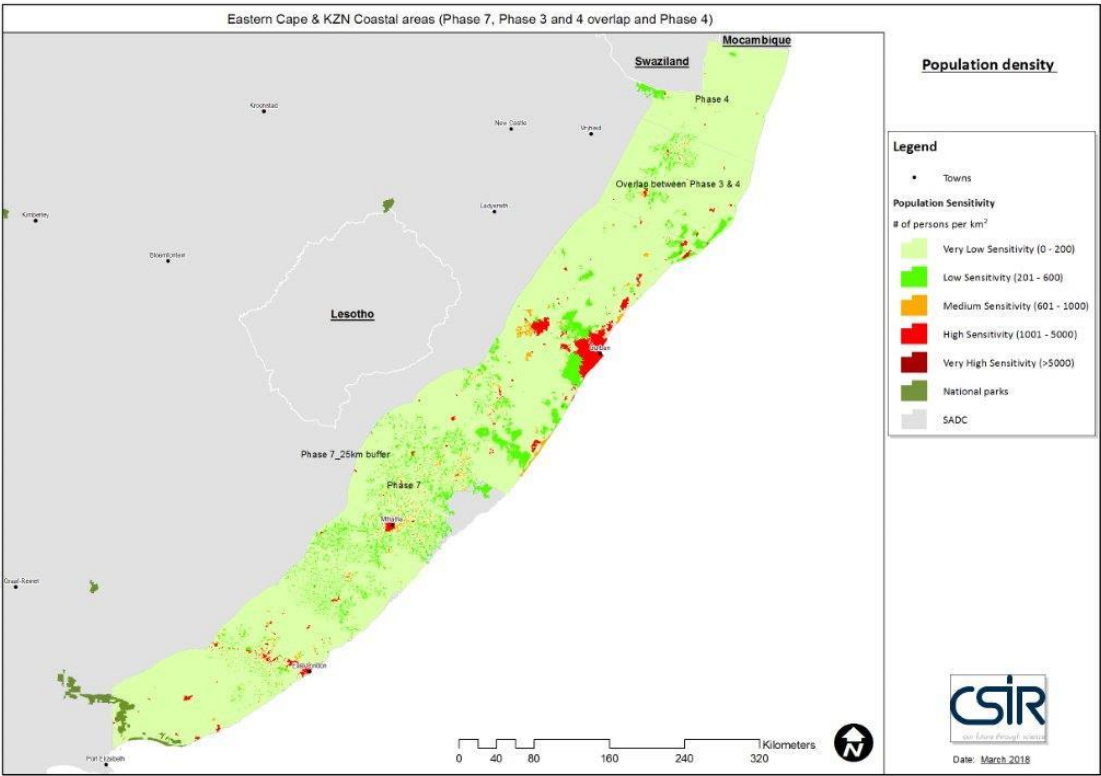


Figure C.3: Settlement population density Sensitivity - Eastern Cape and KwaZulu-Natal Coastal Areas

C.2 Inland corridor

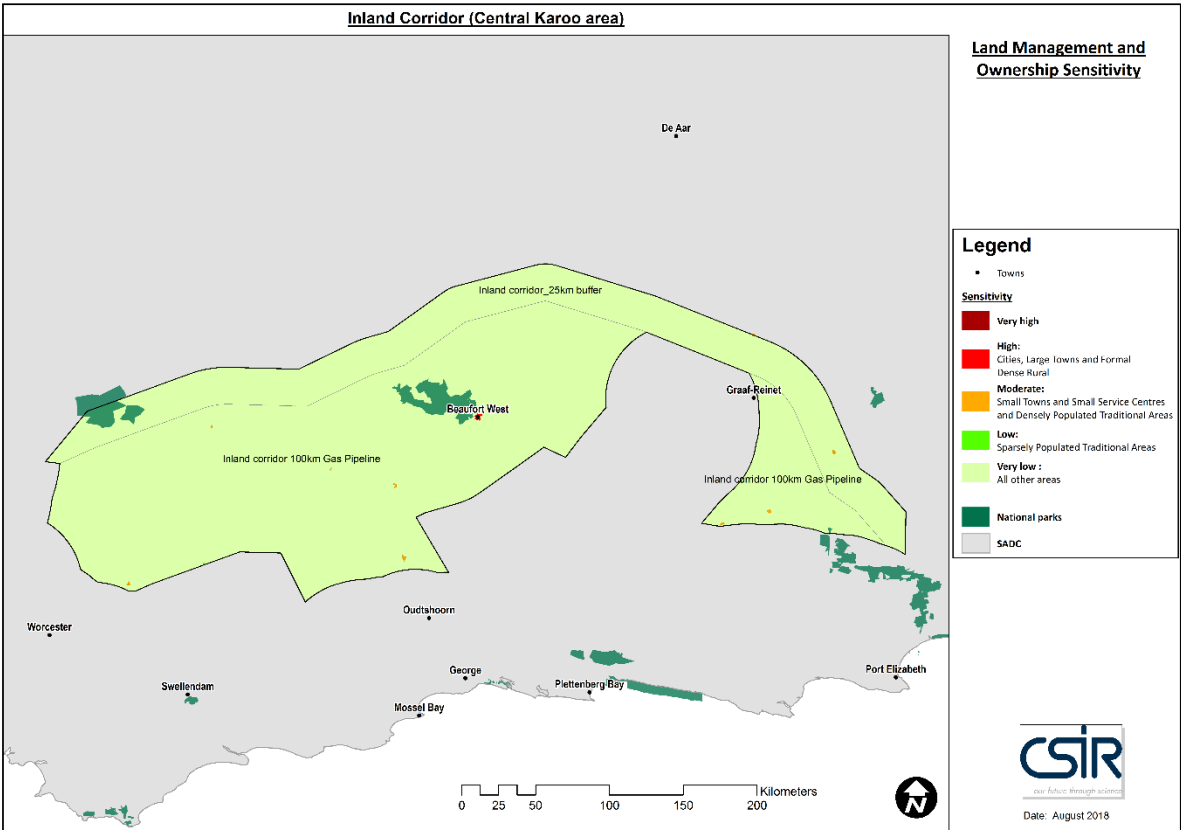


Figure C.4: Land Management and Ownership Sensitivity- Inland Corridor

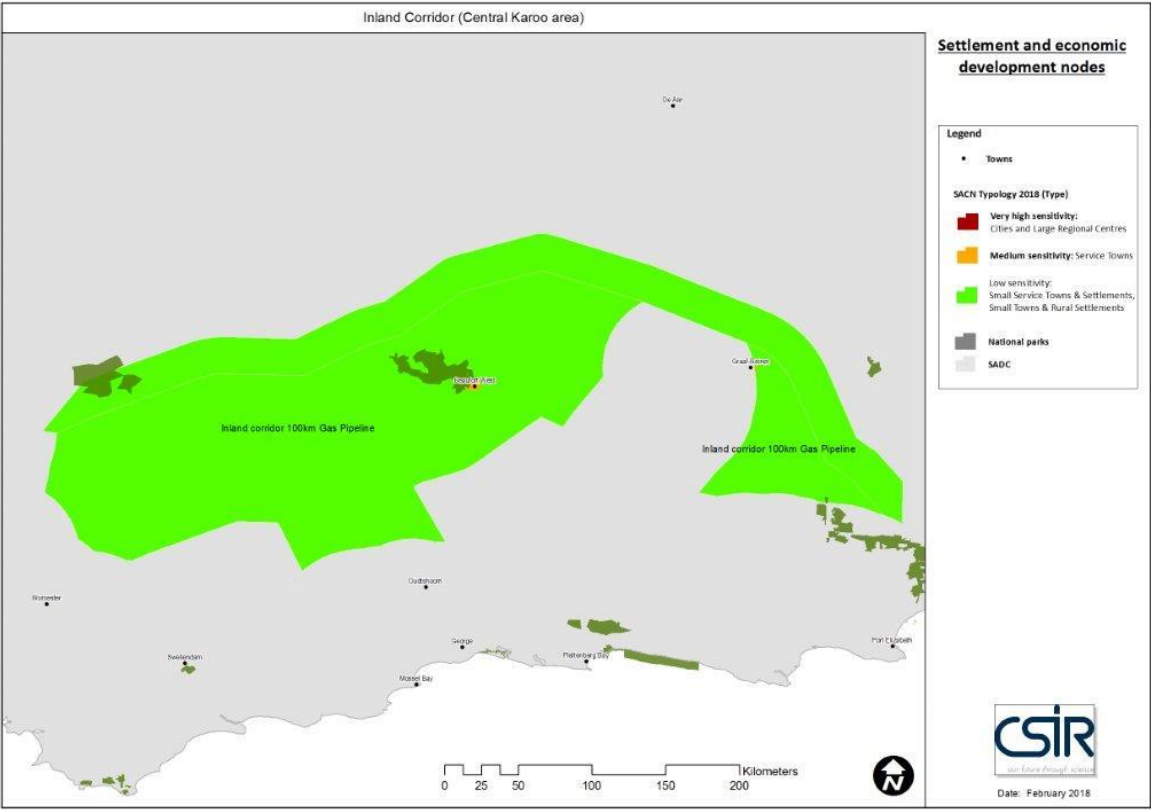


Figure C.5: Settlement and Economic Nodes Sensitivity - Inland Corridor

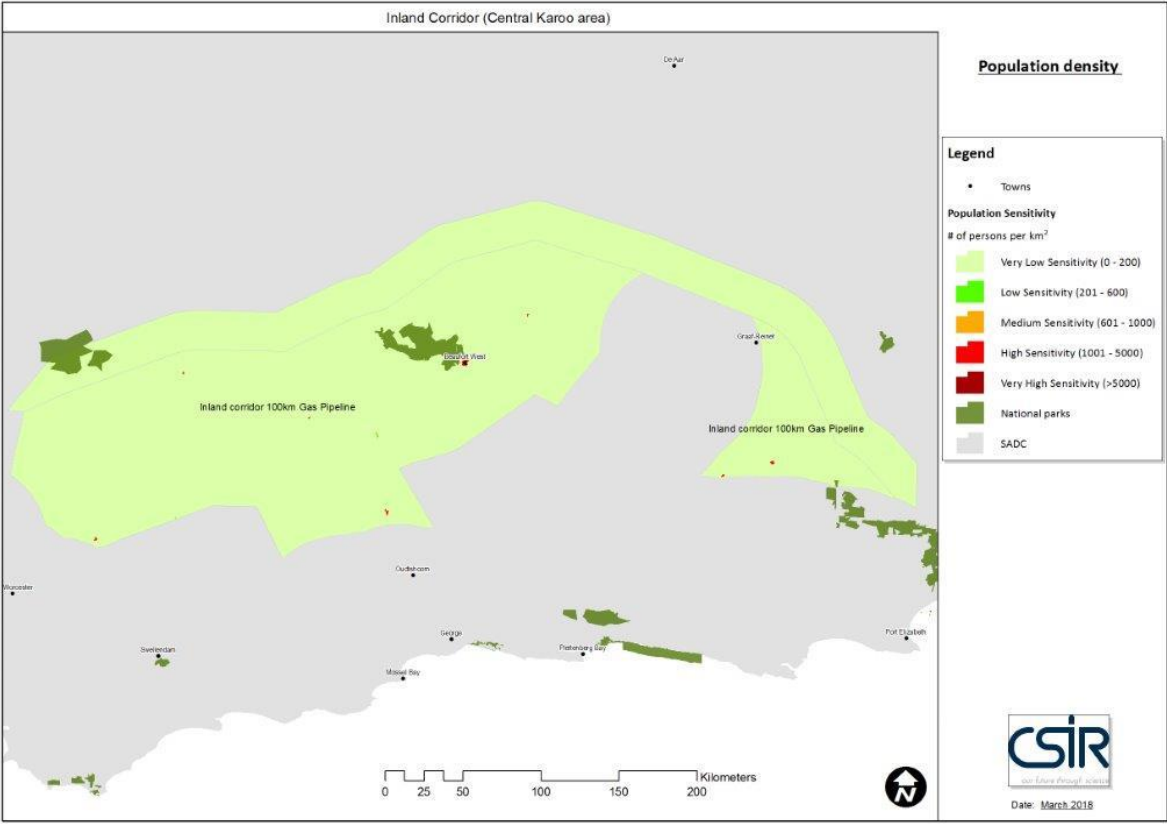


Figure C.6: Settlement population density Sensitivity - Inland Corridor

C.3 Northern and Gauteng Corridor (Phases 3 and 8)

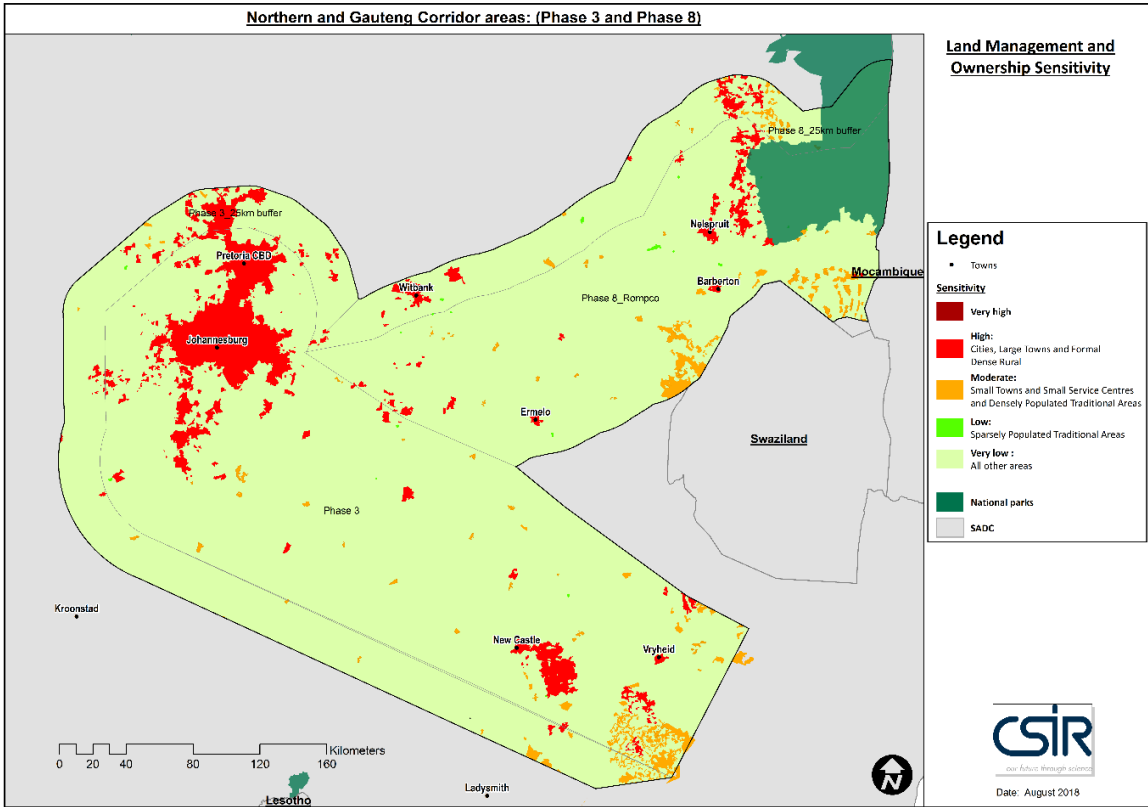


Figure C.7: Land Management and Ownership Sensitivity - Northern and Gauteng Corridor



Figure C.8: Settlement and Economic Nodes Sensitivity - Northern and Gauteng Corridor

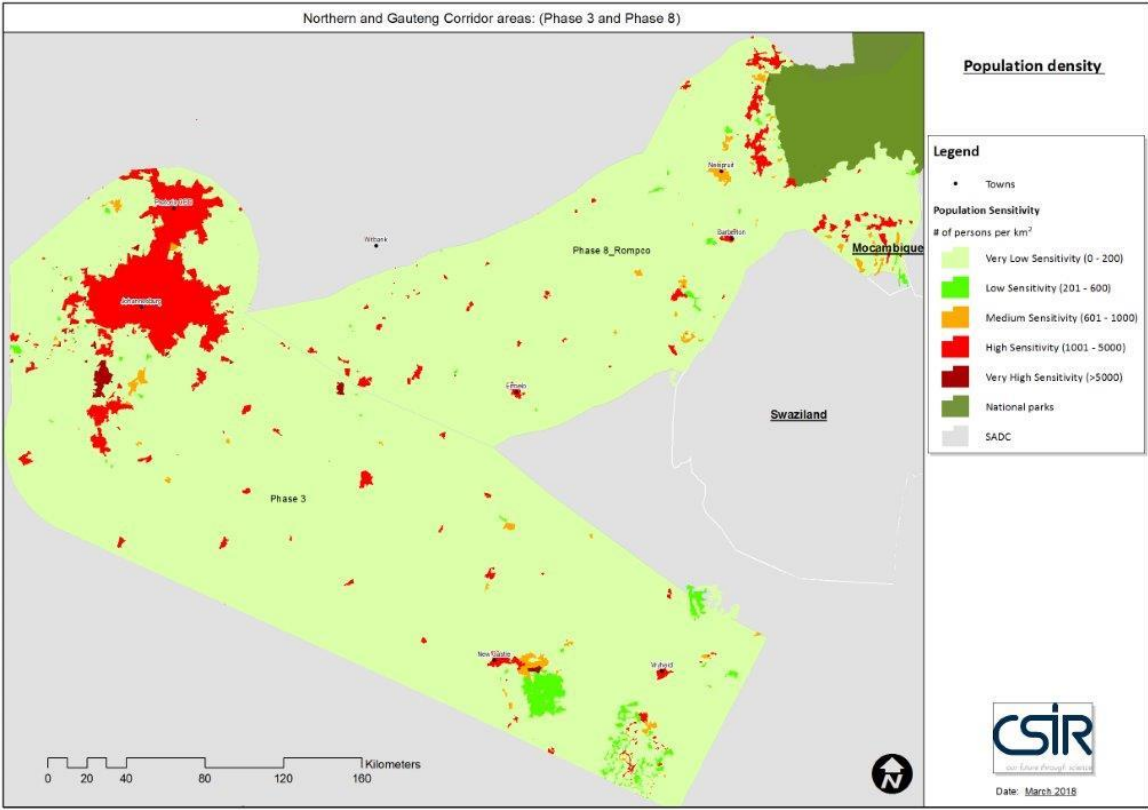


Figure C.9: Settlement population density Sensitivity - Northern and Gauteng Corridor

C.4 West Coast Corridor (Phases 5 and 6)

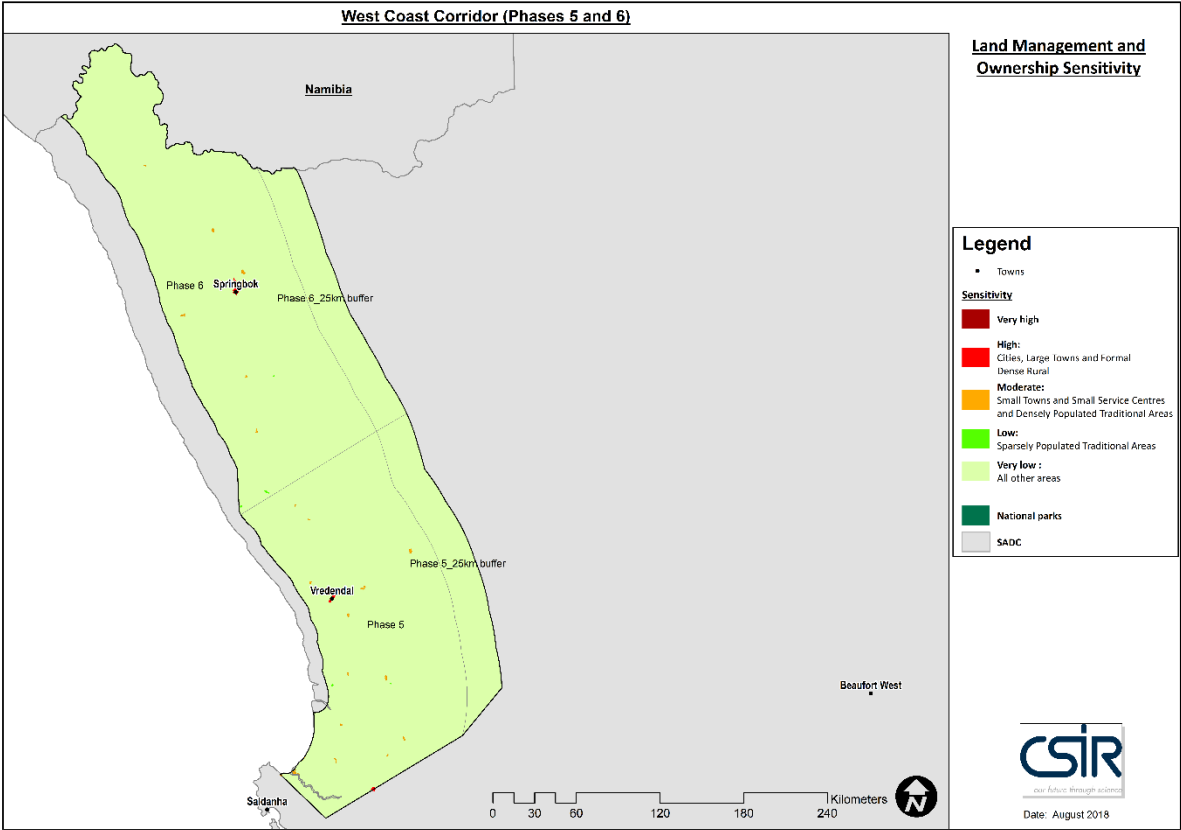


Figure C.10: Land Management and Ownership Sensitivity - West Coast Corridor

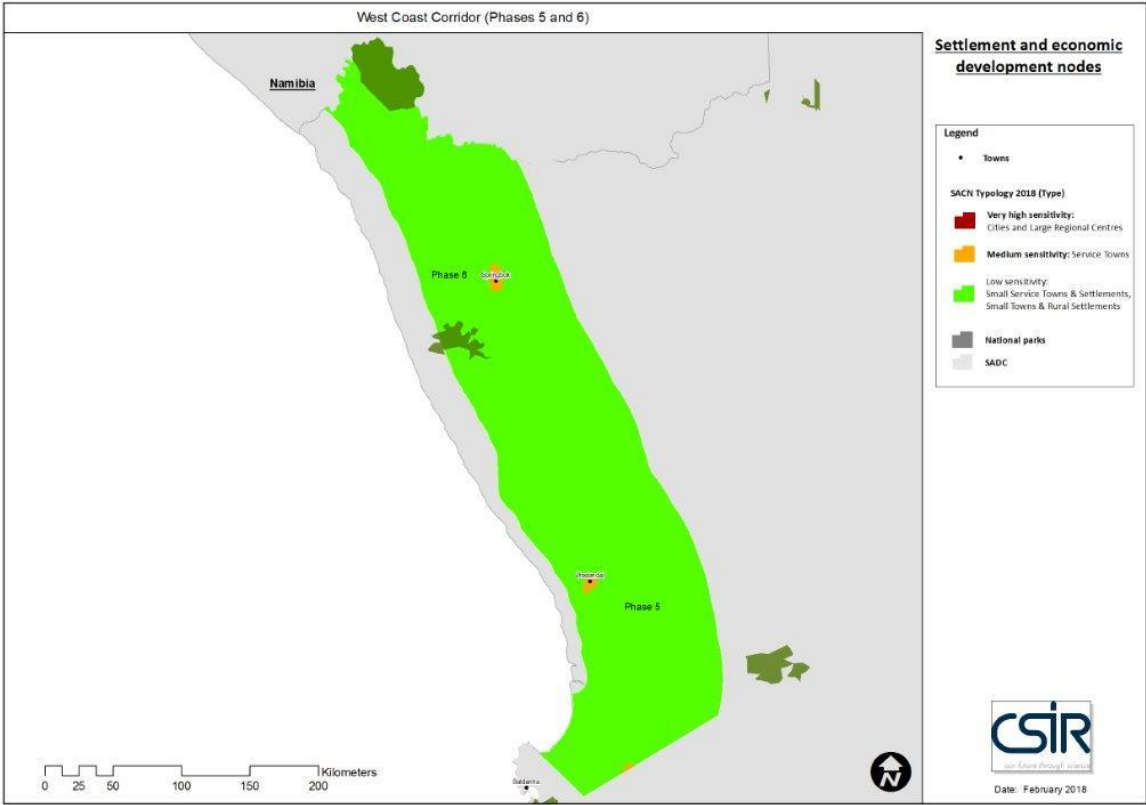


Figure C.11: Settlement and Economic Nodes Sensitivity - West Coast Corridor

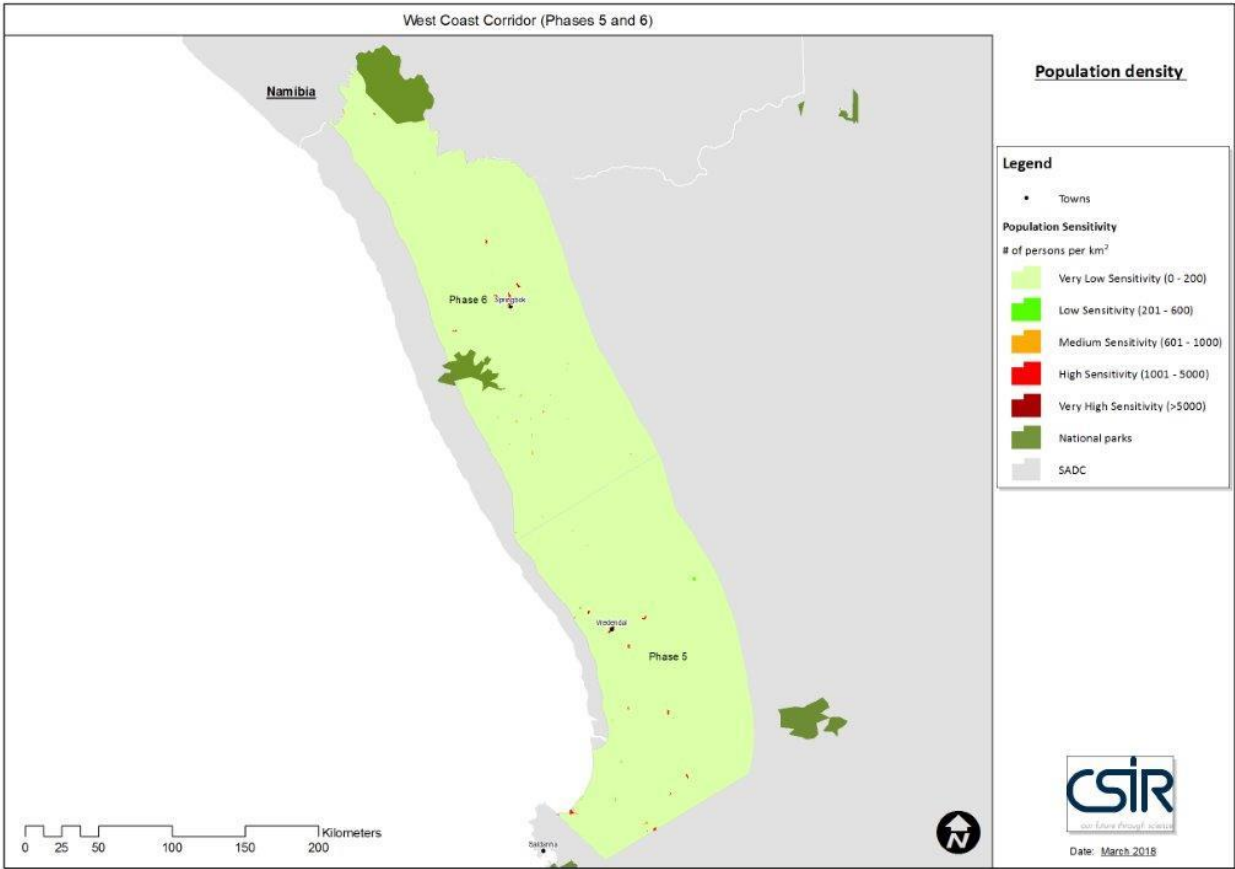


Figure C.12: Settlement population density Sensitivity - West Coast Corridor

C.6 Southern Coastal Corridor (Phases 1 and 2)

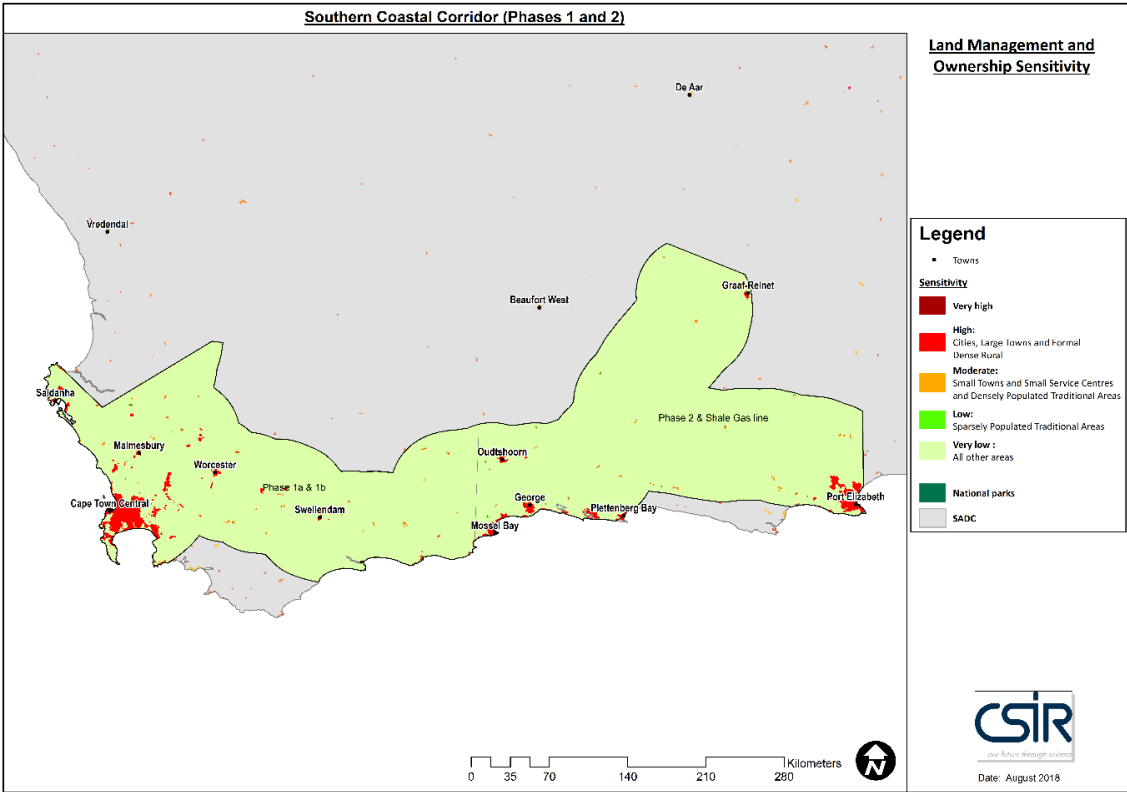


Figure C.13: Land Management and Ownership Sensitivity - Southern Coastal Corridor

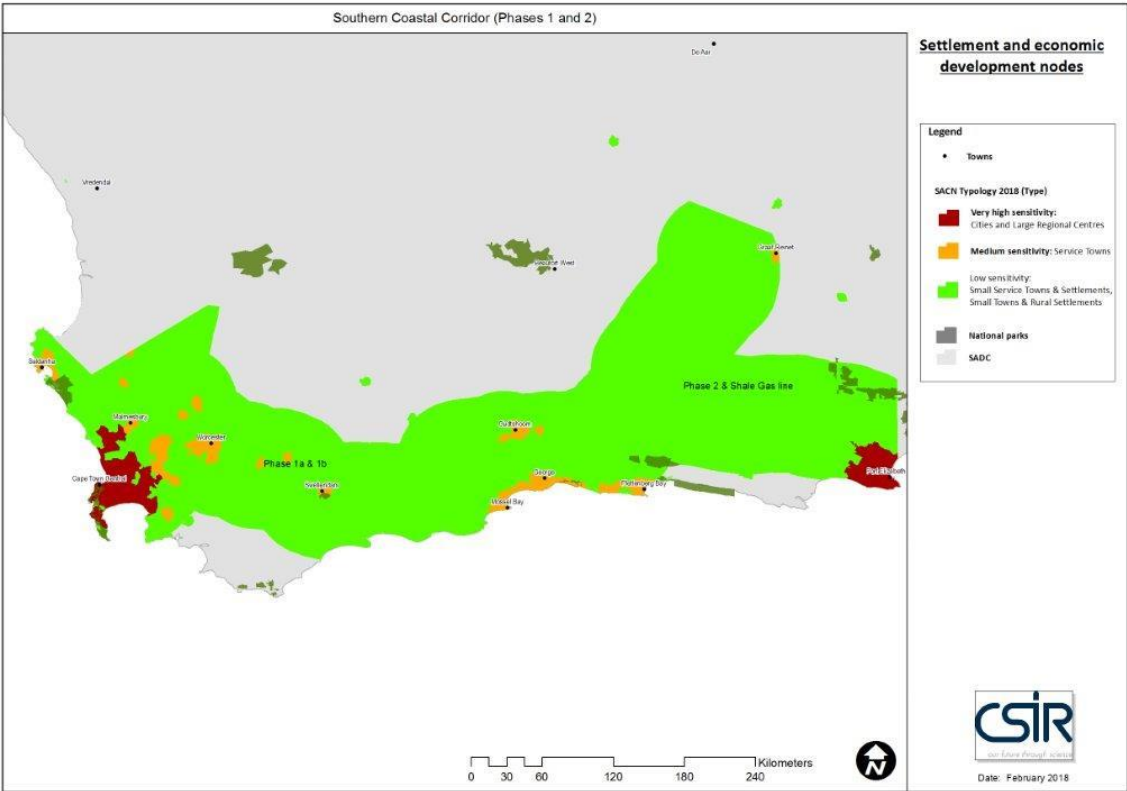


Figure C.14: Settlement and Economic Nodes Sensitivity - Southern Coastal Corridor

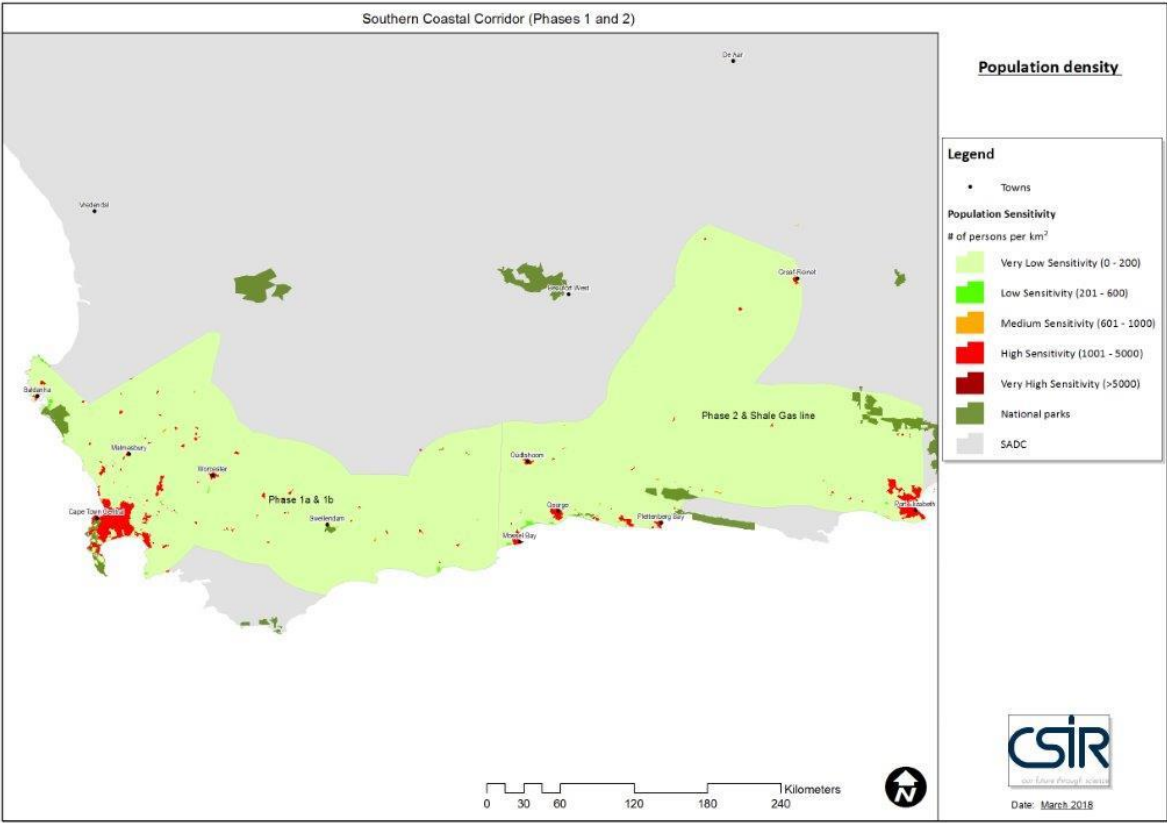


Figure C.15: Settlement population density Sensitivity - Southern Coastal Corridor

APPENDIX D - OVERALL SENSITIVITY MAPS PER CORRIDOR

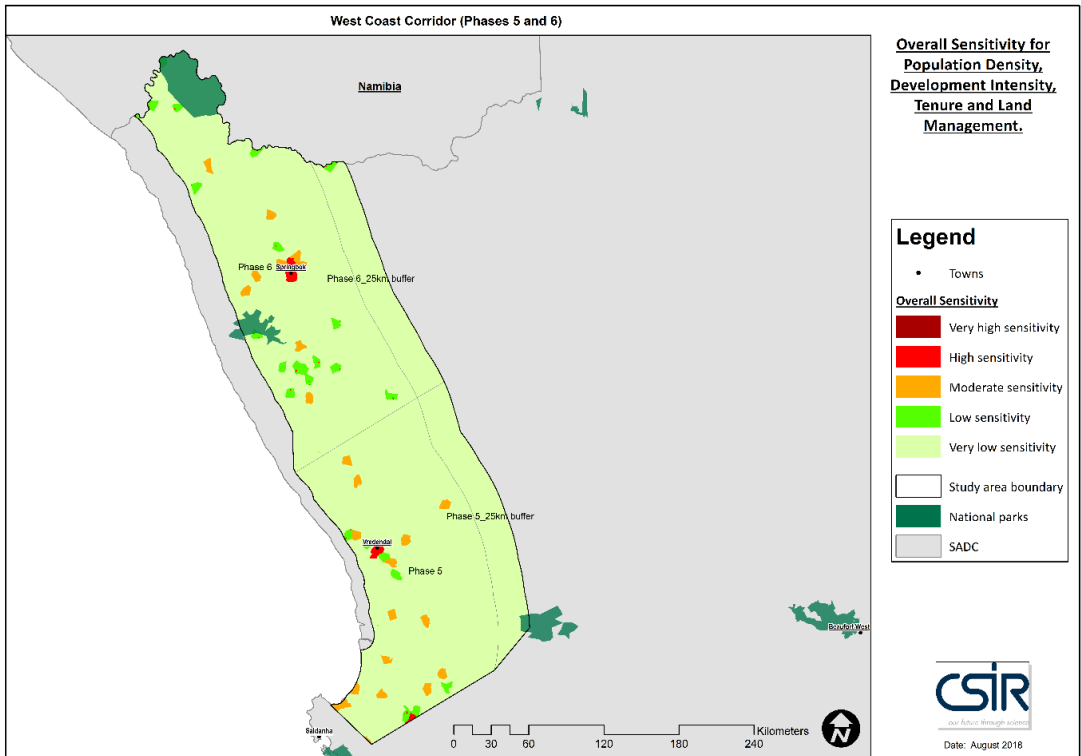


Figure D.1: Overall sensitivity in terms of population density, development intensity and land tenure in Gas Pipeline Corridor (West Coast Corridor (Phases 5 and 6))

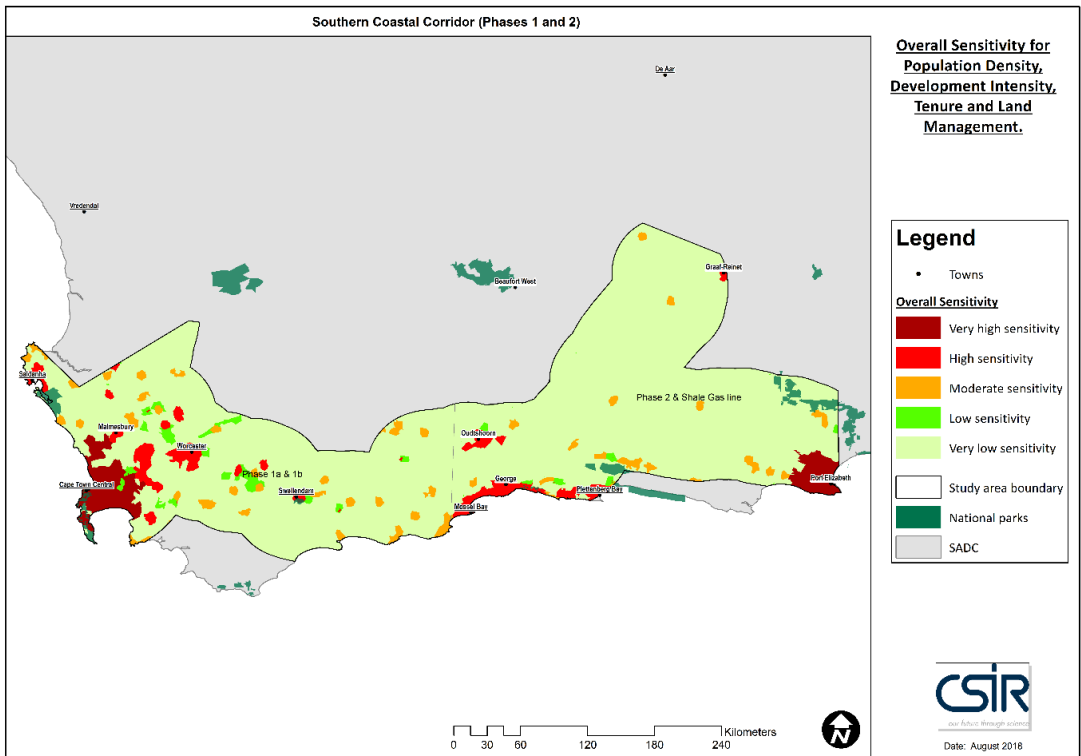


Figure D.2 Overall sensitivity in terms of population density, development intensity and land tenure in Gas Pipeline Corridor (Southern Coastal Corridor (Phases 1 and 2))

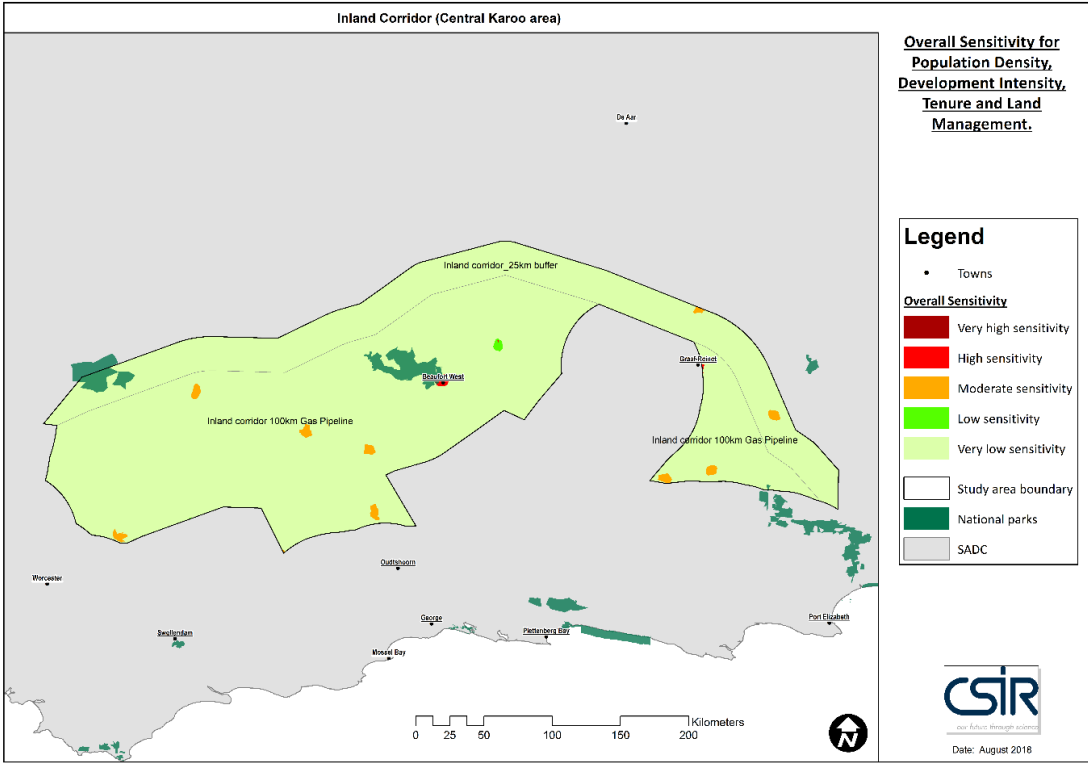


Figure D.3: Overall sensitivity in terms of population density, development intensity and land tenure in Gas Pipeline Corridor (Inland Corridor (Central Karoo area))

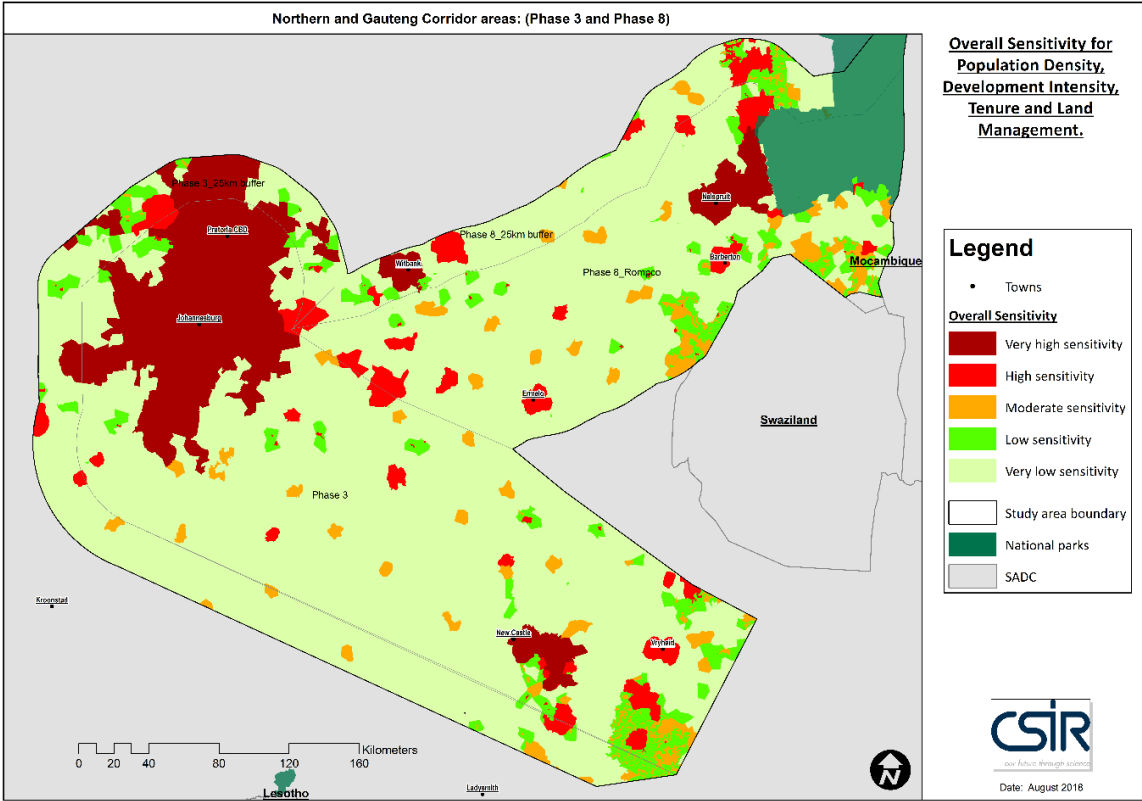


Figure D.4: Overall sensitivity in terms of population density, development intensity and land tenure in Gas Pipeline Corridor (Northern and Gauteng Corridor areas: (Phase 3 and Phase 8))

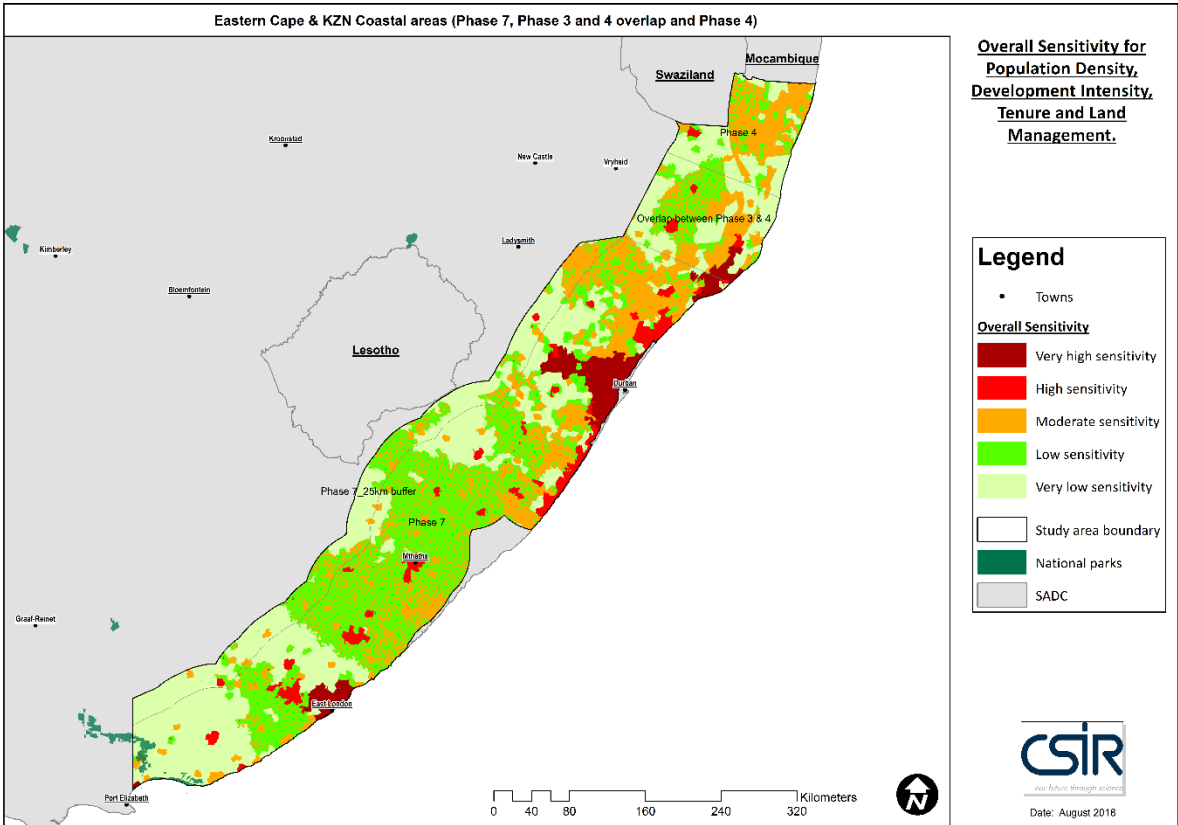


Figure D.5: Overall sensitivity in terms of population density, development intensity and land tenure in Gas Pipeline Corridor (Eastern Cape & KZN Coastal areas: (Phases 7, 3 and 4)

APPENDIX E - FUNCTIONAL TOWN TYPOLOGY

E.1 The creation of the settlement footprints for South African towns and settlements and description of the South African Functional Town Area Typology

Creation of a more defined boundary layer for settlements (Open settlement footprint layer)

May 2018

Author: G Mans, J Maritz & D McKelly
CSIR, BE, SPS

TECHNICAL DOCUMENT

South Africa's main spatial frameworks:

South Africa's frameworks for representing spatial data (particularly economic and demographic data) are made up of a combination of enumerator and large administrative zones. The following figure lists the main spatial units (zones) applied. These spatial units are mostly created by the Municipal Demarcation Board and Statistics South Africa. Currently Local Municipalities (LMs) are the lowest (most detailed) demarcation used for administrative management. Most data (or information) relating to municipal management as well as strategic planning and investment documents are done per municipality.

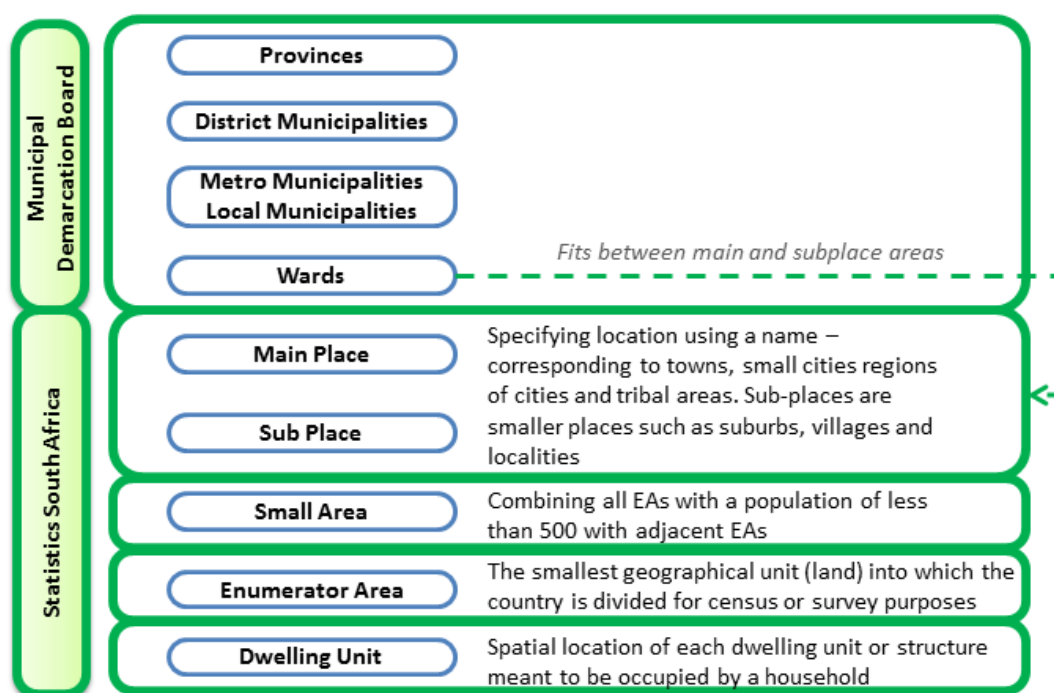


Figure E.1: South Africa's main spatial units.

The StatsSA census data does provide users with more detailed spatial data within municipalities such as Main-Place, Sub-Place, and Small Areas. Enumerator units were developed for a particular purpose and designed to represent fixed sets of people or households per zone and were suited to purposes of enumeration. Similarly other units (wards) were created to represent geopolitical subdivisions of local municipalities used for electoral purposes. These units do not accurately represent the extent of settlements.

Constraints of spatial frameworks:

Although these units nest seamlessly within the local municipal boundaries, at a larger scale they do not accurately represent the extent of settlements. The constraint can be illustrated using the following

example; using the town of Ventersdorp and surrounds. Both the Main- and Sub-place layers extend deep into the surrounding area which does not contain settlement similar to the town of Ventersdorp. As can be deduced from the image these outlying areas, which forms part of the “town” demarcations, is actually commercial farming or other non-residential areas. This is not an isolated case and the same situation can be found in many other settlements across South Africa - there are many such spatial demarcations within a LM which cuts across, or includes portions of built up areas and outlying lower density land uses like commercial farming, small holding, mining or vacant land, to name the most common occurrences. **This therefore misrepresents the true extent of the town or settlement.** Additionally these units do not keep track of the growth experienced by towns. There often exists a mismatch between the boundaries of Main-Place, Sub-Place and Wards compared to the extent of settled areas (as can be observed when compared to more recent satellite imagery).

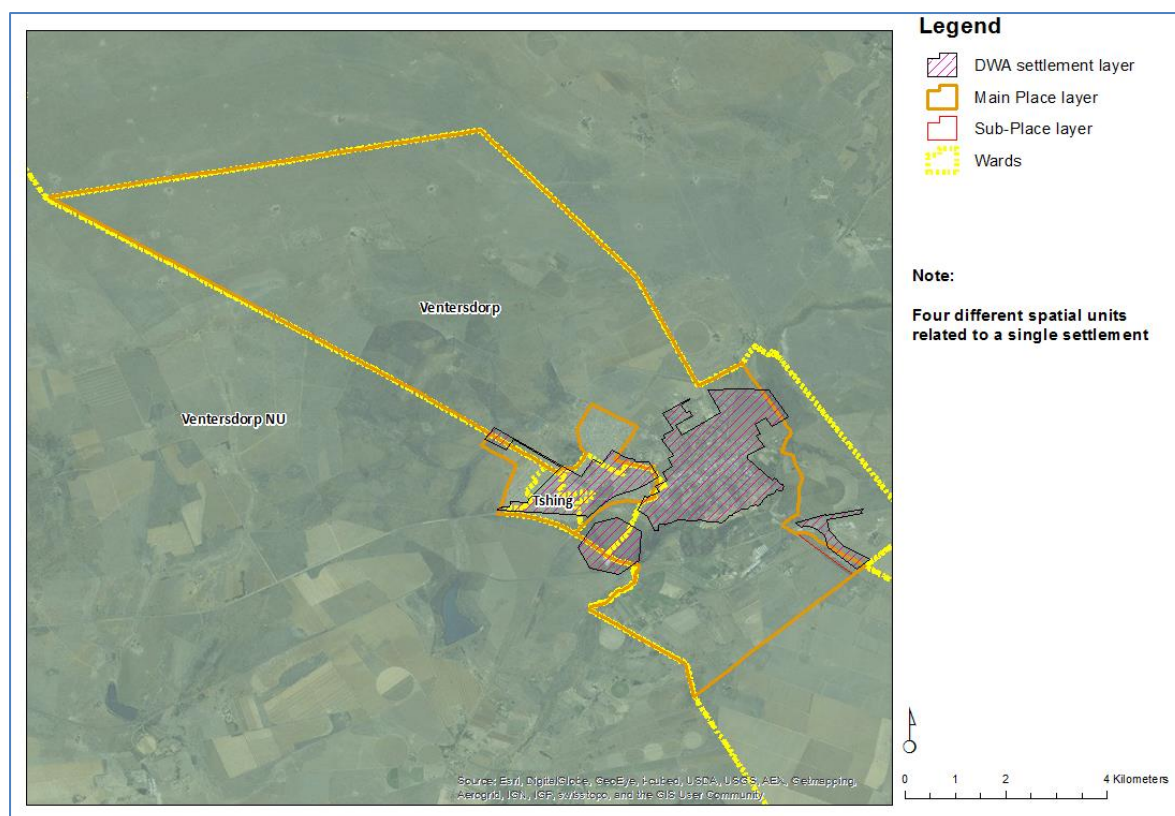


Figure E.2: Comparison of several spatial units.

Other spatial layers such as the mesozones (developed by CSIR) also represent settlements but they do so more from the point of broad differentiation across space than as accurate features. This is also largely due to their scale of application which is not localised but used at the meso (intermediate) scale.

What do we mean with settlement?

Settlement geography is an established branch of geography that investigates where humans have settled. The nature and scale of this settlement varies but central to all settlement is that they represent spaces where people live (reside) and also interact through a range of activities, from personal interaction such as trading or economic activity, employment, and accessing services. Larger and more organised (formal / proclaimed) settlement also has governance and management functions administered through elected representatives, or traditional structures. Settlements according to Bunce (1983, p23) can also be categorised or classified considering a number of factors such as groupings of building, morphology, location, size and functions.

There have been efforts to demarcate settlement areas in more detail such as the Department of Water Affairs' Settlement layer. The purpose of this layer should be noted; it consists of a grouping of structures (in clusters) that often coincides with 'villages'. These represent users of water and sanitation infrastructure and forms 'local planning units' when considering the extent of water service provision as

well as future services. Because these units also do not combine to form the extent of a coherent village, town, city or large settlement, it does not always serve to define settlement boundaries. Although this dataset have proven extremely useful for spatial planning and locational purposes, it does not always succeed in defining settlement boundaries. In South Africa there exists currently two broad types of settlements; those created through a formal town establishment process and those created within traditional authority areas, mostly created through decisions taken by traditional leadership (preceded by homeland governments in some cases).

In the case of settlement data layers no hard categorisation is applied, instead the aim is:

- to encapsulate settlement footprints of both formal and traditional types, that are mostly continuous areas of human settlement and activities,
- that would be in need of services such as water and electricity,
- that could contain non-residential functions that contribute to the existence of the settlement such as commerce, industry, retail etc.

Why are more refined settlement layers needed?

As indicated above, when portraying information per settlement it can be distorted due to the particular spatial framework used and could also misrepresent items such as densities from both a computational as well as visual interpretation perspective. It becomes even more important when the scale of analysis is more localised. The effect of zone size distortions becomes more noticeable when working with data on a more detailed level. Apart from more accurately representing the settlement, this is also relevant when it is about controlling development and managing the use of land. Settlement dynamics is a wide field where many factors could influence or determine settlement. For the purpose of this exercise we will not be going into details. Neither is the objective to attach labels such as 'Urban' or 'Rural' due to the connotations these terms carry.

From a spatial planning point of view it is, however cardinal to have your settlements - with all the internal supporting functions associated with that settlement - clearly differentiated from the 'rest'. The 'rest' referred to includes land with uses like commercial- or subsistence farming, mining, vacant land, small holdings, conservations areas, etc. Divisions such as a river or ridge might create a natural divide but in terms of being part of a community/ or considering the interaction, such areas could be contained within the boundary of a particular settlement.

Do we need to define land uses to demarcate the settlement boundary line?

When following formal planning processes space/land is often identified based on its function its intended or actual land use. Although ideal this information is not always available particularly in non-formalised towns or settlements that fall outside typical land use management practices. What is practically available across all of South Africa is satellite imagery that provides a background to land cover information though that can be used to create or modify settlement boundary layer. It is also hoped that people's knowledge of a settlement could contribute towards its better defined boundary.

How was the current draft (formal) Settlement layer created?

The main input dataset used in the process of identifying the settlement footprints was the EAs produced by StatsSA for the 2011 census. The reason for using the EAs are due to the high resolution of the dataset and therefore it is fairly homogenous in its land use and socio-economic characteristics. The EA dataset is classified as indicated in Figure E.3 below. The figure also indicates how the classes were grouped together to come up with a new classification of built-up areas (types of footprints). There were certain classes (industrial, vacant and small holdings) which were split between those EAs classified as being part of a settlement and whether it falls on the outside of a particular settlement. Mining is one of the sub-classes within the industrial class. Mines that sit isolated on the far outskirts of a town or city with now residential development linked to it was not included in the settlement footprints. Small holdings, especially in Gauteng, which are completely surrounded by built-up areas were included in the settlement footprint, due to the high probability that these small holdings will get redeveloped as residential, commercial or industrial areas. Some EAs were classified as vacant land (no development on it). Again if such an EA was completely surrounded by built up areas, it was included in the settlement footprint as it either functions as a public open space for recreation or it also stands a high chance of being developed to some form of built-up area.

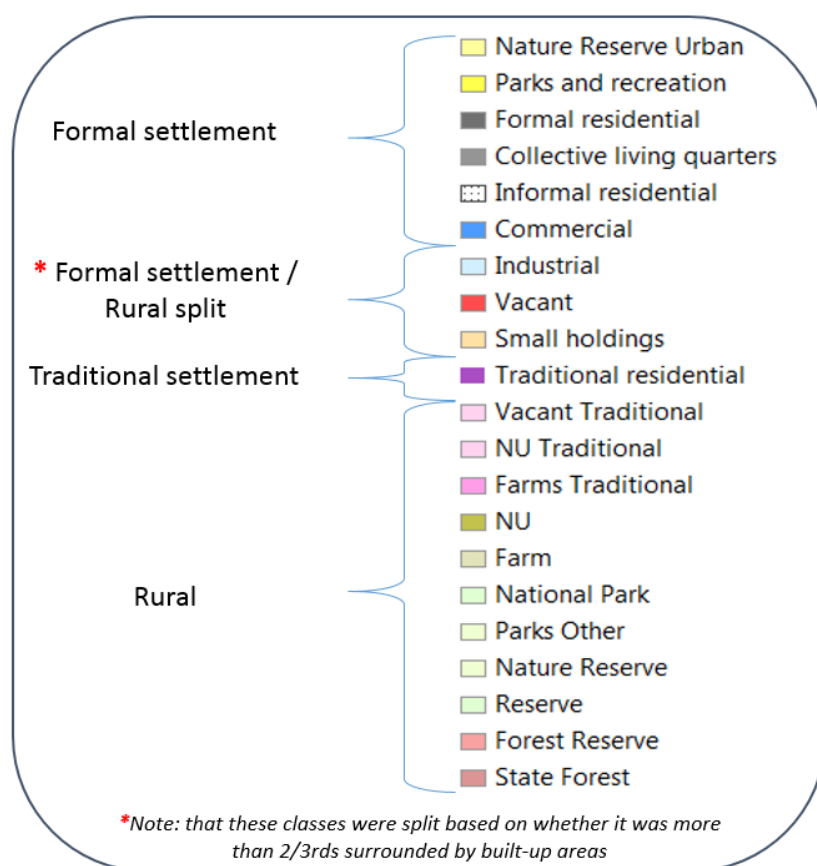


Figure E.3: EA re-classification to settlement footprint categories

The identified settlement footprints were further classified into two categories: formal settlements and traditional settlements. The settlement footprints classified as traditional are settlements that closely coincide with Traditional Authority areas.

After the EAs were re-classified as indicated in Figure E.3, a manual editing process was used to identify and edit EAs that should have been inside or outside a settlement footprint. This was followed by another manual editing process where the actual boundaries of EAs were adjusted if the EA had a significant split between undeveloped and built-up areas whilst this EA is situated on the outskirts of a settlement footprint.

The result was the classification of EAs (few with manually adjusted boundaries) representing the settlement footprints of the country. The next step was to aggregate these EAs into a functional settlement and link a name to such a settlement.

The latter process was done in three steps. The first was to aggregate the selected EAs based on the sub-place names as indicated in the 2011 spatial database provided by StatsSA. These area sub-place (SP) areas therefore have a strong resemblance to StatsSA 2011 SPs, however the extent do differ as large undeveloped areas, which many times form part of StatsSA SPs, have been removed. The naming convention was also adjusted and multi-part polygons removed. The next level in the hierarchy of the settlement layer was to follow the same process as discussed using the SPs, but in this instance using the StatsSA main-places (MPs). Lastly, the continuous settlement footprints were identified. This is in cases where several MPs adjacent to each other forms a continuous built-up footprint. In cases where such a footprint stretched across a local municipal boundary, the 2016 official local municipal boundaries (as published by the Demarcation Board) was used to define the boundary. The result of the settlement demarcation is therefore a three tier hierarchy (T1 is a continuous built-up footprint only broken where it crosses a local municipal boundary; T2 is based on StatsSA MPs, but only built-up areas and no multi part polygons; T3 is based on StatsSA MPs, but only built-up areas and no multi part polygons). Figure E.4 below shows an example of the settlement footprint hierarchy that was created during this process.

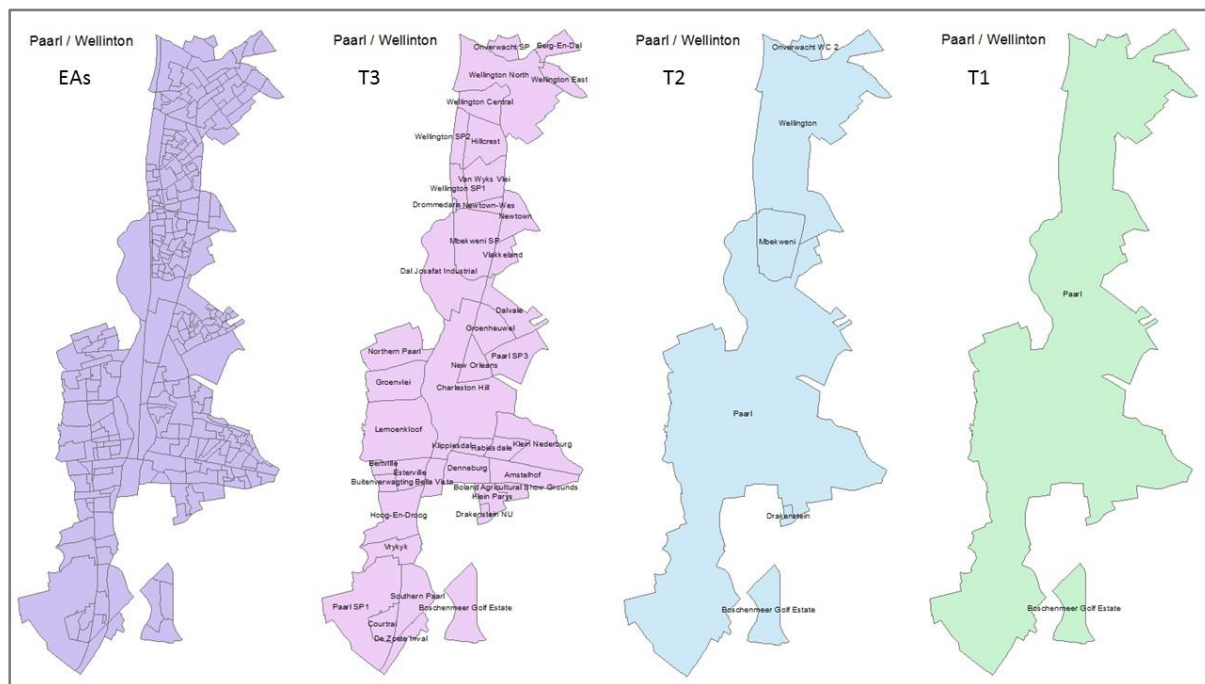


Figure E.4: Spatial hierarchy of the settlement footprint layer

Some point to guide the boundary adjustment process:

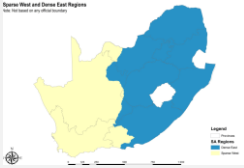
Given South Africa's settlement makeup it is quite difficult to distinguish the footprints of settlements. The following can serve as items for consideration when editing the settlement layers.

- Often settlements (particularly those that are formalised) would have a central business area. Such a point is surrounded by residential, commercial, industrial functions.
- Open spaces such as parks or undeveloped land could occur adjacent of in-between these activities.
- Areas such as small holdings that are slowly being taken up for expansions of the settlement should be included in such a boundary layer (In the process to prepare the provided settlement layer such areas were included where possible). Small holdings in close proximity to the settlement housing commercial or industrial functions could be included.

Editable open feature

Creating and modifying up to date settlement boundary layers requires a collaborative effort. As a result the approach will be an **open data approach**. This means that anyone can freely contribute to the item. This item can also be shared and used by users at no cost. This item is made publically available under the Open Database License. The Open Database License (ODbL) is a license agreement intended to allow users to freely share, modify, and use this Database while maintaining this same freedom for others. (see <https://opendatacommons.org/licenses/odbl/1.0/>) Due to the collaboration with other users the process to update the item will be easier and less reliant on a single entity to undertake.

South African Functional Town Area (FuTA) TYPE 2018 - CSIR 2018

RSA Settlement Landscape	SA Functional Town Area Type	Description of Functional Town Area Types / Sub-types Based on urban function in surrounding region and urban area size
Metropolitan Areas & Cities	City Regions	Metro's and cities with more than 1 million people in large conurbations. Service related economic output estimated as average R188 000 mill and total economic output above R40 816mill in 2013
	Cities and Large Regional Centres	City Area (City) - More than 500 000 people in city and functional hinterland areas. Service related economic output estimated as average R14 192mill and total economic output above R7 900mill in 2013 for team understanding
		Large Regional Centre (RC1) Cities and large regional nodes with more than 300 000 people in interconnected settlements and direct hinterland. Service related economic output estimated as average R5 500mill and total economic output above R4 000mill in 2013
Regional Service Centres & Service Towns (Urban core areas and surrounding functional town areas)	Regional Service Centres	Big Regional Service Centre (RC2) - Regional nodes and corridors with 100 000-300 000 people in interconnected settlements and hinterland, playing a significant social and economic service role in region. Service related economic output estimated as average R3 400mill and total economic output above R 1400mill in 2013
		Regional Service Centre (RC3) - Smaller Regional nodes and corridors with less than 100 000 people in interconnected settlements and hinterland, playing a significant social and economic service role in region. Total economic output in all cases above R1 100mill (2013) but service related economic output estimated as average R1 660mill
Formal Small Towns	Service Town	Service Town - Towns of various sizes, providing an economic and social service anchor role in hinterland. Population variation between 15 000 to 100 000 population, with total economic output more than R270mill (2013) in all cases. Service related economic output estimated as average R670mill per town
	Small Service Town	Small Service Town - Towns of which economies and/or population smaller than that of Service towns. Playing an anchor role as social service point , serving a large number of people within 30km from the town in denser areas and within 50km from the town in sparser areas. Government and community services significant in local economy. Identified as priority service centre to people in towns and hinterland based on CSIR & DRDLR research & spatial profiling.
	Small Town	Small Town - Small towns of which economies and/or population smaller than that of Service towns. Primarily serve local population and/or 'niche' economic activity such as mining, tourism or fisheries. (Monocentric small towns, often apartheid landscape double centre towns)
Rising Small Towns - Nodes of Consolidating in dense rural settlements	Rural Service Settlement	Rural Service Settlement - Dense Rural Settlements that are strategically located to play an anchor role as social service point , serving a large number of people within 30km from the town in denser areas and within 50km from the town in sparser areas. Identified based on priority nodes for social service delivery in areas without formal towns and multiple settlement nodes, from DRDLR & CSIR research
Rural Settlement Areas (Formal & Traditional)	Smaller towns/ villages/ dorpias & nodal places in rural areas	Nodal settlement with limited population and economy but forming part of the South African group of towns. May be found in both sparse or densely settled areas. Small nodal places (any- not forming part of above)
	Dense Rural Settlements	This area incorporates both (i) Formal Rural settlement area - EA's and Settlements Footprint classified as formal as well as (ii) Traditional Authority Rural Settlement Area - EA's and Settlement Footprint areas classified as traditional. Both have very small formal service economy activities. Within such areas Rural Service Settlements and smaller nodal places have been identified for location of social services as applicable based on the population threshold and characteristics.
Sparsely Populated	Sparsely Populated	Sparsely populated areas (meso zone areas without rural settlements) Sparse East (more than 10 persons per sq km) while in the Sparse west this is defined as less than 10 persons per sq km and has an impact on the accessible travel access distance and threshold of certain social services. 

Reference: Maritz, J., van Huyssteen, E. Green, C. and Sogoni, Z. South African Functional Town Typology (CSIR 2018 v2). Available at www.stepsa.org.za.

E.2 Town and settlement population characteristics by Corridor Groupings

The town and settlement population characteristics have been sourced from the South African Functional Town Typology (Maritz et al, 2018) and Settlement Footprint Layer (Mans et al, 2017).

Table E.1: Population numbers and growth West Coast Corridor –Phase 5 &6

WEST COAST Corridor : Phase 5 & 6		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) Negative growth indicated in brackets
Phase 5		
Service Towns(2)		
Vredendal	18 070.13	13.76
Piketberg	11 947.50	29.92
Small Service Towns & Settlements(2)		
Clanwilliam	7 567.89	26.17
Citrusdal	7 022.01	(4.95)
Small Towns(13)		
Velddrif	10 921.38	49.28
St Helena Bay	8 341.25	50.92
Klawer	6 115.25	29.57
Van Rhynsdorp	5 954.34	41.76
Luizville	5 235.00	12.84
Graafwater	2 254.89	22.15
Nieuwoudtville	2 018.53	43.18
Eendekuil	1 531.00	54.50
Dwarskersbos	667.00	87.69
Nuwerus	651.00	21.40
Aurora	576.00	61.47
Redelinghuys	573.00	(3.51)
Bitterfontein	545.76	8.80
Dense Rural Settlements(4)		
Rural Settlement Area	5 627.53	7.03
Sparsely Populated Area(2)		
Sparse Rural	371.05	98.92
Phase 6		
Service Towns(1)		
Springbok	18 635.96	18.83
Small Service Towns & Settlements(1)		
Steinkopf	7 780.86	7.63
Small Towns(7)		
Concordia	4 960.11	18.47
Nababeep	4 297.04	(9.45)
Komaggas	3 115.00	(6.00)
Garies	2 074.32	25.57
Carolusberg	960.09	(0.99)
Kamieskroon	893.00	(1.32)
Eksteenfontein	528.00	17.26

WEST COAST Corridor : Phase 5 & 6		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Dense Rural Settlements(19)		
Rural Settlement Areas	9 581.22	6.84
Sparsely Populated Areas(3)		
Sparse Rural Areas	1 560.59	45.59
Phase 6_25km buffer		
Dense Rural Settlements(1)		
Rural Settlement Area	168.00	482.62

Table E.2: Population numbers and growth Southern Coastal Corridor –Phases 1a &b and 2

Southern Coastal Corridor: (Phases 1 a &b and Phase 2&Shale Gas line		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Phases 1 a &b		
Cape Town City Regions (CCR)	3 811 934.80	28.42
City of Cape Town	3 708 427.81	28.83
Stellenbosch Cape Winelands CCR area	103 506.99	28.01
West Coast CCR area	4 739.00	108.49
Regional Service Centres(3)		
Paarl/Wellington	201 459.84	29.58
Vredenburg	75 227.02	42.05
Worcester	99 857.44	18.25
Service Towns(9)		
Ceres	39 292.50	16.94
Franschhoek	18 576.25	29.73
Grabouw	31 269.81	18.42
Malmesbury	39 631.98	54.03
Montagu	14 892.90	35.53
Moorreesburg	12 184.39	39.48
Robertson	27 449.01	17.20
Swellendam	18 458.89	30.46
Wolseley	12 131.00	50.75
Small Service Towns & Settlements(9)		
Barrydale	3 899.38	14.34
Darling	10 400.29	24.53
Genadendal	5 642.21	25.93
Heidelberg-WC	7 870.88	13.16
Ladismith	6 461.79	8.40
Riversdale	15 183.31	28.49
Riviersonderend	5 203.17	44.59
Ashton	13 093.27	12.87
Riebeek West	4 524.10	59.23
Small Towns(26)		

Southern Coastal Corridor: (Phases 1 a &b and Phase 2&Shale Gas line)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Albertina	6 350.72	35.37
Boggomsbaai	71.00	(57.23)
Bonnievale	8 722.66	37.84
Calitzdorp	3 638.31	9.82
Gouritsmond	514.00	13.22
Greyton	2 780.73	7.97
Herbertsdale	661.46	5.76
Hopefield	5 770.80	30.39
Kleinmond	6 330.88	3.76
Koringberg	1 214.61	244.62
McGregor	2 783.65	31.12
Op-die-Berg	1 529.00	60.79
Paternoster	1 955.74	31.92
Porterville	6 967.30	20.45
Riebeek-Kasteel	4 465.14	72.85
Saron	7 831.68	(3.21)
Stilbaai	6 378.28	37.41
Suurbraak	2 106.15	13.30
Tulbagh	8 973.00	20.32
Villiersdorp	10 002.13	31.95
Vleesbaai	195.00	(21.09)
Yzerfontein	1 132.53	99.79
Zoar	4 648.10	14.55
Pringle Bay	2 299.00	50.41
St Helena Bay	3 085.16	20.24
De Doorns	10 452.21	(31.09)
Dense Rural Settlements(4)		
Rural Settlement Area	7 294.45	25.90
Sparsely Populated Area(7)		
Sparse Rural	2 244.66	35.21
Phase 2 and Shale Gas line		
Nelson Mandela Bay City Region Area (1)	1 123 382.82	12.96
Nelson Mandela Bay NMCR	1 123 382.82	12.96
Regional Service Centres(4)		
George	170 580.83	31.73
Knysna	50 881.36	26.85
Mossel Bay	80 700.32	29.87
Oudtshoorn	73 635.66	8.82
Service Towns(2)		
Graaf-Reinet	35 151.73	12.10
Plettenberg Bay	39 484.84	64.47
Small Service Towns & Settlements(7)		
Aberdeen	7 138.26	13.27

Southern Coastal Corridor: (Phases 1 a &b and Phase 2&Shale Gas line)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Hankey	11 328.55	17.07
Joubertina	6 215.95	6.77
Kirkwood	13 723.25	28.00
Murraysburg	5 061.50	14.67
Willowmore	7 551.51	21.13
De Rust	3 540.33	27.07
Small Towns(12)		
Barsheba	2 157.00	52.94
Buffelsbaai	70.00	(40.17)
Friemersheim	1 202.62	30.36
Haarlem	2 375.00	0.39
Karatara	502.25	169.19
Loerie	2 785.00	24.48
Louterwater	4 830.00	29.96
Patensie	4 855.50	11.28
Steytlerville	4 010.57	10.79
Thornhill	2 459.00	88.80
Uniondale	4 454.75	9.82
Krakeel River	1 932.00	12.78
Dense Rural Settlements(3)		
Rural Settlement Area	8 339.69	48.79
Sparsely Populated Area(8)		
Sparse Rural	3 842.94	91.16

Table E.3: Population numbers and growth Inland Corridor

Inland corridor		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Service Towns(1)		
Beaufort West	34 012.79	10.16
Small Service Towns & Settlements(2)		
Jansenville	5 419.69	13.39
Prince Albert	7 013.73	19.13
Small Towns(7)		
Klipplaat	2 952.91	1.91
Merweville	1 579.39	38.18
Sutherland	2 700.79	43.04
Touwsrivier	7 670.11	15.03
Leeu Gamka	2 568.12	22.06
Nieu-Bethesda	1414.57	52.13
Pearston	4474.48	10.90
Dense Rural Settlements(1)		

Inland corridor		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Rural Settlement Area	1 530.60	105.53
Sparsely Populated Area(1)		
Sparse Rural	417.08	10.44

Table E.4: Population numbers and growth: Eastern Cape and KZN Coastal areas (Phase 7, Portion of Phase 3 and Phase 4)

Eastern Cape and KZN Coastal areas (Phase 7, Overlap of Phase 3 & 4 and Phase 4)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Phase 7		
eThekweni City Region (ECR) (1)	3 479 924.45	16.35
eThekweni City ECR	3 440 670.50	11.39
iLembe ECR	23 170.01	30.44
Umgungundlovu ECR	16 083.94	7.22
Cities and Large Regional Centres(3)		
Pietermaritzburg	654 975.65	12.92
East London	537 603.36	11.74
Richards Bay	302 815.57	16.56
Regional Service Centres(7)		
Mthatha	199 151.42	25.90
Stanger	187 434.35	41.15
Port Shepstone/Margate	169 339.86	23.97
King Williams Town	138 513.75	1.84
Butterworth	73 005.26	(4.38)
Pennington/Scottburgh	71 531.39	8.92
Grahamstown	66 963.81	1.75
Service Towns(16)		
Mandini	74 436.93	17.76
Kokstad	51 419.75	38.87
Umzinto	37 680.82	35.48
Dimbaza	33 473.26	(14.79)
Richmond	32 852.53	20.72
Howick	26 726.21	45.23
Stutterheim	26 121.92	3.99
Port Alfred	25 766.39	22.14
Flagstaff	22 574.59	18.46
Idutywa	20 223.58	47.47
Clydesdale	19 743.12	31.50
Greytown	19 314.00	13.08
Eshowe	18 463.28	24.55
Engcobo	15 419.18	36.67
Mount Frere	14 768.00	27.31

Eastern Cape and KZN Coastal areas (Phase 7, Overlap of Phase 3 & 4 and Phase 4)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Bizana	10 151.06	65.23
Small Service Towns & Settlements(21)		
Maclear	10 499.19	9.83
Ixopo	10 302.08	23.66
Keiskammahoek	10 293.77	(8.68)
Harding	9 378.01	53.60
Nqamakwe	8 692.00	2.17
Peddie	8 314.00	6.42
Libode	8 067.00	12.65
Mount Ayliff	7 874.00	26.74
Melmoth	7 751.27	12.45
Bathhurst	6 224.07	2.35
Willowvale	6 107.74	(3.53)
Paterson	5 560.15	26.73
Dalton	4 066.00	35.79
Nkandla	3 406.91	27.85
Ngqeleni	3 378.00	19.60
Centane	3 354.69	11.23
Kei Mouth	2 357.00	(11.63)
Elliotdale	2 010.66	126.48
Kranskop	1 509.00	78.80
Creighton	860.30	89.69
Highflats	542.00	72.32
Small Towns(39)		
Alice	19 211.00	35.39
Addo	16 933.98	4.43
Tabankulu	15 817.31	2.45
Kwarela	13 747.09	5.34
Mt Fletcher	13 256.00	30.46
Kenton on sea-Boesmans	11 270.33	5.97
Hopewell	11 118.00	13.46
Alexandria	10 063.62	17.10
Qumbu	10 053.89	16.95
Tsolo A	9 724.00	9.70
Tsolo B	8 129.00	(18.08)
Komga	8 043.61	17.13
Donnybrook	7 806.67	(3.20)
Mqanduli	6 481.05	12.68
Middeldrift	5 013.00	35.34
Albert Falls	4 534.00	23.61
Cedarville	4 413.00	76.45
Lidgetton	4 365.07	57.57
Tsomo	3 569.54	30.48

Eastern Cape and KZN Coastal areas (Phase 7, Overlap of Phase 3 & 4 and Phase 4)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
New Hanover	3 172.00	45.76
Clarkebury	2 967.00	(7.84)
Braemar	2 849.42	(31.79)
Colchester	2 057.55	70.91
Hamburg	1 935.00	(8.19)
Franklin	1 844.03	256.04
Kei Road	1 649.00	2.55
Wesley	1 634.00	(0.49)
Kayser's Beach	1 416.02	49.92
Ginginlovu	1 110.00	(5.71)
Hogsback	930.84	31.43
Wartburg	906.00	(0.85)
Riebeek east	727.64	15.24
Taweni	694.00	(13.52)
Boknes Strand	528.32	8.40
Amatikulu	513.00	(30.20)
Kidd's Beach	500.00	10.34
Haga Haga	370.00	(39.46)
Seafield	290.30	1.88
Zigagayi	97.00	35.40
Dense Rural Settlements(2131)		
Rural Settlement Area	3 822 411.82	(5.19)
Sparsely Populated Area(25)		
Sparse Rural	10 463.16	(9.78)
Phase 7_25km buffer		
Service Towns(2)		
Fort Beaufort	26 997.93	7.92
Moorivier	17 645.26	33.04
Small Service Towns & Settlements(8)		
Nababeep	14 667.00	(9.98)
Matatiele	12 399.17	21.19
Adelaide	12 090.72	(9.68)
Cofimvaba	11 878.32	44.84
Cathcart	7 201.44	(7.68)
Seymour	3 088.00	15.38
Tugela Ferry	1 811.30	37.92
Bulwer	1 319.00	40.08
Small Towns(6)		
Maluti	25 543.00	42.54
Ugie	12 917.66	58.59
Dumasini	5 395.00	9.18
Nottingham Road	1 784.00	31.82
Mt Fletcher	1 480.00	(6.87)

Eastern Cape and KZN Coastal areas (Phase 7, Overlap of Phase 3 & 4 and Phase 4)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Pomeroy	577.57	86.17
Dense Rural Settlements(275)		
Rural Settlement Area	275 081.47	(4.40)
Sparsely Populated Area(12)		
Sparse Rural	2 223.88	5.73
Overlap between Phase 3 & 4		
Cities and Large Regional Centres(1)		
Richards Bay	53 706.62	15.23
Service Towns(3)		
Mtubatuba	24 378.42	53.67
Nongoma	14 438.59	105.65
Ulundi	49 729.74	10.56
Small Service Towns & Settlements(5)		
Babanango	2 343.00	48.15
Hlabisa	2 470.00	84.76
Hluhluwe	3 643.50	72.03
Melmoth	1 105.77	34.86
Ntambanana	10 528.97	26.60
Small Towns(2)		
St Lucia	1 103.00	27.37
Khula Village	9 602.59	48.38
Dense Rural Settlements(209)		
Rural Settlement Area	649 173.06	1.99
Sparsely Populated Area(5)		
Sparse Rural	1 480.67	78.04
Phase 4		
Service Towns(1)		
Pongola	18 362.00	(2.83)
Small Service Towns & Settlements(5)		
Ndumu	5 631.00	(1.02)
Mkuze	5 609.11	73.43
Jozini	2 847.34	(0.61)
Mbazwana	2 899.43	26.36
Ingwavuma	1 303.92	17.99
Dense Rural Settlements(33)		
Rural Settlement Area	399 520.22	5.61
Sparsely Populated Area(2)		
Sparse Rural	687.00	(10.77)

1
2

Table E.5: Population numbers and growth Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)

Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Phase 3		
Gauteng City Region (GCR)(1)	7 573 308.23	27.95
City of Johannesburg GCR	4 413 405.57	37.63
Ekurhuleni GCR	3 147 764.04	27.54
City of Tshwane GCR	2 717 810.70	36.42
Sedibeng GCR	834 857.30	15.55
West Rand GCR	665 099.80	17.65
Fezile Dabi GCR	139 197.20	30.83
Bojanala GCR	68 579.19	30.04
Cities and Large Regional Centres(1)		
Newcastle	427 732.37	5.95
Regional Service Centres(4)		
Brits	2 741.69	41.11
Secunda	119 867.36	22.87
Standerton	84 371.35	21.50
Vryheid	132 634.16	2.68
Service Towns(9)		
Balfour	25 962.97	28.99
Delmas	2 908.30	136.45
Dundee	34 148.59	23.57
Frankfort	26 066.93	22.48
Leandra	596.00	62.28
Nqutu	17 651.05	35.72
Parys	48 062.08	9.72
Paul-Pietersburg	31 684.28	8.91
Volksrust	24 246.94	18.55
Small Service Towns & Settlements(8)		
Amersfoort	12 228.50	46.96
Heilbron	27 368.95	7.82
Louwsburg	4 034.41	31.86
Memel	7 143.00	20.98
Morgenzon	7 596.67	72.11
Utrecht	6 948.00	34.39
Villiers	17 316.00	(5.01)
Vrede	17 574.37	1.60
Small Towns(17)		
Charlestown	3 916.49	30.79
Cornelia	2 885.67	(14.63)
Coronation	11 724.27	30.71
Devon	9 572.00	33.21
Dunnhauser	5 370.22	11.40
Enyati	1 074.00	22.60

Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Nondweni	10 482.00	(0.46)
Oranjeville	5 145.16	47.60
Perdekop	5 030.18	51.57
Pumalanga	2 067.22	47.79
Tweeling	6 446.76	30.22
Wakkerstroom	5 257.00	7.66
Charl Cilliers	769.00	259.01
Holly County	588.00	(3.74)
Vaal Marina	1 876.00	98.11
Dense Rural Settlements(79)		
Rural Settlement Area	168 609.68	2.04
Sparsely Populated Area(6)		
Sparse Rural	996.62	(35.57)
Phase 3_25km buffer		
Gauteng City Regions (GCR) (1)	413 857.77	14.42
Bojanala GCR	225 809.95	19.82
City of Tshwane GCR	121 350.96	37.59
West Rand GCR	66 696.86	(14.14)
Cities and Large Regional Centres(7)		
Rustenburg	54 442.02	65.87
Regional Service Centres(2)		
Brits	104 671.84	46.19
Potchefstroom	143 181.82	27.23
Service Towns(3)		
Delmas	27 545.60	68.74
Dundee	16 699.96	19.78
Vredefort	14 563.41	25.07
Small Service Towns & Settlements(3)		
Koppies	13 797.23	57.95
Warden	10 406.25	57.82
Petrus Steyn	511.21	102.22
Small Towns(1)		
Wasbank	2 520.14	58.50
Dense Rural Settlements(42)		
Rural Settlement Area	325 535.60	2.50
Sparsely Populated Area(1)		
Sparse Rural	225.00	119.53
Phase 8_Rompco		
Cities and Large Regional Centres(1)		
Nelspruit	474 503.15	25.06
Regional Service Centres(5)		
Hazyview	131 312.47	11.51
Ermelo	83 658.64	52.58
Secunda	66 916.60	53.85

Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Bethal	59 254.59	37.28
Bushbuckridge	14 307.44	14.05
Service Towns(7)		
Matsulu	49 868.51	29.21
Barberton	48 634.43	31.39
Leandra	32 967.00	49.34
Kriel	29 230.82	45.59
Carolina	16 751.86	38.67
Kamaqhekeza	16 303.83	15.69
Sabie	15 612.19	27.17
Small Service Towns & Settlements(7)		
Nhlazartshe	40 292.03	20.43
Driekoppies	22 852.66	8.00
Hendrina	22 771.97	28.52
Belfast	16 313.57	67.09
Lothair	5 924.44	(8.85)
Komatiepoort	4 755.63	14.76
Ngodwana	1 177.00	169.00
Small Towns(17)		
Schoemansdal	45 071.00	23.85
Kamhlushwa	26 122.26	89.09
eMangweni	22 949.00	18.13
Masibeleka	21 552.02	(0.60)
Glenmore	19 326.01	(12.44)
Breyten	14 345.00	17.24
Mgobode	14 115.00	10.15
Empuluzi	13 542.00	7.88
Machadodorp	8 398.13	54.87
Badplaas	6 921.00	21.92
Vanwyldsdrif	6 213.77	43.46
Waterval Boven	5 871.54	0.99
Davel	4 975.00	34.18
Chrissiesmeer	4 010.11	(18.71)
Malelane	3 877.20	8.32
Hectorspruit	3 084.72	36.06
Kaapmuiden	268.00	(32.74)
Dense Rural Settlements(59)		
Rural Settlement Area	289 267.22	13.01
Sparsely Populated Area(11)		
Sparse Rural	6 182.38	20.86
Phase 8_25km buffer		
Cities and Large Regional Centres(1)		
Witbank	295 712.79	52.45
Regional Service Centres(3)		

Northern and Gauteng Corridor areas: (Phase 3 and Phase 8)		
Towns by Typology category	Population 2011	% growth/decline (2001-2011) <i>Negative growth indicated in brackets</i>
Bushbuckridge	173 918.15	5.41
Middelburg	163 139.04	76.55
Hazyview	86.00	(17.34)
Service Towns(4)		
Acornhoek	81 093.35	20.20
Ogies	33 118.07	14.05
Delmas	24 472.00	19.10
Lydenburg	14 541.68	129.14
Small Service Towns & Settlements(2)		
Lillydale	24 550.00	9.65
Dullstroom	5 183.93	51.08
Small Towns(3)		
Graskop	3 833.47	14.24
Skukuza	1 603.00	284.02
Pilgrim's Rest	1 594.57	315.25
Dense Rural Settlements(27)		
Rural Settlement Area	81 380.39	6.38
Sparsely Populated Area(2)		
Sparse Rural	588.25	16.58

1
2
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Figure E.5: Infrastructure projects as listed in Provincial SDF documents



Table E.6: List of Infrastructure projects based on a review of Provincial SDF documents

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
Western Cape							
WESCAPE Mixed Land Use Development	20km outside Cape Town up the west coast, along the N7 Ward 104 City of Cape Town	-Residential Development	Yes	Long Term	Yes		City of Cape Town Spatial Development Framework (2012)
Cape Town Port upgrade and future expansion	Cape Town port	-Industrial development	Yes	Medium Term	No		Western Cape Provincial Spatial Development Framework (2014)
Saldanha Bay Port upgrade and future expansion	Saldanha Port	-Industrial development	Yes	Medium Term	No		Western Cape Provincial Spatial Development Framework (2014)
Saldanha Renewable energy industrial growth	Saldanha Port	-Industrial development	Yes	Medium Term	Yes		Western Cape Provincial Spatial Development Framework (2014)
Laingsburg Renewable energy industrial growth	Laingsburg Town	-Industrial development	No	Medium Term	Yes		Western Cape Provincial Spatial Development Framework (2014)
N7 Upgrading	Malmesbury - Philadelphia intersection	-Road corridor	Occurring	Present	Yes		City of Cape Town Spatial Development Framework (2012)
Mines and Quarries	-City of Cape Town -Saldanha -Oudtshoorn -Bredasdorp -Mossel Bay -Malgas - Albertina	Industrial Activity	Occurring	Present	No	There are a number of Mining and quarry activities which the project should avoid. The majority are found within the City of Cape Town metropolitan, however there are also three significantly sized quarries/mines found in Saldanha and a few others along the coast from Bredasdorp towards Mossel Bay and one in Oudtshoorn.	Western Cape Provincial Spatial Development Framework (2014)
Priority Tourism Nodes	Table Mountain National Park	Tourist Attractions	Occurring	Present	No	The Gas Pipeline should avoid established areas of touristic interests.	Western Cape Provincial Spatial Development Framework (2014)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
	Tsitsikamma National Park -Karoo National Park -West Coast National Park - Wilderness National Park -De Hoop National Park						
Agricultural Activities	-Swellendam -Brede Valley -Stellenbosch -Constantia -Knysna -Bitou	Farming Constraints	Occurring	Present	No	Western Cape has a plethora of farming activities across province most of which can be traversed by an active Gas Pipeline. However areas shown for deep rooted and long term produce i.e. vineyards and forestry should be avoided.	Western Cape Provincial Spatial Development Framework (2014)
Free State							
Industrial Corridor Bloemfontein and Botshabelo	-Bloemfontein to Botshabelo	Industrial Corridor	Yes	Medium Term	Yes	Bloemfontein and Botshabelo fall outside of the affected area by the Proposed Gas Pipeline, however it may increase Gas demand within the province.	Free State Province Provincial Spatial Development Framework (2014)
Proposed Industrial restructuring and expansion	-Phuthaditjhaba	Industrial Development	Yes	Medium Term	Yes		Free State Province Provincial Spatial Development Framework (2014)
Harrismith New Regional Airport	-Harrismith	Industrial Development	Yes	Long Term	Yes		Free State Province Provincial Spatial Development Framework (2014)
Welkom New Regional Airport	-Welkom	Industrial Development	Yes	Long Term	Yes		Free State Province Provincial Spatial Development Framework (2014)
Mineral and Mining Activities	-Frankfort -Heilbron -Sasolburg -Vredefort	Industrial Development	Occurring	Present	No		Free State Province Provincial Spatial Development Framework (2014)
Priority Tourism Nodes	-Memel -Vaal Dam -Parys	Tourism Nodes	Occurring	Present	No		Free State Province Provincial Spatial Development Framework (2014)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
Agriculture Activities	-Vaal Dam	Agricultural Scheme	Yes	Medium Term	Yes	The forms of agriculture found throughout the Province are traversable by the Proposed Gas Pipeline where it is mostly maize farming. However, the presence of the dam could present engineering constraints for the gas pipeline.	Free State Province Provincial Spatial Development Framework (2014)
Eastern Cape							
Port St Johns Proposed Renewable Energy Zone	-Port St Johns	Industrial Development	Yes	Long Term	Yes		Eastern Cape Provincial Spatial Development Plan (2010) Eastern Cape Infrastructure Plan 2013 (August 2016)
Urban Infilling Project	-Bizana -Sterkspruit	Residential Development	Yes	Medium Term	Yes		Eastern Cape Provincial Spatial Development Plan (2010)
Karoo Shale Gas optimisation	-Queenstown	Industrial Development	Yes	Very Long Term	Yes	This development would be a pull factor for this project as it would facilitate gas related development derived from Shale Gas should it ever occur.	Eastern Cape Provincial Spatial Development Plan (2010)
Wild Coast Road Development	-Ndwalane -Mntafufu -Lusikisiki -Msikaba -Holy Cross/ Mkambati	N2 Corridor Development	Occurring	Present	Yes	The Wild Coast Development Zone which looks to unlock the tourism potential along the coast through new road networks.	Eastern Cape Provincial Spatial Development Plan (2010) Eastern Cape Infrastructure Plan 2013 (August 2016)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
	-Mtentu -Mzamba -Port Edward						
Upgrade of dedicated Mineral Rail Link	-Coega -Kirkwood (Addo) -Somerset East -Pearston -Nieu- Bethsdal	Rail Corridor Development	Yes	Long Term	Yes	Proposed upgrade of dedicated Mineral Rail Link from Coega and entering Northern Cape towards Colesburg.	Eastern Cape Provincial Spatial Development Plan (2010)
Proposed mining Projects	-Xolobeni	Industrial Development	Yes	Medium Term	Yes		Eastern Cape Provincial Spatial Development Plan (2010)
Priority Tourism Nodes	-Addo National Park -Tsitsikamma National Park -Mountain Zebra National Park -Camdeboo National Parks	Tourism Nodes	Occurring	Present	No		Eastern Cape Provincial Spatial Development Plan (2010)
Priority Agricultural Areas	-Sakhisizwe - Engcobo -Emalahleni,	Agricultural Nodes Development	Yes	Medium Term	Yes		Eastern Cape Provincial Spatial Development Plan (2010)
North West							
Residential Housing Projects	-Rustenburg -Klerksdorp -Brits	Residential Development	Yes	Medium Term	Yes		North West Province Provincial Development Plan (2013)
Mining Corridor Consolidation (Road Expansions)	-Mafikeng -Lichtenburg -Coligny	Corridor Development	Yes	Long Term	Yes		North West Province Provincial Development Plan (2013)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
	-Ventersdorp -Dovesdale -Potchestroom						
Mining Projects	-Carletonville -Klerksdorp	Industrial Development	Yes	Medium Term	Yes		North West Province Provincial Development Plan (2013)
Priority Tourism Areas	-Sun City -Magaliesburg -Hartbeespoort -Madikwe	Tourism Nodes	Occurring	Present	No		North West Province Provincial Development Plan (2013)
Proposed Potential Tourism Areas	-Borakalalo -Vredefort Dome -Vaalkop Dam -Ganyesa/Kalahari	Tourism Potential Nodes	Yes	Medium Term	Yes		North West Province Provincial Development Plan (2013)
Priority Agricultural Areas	Brits Agricultural Node	Agricultural Node Development	Yes	Medium Term	Yes		North West Province Provincial Development Plan (2013)
Mpumalanga							
Urban Expansion Projects	-Ermelo -Secunda -Emalahleni -Nelspruit -Middelburg	Residential Development	Yes	Medium Term	Yes		Mpumalanga Economic Growth and Development Plan (2011)
Urban Corridors between Developing Industrial Hubs	- Ermelo - Secunda - Emalahleni	Industrial Development	Yes	Long Term	Yes		Mpumalanga Economic Growth and Development Plan (2011)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
	- Nelspruit - Middelburg						
Primary Mining Town Expansion	-Secunda -Emalahleni	Industrial Development	Yes	Medium Term	Yes		Mpumalanga Economic Growth and Development Plan (2011)
Northern Cape							
Vioolsdrift Dam Project	-Vioolsdrift	Industrial Development	Yes	Medium Term	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)
Kimberly University	-Kimberly	Occurring	Yes	Present	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)
Kimberly University (Upington Campus)	-Upington	Educational Development	Yes	Medium Term	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)
Food Production Corridor	-Hartswater -Jan Kempdorp -Prieska -Hopetown -Douglas	Food Corridor	Yes	Long Term	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)
Upington Airport Cargo Hub	-Upington	Industrial Development	Yes	Long Term	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)
Mining Corridor	-Lime Acres -Danielskuil -Hotazel	Industrial Development	Yes	Long Term	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
Tourism Potential Nodes	-Lake Gariep -Colesburg -Richmond	Residential Development	Yes	Medium Term	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)
Agrilutural Potential Nodes	-Port Nolloth -Hondeklip Bay -Alexander Bay	Industrial Development	Yes	Long Term	Yes		Northern Cape Provincial Development and Resource Management Plan/ Provincial Spatial Development Framework (2012)
Gauteng							
Urban Expansion Projects	-Westonaria -Randfontein -Heidelberg -West Capital -East Capital -African Gateway -Lanseria Lion Park -Steyn City -Waterfall -Modderfontein -Linksfild -Masingita -Gauteng Highlands -Savanna City -Vaal River	Residential Developments	Yes	Medium to Long Term	Yes		Gauteng Spatial Development Framework 2030 (2016)
Infilling Development	-Tembisa -Germiston -Daveyton	Node Development	Yes	Medium Term	Yes		Gauteng Spatial Development Framework 2030 (2016)
	-Mogale City						

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
Industrial Corridor Developments	-Vereeniging -Vanderbijlpark -Sebokeng	Corridor Development	Yes	Medium Term	Yes		Gauteng Spatial Development Framework 2030 (2016)
Westonaria Airfield Development	-Westonaria	Industrial Development	No	Long Term	Yes		Gauteng Spatial Development Framework 2030 (2016)
Rail way Development areas	-Chamdor -Ennerdale -Sandton -Lanseria -Fourways -Tshwane -Hammanskraal -Mabopane	Transport Development	No	Long Term	Yes		Gauteng Spatial Development Framework 2030 (2016)
Tourism Nodes	-Cullinan -Dinkokeng -Magaliesburg -Cradle of Humankind -Vereeniging -Vaal River -Heidelberg -Suikersobrand	Tourism Developments (Accommodation)	Yes	Medium Term	Yes		Gauteng Spatial Development Framework 2030 (2016)
KwaZulu-Natal							
Durban Aerotropolis Development	-King Shaka Airport	Mixed Development	Used Yes	Long Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011)
							KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
Inkululeko Development Initiative	-Ndumo	Educational Development	Yes	Medium Term	No		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Proposed Newcastle University	-Newcastle	Educational Development	Yes	Medium Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Richards Bay 2000MW Gas to power Station	-Richards Bay	Industrial Development	Yes	Long Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Cornubia Integrated Human Settlement	-Mt Edgecombe	Mixed Use Development	Yes	Medium Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Emadlangeni Agri-Village	-Emadlangeni	Agricultural Development	Yes	Medium Term	No		KwaZulu-Natal Provincial Spatial Development Framework (2011)
Groenvlei Agri-Village	-Groenvlei	Agricultural Development	Yes	Medium Term	No		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Empangeni Housing	-Empangeni	Agricultural Development	Yes	Medium Term	No		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Greater Amaoti Housing Project	-Amaoti	Residential Development	Yes	Medium Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011)
							KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)

STRATEGIC ENVIRONMENTAL ASSESSMENT FOR GAS PIPELINE DEVELOPMENT IN SOUTH AFRICA

Project	Location	Activity	Likelihood	Timeframe	Rapid Population Growth	Comment	Documents Used
Greater Dukuduku Project	-Dukuduku	Residential Development	Yes	Medium Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Greater Kwamashu Bridge City	-Kwa-Mashu	Residential Development	Yes	Medium Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Development of Aluminium Hub	-Richards Bay	Industrial Development	Yes	Medium Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Development of Auto Supply Park	-Durban South	Industrial Development	Yes	Medium Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)
Fast Rail Line Development	-Kwadukuza -Dube Trade Port -Gateway -Durban	Transport Development	Yes	Long Term	Yes		KwaZulu-Natal Provincial Spatial Development Framework (2011) KwaZulu-Natal Provincial Growth and Development Plan 2035 (2018)

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APPENDIX F- ADDITIONAL INFORMATION RELATED TO DISASTER MANAGEMENT

F.1 What happens during a gas pipeline accident?

In 2010, a conflagration in San Bruno, California, showed a true worst case scenario of the potential threat natural gas has. A high pressure natural gas pipeline suffered a leak and eventually ignited explosively without warning. In the end, 37 homes were destroyed, nearly 300 others evacuated, and unfortunately eight civilians perished (Krusen 2011). In 2014, a series of explosions resulted from a leakage of propylene from an underground pipeline resulted in 32 fatalities and 321 injuries in Kaohsiung, Taiwan. These explosions resulted in several major fires and property damage such as overturned vehicles and substantial roadway damage (Liaw 2016:228).

There are various reasons why human error, related to Pipeline Developer staff, can lead to disasters. Typically, companies use advanced computer-based devices from a centralized control room. Accidents at these plants typically start with equipment malfunction, process upset or operator error; but they are aggravated and propagated through the system by a series of factors that could be attributed to human, organizational, and safety factors within the system. Also, most complex systems' accidents resemble an "unkind work environment"; that is, an environment in which once an error has been made, it is not possible for the person to correct the effects of inappropriate variations in performance before they lead to unacceptable consequences. This is because the effects of the errors are neither observable nor reversible. Research has shown that operator error is an attribute of the whole technological system—a link in a chain of concatenated failures — that could result in accidents. The most important lesson to be learned from past accidents is that the principal cause tends to be neither the isolated malfunctioning of a major component nor a single gross blunder, but the unanticipated and largely unforeseeable concatenation of several small failures, both engineered and human. Each failure alone could probably be tolerated by the system's defences. What produces the disastrous outcome is their unnoticed and often mysterious complex interaction.

Human errors may be exacerbated by workplace factors, such as poor workstation and workplace designs, unbalanced workload, complicated operational processes, unsafe conditions, faulty maintenance, ineffective training, lack of motivation and experiential knowledge, nonresponsive managerial systems, poor planning, non-adaptive organizational structures, rigid job-based pay systems, and haphazard response systems (Meshkati 2006:81).

Staff workloads increases substantially during an event of system upset, such as a leak or equipment malfunction (e.g. valve or pump breakdown). Leak detection requires a good understanding of the physical characteristics of the product, the "profile" of the pipeline system and its hydraulic characteristics (pressure and flow), the terrain, and environmental conditions (temperature) (Meshkati 2006:85). This is very demanding on the staff.

Although rare, emergencies involving gas pipelines are the most catastrophic and most dangerous because of the high operating pressures and large volumes of escaping gas. Natural gas transmission lines are high-volume, high-pressure delivery systems. Finding the leak is often the most urgent challenge. The damage to the immediate area, including structures, can be severe even when no ignition of escaping gas occurs. Failures on transmission pipelines will almost always cause escaping gas to excavate a large crater at the point of damage.

The accumulation of natural gas in the air creates an explosive atmosphere. If the escaping gas ignites during the resulting pressure-release explosion, the heat release will be tremendous, creating life-safety and fire-exposure problems (Parsley and Schwab 2000). Fires on transmission lines are extremely large, hot fires that release large amounts of energy in the form of radiant heat. These incidents may last many hours, or perhaps days.

This is different from normal fires. Dealing with a natural gas is more like defusing a bomb than putting out a fire. Additionally, the "bomb" (accumulating gas) and the ignition source might not be readily apparent, and therefore it may be very difficult to anticipate where such an explosion may take place (Munthe 2005).

The goals of managing emergencies on transmission pipelines start with the basics: Establish A command and a safe staging area, effect viable rescues, eliminate ignition sources (if gas has not ignited), and protect exposures. In populated areas, anticipate exposure fires; in rural areas, anticipate wildfires.

A natural gas incident should be treated as a hazmat (hazardous materials) incident. It is the role of the first responders to handle it as such, and hopefully mitigate the incident before it progresses. Typically, these calls end without any incidents, and quite often are treated as though they pose no threat to the responder or the community. However, *a lack of understanding and complacency will eventually lead to disaster*. Well defined guidelines and proper training will help prevent incorrect operations by response personnel, and properly mitigate the leak.

The environment can also create problems for gas pipelines. In particular, electricity outages can have a dire impact on pipeline operations. During Hurricane Sandy (2012), in the US, for example, oil and gas industries suffered severe outages due to the loss of commercial power through cascading failures. Backup power was only of minor help and could not prevent disruptions in gas and petrol distribution. This bottleneck led to further outages in backup power, which then brought cascading failures to further infrastructures. The interdependency of oil and gas and power infrastructure was among the most critical interdependencies due to its downstream consequences on the entire infrastructural system (Comes and Van de Walle 2014:8).

F.2 Pipelines, “critical Infrastructure” and physical planning to reduce risks

Critical infrastructure often forms part of a “lifeline system” – typically referring to electric power, gas and liquid fuels, telecommunications, transportation, waste disposal, water supply, agriculture and food systems, the defence-industrial base, energy systems, public health and health care facilities, national monuments and icons, banking and finance systems, drinking water systems, chemical facilities, commercial facilities, dams, emergency services, nuclear power systems, information technology systems, telecommunications systems, postal and shipping services, transportation systems, and government facilities. Taken individually, or in the aggregate, all of these systems are intimately linked with the economic well-being, security, and social fabric of the communities they serve (O’Rourke 2007:23).

Critical infrastructure in crowded urban and suburban areas are subject to increased risk from proximity. Damage to one infrastructural component, such as a cast-iron water main, can rapidly cascade into damage to surrounding components, such as electric and telecommunications cables and gas mains, with system-wide consequences (O’Rourke 2007:23).

Pipeline planning processes need to be sufficiently careful not to compromise existing infrastructure, particularly if it is located underground. A pipeline rupture in 2010 in San Bruno, California, referred to earlier in the report, released over 1.3 million m³ of natural gas, resulting in a fire that destroyed thirty-seven homes. Remarkably, the homes destroyed in the transmission pipeline explosion had been planned and built several years *after* the construction of the pipeline, illustrating the relevance of planning that addresses pipeline hazards (Osland 2015:1064). In the 2014 Taiwanese gas explosion, a gas pipeline ran alongside a water drainage channel. Since the drainage channel was built after the propylene pipeline, its construction represented a substantial change in the environment of the pipeline. Corrosion of the pipeline resulting from moisture in the drainage channel housing the pipeline was never considered in planning, or in subsequent maintenance (Liaw 2016:229).

Regulatory frameworks affect land uses near transmission pipelines. In the United States, local governments lack authority to address pipeline operations; and pipeline operators lack authority to regulate land uses close to the pipeline. In the United States, land-use practices surrounding pipelines vary widely by community, and there are no federal government regulations to guide local decisions about appropriate land-use practices. In contrast to the United States, European Union transmission pipeline operators must adhere both to local and to international legal frameworks (Osland 2015:1065).

F.3 A multi-pronged approach to building resilience

Disaster planning includes developing a set of activities and systems to prepare for and predict disasters. Forecasting and warning systems, community education, emergency operations centres, and medical and food stockpiles are part of the preparation. This can be difficult in underdeveloped localities, where basic infrastructure and municipal services are lacking. Funding infrastructure and activities in these areas for

events that may never occur may seem to local decision-makers like a waste of precious financial resources (Quarantelli 2003:219).

Once a disaster strikes, the overwhelming majority of search and rescue activities are carried out by friends, relatives, and neighbours. It is impossible to predict how people will respond, but knowing of risks and preparing communities to face them can help to improve their response.

In many countries, the military is often the key respondent to a disaster. Ironically, however, military organisations are often not been systematically approached for an analytical perspective on disaster response. Neither are religious organisations, even though relief provided by churches and organized religious groups frequently ranks very high as a major source of aid (Quarantelli 2003:220), but are seldom involved in disaster planning.

Municipal officials in disaster zones should ensure that equipment and trained crews are available (Quarantelli 2003:220). Even though some communities have put disaster management plans in place, difficulties in implementing them can be illustrated by the following observations made in Ecuador, Peru, and Bolivia during 1997 and 1998: While the civil defence organisations in the respective countries were the nominal “national emergency organizations” ... each was rapidly pushed to the sidelines by one or more new but temporary governmental organization charged with supposedly managing the response. The result was confusion and duplication at the institutional level, and a serious loss of credibility and morale in each country’s civil defence structure. Local agencies knowledgeable about an area should assume a lead role, especially if they have prepared for such an event. The strengthening of their capacities for all levels of a crisis means that “fewer crises will become emergencies, fewer emergencies will become disasters, and fewer disasters will become catastrophes” (Quarantelli 2003:220).

Without adequate disaster management planning, an emergency can escalate into a disaster. The core emergency and response facilities may be destroyed. In recent catastrophes in developing countries, small towns have had their medical and police personnel wiped out. Outside agencies later responded, though their response times were longer, they were unfamiliar with the area, and there were “turf wars” as agencies staked out their territories (Quarantelli 2003:221). Significantly, the core capacity of local agencies should be maintained, if at all possible, and this requires various measures to promote resilience – as argued below.

A real challenge is the lack of information about possible risks and appropriate responses (Mitchell 1999:139). The effective flow of information across organizational boundaries – before and during a disaster - is critical for an organization’s ability to remain effective in a dynamic disaster environment. Valid and timely information sharing is critical in emergency response operations. Institutional networks need to be created before disasters happen (Kapucu 2006:208). This is particularly important for cross-sectoral collaboration.

The key element of effective responses to disaster is to build *resilience*, for both physical and social systems. Resilience includes four main qualities:

- *Robustness*: the inherent strength or resistance in a system to withstand external demands without degradation or loss of functionality.
- *Redundancy*: system properties that allow for alternate options, choices, and substitutions under stress.
- *Resourcefulness*: the capacity to mobilize needed resources and services in emergencies.
- *Rapidity*: the speed with which disruption can be overcome and safety, services, and financial stability restored (O’Rourke 20007:25).

Table F.1. The concept of resilience has technical, organizational, social and economic dimensions (O'Rourke 2007:27).

TABLE 1 Matrix of Resilience Qualities with Examples Pertaining to the Technical, Organizational, Social, and Economic Dimensions of Infrastructure				
Dimension/Quality	Technical	Organizational	Social	Economic
Robustness	Building codes and construction procedures for new and retrofitted structures	Emergency operations planning	Social vulnerability and degree of community preparedness	Extent of regional economic diversification
Redundancy	Capacity for technical substitutions and "work-arounds"	Alternate sites for managing disaster operations	Availability of housing options for disaster victims	Ability to substitute and conserve needed inputs
Resourcefulness	Availability of equipment and materials for restoration and repair	Capacity to improvise, innovate, and expand operations	Capacity to address human needs	Business and industry capacity to improvise
Rapidity	System downtime, restoration time	Time between impact and early recovery	Time to restore lifeline services	Time to regain capacity, lost revenue

According to O'Rourke (2007:28), four main interventions are required to build resilience:

- Awareness, public education and knowledge, at all levels of society – from schools to business and politics
- Effective leadership, making informed decisions at the right time
- Planning for potential disasters and breakdowns, based on analyses of realistic risk factors
- Resource allocation to systems, to build alternative systems of provision ("resource redundancy"). For example, keeping secondary and tertiary roads in good condition is as important as maintaining the main highways.

F.4 Urban fire-fighting - Fire Brigade Services Act, 1987

An important piece of legislation is the *Fire Brigade Services Act, 1987* [Act 99 of 1987], which still appears to be in force. In 2010, the Minister of COGTA still used this piece of legislation to issue regulations.

This Act defined the functions of a fire brigade service as:

1. Preventing the outbreak or spread of a fire
2. Fighting or extinguishing a fire
3. The protection of life or property against a fire *or other threatening danger*
4. The rescue of life or property from a fire *or other danger*
5. Subject to the provisions of the Health Act of 1977, to render an ambulance service as an integral part of the fire brigade service.

Those Local Authorities who did establish Fire Brigades had to appoint a person with prescribed qualifications and experience, as chief fire officer, to be in charge of this service. Additional people, with the prescribed qualifications and experience, may be appointed to assist the chief fire officer. A local authority may also establish a fire brigade reserve force, consisting of temporary members. The powers of the members of the service includes, pursuant to implementing their functions: (a) closing any road or street, (b) enter any premises, (c) damage or destroy any property, (d) forcibly remove any person who is in danger, or obstructs the brigade in performing its duties, and (e) take material or objects from any person, who would be compensated subsequently.

A local authority may levy fees, payable by a person on whose behalf the fire service was applied. This would include the service, equipment, and material consumed.

Significantly, the Administrator could, after consultation with the Fire Brigade Board, pay grants-in-aid to local authorities, to establish or maintain their service. The local authority would be required to submit annual reports on expenditures.

Local authorities may make agreements (create partnerships) with one another, to co-operate with regards to fire services. They could also make agreements with other persons or institutions.

Municipalities were therefore the front-line agencies for fire services. Provincial administrations were tasked with guiding and evaluating them. The Provincial Administrators could give written notices to local authorities, requiring them to comply with requirements or standards. If a local authority failed to do so, the Administrator could take steps to enforce such requirements.

The national Minister (of Local Government) also played a role. He/she could make regulations regarding employment procedures, uniforms, safety requirements, the use of flammable materials (**including petroleum and gas**), equipment, materials, and the qualifications and experience of chief fire officers. The Minister could also establish a Training Institution for fire officers.

F.5 Rural fire-fighting - National Veld and Forest Fire Act, no. 101 of 1998

This Law is implemented by a different sectoral department – the Department of Agriculture, Forestry and Fisheries (DAFF). The Fire Protection Associations must be registered with the national Ministry, and the Minister could provide a loan or grant to Associations. In contrast, the Fire Brigade Services Act is administered by the national department responsible for municipalities (now COGTA, or the Department of Co-operative Governance and Traditional Affairs).

Municipalities are *required* to join such a local or district fire association. Any State landowner in the area is *required* to join the association. These measures give the Fire Protection Associations a fair degree of power. Several Associations may work together and establish an umbrella organisation. Clearly, the main impetus of this legislation was private initiative and civil society, not municipal control.

The Associations *are required* to implement at least these functions:

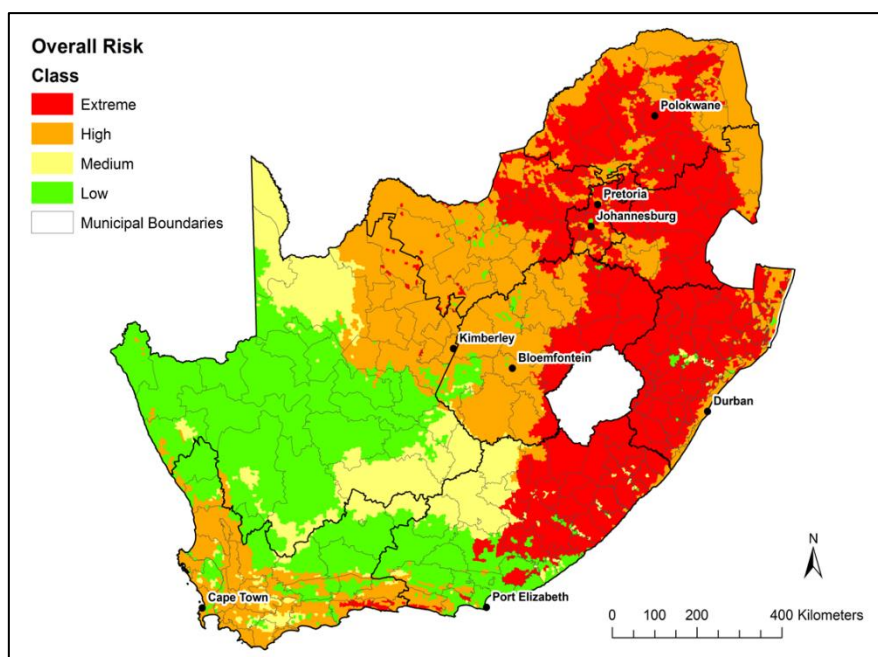
1. Develop and apply a veldfire management strategy for the area
2. Devise mechanisms to co-ordinate actions with adjoining Associations, in the event of a fire crossing boundaries
3. Make rules which bind its members
4. Identify the ecological conditions that affect the fire danger
5. Regularly communicate the fire danger rating
6. Organise and train its members in fire fighting, management and prevention
7. Inform its members of equipment and technology for preventing and fighting veldfires
8. Provide management services, training and support for communities in their efforts to manage and control veldfires
9. Supply the Minister at least once every 12 months with statistics about veldfires in its area
10. Furnish any information requested by the Minister in order to prepare or maintain the fire danger rating system
11. Exercise the powers and perform the duties delegated to it by the Minister,
12. And appoint a fire protection officer, unless a municipality is a member (presumably, the fire protection officer would then be that official employed by the municipality).

There is a link between the Fire Associations and the Municipalities' Fire Brigade function. In this law, "Chief Fire Officer" refers to those officials appointed in terms of the *Fire Brigade Services Act, 1987*.

The *National Veld and Forest Fire Act (1998)* also provides that the Department must prepare and maintain a fire rating system for the entire country. For each region, this would include the topography, vegetation, seasonal climatic cycle, and weather conditions. For each region, the fire danger in different periods can be rated, and dangerous activities identified. The Minister can then issue public warnings if these dangers are imminent, and public activities (such as lighting fires) can be prohibited.

All owners of land need to prepare and maintain firebreaks. They also need to maintain equipment, protective clothing and trained staff to extinguish fires. Typically, fire protection officers would take over a fire-fighting operation, as soon as they arrive on the scene. In the absence of a fire protection officer, a forest officer may take over control of the fighting of a fire within 10 km of a state forest.

Any fire protection officer, or a person functioning in that capacity, may, in controlling a fire, enter any land, destroy trees or crops, enter any premises, remove vehicles, or forcibly remove any person who is in danger or who obstructs the fire-fighting operation.



National Veld Fire Risk profile (COGTA n.d.)

F.6 Disaster Management Act, Act 57 of 2002

This Act created a new institutional architecture. At the apex of the DM system is an Intergovernmental Committee on Disaster Management (**ICDM**), established by the President. The ICDM consists of the Cabinet members involved in Disaster Management, as well as relevant Provincial MECs, and members of municipal councils, as selected by SALGA. The ICDM must promote co-operative governance with regards to Disaster Management; report to Cabinet on such co-ordination; and advise Cabinet about the creation of a national Disaster Management framework.

Like the Fire Brigades Act, the relevant Minister is the one who co-ordinates provincial and local government – i.e. COGTA. This Minister chairs the ICDM.

The Minister must establish a **National Disaster Management Advisory Forum**, consisting of the Head of the National Centre; a senior representative of each national department and each provincial department represented on the ICDM; municipal officials nominated by SALGA; and representatives of other stakeholders – notably, organised business, the Chamber of Mines, organised labour, the insurance industry, organised labour, traditional leaders, religious and welfare organisations, medical organisations, organisations representing DM professions in South Africa, institutions of higher education, technical institutions, DM experts chosen by the Minister, and any other relevant organisations.

Other staff may be seconded to the Centre. Its main tasks are to monitor compliance with the Disaster Management Framework across the government system, collect relevant information on disasters, advise government and non-state actors, promote the recruitment of volunteers, promote Disaster Management training in schools, and promote research. The National Centre must report annually to the Minister on its activities, the monitoring of prevention and mitigation initiatives, disasters in each province, impacts of these disasters, and particular problems that were experienced in dealing with these disasters. It can also make recommendations.

The Centre must establish a **directory of all role-players** relevant to Disaster Management, including their contact details. These role-players may include government agencies, NGOs, experts, private sector specialists, and foreign organisations. It must also create an electronic data-base on previous and future disasters, risk factors, prevention, mitigation, early warning systems, vulnerable areas, emergency response resources, police stations, medical institutions, useful public buildings, fire-fighting services, airports and railway stations. This data-base must be available to any person, free of charge.

F.7 Critiques of the Fire Brigade Services: 1999-2013

In 1999, a study of fire services was undertaken by the South African Insurance Association. Several problems were identified (COGTA 2013:26):

- Lack of compulsory national standards
- Inappropriate employment practices
- Inadequate accountability at some municipalities for this function
- Lack of effective management
- Poor maintenance of equipment
- Fire safety challenges, and
- Inadequate funding.

By 2013, the *Fire Brigade Services Act, 1987* (FBSA) was still the primary piece of legislation regulating fire services. COGTA identified the need to review FBSA. This was intended to be followed by a White Paper and a new Bill and Act, to establish a clear policy framework.

The Discussion Document then lists several important problems with current legislation (COGTA 2013:16):

- The FBSA does not sufficiently provide for fire safety, fire prevention and community fire safety education.
- The FBSA does not clearly outline national norms and standards in the provision of a fire service.
- After 1987, a myriad new pieces of legislation have impacted on the FBSA, in a chaotic manner.
- The FBSA established the Fire Brigade Board, which has not functioned well. The Secretariat of the Board, working as a directorate in the National Disaster Management Centre, is under-capacitated and under-funded.
- The FBSA does not clearly provide for support, oversight and capacity-building of municipalities.
- There are ambiguities in interpretations of Section 84(1) of the *Local Government Municipal Structures Act, 1998*, which led to complex and varied division of fire functions between DMs and LMs. The division of functions between Local and District Municipalities often results in a wasteful duplication of resources and efforts.
- The *National Veld and Forest Fire Act* and FBSA are not well integrated, and the division of functions between municipalities and Fire Protection Associations remained unclear. This resulted in jurisdictional contests between municipal fire services and other functions such as veldfire management. There was also a lack of clarity on the jurisdiction of Chief Fire Officers.
- Inadequate statistics regarding fires, injuries, property losses, and deaths.

There is overarching role confusion between two central departments. Whereas the National Veld and Forest Fire Act is administered by the Department of Environmental Affairs, the FBSA is administered by COGTA. Within COGTA, the National Disaster Management Centre (NDMC) is responsible for the administration and oversight of the FBSA.

Other agencies also play an important role in firefighting, but they have not been sufficiently integrated in Disaster Management Planning. These agencies include (COGTA 2013:39):

- South African Police Service (SAPS): Joint incident command during incidents; assists fire prevention units with fire investigation, especially arson; incident access control and evacuation; support of Urban Search and Rescue (USAR) ; traffic and crowd control at emergencies
- Emergency Medical Services: Joint incident command during incidents; provision of emergency medical services; provision of equipment; provision of support in hazardous materials incidents; provision of support in rescue efforts
- South African National Defence Force: Support local fire services; Support USAR and other special incidents; training of firefighters;
- State-owned Entities: Performing fire safety functions; Performing fire risk assessments; emergency planning.

Critically, firefighting requires water. This is a municipal function, and it requires careful planning (COGTA 2013: 52). There are three sources of piped water supply for firefighting:

- Public supply usually delivered by municipal infrastructure
- Private supply wherein National Building Regulations require building owners to install tanks and pumps
- Operational supply, such as water tankers.

In fact, the water current provision problems faced by many municipalities may well affect their firefighting capability.

The Discussion Document noted that South Africa has lost many experienced firefighters during the transitional years. While there is training of new firefighters, there has been a loss of capacity and skills (COGTA 2013: 63). “The quality assurance of training and training institutions remains problematic and open to untoward activity” (COGTA 2013:63).

F.8 The 2016 Draft White Paper on Fire Services

Since 2014, COGTA has worked on building a partnership between the National Disaster Management Centre (NDMC) and the South African Local Government Association (SALGA) to develop a disaster management capacity building programme for local government. The overall aim of the project is to ensure full understanding and application of disaster management in local government to facilitate well-informed developmental decisions that impact positively on sustainable development.

One outcome was the recent *Draft White Paper on Fire Services*, which was gazetted for public comment in December 2016. The Draft White Paper provided a good overview of the problems facing the fire services sector and noted that the *Fire Brigade Services Act* of 1987 was still the primary piece of legislation regulating fire services. It does not seem that this has subsequently been taken forward. It seeks to reposition the country’s municipal fire services from a response-oriented approach towards a greater emphasis on fire prevention and risk reduction. The White Paper admits: “It is clear that traditional methods of providing fire services have not enabled the country to adequately manage the evolving fire risk faced by communities. Following extensive interactions between the National Disaster Management Centre and stakeholders involved in fire services, this White Paper seeks to entrench fire safety and prevention as core components of fire services. This requires a paradigm shift from response-oriented methodologies of providing fire services towards an approach that primarily strives to reduce fire risk through fire safety and prevention initiatives.”

Gazetted in accordance with the *Fire Brigade Services Act of 1987*, among the draft document’s policy proposals are a clear definition of the roles and responsibilities of the three spheres of government, the professionalisation of the fire service, the introduction of a risk-based approach in the provision of fire services, the introduction of a funding strategy for fire services, and the establishment of a national fire research and data centre.

There were 16 key policy proposals set out in the 2016 *White Paper on Fire Services*:

1. Amend the legislation to reposition the fire services into the 21st century
2. Provide a clear definition of roles and responsibilities of all spheres of government
3. Establish national and provincial Fire Services Directorates
4. Locate fire services within the broader development agenda of the country
5. Development of a National Fire Services Framework
6. Professionalisation of the fire services
7. Alignment of applicable regulatory and legislative frameworks so as to provide comprehensive and unified legislation for fire services
8. Establishment of a national fire research and data centre
9. Development of a uniform risk assessment model
10. Develop various categories of designated services
11. Develop a national education and training strategy
12. Introduce a risk-based approach in the provision of fire services
13. Entrench fire safety and prevention as core deliverables of the fire services
14. Introduce a funding strategy for fire services
15. Make provision to adopt applicable South African National Standards (SANS) to provide benchmarks for the delivery of fire services
16. Introduce and implement a new Fire Services Act.

Significantly, many of these goals had been discussed before, but had never been effectively addressed.

The White Paper admits that this old legislation had a number of weaknesses –

- The Act did not make adequate arrangements or place explicit focus on fire safety and prevention, particularly community fire safety education.

- The Act did not clearly outline *national norms and standards* that can be utilised as benchmarks in the provision of a fire service. In addition, aspects related to research and development, as well as mechanisms for dealing with quality assurance, are not addressed.
- The Act had been promulgated in 1987 and the advent of the new democratic dispensation in 1994 resulted in new legislation that significantly impacts on local government functions and institutional arrangements. This necessitated a review of the Act to harmonise it with other key legislation that impacts on the provision of fire services.
- The Act established the *Fire Brigade Board (FBB)* as a forum to be consulted on various matters relating to the oversight, regulation and administration of fire services. However, it met infrequently which *makes its functioning ineffective* and the administration of fire services weak. Political oversight is not achieved as the platform to achieve this vital function is not functioning.
- The Act assigned the administrative work of the FBB to a *secretariat*. The secretariat, established as a Directorate in the National Disaster Management Centre, was *under-capacitated and under-funded* to perform the assigned function.
- The current Act did not provide clear provisions for the support, oversight and *capacity-building roles of provinces and national government* as outlined in the Constitution, the 1998 White Paper on Local Government and other applicable legislation.

The White Paper addressed the ongoing problem of role confusion between national, provincial and local government in fire services. It argued for expanding the municipal fire-fighting function to include new roles and responsibilities, inter alia,

- *integrated development planning* towards uniform fire services
- *coordination* and regulation of local authority fire services, designated fire authorities and volunteer fire associations
- development of *specialised capacity* to deal with fire risks prevalent in the area such as veld fires, *chemical fires*, and informal settlements fires
- development of *specialised dangerous goods incident response capacity*
- coordination of the *standardization* of infrastructure, vehicles, equipment and operational procedures
- facilitation and coordination of the *training* and development of practitioners
- development and facilitation of the implementation of *standardised municipal by-laws*
- the coordination of planning for the provision of *fire safety and prevention*
- the development, implementation and maintenance of *mutual aid agreements* amongst local fire services, designated fire authorities, fire protection associations and volunteer fire associations
- development, support and implementation of *community-based fire safety* and prevention programmes
- establishment and maintenance of a *District Fire Service Coordination Forum*
- preventing the outbreak and spread of a fire, by making arrangements for the provision of *information, publicity, training, education* and encouragement in respect of the steps to be taken to prevent fires and death or injury by fire and by conducting regular and random fire safety inspections at any premises where the chief fire officer deems necessary
- conducting *fire risk assessments*.

Once again, the White Paper fell into the temptation of dealing with municipal problems by actually *increasing* their portfolio of functions, without clarifying how they would be supported in practice.

At the same time, the White Paper also highlighted the problematic division of powers and functions between various categories of municipalities. Fire-fighting is listed as a local government function in Schedule 4 Part B of the Constitution. Although Section 156(1)(a) of the Constitution does not differentiate between district and local municipalities, the service delivery model emanating from the two-tier system is beset with challenges such as *fragmentation in the delivery of services, duplication of efforts and resources, and jurisdictional contestation*.

In view of the complexity involved in addressing this matter, GoGTA identified the following fundamental principles as critical to the allocation of powers and functions –

- A *clear definition of roles* and responsibilities is necessary to avoid duplication of efforts and resources which is costly and wasteful

- Recognition that *district municipalities have an inherent responsibility to support* local municipalities in their area of jurisdiction
- Recognising the importance of a *differentiated approach* as opposed to a one-size-fits-all approach that fails to appreciate the specific contextual variables of each municipality
- Appreciating that the function can be delivered as a *shared service* as long as roles and responsibilities are clearly defined
- An approach to division of powers must be underpinned by the principles of a risk-based approach to the provision of fire services.
- The allocation of powers, especially for local municipalities, must recognise the role played by fire services in building plan approvals, and land and township development initiatives
- Municipalities must act in accordance with the constitutional requirement of *cooperative government*.

Most local municipalities have fire services by-laws which are used to manage various aspects of their fire services. CoGTA must ensure that applicable legislation is aligned and harmonised to create a unified legislative framework which provides clarity on the division of powers and functions between the various categories of municipalities. While a metropolitan municipality has the powers to render all functions outlined above, a provincial MEC may adjust powers between a district and a local municipality in terms of the Municipal Structures Act.

The draft White Paper also proposed that:

- Chief fire officers and service members must have prescribed *qualifications and experience* to perform their respective functions. Although appointment of members of service will remain a prerogative of the municipality or designated service, the national government must ensure that the qualifications and experience required for such appointments are prescribed appropriately. National government must also develop a career path for fire services personnel.
- The proposed fire services legislation must make provision for the recruitment and utilization of *reservists in fire services*, with powers similar to those enjoyed by member of service.
- Because the infrastructure needed for *call-taking and dispatch* is expensive and complex, and requires significant management input, most municipal fire services have made little progress towards installing and using systems such as two-way radio communications networks, computer-aided dispatch systems and resource tracking systems. The envisaged fire service legislation must provide adequate mechanisms for this critical component of the fire service.
- Fire services must determine their level of capacity to discharge their legal mandate. To strengthen this capacity, they must enter into *mutual aid agreements* with neighbouring fire services, the private sector and any other agency involved in the provision of fire services.
- *While fire services play a fundamental role in the safe storage and transportation of dangerous goods, there is no single policy or legislative framework dealing with this function.* The roles and responsibilities of fire services must be clearly defined to minimise confusion, costly overlapping and the wasteful duplication of efforts and resources which is costly and wasteful. Furthermore, it is critical that fire services must enter into partnerships with other role players involved in dangerous goods management.

The White Paper also recognised that the funding of fire services is problematic. Generally, local government bears most of the financial responsibility for funding fire services. This funding model is, however, strongly linked to municipal viability, with municipalities that are financially viable able to adequately and sustainably fund the function, while those that are not viable struggle to finance fire activities in any meaningful way. Fire services are not defined as a basic service and this to a large extent often results in inadequate allocation of resources to the function.

The fact that fire services are *capital and resource-intensive, coupled with its low revenue-generating capacity*, is a disincentive for decision-makers to provide adequate funding for the function. In short, the competition for limited resources by all basic services such as electricity, sanitation and water often means that fire services is not able to receive priority.

It is important that *future funding models* put measures in place to support resource-poor municipalities in providing the service sustainably. While financially viable municipalities have been able to allocate resources for the function, an analysis of their expenditure patterns indicates that the bulk of resources expended has been to support fire services operations (fire-fighting and procurement of equipment, etc.). Very little investment has been made by fire services to support fire safety, prevention and protection activities especially community-based fire risk-reduction initiatives.

Future funding arrangements must provide for the funding of fire services across the entire value chain of the function. This will require a *combination of sources* found at all levels of government to adequately fund the fire service.

F.9. Municipal overview of Disaster Management capacity

Eastern Cape

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Alfred Nzo District Municipality			main	1				
Umzimvubu	Mount Ayliff	Alfred Nzo	Satellite			1		
Matatiele	Matatiele	Alfred Nzo	Satellite			1		
Mbizana	Bizana	Alfred Nzo	Satellite			1		
Ntabankulu	Ntaban-kulu	Alfred Nzo	Satellite			1		
Amathole District Municipality			Main	1		0		
Mbhashe	Idutywa	Amathole	Satellite			1		
Mnquma	Butterworth	Amathole	Satellite			1		
Great Kei	Komga	Amathole	Satellite			1		
Amahlathi	Stutterheim	Amathole	Satellite			1		
Ngqushwa	Peddie	Amathole	Satellite			1		
Nkonkobe	Alice	Amathole	Satellite			1		
Raymond Mhlaba ⁹	Fort Beaufort	Amathole	Satellite			1		
Nxuba	Adelaide	Amathole	Satellite			1		
Buffalo City Metro			Main		1			
Sarah Baartman District Municipality			Main		1			
Dr Beyers Naude ¹⁰	Graaff-Reinet	Sarah Baartman	Main		1			
Blue Crane Route	Somerset East	Sarah Baartman	Main			1		
Makana	Grahamstown	Sarah Baartman	Main			1		
Ndlambe	Port Alfred	Sarah Baartman	Main		1			
Sundays River Valley	Kirkwood	Sarah Baartman	Main			1		
Kouga	Humansdorp	Sarah Baartman	Main	1				
Kou-Kamma	Kareedouw	Sarah Baartman	Main		1			
Chris Hani District Municipality			Main		1			
Enoch Mgijima ¹¹	Queenstown	Chris Hani	Satellite				1	
Intsika Yethu	Cofimvaba	Chris Hani	Satellite			1		
Engcobo	Engcobo	Chris Hani	Satellite			1		

⁹ This is an amalgamation of the erstwhile Nkonkobe and Nxuba Local Municipalities.

¹⁰ This is an amalgamation of the erstwhile Camdeboo, Ikwezi and Baviaans LMs.

¹¹ Previously Lukhanji LM.

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Inxuba Yethemba	Cradock	Chris Hani	Satellite			1		
Sakhisizwe	Elliot	Chris Hani	Satellite				1	
Joe Gqabi			Main				1	
Elundini	Mount Fletcher	Joe Gqabi	Satellite			1		
Nelson Mandela Bay Metro			Main	1				
O.R. Tambo District			Main		1			
Ngquza Hill	Flagstaff	O.R. Tambo	Satellite				1	
Mhlontlo	Qumbu	O.R. Tambo	Satellite				1	
King Sabata Dalindyebo	Umtata	O.R. Tambo	Satellite				1	
Nyandeni	Libode	O.R. Tambo	Satellite				1	
Port St Johns	Port St Johns	O.R. Tambo	Satellite				1	

Free State

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Fezile Dabi District Municipality			? ¹²					1
Moqhaka	Kroonstad	Fezile Dabi	?					1
Ngwathe	Parys	Fezile Dabi	?					1
Metsimaholo	Sasolburg	Fezile Dabi	?					1
Mafube	Frankfort	Fezile Dabi	?					1
Thabo Mofutsanyane District								1
Phumelela	Vrede	Thabo Mofutsanyane	?					1
Nketoana	Reitz	Thabo Mafutsanyane	?					1
Maluti a Phofung	Qwa-Qwa	Thabo Mafutsanyane	?					1

¹² “?” means that the information is not clear in the IDP. This, in turn, reflects the deep underlying confusion regarding powers and functions – so that even the IDPs have not attempted to clarify the matter.

Gauteng

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Johannesburg Metro	Johannesburg	Johannesburg Metro	Main	1				
Tshwane Metro	Pretoria	Tshwane Metro	Main	1				
Ekurhuleni Metro	East Rand	Ekurhuleni Metro	Main	1				
Sedibeng District Municipality			Main			1		
Emfuleni	Vereeniging	Sedibeng	Main	1				
Midvaal	Meyerton	Sedibeng	Main	1				
Lesedi	Heidelberg	Sedibeng	Main	1				
West Rand District Municipality			Main	1				
Merafong	Carletonville	West Rand	Satellite				1	
Mogale City	Krugersdorp	West Rand	Satellite				1	
Randfontein	Randfontein	West Rand	Satellite				1	
Westonaria	Westonaria	West Rand	Satellite				1	

KwaZulu-Natal

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Amajuba District Municipality			Satellite					1
Newcastle	Newcastle	Amajuba	Main					1
Emadlangeni	Utrecht	Amajuba	Main	1				
Dannhauser	Durnacol	Amajuba	Main		1			
Ethekwini Durban Metro			Main	1				
iLembe District Municipality			Main			1		
Mandeni	Mandeni	iLembe	Satellite				1	
KwaDukuza	Stanger	iLembe	Main	1				
Ndwedwe	Ndwedwe	iLembe	Satellite				1	
Maphumulo	Maphumulo	iLembe	Satellite				1	
Harry Gwala District Municipality			?			1		
Umzimkhulu	Umzimkhulu	Harry Gwala	?			1		
Dr Nkosazana Dlamini-Zuma ¹³	Creighton	Harry Gwala	?					1
Greater Kokstad	Kokstad	Harry Gwala	?				1	
Ubuhlebezwe	Ixopo	Harry Gwala	?				1	
Ugu District Municipality			?		1			
Vulamehlo	Dududu	Ugu				1		
Umdoni	Scottburgh	Ugu	Main	1				
Umkumbe	Umkumbe	Ugu	Main?			1		
UMuziwabantu	Harding	Ugu	satellite			1		
Ray Nkonyeni ¹⁴	Izinqolweni	Ugu	satellite			1		
Ray Nkonyeni ¹⁵	Port Shepstone	Ugu	Main		1			
uMgungundlovu District Municipality			?			1		
uMshwathi	Wartburg	uMgungundlovu	?					1
uMngeni	Howick	uMgungundlovu	satellite			1		

¹³ This Municipality is an amalgamation of the Ingwe and Kwa Sani Local Municipalities.¹⁴ This Municipality was previously the Ezingoleni LM.¹⁵ This Municipality was previously Hibiscus Coast LM.

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Mpofana	Moorivier	uMgungundlovu	?				1	
Impendle	Impendle	uMgungundlovu	?				1	
The Msunduzi	Pietermaritzburg	uMgungundlovu	Main	1				
Mkhambathini	Camperdown	uMgungundlovu	?					1
Richmond	Richmond	uMgungundlovu	?					1
uMkhanyakude District Municipality			Main		1			
Umhlabya-lingana	Emangusi	uMkhanyakude	Satellite					1
Jozini	Mkuze	uMkhanyakude	Satellite					1
The Big 5 Hlabisa	Hluhluwe	uMkhanyakude	Satellite					1
Mtubatuba	Mtubatuba	uMkhanyakude	Satellite					1
uMzinyathi District Municipality			Main		1			
Endumeni	Dundee	uMzinyathi	Main		1			
Nqutu	Nqutu	uMzinyathi	Satellite				1	
Msinga	Pomeroy	uMzinyathi	Satellite				1	
Umvoti	Greytown	uMzinyathi	Main	1				
King Cetshwayo District Municipality			Main				1	
Mfolozi	KwaMbonambi	King Cetshwayo	Satellite					1
uMhlathuze	Richards Bay	King Cetshwayo	Main	1				
Ntambanana	Ntambana	King Cetshwayo	Satellite					1
uMlalazi	Eshowe	King Cetshwayo	Main		1			
Mthonjaneni	Melmoth	King Cetshwayo	?					1
Nkandla	Nkandla	King Cetshwayo	?					1
Zululand District Municipality			Main	1				
eDumbe	Paulpietersburg	Zululand	Satellite			1		
UPhongolo	Pongola	Zululand	Satellite				1	
Abaqulusi	Vryheid	Zululand	Main			1		
Nongoma	Nongoma	Zululand	Satellite				1	
Ulundi	Ulundi	Zululand	Satellite				1	

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Mpumalanga

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Ehlanzeni District Municipality			?			1		
Bushbuckridge	Bushbuckridge	Ehlanzeni	Main			1		
Thaba Chweu	Sabie	Ehlanzeni	Main					1
Mbombela	Nelspruit	Ehlanzeni	Main	1				
Umjindi	Barberton	Ehlanzeni	Main		1			
Nkomazi	Nkomazi	Ehlanzeni	Main			1		
Gert Sibande District Municipality					1			
Albert Luthuli	Carolina	Gert Sibande	Main		1			
Msukaligwa	Ermelo	Gert Sibande	Main	1				
Mkhondo	Piet Retief	Gert Sibande	Main				1	
Lekwa	Standerton	Gert Sibande	Main				1	
Dipaleseng	Balfour	Gert Sibande	Main				1	
Govan Mbeki	Highveld Ridge	Gert Sibande	Main	1				
Nkangala District Municipality			Main			1		
Victor Khanye	Delmas	Nkangala	Main	1				
Emalahleni	Witbank	Nkangala	Main		1			
Steve Tshwete	Middelburg	Nkangala	Main		1			
Emakhazeni	Belfast	Nkangala	Main	1				
Thembisile	KwaMhlanga	Nkangala	Main			1		

Northern Cape

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Pixley ka Seme DM			Main		1			
Ubuntu LM	Victoria West	Pixley ka Seme	satellite			1		
Namakwa District Municipality			Main	1				
Richtersveld	Port Nolloth	Namakwa	?		1			
Nama Khoi	Springbok	Namakwa	Main					1
Hantam	Calvinia	Namakwa	Satellite			1		
Karoo-Hoogland	Williston	Namakwa	satellite			1		
Kamiesberg	Garies	Namakwa	Main					1

North-West Province

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Bojanala District Municipality			Main?		1			
Madibeng	Brits	Bojanala DM	main		1			
Moretele	Unclear	Bojanala DM	Satellite?		1			
Rustenburg	Rustenburg	Bojanala DM	main	1				
Dr Kenneth Kaunda DM						1		
JB Marks ¹⁶	Potchefstroom	Dr K Kaunda	Main	1				

¹⁶ Previously the Tlokwe Local Municipality.

Western Cape

Local Municipality	Centre	District Municipality	Main or Satellite	Good	Fair	Marginal	None	No info available
Cape Winelands District Municipality				1				
Witzenberg	Ceres	Cape Winelands	Main	1				
Drakenstein	Paarl	Cape Winelands	Main	1				
Stellenbosch	Stellenbosch	Cape Winelands	Main					1
Breede Valley	Worcester	Cape Winelands	Main					1
Langeberg	Robertson	Cape Winelands	Main	1				1
City of Cape Town Metro			Main	1				
Eden District Municipality			Main	1				
Kannaland	Ladismith	Eden	Satellite; wants to be Main		1			
Hessequa	Riversdal	Eden	Main?		1			
Mossel Bay	Mossel Bay	Eden	Main?				1	
George	George	Eden	Main	1				
Oudtshoorn	Oudtshoorn	Eden	Main	1				
Bitou	Plettenberg Bay	Eden	Main?				1	
Knysna	Knysna	Eden	Main	1				
Overberg District Municipality			Main	1				
Theewaters-kloof	Caledon	Overberg	Main?				1	
Overstrand	Hermanus	Overberg	Main?				1	
Cape Agulhas	Bredasdorp	Overberg	Main?				1	
Swellendam	Swellendam	Overberg	Main				1	
West Coast District Municipality			Main	1				
Matzikama	Vredendal	West Coast	Main?				1	
Cederberg	Citrusdal	West Coast	Main?				1	
Bergvrievier	Velddrif	West Coast	Satellite?				1	
Saldanha Bay	Saldanha Bay	West Coast	Satellite				1	
Swartland	Malmesbury	West Coast			1			
Central Karoo DM			Main				1	
Beaufort West	Beaufort West	Central Karoo	main		1			
Laingsburg	Laingsburg	Central Karoo	main		1			
Prince Albert	Prince Albert	Central Karoo	main			1		